ELISHA HANSON

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE U. S. COAST AND GEODETIC SURVEY*

By O. H. Tittmann, Superintendent

FIVE years from now the Coast and Geodetic Survey may celebrate the centenary of the act creating it, for it was in 1807 that Cougress passed "An act for surveying the coasts of the United States." The President was authorized and requested to cause a survey to be taken of the coasts of the United States, in which shall be designated the islands, shoals, with the roads and places of anchorage within 20 leagues of any part of the shores of the United States, and also the respective courses and distances between the principal headlands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts within the extent aforesaid. He was also to cause such examinations and observations to be made with respect to Saint Georges Bank and any other bank or shoal and the soundings and currents beyond the distance aforesaid to the Gulf Stream as in his opinion may be especially subservient to the commercial interests of the United States.

To Professor Patterson, of Philadelphia, is due the credit of having urged the undertaking, and to President Jefferson and Secretary Gallatin of having interested themselves and given their support to the suggestion of Professor Patterson.

In 1807 the coasts of the United States extended from the eastern boundary of Maine to the northern boundary of Florida, for the latter still belonged to Spain. The coast of Louisiana between the Sabine and the Mississippi had recently been acquired, and gave to the United States a small, if important, strip of coast on the Gulf. These, then, were the coasts which at that time were deemed needful to be surveyed in the interests of commerce. Not that no charts existed of the regions in question; Des Barres, His British Majesty's Surveyor General for the Colonies, had begun the good work, which was interrupted by the War of the Revolution, but at best the results of his surveys were meager, insufficient, and inaccurate.

ITS INCEPTION

may be worth while to call attention to and to dwell for a moment on e unusual but eminently practical and s nsible measures that were taken to

*An address before the National Geographic Society, November 21, 1902.

bring the Survey into existence after it had been authorized by Congress.

Mr Gallatin's first step was to invite the opinion of scientific men as to the plans to be adopted, in a circular setting forth the objects to be attained. Thirteen replies were received, and these were referred to a committee of the American Philosophical Society, which recommended the adoption of the plan submitted by Mr Hassler. We shall presently see that 36 years later another committee of learned men, called together to reorganize the Survey, affirmed and adopted the scientific methods of Hassler and adapted them to the larger work devolved on the Survey by the extension of our domain. It thus happens that in the case of the Coast Survey the most competent authorities of the times were consulted to prescribe the principles on which the work was to be carried out. This later generation of men may well be thankful for the prevision of the two statesmen who gave direction to the work, and for the wisdom of those who conceived in those early days the broad lines on which the work was to be conducted; for though the methods have been modified, changed, and perfected, the principles then prescribed have guided the Survey ever since.

THE NEED FOR A COAST SURVEY

The problem before the Survey was to perform a national as well as an international duty. It behooves every country, in the interests of humanity, to safeguard the lives and property which are continually at stake on the great highways of commerce along the shores of the oceans; and the first step toward the fulfillment of this obligation is to map the coasts and chart the waters, in order that the mariner may have before him a graphic guide of the routes he must follow to insure the safety of the lives and property committed to his charge. The high seas claim their victims through fogs and storms and collisions, but to the experienced navigator the open ocean is a place of safety, while a proximity to the coasts, even where surveys and light-houses have minimized the risks, inspires feelings of grave responsibility and even of dread of hidden dangers, of unknown currents, and of collisions where busy commerce concentrates in narrowing lines the coming and departing ships.

Mr Hassler, whose plan was adopted, was a Swiss by birth, a man of great learning and well qualified by experience to outline the scientific principles on which an extended survey was to be conducted. His task was a difficult one, for neither men trained in the profession nor instruments were to be had in our country, nor was there a common appreciation of the importance of the work at that time. He went to England in 1811 to procure instruments, but the war with that country deferred the accomplishment of his purpose. It was not until 1816 that he was appointed Superintendent, and though he immediately began his operations with vigor they were cut short by the practical abolition of the Survey two years later through the revocation of the authority to employ civilians on the work. Its connection with the Treasury Department ceased, and the country became dependent for its charts on the private enterprise of the Messrs Blunt, of New York, and on fitful and unsystematic surveys made under the Navy Department. On the recommendation of the Secretary of the Navy the original act of 1807 was revived and the Survey was resumed in 1832 under Mr Hassler's direction, and it was again placed under the Secretary of the Treasury, only, however, to be retransferred to the Navy in 1834. This arrangement again proved to be unsatisfactory, and in 1836 the Survey was finally placed under the Treasury Department.

Suggestions for changing its status were again made, and its condition of apparent unstable equilibrium prompted Congress to take the matter in hand. Reference has already been made to a committee which was appointed by act of Congress in 1843 to reorganize the Survey. It consisted of six commissioned officers—that is, two officers of the Navy, four of the U. S. Topographical Engineers, all experienced in the work of the Survey, and three civilians. The act of Congress provided that the work should be conducted in accordance with the plan of reorganization of this committee, but prescribed that as many army and navy officers should be employed upon the work as would be compatible with the successful prosecution of the work.

At the same time the committee made the following recommendation :

"*Resolved*, That inasmuch as the object and purpose of the survey of the coast refers principally to the commercial interests of the country, and as all the laws of Congress in relation to the same contemplate the employment of civilians and officers of the army and navy upon said work, it is the opinion of this board, and they do hereby respectfully recommend, that it should be under the control and considered a part of the Treasury Department."

The President's formal approval of the plan of reorganization and of the recommendation just recited placed the Survey under the Treasury Department, where it has remained ever since.

Before describing its present organization, it must be explained why the original one was gradually modified by the withdrawal of army and navy officers from participation in its work.

During the Mexican war the withdrawal of all the navy officers was threatened, and nearly all the army officers were withdrawn. At the outbreak of the civil war in 1861 all army and navy officers were withdrawn and the connection of the Army with the Survey ceased altogether. The navy officers did not return until about 1870, but as the needs of the country required the continuation of the Survey, its execution was entrusted entirely to civilians during these years.

At the outbreak of the Spanish war the progress of the Survey was again endangered by the sudden withdrawal of all the navy officers and enlisted men of the navy. With the concurrence of the Secretary of the Navy, Congress made provision to put the Survey on an entirely civil basis. Its present organization may be described as follows:

PRESENT ORGANIZATION

The head of the Survey, called the Superintendent, reports to the Secretary of the Treasury. The Superintendent is charged with full responsibility in every respect for all the work of the Bureau. He is aided in such of his duties as cannot be delegated to officers of lower rank in the organization, by an Assistant Superintendent, who acts as Superintendent in his absence.

Eight officers or groups of officers report directly to the Superintendent and Assistant Superintendent, viz :

The assistant in charge of the office.

The inspector of hydrography and topography.

Inspector of geodetic work.

Inspector of magnetic work.

The disbursing officer.

Editor.

Chiefs of field parties.

Heads of suboffices.

The first four of these officers have a general supervision over all the operations of the Survey indicated by their designation, each acting as an advisory officer to the Superintendent in regard to the specified portions of the work. The chiefs of field parties and the heads of suboffices have direct charge of all operations in the field.

Each field party is a temporary organization which is created for a specific operation by an order of the Superintendent, which makes one of the officers of the field force the chief of party, and if necessary assigns to him as subordinates one or more other officers from the same force. The party is disbanded when the work assigned to it has been completed. If the party is for duty on land, the remainder of the organization of the party, the hiring of recorders, laborers, drivers, etc., is left entirely to the chief of party. If the party is for duty on a vessel, the assignment of an officer of the field force to command the vessel carries with it necessarily the command of the whole force on board the vessel, including watch and deck officers as well as crew.

Congress has provided for over 100 field officers, of which number about 77 are subject to ship or shore duty, and are also subject to office duty between field seasons, while about 30 are mainly engaged in hydrographic surveying and ship duty.

The Survey has its own fleet of twelve steamers and six sailing vessels, aside from launches and other small craft.

There are at present two suboffices, each in charge of a field officer reporting directly to the Superintendent, viz., at San Francisco, California, and Manila, Philippine Islands. The purpose of these suboffices is to aid in the prompt dissemination of information, to serve as storage depots, and to save traveling expenses by providing points at which the field officers may be temporarily assigned to office duty between the seasons. At the Manila suboffice the publication of preliminary charts is authorized.

DUTIES OF THE OFFICE FORCE

The inspector of hydrography and topography, reporting directly to the Superintendent, has general supervision over the classes of field work indicated by his title, places before the Superintendent plans for such work, makes the necessary inspection in the field to insure that the Superintendent's orders are carried out economically and effectively, and is especially charged with the supervision of all matters relating to the ships and their personnel. The *Coast Pilot*, a publication in several volumes, giving full description of the coast from the mariner's point of view, sailing directions, warnings as to dangers to navigation, and other information of special value to navigators, is prepared under his direction.

The inspector of geodetic work, reporting to the Superintendent, is charged with the duty of preparing plans for the field operations of triangulation, astronomical determinations and precise leveling, and of making inspections of parties in the field, and of records and correspondence received at the office from field parties, with a view of insuring that the field operations are in accordance with the Superintendent's orders, are of the desired degree of accuracy, and are efficient and economical.

The inspector of magnetic work, reporting to the Superintendent, is charged with similar duties in regard to the magnetic work of the Survey.

The assistant in charge of the office, reporting to the Superintendent, supervises the work of the office at Washington, is charged with the disbursement of all moneys allotted for that office, is responsible for the safety and arrangement of archives and property, and receives all money paid to the Survey for charts and other publications. As the official head of the office, the chiefs of the following divisions of the office force report to him: Computing Division, Magnetic Division, Tidal Division, Drawing and Engraving Division, Chart Division, Library and Archives Division, Instrument Division, and Miscellaneous Division. Each of these divisions, under the direction of the assistant in charge of the office, prepares replies for the Superintendent's signature to such parts of the correspondence as falls within its particular field, and also furnishes such information and equipment to field parties as it is within their power to furnish.

In the computing division all computations in connection with triangulation, astronomical determinations, and precise leveling are made, appropriate registers of results are kept, and the results prepared for publication as rapidly as possible.

The magnetic division and the tidal division deal similarly with the computations and publications of magnetic and tidal results respectively.

The drawing and engraving division is divided into five sections :

The photographing section, engaged in reducing, enlarging, and reproducing drawings for various purposes.

The drawing section, engaged in making from the original topographical and hydrographical field sheets the office drawings, which are the original from which charts are produced, either by engraving on copper or by photolithography.

The engraving section, engaged in copper-plate engraving.

The electrotype section, engaged in producing from the original engraved copper plates by electrotype process the copper plates actually used in printing the charts.

The printing section, engaged in printing charts from the copper plates (the lithograph printing is done by contract outside of the organization).

The chart division is divided into two sections. The hydrographic section is engaged in completing unfinished hydrographic sheets sent in from the field, in the correction of charts, especially with reference to aids to navigation (lights, buoys, etc.), preparation of monthly Notices to Mariners in regard to this matter, and the inspection of charts in their various stages of preparation. The chart section is engaged in applying such hand corrections to charts at the last opportunity before issuing as has become necessary on account of such changes, principally in aids to navigation, as have taken place after the chart was printed, and with the clerical work connected with the issue and sale of charts.

The library and archives division has charge of the library of the Survey and the archives in which all hydrographic and topographic sheets and all the original records and computations are stored.

The instrument division has charge of all the instruments and general property. Many of the best of the new instruments for the Survey are designed and made in this division, and it is continually engaged in repairing and remodeling necessary to keep the instrument outfit at a high standard of efficiency.

The miscellaneous division is charged with the purchase and distribution of all supplies required for use in the office and of such supplies as are furnished to field parties on requisition ; also with the making of requisitions for printing and binding, the custody of blank forms, stationery, etc., and the distribution of the reports of the Superintendent and of all other publications of this Bureau, with the exception of charts.

As already noted, the accounting division, at the head of which is the disbursing officer, is not a division of the office in the sense of reporting to the assistant in charge of the office. The disbursing officer makes all disbursements on account of the Survey, with the approval of the Superintendent ; renders a monthly account of all disbursements to the Auditor for the Treasury Department for audit by him, renders a statement of expenditures and balances to the Superintendent whenever required to do so, suspends returns for correction, or disallows, under the Superintendent's direction, all items of expenditures irregular in form or in contravention of law or regulations, and refers to the Comptroller of the Treasury for decision all questions of law involving a payment to be made by him.

The editor, reporting to the Superintendent, compiles the admiuistrative part of the annual report and acts as editor in connection with all other publications of the Survey except the charts.

THE EXTENSION OF FIELD WORK

The acquisition of Florida and Oregon in 1819 and of Texas and California soon after the reorganization of the Survey before described vastly extended the operations, and in view of the desirability of counecting the surveys of the Pacific and Atlantic coasts, a transcontinental triaugulation was authorized in 1871. Eight years later, in recognition of one of its functions, the name of the organization was changed to that of Coast and Geodetic Survey.

When Alaska was purchased in 1867 the charting of its vast and intricate shore line was added to the duties of the Survey, and still more recently, in conformity with and iu pursuance of the established policy, its labors were extended, to use the phraseology of the law, to all "the coasts under the jurisdiction of the United States," in order to include Porto Rico, Hawaii, Guam, the Samoan Islands, and the Philippines.

The plan of reorgauization contemplated a chain of triangles along the coasts which should unite and coördinate all the local surveys. Astronomical observations were to fix the geographical position of the triangulation, and the differences of longitude between some of principal stations and Europe were to be determined.

The topography was to be carried inland as far as would subserve the purposes of commerce and defense, and, resting upon the data thus obtained, soundings were to be made along the shores and seaward to insure the safety of commerce. Such was the simple scheme, but there were inherent in it certain requirements for the accomplishment of which extended researches in many branches of science were needed, and there were inherent in it also possibilities for greater usefulness to the nation and the world than the mere attainment of the immediate objects sought. It was foreseen that the triangulation if carried out with sufficieut care would ultimately form the basis of a national trigonometric survey. The great extent of territory to be covered indicated that the triangulation would be used to determine the size and figure of the earth, which is the ultimate base of dimensional astronomy. The need of compasses on the charts compelled the determination of at least one of the elements of the earth's magnetism and a study of the law of its variation. The rise and fall of tides required observations along the coasts which would disclose the law of their periodicity in order that predictious could be made long iu advance; a needful regard to benchmarks to which the tides were referred would betray the subsidence or rise of the land. Observations on tidal and ocean currents were needful to supplement the other information on the charts. The determination of astronomical positions required the perfection of existing star places, and thus practical astronomy was stimulated, and when the importance of the geodetic function of the Survey was recognized by law, the pendulum, by means of which the figure of the earth can be determined, was employed in gravity research.

Deep-sea soundings and incidental physical observations and dredgings contributed no little to our knowledge of marine life.

WORK DONE BY THE SURVEY

What the Survey has accomplished in the 70 years of its active existence may be broadly stated as follows:

It has carefully mapped about 30,000 miles of topography and sounded out minutely nearly 300,000 square miles of water, while its deep-sea soundings cover a little less than a million square miles. The results of this work are shown on about 500 charts of unrivaled accuracy and beauty. But it must not be forgotten that its energies have been largely devoted to resurveys required by the constantly shifting bottoms of our southern shores. Bearing this fact in mind, it may be stated that is has completed a first survey of the Atlantic, Gulf, and Pacific coasts of the United States. It has observed tides at thousands of stations, and publishes annually in advance predictions not only for our own coasts, but for all the ports of the world to which our shipping is likely to go. It has covered an area of between three hundred thousand and four hundred thousand square miles with its network of triangulation, and has incidentally completed the measurement of an arc of the parallel traversing our country from ocean to ocean, and has measured an oblique arc extending from Maine to Louisiana.

It has run many thousand miles of precise levels.

It has determined transatlantic longitudes and covered the country with a homogeneous system of astronomically determined points. It has taken an active part in the delimitation of national and state boundaries.

It has undertaken the study of the law of the earth's magnetism, and made observations for determining the declination, dip, and intensity at many stations throughout our domain.

It has published and maintains Coast Pilot volumes of the Atlantic and Pacific coasts and parts of Alaska.

In regard to the present activity of the Survey, a few words will prove of interest. The completion of the transcontinental triangulation and that of the oblique arc has rendered it possible to adopt a single system of geographic coördinates for all points in this country which have been trigonometrically determined, and the office is engaged in the great and useful task of making the computations and preparing them for publication. Coöperation between the Lake Survey and the Coast Survey has resulted in the adoption by the former of the same system, and the necessary computations to bring about this unification have been made. At the same time, a comprehensive investigation of the deflections of the plumb-line throughout the area covered by the triangulation is in progress, and one of its immediate results will be to guide the Survey in making future gravity researches.

A few years ago Congress authorized, by increased appropriation and legislation, the extension of the magnetic survey of the country. Magnetic observatories, equipped with the most modern and economical appliances, are being maintained—one in Maryland, one in Kansas, one at Sitka, Alaska, and one in Hawaii. These observatories, at the formal request of the German government, are coöperating, in common with others under foreign governments, with the German and British South Polar Expeditions by making simultaneous observations. At the American observatories the magnetic instruments record photographically day and night the changes of the magnetic forces. Rapid progress has been made in the accumulation of magnetic data, their discussion, and publication. Meridian lines to aid surveyors are being established at or near county seats of the several states. There has just been issued a comprehensive volume of declination tables and isogonic charts.

As a member of the International

Geodetic Association, the Coast and Geodetic Survey supervises the maintenance of two astronomical observatories established exclusively for the purpose of observing the variation of latitude.

The Tidal Division has made good progress not alone in the reduction of tidal observations and in the publication of predictions, but has devoted attention to the theoretical investigations needful in this important and difficult branch of applied science.

The Coast Pilot Division issued last year a new Coast Pilot of Southeastern Alaska. It has in preparation another volume of the Pacific coast from San Diego to Puget Sound, and has just completed, in the field, an examination of the coast from Eastport to Point Judith.

The triangulation along the 98th meridian is progressing with remarkable rapidity in consequence of carefully devised plans, which prescribed the method to be followed along efficient and economical lines without any sacrifice of accuracy. During the last season an axial distance of about 400 miles was measured, which in itself constitutes an arc of no mean extent.

Speed trial courses based on the triangulation of the Survey have been laid out in various localities at the request of the Navy Department.

At the request of the states of Pennsylvania and Maryland, a remarking of Mason and Dixon's line has been undertaken by the Survey in coöperation with commissioners from those states, and the work is nearly finished.

Two officers of the Survey were appointed by the United States Supreme Court to take part in the remarking of the disputed boundary between Virginia and Tennessee, and this work has reached a conclusion.

The work of determining trigonometrically light-houses and beacons along the coasts of Maine and Massachusetts erected or rebuilt since the original triangulation was made, and elsewhere, was taken up and a junction was made between the secondary coast triangulation near Beaufort, South Carolina, and the oblique arc near the northeastern corner of Georgia.

Revisionary hydrographic surveys were made in Nantucket Sound, in New York Bay and in the Chesapeake Bay and its tributaries, as well as on the Gulf coast, and new hydrographic developments were made on the coasts of Porto Rico.

PORTO RICO

In the survey of that island great progress has been made. The entire shoreline of Porto Rico, Vieques, and Culebra Islands has been mapped. A triangulation extending from Mona Island on the west to St Thomas on the east has been made. It encircles the island of Porto Rico and traverses it in the direction from San Juan to Ponce. Surveys of all the ports have been made and are either published or in process of publication. A corrected general chart of Porto Rico and adjacent waters embodying all the work done has been engraved on copper and is in the printer's hands, and a series of 4 charts on a scale of 1 : 100,000 is rapidly being prepared and two of these will soon be issued. Tidal and magnetic observations have been made at numerous points. The harbor charts which have been published or which are about to appear are those of San Juan, Fajardo, Culebra, Port Mulas, Bahia Honda, Ponce, Guyanilla, Guanica, and Mayaguez.

The hydrography of by far the greater part of the south coast has been finished, and great progress has been made on the west coast, but more especially on the east coast, which is the scene of the coming naval maneuvers. There an area of no less than 400 square miles has to be sounded out with minute accuracy, owing to the importance of the locality and the irregularities of the bottom which accompany coral formations.

ALASKA

In Alaska, Cross Sound and Icy Straits have been surveyed and much work has been accomplished in Prince William Sound, which promises to become one of the most important regions commercially in Alaska. During the last season two survey vessels were at work in that Sound. A chart of Fox Island Passes and the dangerous region of the Sannak Islands has been published. One of the surveying vessels was employed in a chronometric longitude expedition to determine respectively the geographical positions of the eastern end of St Lawrence and the western end of Nunivak Islands, and a successful termination of the expedition has been announced.

IN THE PHILIPPINES

In the Philippines most gratifying progress has been made under the direction of Mr. George R. Putnam, a gifted and energetic officer of the Survey. An office was established at Manila, and it was organized to publish the preliminary results of the work accomplished with the least possible delay.

The sub-office at Manila has published over thirty charts, many of them original surveys. It has availed itself of the facilities afforded by the cable and telegraph lines recently established and has determined the telegraphic longitude of the principal ports of the archipelago. Tidal and magnetic observations have been made and sailing directions have been printed in pamphlet form in addition to the continued issue of Notices to Mariners which were given to the public with great expedition. A small ship called the *Research* was provided by the island authorities for the use of the survey, and a larger vessel has been actively engaged there for over a year.

JADE

By S. E. Easter

JADE, which has been found in every part of the world—China, Burma, New Zealand, Alaska, Mexico, and central Europe—is the best illustration of the universal passion of all primitive peoples for the possession of green stones. From prehistoric times to the last looting of Peking, jade has been a treasure most highly prized and eagerly sought. The most famous quarries of jade are those of the Karakash Valley, in Chinese Turkestan, from which the chief supplies of the Chinese Emperors were drawn.

Much confusion has arisen from the too general application of the term "jade" to kindred mineral substances, such as saussurite, chloromelanite, pectolite, serpentine, and fibrolite or sillimanite, and Dr Fischer has collected one hundred and fifty specimens of stones carelessly called jade. Properly speaking, jade only includes *nephrite*, a variety of amphibole, and *jadeite*, one of the pyroxene group.

Nephrite, which occurs more frequently than jadeite, and the best-known quarries of which are those of Chinese Turkestan, is, according to Dana, a tough, compact, fine-grained tremolite (or, in green specimens, actinolite), breaking with a splintery fracture and glistening luster. Its specific gravity is

2.96–3.1, and it varies in color from wax white, cream white, green white, greenish gray to pale green, passing through many gradations to the very darkest green, in which variety iron protoxide is present up to 6 or 7 per cent.

Jadeite, which occurs in the Mogoung District, in Upper Burma, and in the Province of Yun-nan, China, is essentially a metasilicate of sodium and aluminium and has a specific gravity of 3.33–3.35 and a hardness of 6.5–7. Its luster is subvitreous and its fracture splintery, while in color it varies even more than nephrite. It may be gray green, bluish green, bluish gray, clear gray, orange yellow, smoky green, passing to black (the latter resembling the nephrite of Siberia), smoky white, white with green tints and splotches, and apple green; also, but rarely, violet and mauve. All the green tints are, as a rule, much brighter than those of nephrite. The so-called "jewel jade," the Chinese *fei tsin* (kingfisher—feather color), is jadeite of an intense emerald hue. It is seldom found, and then generally in thin veins and often much flawed. It is said to be harder than ordinary jadeite. Much of it is taken to Canton, where it is converted into jewelry. In earlier times, this apple-green jade was not so highly valued as the darker olive shades, while the Emperors of the Ming Dynasty (1368–1664) esteemed pale bluish-green specimens above all others, and white next held imperial and Manchu fancy.

Both nephrite and jadeite have a waxy, oily surface and take a high polish in the hands of oriental artisans. When modern European machinery is used, a dazzling, mirror-like surface is obtained. Though generally opaque or translucent, there is a very rare variety known as "camphor jade," from its appearance, which resembles a much-flawed crystal, and is actually transparent in spots. Under the name of "oceanic jade," Damour describes a variety found in New Caledonia and the Marquesas Islands, "which possesses a somewhat silky luster, due to exceedingly delicate fibers which traverse the mass, and which has a specific gravity of 3.18."

Collectors of jade objects of the present day have given much attention to distinguishing, by means of the scientific tests of specific gravity, analysis, and microscopical examination, between true nephrite and jadeite and the numerous substances which, so far as outward appearances go, resemble them. The common and predominant characteristic of all the stones to which the name jade from time to time has been applied is their tenacity. Their compactness of texture and extreme toughness recommended them in prehistoric times as the best materials from which to manufacture tools with sharp cutting edges. Since jade in its natural state was for a long time vainly sought in Europe, many scholars concluded that the jade implements found in the Swiss lake dwellings, or the materials from which they were made, must have been brought from the quarries in Turkestan. If, it was argued, jade were a product of the countries in which these implements were found, how did it happen that it was never discovered by the races who succeeded the men of the Palæolithic Age? There is no evidence of jade having been employed by the Greeks and Romans for any purpose, nor was it kuown in mediæval times. As it was only through its introduction from Mexico by the Spaniards that modern Europe was made aware of its existence, it was questioned whether Aryan wanderers could have brought these jade objects with them from the Kuenlun Mountains. Professor Max Muller asks: If the Aryan settlers could carry with them so ponderous a tool as their language, what is surprising in their having carried along, preserved from generation to generation, such handy and valuable instruments as these jade celts?

Lengthy discussions were waged as to how this "venerable witness to the brotherhood and intercommunication of the human race" first found its way into Europe, and the famous "nephrite question" long divided European scientists. By many it was insisted that jade implements were brought by migratory tribes from the cradle of their race in Asia, the perfect fitness of the material to the uses to which it was put, as well as the inherent preciousness of the stone, rendering such instruments of sufficient value to be prized and preserved throughout the many generations who lived and died ere the long march ended.

Other investigators held that jade celts, or the material for making them, were objects of actual commerce between Europe and the Orient; but Sir John Lubbock considers it more probable that they were passed from hand to hand and tribe to tribe by a system of primeval barter. As a parallel case, he cites the tumuli of the Mississippi Valley, where the same mound often contains copper from Lake Superior, mica from the Alleghanies, shells from the Gulf, and obsidian from Mexico.

The discovery of jade implements in Swiss lake villages followed long after their occurrence in a stone tomb in Normandy, in caves in Brittany and at Mentone, in the tumulus of Mont St Michel, and in southern Italy. Schliemann found thirteen jade celts in the ruins of ancient Troy. One of these celts and one other found in Crete are the only white celts so far found in Europe. The British Museum possesses one Babylonian cylinder of jade, and also a gold necklace with a small jade celt as a pendant. Both faces of the pendant are occupied by Gnostic formulæ engraved in Greek characters. The formulæ are cut in the outline of a wreath of fourteen leaves, the ends being tied together with four ribbons, on which are engraved different combinations of the Greek vowels, while each leaf is emblazoned with a holy name. The other face of the celt is covered with an inscription in eight lines. This celt, which is supposed to have come from Alexandria and, judging from the character of the lettering, to date from the third or fourth century, is the only known specimen of jade bearing indisputable marks of either Greek or Roman workmanship. It was a celt originally, however, and not an object of Greek manufacture.

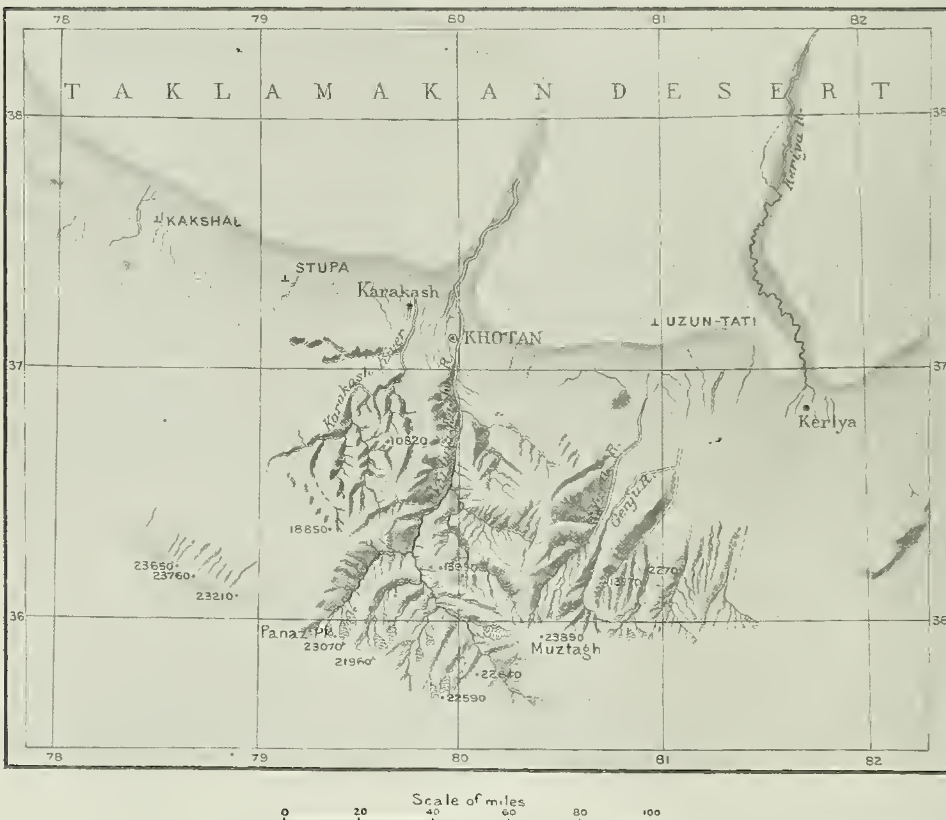
There is no ancient name for jade in any European language. Its name is derived from the Spanish *pietra de hijada*, "stone of the loins," a reference, doubtless, to the Aztec superstition that jade was the surest protection against diseases of the loins.

Jade has been known to the Chinese since the earliest times as *Yu*, or "the gem." They class the different kinds of jade under seventy-seven heads, but for the mineral itself they have no distinct, generic name. It is the typical precious stone, the gem. Throughout every age they have attached an extraordinary value to it, comparing it to "the subtle matter of the rainbow concreted and fixed under the form of a stone," and regarding it as the most beautiful substance in which human thought can embody itself. Confucius explained this by telling one of his disciples that "in the eyes of wise men its polish and its brilliancy represent virtue and humanity, and its perfect compactness and extreme hardness the safeguards of intelligence; the angles of jade, which, seeming sharp yet do not cut, represent justice; the little buttons which hang from the hat or belt, as if about to fall, represent ceremony and politeness; the sound—pure, sustained, and prolonged—which it gives forth when struck and which ceases suddenly, represents music; the impossibility for the bad shades to hide the beautiful, or the beautiful the bad, represents loyalty; the defects under the surface, yet apparent, represent sincerity; its luster, like that of the rainbow, represents the firmament; its wonderful material, extracted from the mountains and waters, represents the earth; cut into Kueï or Chu, without other embellishment, it symbolizes virtue, and the price at which all the world values it symbolizes truth."

This passion for jade, the classic or poetic color of which is white in China, causes Chinese writers to use the word figuratively whenever they wish to indicate anything very white, very pure, or very perfect. In the language of compliment no word of praise rises above that which likens beauty to jade, and the loftiest thought, as well as the highest morality, are compared to it. References are constantly made to it in poetry, as in the Emperor Kien-lung's verse—

> "While the waning moon in the westward
> hangs like an orb of jade."

The most ancient of the Chinese classical books, the Shu King, or Book of Historical Documents, relating to the period B. C. 2357 to 627, mentions jade

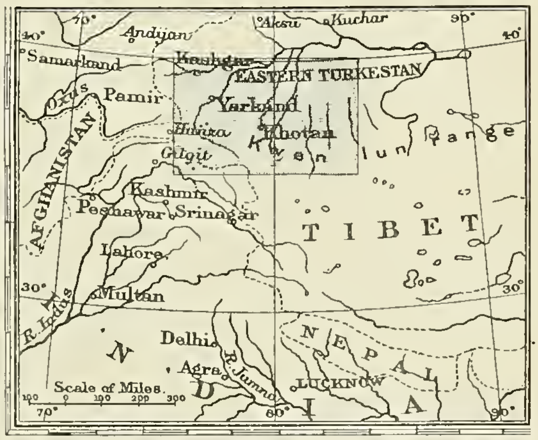


Preliminary Survey Map of the Khotan Valley, Site of the Chinese Jade Mines. By Dr M. A. Stein, H. M. Indian Educational Service. Printed by Courtesy of Dr. M. A. Stein and Royal Geographical Society, London.

as one of the articles of tribute of the Province of Yung Kan, which embraced nearly all the present provinces of Shenhsi and Kan-su, and extended indefinitely northward to the desert.

It is an old saying with the Chinese that "jade stone comes from the Kuenlun Mountains, in the Province of Khotan," and in the history of the T'ang Dynasty (618–906) reference is made to a yearly tribute of 500 pieces of jade sent to the Emperor by the king of that region. Travelers describe the jade quarries as situated on the south face of the Kuenlun Mountains, in the main valley of the upper part of the Karakash River, south of the city of Khotan. They extend for a mile or more in length, and in this space are the entrances of at least a hundred tunnels which riddle the mountain side in every direction, and in some cases pierce through the mountain to the further side. The mineral is found in veins of varying thickness, in width from a few inches to ten feet, but so seamed and cracked as to make it difficult to find a piece even a few inches thick which is not badly flawed. Until the middle of the last century China maintained her authority over eastern Turkestan, including Yarkand and Khotan. The people, however, were Mohammedan, and in 1852 they succeeded in throwing off the Chinese yoke by a general uprising, in which all the officials were massacred. The jade workers, who were Chinese, probably fled from the quarries at this time and shared the fate of their countrymen. Their clothing, implements, and remnants of food were left in their haste, and were seen by Cayley when he visited the quarries in 1871. Work has since been resumed, but too many of the expert carvers and workmen were killed during the rebellion for the industry to recover its former preëminence.

Loose boulders of jade are often carried down by the force of the current in the Karakash and tributary streams, and they eventually become embedded in the soft clay banks or are deposited in the bed of the river. This "water jade" is highly valued by the Chinese carvers, as its rough journey is a severe test of hidden flaws, which might otherwise cause the block to fall to pieces after much labor has already been expended on it. It is obtained either by digging the boulders out of the banks or by divers specially trained for the work. An inspector always accompanies these diving parties, whose duty it is to mark each lump as it is brought up, estimate its value, and finally ship the jade to Peking. Such pieces bring three times the price of quarried specimens of similar size and color.



Eastern Turkestan. After the Map of Dr M. A. Stein, Indian Educational Department. Reprinted by courtesy of the Royal Geographical Society and Dr M. A. Stein.

In many rivers of eastern Turkestan jade pebbles are found in abundance. The word "kash," so often found in the names of rivers and places in this region, means "jade" in Toorkee, and there seems little reason to doubt the existence of the mineral along the whole of the Kuenlun range. Much difficulty is experienced in tracing the veins, owing to the shifting sands.

A huge dike of nephrite embedded in the rocky banks of the Raskemdaria, on the eastern slope of the Pamir, was another source from which the Chinese formerly drew large supplies of jade. They extracted it by lighting large fires on the rock and then throwing water on it when it became thoroughly heated. The rock was abandoned some years ago in consequence, it is said, of the illness of a member of the Imperial family, who was taken sick after having slept on a bed made of Raskem nephrite. A large block of the stone which was then on its way to Peking was put in chains and thrown on the roadside at Kutcha, where it still remains. It was from this ridge on the Raskemdaria that the monolithic tombstone of Tamerlane was cut. This famous tomb of darkest-green jade stands in a half-ruined mosque at Samarkand, and is 7 feet 8 inches long, 17 inches wide, 14 inches high, and weighs about 1,800 pounds. It is broken through the middle, but is well polished, completely covered with inscriptions, and rests on a white marble base. In addition to this and the Karakash quarries, the Chinese also obtained jade from deposits in Yun-nan, Kan-su, Shen-se and Quang-se, and other provinces of China. Many mines throughout China are owned by private individuals, who keep the existence of their quarries secret, fearing the extortions of the government.

Jade has also been found in fair abundance on the shores of Lake Baikal, Siberia. The South Kensington Museum possesses a large, water-worn, well polished boulder from this region, weighing more than half a ton.

The Chinese use the utmost care in carving jade. The workman having determined from the natural form of the block, and its visible and probable flaws, into what object he will carve it, fixes it on a lathe and gives it the general outline. The interior is then hollowed out by first drilling, with diamond-pointed needles, innumerable little holes all over the surface which is to be broken away. When this is completely honeycombed the partitions are broken down by being sharply tapped with a hammer. Too hard a tap might develop some hidden flaw and shatter the half-finished object. The piece is finally polished with corundum. The harder the stone and the more difficult the cutting, the more brilliant the polish it is capable of acquiring. It is claimed the jade is softer when freshly taken from the quarries. So great is the difficulty of carving jade that an elaborate piece may represent a lifetime's labor. In Kienlung's ateliers, in the Summer Palace at Peking, the workmen succeeded each other without interruption night and day. Even then many years were occupied in completing a single piece.

Jade is becoming more and more appreciated as a material for interior decorative construction by the splendor-loving Russians. By cutting the stone into sections an eighth of an inch thick it is employed for the panelling of walls and chimney pieces, and even window panes—the translucent pieces showing the most exquisite shading and clouding.

European and American collections owe many of their finest specimens to the plunder taken from the Summer Palace in Peking in 1860, when the enormous collections of the Emperor of China were at the mercy of the French and British forces, who were ordered to burn and destroy all the buildings. The palace ateliers, having long been declining in activity and in the quality of their productions, had in a measure ceased jade-cutting a few years previous to the sacking of the Summer Palace, because the tribute of jade from the

Turkestan mines did not come to Peking during the Mohammedan rebellion. The imperial ateliers have not been maintained since 1860, but the treasures of jade again gathered at the Summer Palace were promptly sold or sent home by the Russian, English, and Italian troops, who in turn occupied that demesne in 1900 and 1901. The Winter Palace, the temples within the imperial inclosure, and the princes' palaces, in Peking, yielded up an enormous treasure of jade in 1900, nearly all of which has found its way since to Europe and America.

The uses to which jade has been put by the Chinese are almost endless. Discs of the stone, which when struck give forth a clear, resonant note, are used as temple gongs and musical instruments. Ritual vessels are made of it, and it is to this fact that Paléologue attributes the peculiar veneration in which the Chinese hold the stone. Tablets inscribed with sacred writings, bowls and vases of fantastic form and intricate design, statuettes of Buddha, perfect alike in conception and execution, candelabra, boxes, pencil-holders and all the paraphernalia of the writing-table, as well as buckles, bracelets, rings, hooks, buttons, and other ornaments, are all wrought with untiring patience and matchless skill from the same intractable material. Carved works of jade seldom bear any marks such as are seen on porcelain, whereby a date is indicated. Sometimes objects are inscribed with a poem or quotation, which may afford some clue to the date. All such marks are comparatively rare, and the style of ornamentation is generally the only guide. Extreme simplicity of design and purity of form characterize the earliest examples, while those of later periods are often marvels of fantastic and ornate decoration.

The Chinese rarely embellish their jade carvings with other substances, possibly owing to their excessive admiration for the stone and the symbolism with which they surrounded it. The Hindus saw in jade, however, only a green background for encrustations of many-tinted gems and gold. It afforded them opportunities for the display of their cunning, as jewelers, to combine the softly shaded tones of the jade with rubies, diamonds, and other stones, as well as scarcely less brilliant enamel. As a material for artistic workmanship, jade was only known in India from the time of the Moguls, who encouraged its employment unstintingly. The arts of carving in frost-like open-work and of inlaying, which found such perfect expression in the Taj Mahal, were lavished in miniature on jade cups, beetle-boxes, sword and dagger hilts, and turban ornaments, for which there was an unfailing demand at court. Work of a less elaborate character was sometimes executed, and a large jadeite tortoise found in a water-tank at Allahabad is now in the South Kensington Museum. It is bluish gray in color, highly polished, and nearly 20 inches long. Although mines of jadeite exist in Burma, the Hindus probably drew the greater part of their supply from central Asia, and much of that now sold by them as Yarkand jade is only chloromelanite and serpentine.

When Captain Cook visited the middle island of New Zealand the natives told him it was called Te Wahi Pounamu, or "the place of the green stone," because all of their much-valued green stones came from that island. In old atlases the island is still called Tavai Poenammo, a corruption of the native name. The natives, like the primitive inhabitants of Europe, fashioned weapons called "Meri" from the coarser varieties. Like the celts of the Lake-dwellers, too, many of their implements show traces of having been formed by sawing. There is a large block of New Zealand jade in the British Museum retaining the cutter's grooves, and the New York Museum of Natural History contains a similar piece from a primitive Alaskan workshop. Of the finer and more translucent specimens of jade the New Zealanders carved their "tiki." These objects were worn about the neck, and are said by some to have been title deeds of land, as well as venerated charms and symbols of ancestor worship. There is a grotesque figure of New Zealand jade in the British Museum which was evidently carved with much care. The eyes are inlaid in mother-of-pearl.

Jade implements, chiefly celts, have been found along the entire coast of British Columbia and Alaska from the Straits of Fuca to the Arctic Sea, and arrow-heads have been brought from the Arctic coast of both Alaska and Siberia. Such stone implements were highly valued by the Indians, who in some cases still preserve them, although they no longer use them. The majority of jade celts which owe their origin to this region have been discovered in Indian graves, in shell heaps, and on the sites of former villages. Whether the jade thus employed was brought from Asia or found on the spot was for a long time an open question. The discovery of the mineral *in situ* in the vicinity of the Fraser River and in rolled pieces on the Lewes branch of the Yukon has placed its origin beyond dispute.

Jade was known to the Aztecs as the "divine stone," and was valued next to the emerald, with which it was often confused by the early Spaniards. As a religious symbol, it was placed on the altars. It was carved by the Aztecs in the form of parrots' heads, fish, etc., and worn as a charm against kidney troubles and epilepsy. This superstitious esteem for the medicinal qualities of the stone was carried to Europe by the Spaniards, and at one time there existed jade merchants in Paris who sold medals of jade as a remedy for these diseases. The Aztecs also carved masks from jade, which were used in the temples to cover the face of the most illustrious of the gods when the King fell ill. They did not remove them until the recovery or death of the patient. At other times these masks served as a decoration of the temple walls.

In Central and South America similar uses for jade and jade-like stones obtained, and, as in every other quarter of the globe where the stone was known and used, it was held in an esteem amounting, in many cases, to actual reverence.

Collections of jade are found in nearly all the great museums of Europe, perhaps the most notable being that of the South Kensington Museum, which possesses superb examples of the jewel-inlaid Indian jade. The specimens in the British Museum are valuable chiefly from a mineralogical and archæological point of view. A number of choice pieces are owned by the Musée Ethnographique in the Louvre and the Musée Guimet, in Paris. The Musée Chinois at Fontainebleau owes its fine collection of jade to the gifts of French officers to the Empress Eugenie after their return from the campaign in China in 1860. Jade objects which have been presented to the imperial family of Russia are exhibited in the Peter the Great Gallery at St Petersburg. Among the treasures of the Sultan in the old Seraglio at Constantinople are many sword hilts and other small objects of jade.

Although these museums contain many individually fine specimens of jade, no one of them possesses a truly complete collection. American collectors of Orientals have long shown their appreciation of the beauty of jade objects, and the collections of Messrs Brayton Ives, Henry Walters, Thomas Waggaman, and Frederick Ames contain many unique and perfect examples of the jade carver's art. It was left for an American, Mr Heber Bishop, of New

York,* to make the first comprehensive and general collection of jade. The Bishop collection recently presented to the Metropolitan Museum of Art in that city embraces every variety of the stone, and includes examples by prehistoric and primitive jade workers as well as the greatest gem-cutters of the Mogul and Chinese courts. Years of work have been devoted to the descriptive catalogue of this collection, which will be the authoritative work on the subject.

*On December 10, 1902, since this article was written, Mr. Bishop died at his residence in New York City. By the terms of his will ample provision has been made for the preservation of his famous collection in a special room of the Metropolitan Museum of Art.

SOME NOTES ON VENEZUELA

VENEZUELA was the first part of the American continent sighted by Columbus. During his third voyage, in 1498, he first saw the coast from the Island of Trinidad, and thought that it was another island; but the fresh water of the Gulf of Paria, whose shores he coasted for several weeks, soon convinced him that great continental rivers were pouring into the gulf, and that the vast Asiatic continent at last stretched before him. Sickness prevented him from making extended explorations of the coast and sent him back to Hispaniola.

The following year Alonzo de Ojeda, accompanied by the celebrated Amerigo Vespucci, traced a greater extent of the Venezuelan coast. It was Ojeda who gave the country its present name—Venezuela.*

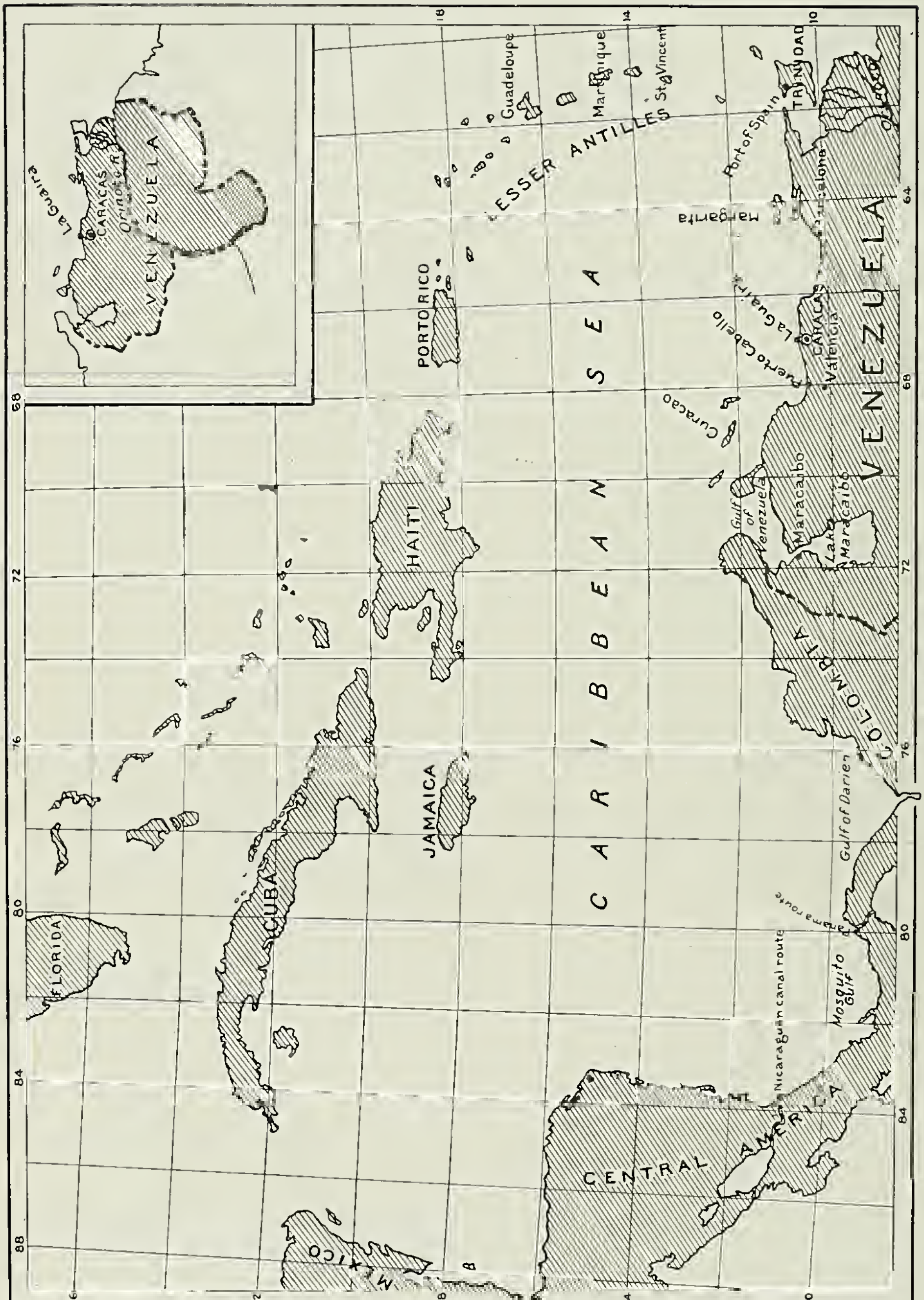
"Proceeding along the coast, he arrived at a vast, deep gulf resembling a tranquil lake, entering which he beheld on the eastern side a village, the construction of which struck him with surprise. It consisted of twenty large houses shaped like bells and built on piles driven into the bottom of the lake, which in this part was limpid and of little depth. Each house was provided with a drawbridge and with canoes, by which communication was carried on. From these resemblances to the Italian city, Ojeda gave to the bay the name of the Gulf of Venice, and it is called to the present day Venezuela, or Little Venice. The Indian name was Coquibacoa."

After a small skirmish Ojeda "sent a detachment of twenty-seven Spaniards on a visit to the interior. For nine days they were conducted from town to town and feasted and almost idolized by the Indians, who regarded them as angelic beings, performing their natural dances and games and chanting their traditional ballads for their entertainment.

"The natives of this part were distinguished for the symmetry of their forms; the females in particular appeared to the Spaniards to surpass all they had yet beheld in the New World for grace and beauty. Neither did the men display in the least degree that jealousy which prevailed in the other parts of the coast.

"By the time the Spaniards set out on their return to the ship the whole country was aroused, pouring forth its population, male and female, to do them honor. Some bore them in litters or hammocks, that they might not be fatigued with the journey, and happy was the Indian who had the honor of

*Washington Irving: "Life and Voyages of Christopher Columbus and the Voyages and Discoveries of the Companions of Columbus." Five vols. Vol. IV, p. 166. G. P. Putnam's Sons, New York.



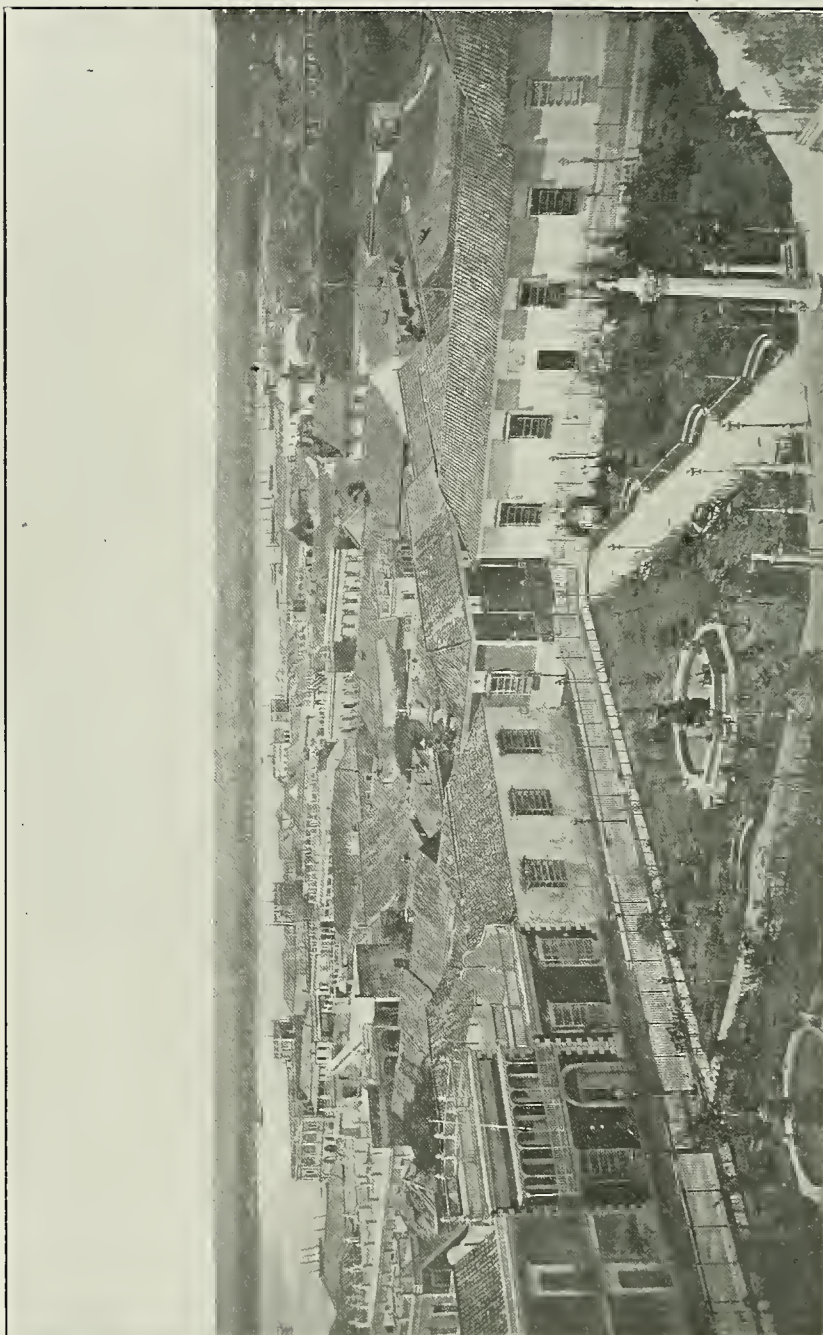
Outline Map Showing Geographical Relation of Venezuela to the Isthmian Canal Routes, to the West Indies and Florida bearing a Spaniard on his shoulders across a river. Others loaded themselves with the presents that had been bestowed on their guests, consisting of rich plumes, weapons of various kinds, and tropical birds and animals. In this way they returned in triumphant procession to the ships, the woods and shores resounding with their songs and shouts."

Venezuela has a larger area than the combined areas of the great States of Texas, Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Oklahoma, and Arkansas. In figures its area amounts to about 590,000 square miles. The population is 500,000 less than that of Massachusetts. In 1891 it was 2,323,527. The capital, Caracas, has 75,000 inhabitants, Maracaibo 35,000, La Guaira 15,000, and Barcelona about 13,000. About one person out of every one hundred is pure white, while the others are descendants of black slaves, mulattoes, etc., and Indians.

The republic has three zones—hot, temperate, and cool—according to the elevation of the land. The lowlands in the northwest are very torrid. Here great quantities of coffee and cacao are raised, which form the largest agricultural exports of the country. The cacao is sent mainly to France, Germany, and Spain, and the coffee, which averages a yearly crop of 55,000 tons, to the United States. South and east of the lowlands, extending eastward to Caracas, are high mountains, where, the climate being temperate, most of the people live. Caracas, the capital, is 3,000 feet above the sea. Trade winds prevent the extremes of heat suffered in the corresponding latitude of northern Africa. The mean temperature at Caracas is only 71°.2 Fahr. On the coast it averages from ten to twelve degrees higher.

A View of Caracas

Vast llanos, or great plains, stretch south of the mountains, making splendid runs for cattle. South again of the



The Port of Maracaibo

The University—Caracas

plains, beyond the Orinoco, are vast forests, from which the natives get rubber, tropical woods, and vanilla. There are also gold diggings south of the Orinoco, which yielded over $600,000 for export in 1900.

Almost nothing is manufactured beyond the cheapest grades of goods. The larger share of the imports come from the United States—$3,271,000 worth in 1901, consisting of flour, lard, hardware, and cotton goods, on all of which a heavy duty was levied. England and Germany send the next largest amount of goods. Venezuela sent in return to the United States in 1901 $6,645,000 worth of coffee, cacao, and skins, all entering free of duty. The annual revenue of Venezuela is about $7,500,000, obtained mainly from customs duties.

AN INTRODUCTION TO PHYSICAL GEOGRAPHY*

DURING the last few years the general public has felt a deeper interest in the facts of the earth—in what the earth is and what it hides—than it has probably ever experienced before. The fearful upheavals in Martinique, St Vincent, and Guatemala, attended by a general natural unrest throughout the globe, have aroused a wide spread desire to understand what

*_An Introduction to Physical Geography._ By Grove Karl Gilbert and Albert Perry Brigham. With 263 illustrations. Pp. 380. 5½ x 8 inches. New York: D. Appleton & Co. 1902.

is known—little though that knowledge is—of the mysterious forces writhing under the earth's crust. The coal strike in the United States has aroused an interest of a different character—an inquiry as to what coal is and how it happens to be stored in certain localities and not in others as well. The prolonged and successful agitation for irrigation in the West and for forest reservations has also had its share in arousing the public to other questions relating to physical geography, as, for instance, weathering and soils, forests and rainfall.

Therefore a book about Physical Geography, written in a simple and interesting manner and not loaded down with innumerable technical terms which are of value to the specialist but not to the general public, is especially welcome. Such a volume has recently been written by Messrs G. K. Gilbert and A. P. Brigham, and published by Messrs D. Appleton & Co., of New York. The authors modestly call the work "An Introduction to Physical Geography." It is planned especially as a text-book for schools and has already gained much success. A second edi-

From Gilbert's and Brigham's "Introduction to Physical Geography." D. Appleton & Co.

Figure No. 1—Watkins Glen; a Gorge Carved from Beds of Shale tion was called for within a few weeks of the publication of the first. But the volume will gain a wider field than the ordinary text-book, for it will appeal to that growing class of amateurs who have been seeking a plain but fascinating description of the present and past facts of the earth.

The treatment, so far as possible, is concrete. Wherever practicable, each subject is opened with a type case, illustrated by a picture of some graphic example. About one-half of the book is given to the lands. The relation of organisms to the earth is introduced wherever appropriate.

Two hundred and sixty-three illustrations, all very well chosen and admirably engraved, accompany the text. By permission of the publishers, six typical illustrations are reproduced in this Magazine.

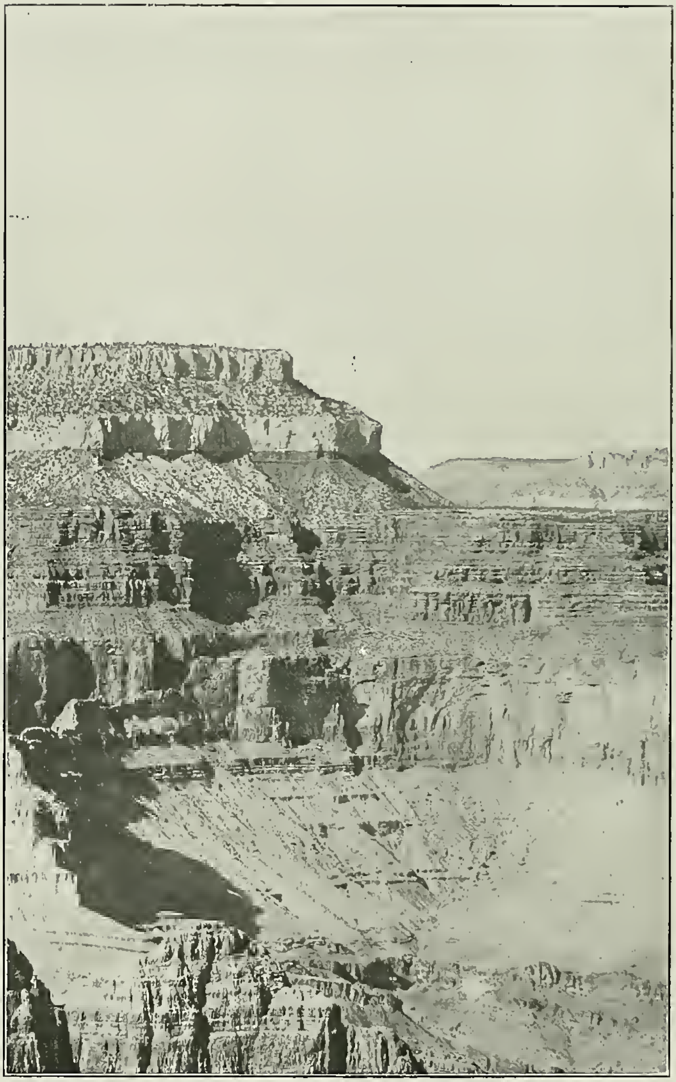
Figure No. 1 is a picture of the noted Watkins Glen, which during the process of time a small stream has carved in the soft rock of the mountain. In some places the stream has cut to a depth of 200 feet; sometimes the gorge is scarcely more than 10 feet wide, and at others broadens into large amphitheaters, in which one's voice echoes and reëchoes with weird effects. The chasm is at the head of Seneca Lake, New York, from which, winding and curving abruptly, it penetrates Glen Mountain for a distance of three miles.

Figure No. 2 is a graphic example of the effect of rain wash. Rain has soaked and softened the rock; then little rills have started, and have gradually worn deep channels of their own, making the high pinnacles.

Figure No. 3 illustrates the different kinds of rock, some hard and some

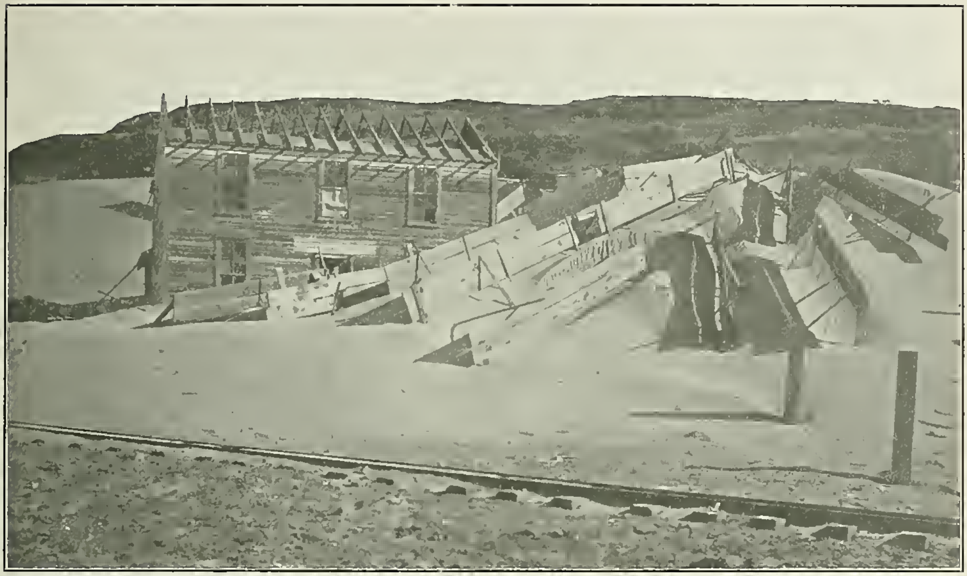
From Gilbert's and Brigham's "Introduction to Physical Geography." D. Appleton & Co.

Figure No. 2.—A Pebbly Rock Carved by Rain; Russian River, California



From Gilbert's and Brigham's " Introduction to Physical Geography." D. Appleton & Co.

Figure 3.—Rock Edges (limestone and sandstone) and Waste Slopes (concealing shale). Grand Canyon of the Colorado River, Arizona



From Gilbert's and Brigham's "Introduction to Physical Geography." D. Appleton & Co.

Figure 4.—The Last House in Riggs, Oregon, a Village Overwhelmed by Dunes. Attempts to hold the sand back by fences were unsuccessful

soft, of which almost every mountain is made.

Figure No. 4, an example of wind work, shows a substantial house in Oregon nearly buried by drifting sand. In Chinese Turkestan, Sven Hedin has recently discovered the ruins of great temples where flourished 2,000 years ago cities with a high degree of culture and civilization. Here in the heart of Asia populous cities and lakes have been buried beneath drifting dunes.

Figure No. 5 shows how some of the people of Cape Cod, Massachusetts, check the advance of the sand by planting grass, which binds the sand and keeps the wind from lifting it. Common oleanders are used for this purpose in Bermuda. Where no effort has been made to check its advance, a dune has been known to migrate as much as 70 feet in one year.

The authors of "An Introduction to Physical Geography" are very well

From Gilbert's and Brigham's "Introduction to Physical Geography." D. Appleton & Co.

Figure No. 5.—Planting Grass to Stop the Drifting of Sand, near Provincetown, Cape Cod, Mass.

From Gilbert's and Brigham's "Introduction to Physical Geography." D. Appleton & Co.

A Traveling Beach on the Shore of Lake Ontario. The stones originally angular become rounded as the waves roll them along

known in the scientific world. Mr Gilbert, geologist of the U. S. Geological Survey, is a past president of the American Association for the Advancement of Science. He was the recipient of the Wollaston Prize of the Geological Society of England in 1899, and is the author of "Geology of Henry Mountains," "Lake Bonneville," etc. Mr Brigham is head of the department of geology in Colgate University and the author of a well-known text-book of geology.

DR SVEN HEDIN

THE distinguished Swedish explorer, Dr Sven Hedin, who ended his last famous expedition to Central Asia in December, 1901,* is at present receiving one continuous series of ovations throughout Europe. He has given lecturing tours in Sweden, Russia, Denmark, England and Scotland, and after New Year's commences a tour in Germany, France, Austria and Hungary, and Norway. It had been hoped that he would visit America this winter, but he writes that his

* See the *National Geographic Magazine* for March, 1902, page 96.

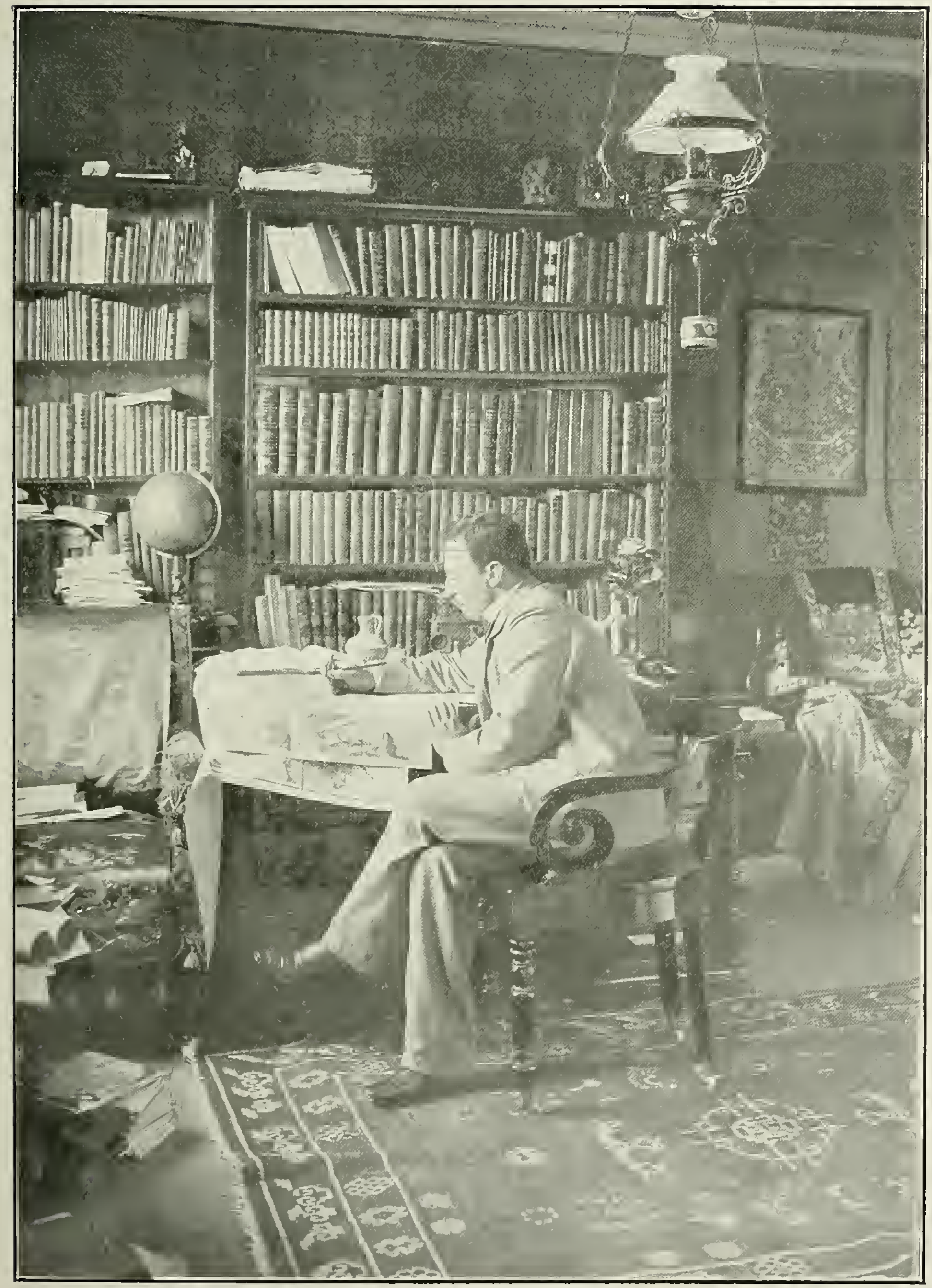


Photo by Dahllof, Stockholm

Dr Sven Hedin in His Study, Stockholm

Republished from the Bulletin of the American Geographical Society of New York

Outline Map of Peary's Sledge Routes and Surveys engagements in Europe make a trip across the Atlantic impossible this year.

Sven Hedin was born in Stockholm, February 19, 1865. He was educated at the universities of Upsala, Berlin, and Halle, and from the last received the honorary degree of Ph. D. His first journey of exploration was in 1885-'86, from Persia to Mesopotamia; in 1891 he traveled in Turkestan; during 1892-'95 he traveled right across Asia from Russia to Peking, penetrating Tibet and studying the Lob-nor district. The results he published in a splendid volume, "Through Asia" (Harper and Bros.). His latest and most important expedition was begun in 1899, and has yielded valuable information about the geography of Chinese Turkestan and Tibet, and of the cities which flourished in the Lob-nor region 2000 years ago and have long since been buried beneath the desert sands.

PEARY ON THE NORTH POLE

IN a lecture before the National Geographic Society November 29, 1902, Commander Robert E. Peary stated very emphatically that he believed the North Pole could be reached by making Cape Hekla, in northern Grinnell Land, the starting point for the sledging trip north. The average distance of Peary's four Arctic sledge journeys over the ice is slightly greater than the distance from Hekla to the Pole and back. If the next arctic explorer will make Cape Hekla his base, will pass the winter there, and starting from that point in spring fight his way as many miles northward over the ice as Peary averaged in his four journeys under equal conditions, he will gain the Pole itself and have ample time to return before the ice pack becomes impassable. To quote from Mr. Peary's address:

"There are two facts I wish to bring to your attention, not in a boastful manner, but as bearing upon the feasibility of reaching the Pole. First, the average air-line distance from start to finish of four sledge journeys which I have made in high arctic latitudes is the same as the distance from the northern shore of Grinnell Land to the Pole. Second, the air-line distance from start to finish of my 1900 sledge journey is such that had my starting point been in the same latitude as that of Abruzzi it would have taken me to the Pole, or had my starting point been in the same latitude as Nansen's or on the northern shore of Grinnell Land, it would have carried me beyond the Pole.

"It may seem to indicate overconfidence to state boldly that the Pole can be reached, and yet it is a fact, even though the struggle for it has been going on unsuccessfully for years and years. Each time we have come a little nearer, each time we have learned a little more, and I say to you here tonight that it is not an impossibility; that it can be done, and that it is no more difficult than many of the great projects which we see being pushed to completion every day and which require money, persistence, hard work, and some ability to bring the full fruition.

"The man who can secure a starting point in early spring on the northern coast of Grinnell Land, who has with him the proper party and the proper equipment and experience, will hold within his grasp the last geographical prize that the earth has to offer—the prize which will rank with the prize which Columbus won for himself and his countrymen, a fame which will last as long as human life exists on the globe."

PLAN FOR CLIMBING MT McKINLEY*

By Alfred H. Brooks and D. L. Reaburn

Of the U. S. Geological Survey

DURING the past summer the writers were engaged in a reconnaissance survey in Alaska† which extended from the Pacific coast through the Alaskan Range and along its western base to Yukon waters. The route of travel lay close to the foot of Mt McKinley, and though it was no part of the plan to ascend the mountain, for which there was neither time nor facilities, time was taken to climb its slopes to snow line, and the members of the party were undoubtedly the first white men to approach the summit.

The Alaskan Range is a rugged mountain mass which extends to the northeast from the vicinity of Lake Clark, and sweeping around the great Sushitna Basin forms the watershed between Cook Inlet on the southeast and the Kuskokwim and Tanana waters on the northwest. On the east and south it rises by a series of foothills from the Sushitna River lowland and on the west it falls off abruptly to a gravel-floored plateau, which slopes gradually toward Kuskokwim waters. The southern end of the range has not been explored, but the peaks probably have attitudes of from 7,000 to 9,000 feet, while to the northward the relief increases very much and the range culminates in Mt McKinley, over ‡ 20,000 feet in height, and Mt Foraker, fourteen miles to the southwest, about 17,000 feet. To the northeast the range includes a number of peaks which are from 10,000 to 14,000 feet high, Mt Hayes, lying between the headwaters of the Cantwell and Delta rivers, being the highest. The crest line of the range lies near its western margin.

In 1898 Eldridge and Muldrow § surveyed the Sushitna River, while Mendenhall traversed the eastern end of the range; Spurr and Post crossed the southern end, and Peters and Brooks explored the region to the north along the Tanana River. In the following year, Lieut. Joseph S. Herron, U. S. A., ‖ made an exploration in the southern part of the Alaskan Range and also of a part of the Kuskokwim basin. These investigations, together with the explorations carried out by the writers, have outlined this great mountain mass, which, as has been shown, contains several of the highest peaks on the continent. The results of these surveys have given not only geographic data, but also thrown much light on the conditions of travel, distribution of timber, and on the climate of this province. The time, therefore, seems now ripe to plan an ascension of Mt McKinley.

Mt McKinley (latitude 63° 04′, longitude 151°, see map) lies in about the center of the range, measured in a northeast-southwest direction, and its summit is only about ten miles distant

* Published by permission of the Director of the United States Geological Survey.

† A report embodying the results of this expedition is now in preparation.

‡ The final adjustment of surveys have not yet been made, so that the exact altitudes can not now be given.

§ For reports on these expeditions see Vol. VII, Twentieth Annual Report, U. S. Geol. Survey.

‖ "Explorations in Alaska in 1899." War Dept., Adjutant-General's Office, No. XXXI, March, 1901.

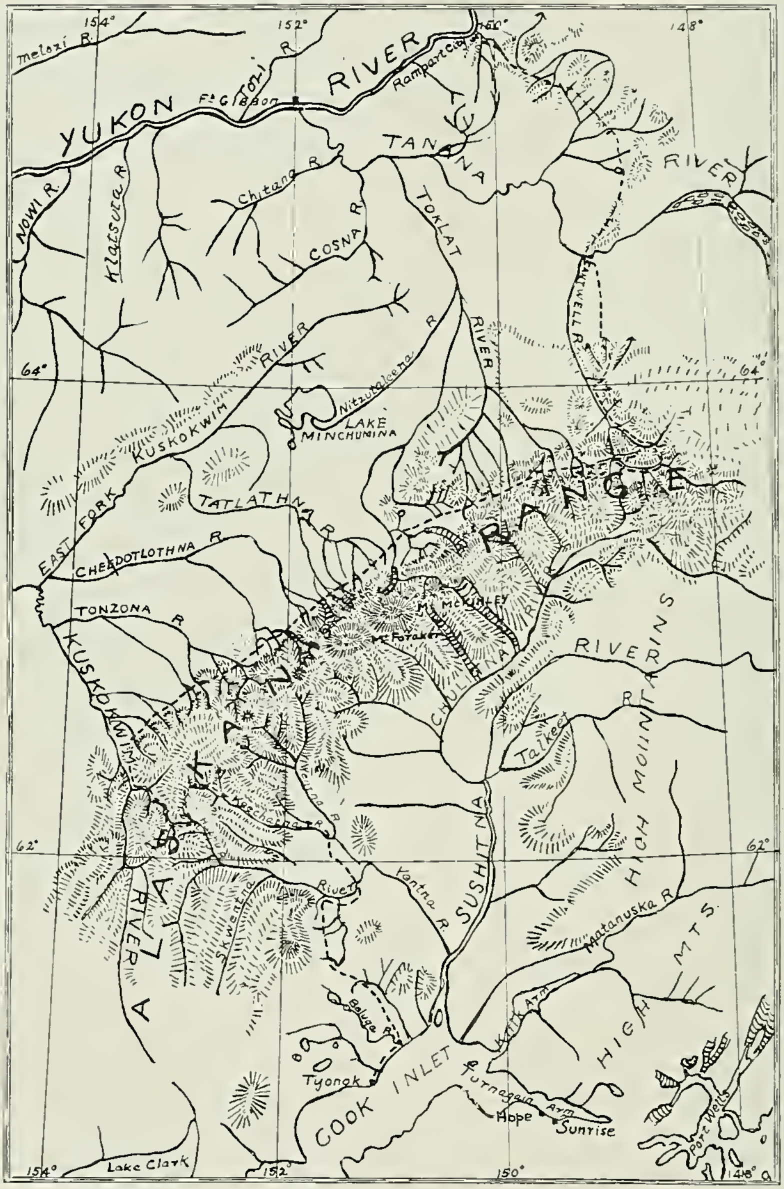
from the western margin and between forty and fifty miles from the eastern margin of the mountains. It is evident, therefore, that an expedition to climb the mountain should approach it from the northwest. This is especially true as the gravel-floored plateau on the northwest side of the range is, for the most part, above timber and, as it affords good traveling, gives ready access to the base of the mountains, where good grass is plentiful.

The mountain itself is dome-shaped and has two summits two miles apart, differing about 1,000 feet in altitude, the southernmost being the highest. Its northwestern slope is drained by a large glacier, which discharges into a river tributary to the Toklat. The most feasible route to the top of the mountain is probably across this glacier or by a ridge which separates it from a glacier flowing to the west and draining into the Tatlathna River. The topographic map now being prepared will aid the climbers, but some preliminary exploratory work to pick out the best route would have to be done. The ascent of the mountain itself would not seem to present serious difficulties to experienced mountain climbers. The fact that the snow line is about 7,000 feet, instead of being nearly at sea-level, as at St Elias, gives the Mt McKinley ascent a decided advantage. The upper limit of spruce timber is about 2,500 feet, but willow sufficient for fuel is found up to 4,000 feet. Pack-horses could find ample grass up to 3,500 feet, and by a careful choice of route could probably be taken up to snow line, on the slope of the mountain.

While the writers must disclaim any personal knowledge of high mountain climbing, yet their study of the question would lead them to believe that Mt McKinley could be ascended by making one camp at the base and three on the slopes. The base camp would be within the zone of grass and fuel, the next at snow line, and the other two at convenient points between the snow line and the summit.

The actual ascent of the mountain will present the difficulties, toils, and dangers with which the experienced mountaineer is familiar and against which he will prepare himself as far as possible. A very serious difficulty for which the average mountaineer might be less prepared is the long and difficult journey to the base of the mountain. Though Mt McKinley in an air line is only about 150 miles distant from tide water, yet to reach its northwest base from Cook Inlet necessitates a journey of at least 400 miles. This distance was traversed by the writers in about two months, but the progress was less rapid than it would have been excepting for the necessity of carrying on surveys and of exploring for a route. The party, consisting of seven men, made the journey on foot, while twenty pack-horses, most of which were loaded with provisions, carried the outfit. The time required for the journey and the energy spent in overcoming obstacles, such as chopping trails, traversing swamps, and crossing rivers, makes the reaching of the base of Mt McKinley a serious undertaking.

Our experience and knowledge of the region would lead us to propose three general plans for reaching the northwest foot of the mountain from which, as had been shown, the ascent should best be made. The first two plans involve a summer journey only, while the third would take a year for its execution. An examination of the map (page 32) will show that Mt McKinley lies about half way between the navigable waters on Cook Inlet and the Yukon River, which is navigated by river steamers. Either of these could be used as a point of departure for the long inland journey. If the project to climb the mountain were to be accomplished in one season,



Mt. McKinley Region Alaska.

Scale

0 40 80 120

------- Route. U.S. Geological Survey Party.

the base could be reached from either Cook Inlet or from the Yukon from near the mouth of the Tanana.

If the Cook Inlet route were chosen, the party should land at Tyonek between the 15th of May and the 1st of June, equipped and provisioned for a three and a half months' journey. The journey from Seattle to Cook Inlet takes about ten days by ocean steamer. For a party of seven men twenty horses would be needed, and every additional man would require about three additional horses. From Tyonek a boat would be dispatched with a part of the provisions to meet the party at the Skwentna, so as to lighten the burden of the horses and to aid in crossing the river. From this point the boat would be sent to the Keechatno, a central fork of the Yentna, and here again would be used for crossing. The pack-train would take a northerly course from Tyonek, crossing the Beluga near the head of tide water, and thence heading directly for the lower canyon on the Skwentna; then after crossing the Keechatna would follow our trail across the Alaskan Range by way of Rainy Pass at the head of Happy River. After reaching the Kuskokwim waters it would turn to the northeast and follow the base of the range, the route being identical with that followed by our party. If such a party had exceptionally good luck (and season were an early one), it might reach the base of the mountain by the first of July. Here a camp would be established at the upper limit of timber, where good grass would be found for the horses. Climatic conditions permitting, a month could then be spent in exploring and ascending the mountain. The quickest way out of the country would probably be to the northward, either to the mouth of the Cantwell or to the mouth of the Toklat, from which point a boat could probably be secured to the Yukon. In the absence of any boat, a raft would be constructed and in a few days the current would carry the party to the Yukon. The cost of such an expedition could be approximated at $15,000 for a party of ten men.

The second plan is to go to Dawson by rail and steamer and thence down the Yukon to the mouth of the Tanana by steamer. In the event of an early season, the party would leave Skagway on Lynn Canal about June 1st, which can be reached by steamer from Seattle in four days, and the mouth of the Tanana could be reached by the middle of June. From this point, if possible, a steamer should be secured to take the party, outfit, and several horses one or two hundred miles up the Toklat to the head of steamboat navigation. The continuation of the journey would be by canoes or small boats, which would carry the supplies, while the horses would be sent across country. When the river became too shallow for canoe transportation the horses would be utilized to portage the outfit to the base of the mountain. It is expected that the expedition would be ready to begin the ascent of the mountain by the middle of July. The cost of an expedition by the Ynkon route can be estimated at about $12,000.

As an introduction to the third plan it may be said that in an expedition of this kind the party is liable to be worn out by the difficulties incident to the journey to the base of the mountain. The necessity of carrying provisions for the entire trip limits the size of the party, and hence the daily tasks must be shared by all its members. Under even the best conditions, the matter of chopping trails, building bridges, crossing rivers, the incessant annoyance by mosquitoes, has a telling effect on the strength of the men, in the course of even a few weeks. It would, therefore, be advisable, if possible, to furnish each man with a saddle horse if the overland route is taken, and thus save his strength for the task of ascending the mountain. These extra horses would, however, involve an additional expenditure of $1,000 or $2,000. The same holds true in regard to the trip from the Tanana with canoes, where the energies of the party would be spent in portaging and in dragging the canoes up against swift currents. Such work is very hard and before very long will have a marked effect on even the strongest. It is possible, therefore, that if the base of Mt McKinley was reached by either of these routes, the energy of the members of the party would be at a low ebb and not at all equal to the task of making the ascent. It should also be noted that by the two plans proposed the base of the mountain would not be reached earlier than the first or middle of July. The midsummer is very unfavorable for reaching the summit, as it is usually shrouded in clouds, and clear days are very exceptional. The clearest weather and most favorable conditions will be found in June.

In view of these facts, it is quite possible that even the best chosen and best equipped party would not be successful in the ascent of the mountain. It is the belief of the writers that success could only be assured by wintering a party in the region and transporting the provisions and outfits to the base of the mountain during the winter and early spring, when dogs could be used. With such a plan it would be possible to reserve the strength of the members of the party for the actual ascent. The writers would propose that a party be outfitted with a year's provisions, which should be sent to the mouth of the Tanana by steamer, either by way of Dawson or St Michaels. From this point a steamer should be chartered to carry the expedition to the head of steamboat navigation on the Toklat. This could probably be accomplished by the first of July, and the party could spend the remainder of the open season in boating the outfit up the Toklat and in establishing the winter camp at some convenient point.

During the winter, with the aid of dog teams, an advance party would establish a camp at timber line near the base of the mountain, and also cache provisions at convenient points on the lower slopes of the mountain. This being accomplished during the winter months, when transportation is easy by means of dog teams, the party would be prepared to take advantage of the clear weather of June to make the ascent, which, as has been shown, is a very important consideration.

A modification of this plan would be to take a steamer up the Kuskokwim, which is known to be navigable as far as the forks, and very probably above. The objection to the Kuskokwim route is that it involves a very long steamboat journey, probably five hundred or six hundred miles, up a river about which very little is known. The mouth of the Kuskokwim lies out of the usual routes of travel, and the river is not easily accessible compared with the Yukon.

The chief point is to obtain steamboat navigation to as near a point to the base of the mountain as possible, then establish a base camp, and distribute the supplies during the winter months. It probably would be advisable to take a few horses for the winter trip, as they could be utilized for transportation both during the summer and winter. If this was done feed would have to be carried for winter use, though, time permitting, it would be possible to cut grass for hay.

The winter plan does not necessitate the entire parties spending a year in the undertaking. It would be possible for one section to prepare the way during the summer and early winter months, while another joined them in March or April by traveling from Dawson with dog teams.

It is the belief of the writers that if the winter trip were undertaken there would be every reason to anticipate a successful result for the expedition. The objection to the plan is, of course, the time which would be required, and also the very heavy additional expense. While it is difficult to estimate the cost of the winter party, it is safe to say that it would not be less than $25,000 and might easily be double that amount.

In closing, the writers would strongly urge that if the expedition is undertaken that it be put under the direction of a man who is not only an experienced mountaineer but who has also had long training in frontier life and exploratory work, for the success of the expedition must depend in a very large measure on its leadership. They would also urge the necessity of having ample funds to thoroughly equip the party, and that each member be especially chosen for the work in hand. It is hoped that this article may encourage the organization of an expedition, so that the credit for the ascension of the highest peak on the continent may fall to some American mountaineer.

WHAT THE UNITED STATES GOVERNMENT DOES TO PROMOTE AGRICULTURE

IT may be stated without exaggeration that no government in the world does so much as the United States to promote the agricultural interests of the country. A tea has been imported which is now being grown successfully in South Carolina. In a short while enough Sumatra tobacco will be grown in Connecticut to satisfy the American market, which has been paying $6,000,000 annually to import Sumatra tobacco. A new variety of long staple cotton, having nearly double the value of the old variety, has been created; new wheats and new rices have been introduced, and even a new orange, which will resist frost more vigorously than those now grown in Florida. These are only a few instances of products which are now being successfully raised within the United States as a result of the watchfulness and teaching of the Department of Agriculture. The fixed capital of agriculture in the United States amounts to twenty billions of dollars, or four times that invested in manufactures. How the American farmer and the consumer are protected and assisted by expert care may be seen from the following abstract of the last annual report of Hon. James Wilson, Secretary of Agriculture, who has done more for the agricultural interests of the United States than any man in its history:

INSPECTION OF MEAT

The Bureau of Animal Industry has made nearly 60,000,000 ante-mortem inspections for the year, at a cost of a fraction over one cent each. The number of post-mortem inspections was nearly 39,000,000. The meat-inspection stamp was affixed to over 23,000,000 packages of meat products, and the number of certificates of ordinary inspection issued for meat products for export, exclusive of horseflesh, was 32,744. The quantity of pork examined microscopically and exported exceeded 33,000,000 pounds. Altogether, the value of exports of animals and animal productions for the year amounted to $244,733,062.

LONG STAPLE COTTON

One of the greatest needs in improving the cotton industry in the United States has been to secure a long staple upland variety of good quality and productiveness. Several varieties of the ideal type have been produced, and the past year's experiments show conclusively that these varieties can be made permanent. Egypt and South Africa are waking up to their possibilities in cotton production, and we must develop and grow better and more productive varieties than will be grown by our competitors.

AMERICAN TEA

The work on the growing of American tea was continued during the year at Pinehurst, near Summerville, S. C., in coöperation with Dr Shepard. There are now about 100 acres in tea gardens. The yield of tea in these gardens last year was about 4,500 pounds and this year will be about 9,000 pounds of marketable tea. During the year careful attention was given to reducing the cost of the production of tea, with very satisfactory results. A tea farm will be established in Texas if suitable land and coöperation can be secured.

LAND-GRANT COLLEGES

Statistics of attendance at the land-grant colleges show over 42,000 students enrolled, an increase over the previous year of 7 per cent. The attendance for the four-year course in agriculture increased more than 26 per cent. The Secretary points to the marked success of agricultural high schools in Minnesota and Nebraska as an indication that there is a demand for agricultural courses with those afforded in various manual arts in the city high schools. He states that all over the country farmers are sending their children to public high schools and paying for their tuition.

GROWING SUMATRA TOBACCO

The commercial success of the shade-grown Sumatra tobacco in the Connecticut Valley has now been fully assured, and the plan adopted by which last year's crop, after being carefully cured and sorted under the direction of the department's experts, was catalogued and offered for sale at public auction, under the supervision of the committee of tobacco brokers, with Hon. E. Stevens Henry, M. C., as chairman, proved highly satisfactory. The ordinary tobacco grown in the open fields in Connecticut brings from 18 to 20 cents a pound. The average price paid for the shade-grown tobacco was $1.20 a pound. The cost of this tobacco, baled and ready for market, averaged 51½ cents a pound. The net profit per acre on the best crop raised on a lot of about six acres exceeded $1,000 per acre. The reports from cigar manufacturers show that the leaf of this Connecticut, grown Sumatra tobacco has successfully stood the test of manufacture.

At the present time the department is advising and instructing thirty-eight growers in Connecticut and Massachusetts cultivating 645 acres of shade tobacco. It may be said of this line of department work that it has demonstrated our ability to produce a leaf for which about $6,000,000 have annually been paid to foreign countries.

The tobacco situation in Texas and Ohio has been thoroughly studied with a view to the production of a desirable type of filler tobacco equal to the imported Cuban leaf, and it is believed that by careful methods of cultivation, fermentation, and assorting this can be done. In fact, leaf has actually been grown that cannot be distinguished from the imported Cuban when properly fermented.

EXPORTS OF FRUIT

He reports investigations having for

their purpose the extension of the export trade in fruits and vegetables, and improvement in methods of handling these products for foreign and domestic use. Several experimental shipments have been made to European markets. The results have been fully satisfactory, the net returns in most cases exceeding domestic values. The net returns are largely influenced by the kind of packages and methods of packing and shipping.

The examination of imported food products for the purpose of determining whether they contain substances injurious to life has been continued by the Bureau of Chemistry. Particular attention has been given to the adulterations of olive oils, with the object of securing an honest market for domestic oils now compelled to compete with cheaper and adulterated oils. Important investigations have been made in the sugar laboratory with a view to improving the quality and quantity of table sirups.

WEATHER BUREAU WARNINGS

The past year affords gratifying evidence of the value of forecast warnings of the Weather Bureau in saving life and property. Ample testimony is afforded that the value of property thus saved from loss amounts to many times the cost of maintaining the Bureau. The Secretary urges the desirability of extending the distribution of daily forecasts coextensively with the rural free delivery. Of the 10,000 rural free delivery routes existing August 1, 1902, it has been found possible to serve only 1,000. To make the distribution coextensive with the rural free delivery would, he estimates, cost about $100,000.

APPALACHIAN FOREST RESERVE

The Secretary enters an earnest plea for the establishment of the Appalachian Forest Reserve. He states that the water power, at an aggregate annual value of $20,000,000, is being gradually destroyed through increasing irregularity in the flow; that the soils washed down from the mountain slopes are rendering annually less navigable the Ohio, Tennessee, Mississippi, and other rivers. These are the results of the deforestation of these mountain slopes. He states that the rate of land erosion on these slopes from which the forest cover has been removed is as great now in a single year as during ten centuries when covered with primeval forests.

WORK IN FORESTRY

Interest in forestry and a perception of its possibilities as a great national resource have developed so swiftly in the United States that the discrepancy between the capacity for government service of this branch of the department and its opportunities was never so great as now. During the past year the Bureau of Forestry has notably increased its store of knowledge on which all forestry depends and has made large gains in introducing practical management of forests of both public and private ownership. Its field-work has engaged 162 men and has been carried on in forty-two states and territories.

Extensive studies were made of commercial trees during the year, and studies of the forest and its industrial relations were made in Michigan, Kentucky, Ohio, Texas, New Mexico, Arizona, South Dakota, Wyoming, Montana, California, and Iowa.

STUDY OF SOILS

The soil survey has been greatly extended, and the division of soil management started during the year gives promise of highly important results. The Bureau of Soils now employs a force of over one hundred persons, seventy-five of whom have had scientific training. The usefulness of this bureau has been greatly extended by coöperation with state institutions, experiment stations, boards of agriculture, and geological surveys, as well as with other bureaus and divisions of this department of the government. An assistant has been furnished to the War Department to organize a soil survey in the Philippines. The area surveyed and mapped during the fiscal year was over 14,500 square miles, or not far from 10,000,000 acres, making a total survey to date of over 14,500,000 acres. This area is distributed in twenty-five states and territories and in Porto Rico.

PUBLICATIONS

The publication work of the department has been unprecedently active. The total number of publications issued was 757. The total number of pages of new matter edited for publication was 81,184. The aggregate number of copies of all publications issued was 10,586,580. Of this number 6,150,000 were Farmers' Bulletins, and of these the Congressional distribution took 4,289,126. Including the Year-book and other reports paid for by special appropriations, the cost of the publication work amounts to about $800,000, but the number of publications is still inadequate to supply the demand.

GROWTH OF INDUSTRY

The Secretary concludes his report with some interesting figures illustrative of the magnitude of the agricultural industry. In 1900 the fixed capital of agriculture was about twenty billions of dollars, or four times that invested in manufacture. In that year there were nearly five million seven hundred and forty farms in the country, covering eight hundred and forty-one million acres, four hundred and fifteen millions of which consisted of improved land. According to the returns of the last census, about forty million people, or more than half of the total population in 1900, resided on farms. Of the twenty-nine million persons reported as engaged in gainful occupations, ten million—more than a third—were employed in agricultural pursuits. The produce of American agriculture in 1899, including farm animals and other products, aggregated nearly five billion dollars. The most valuable crop was Indian corn, $828,000,000; then hay and forage, $484,000,000; then cotton, $324,000,000; wheat returned $370,000,000, and oats $217,000,000. The animals sold and slaughtered during the year were valued at over $900,000,000, the products of the dairy gave $472,000,000, while poultry and eggs returned over $281,000,000. The concluding statement of the Secretary is that results in the work of the government for agriculture are justifying expenditures, and "the future will still further show the value of science applied to the farm."

EXTRACT FROM PRESIDENT ROOSEVELT'S MESSAGE TO CONGRESS, DECEMBER, 1902

In no department of governmental work in recent years has there been greater success than in that of giving scientific aid to the farming population, thereby showing them how most efficiently to help themselves. There is no need of insisting upon its importance, for the welfare of the farmer is fundamentally necessary to the welfare of the Republic as a whole. In addition to such work as quarantine against animal and vegetable plagues, and warring against them when here introduced, much efficient help has been rendered to the farmer by the introduction of new plants specially fitted for cultivation under the peculiar conditions existing in different portions of the country. New cereals have been established in the semi-arid West. For instance, the practicability of producing the best types of macaroni wheats in regions of an annual rainfall of only ten inches or thereabouts has been conclusively demonstrated. Through the introduction of new rices in Louisiana and Texas, the production of rice in this country has been made to about equal the home demand. In the southwest the possibility of regrassing overstocked range lands has been demonstrated; in the north many new forage crops have been introduced, while in the east it has been shown that some of our choicest fruits can be stored and shipped in such a way as to find a profitable market abroad.

GEOGRAPHIC NOTES

IS GERMANY THE CAUSE OF DENMARK'S REFUSAL TO SELL HER WEST INDIAN POSSESSIONS?

GERMANY has always wanted a naval station in the West Indies, but has been unable to obtain one on account of the Monroe Doctrine.

Some years ago Denmark offered to sell the Danish West Indies to the United States, but the United States Congress did not accept. Recently another treaty was made and ratified by the United States Congress, but this time, for some unknown, mysterious reason, Denmark refused to sell. Why?

It is well known that Germany has always wanted Denmark, and if by some peaceable means the kingdom of Denmark should become a State of the German Empire, the Danish West Indies would not have changed sovereigns, but yet the German fleet could have its station there.

Would the Monroe Doctrine interfere with this arrangement?

THE AMOUNT OF WATER HIDDEN BENEATH THE SURFACE

THE amount of water within the crust of the earth, says Professor Charles S. Slichter, in a paper entitled "The Motion of Underground Waters," recently published by the U. S. Geological Survey, is enormous, amounting to 565,000 million million cubic yards. This vast accumulation, if placed upon the earth, would cover its entire surface to a uniform depth of from 3,000 to 3,500 feet. His estimate is based upon the supposition that the average depth which waters can penetrate beneath the surface is six miles below the land and five miles below the ocean floor.

Experiments have shown that not only sands and gravels are porous, but rocks supposed to be solid and compact may be traversed by water. Even so hard a rock as Montello granite, selected for the sarcophagus of the tomb of General Grant on account of its great strength, shows a porosity of 0.23 per cent. The most productive water-bearing rocks are found to be the porous sandstones, and in some cases limestones whose inner texture has been chemically dissolved.

The great mass of ground water slowly percolates through sand and gravel deposits, sandstone, and other porous material under a wide extent of territory. Though its motion carries it but a fraction of a mile in a year, this ground water is so widespread and often so accessible as to be of the greatest economic importance.

The water supply in many sections of the United States depends on an understanding of the water deep beneath the surface. Hence the study of underground water conditions is one of the most important works of the U. S. Geological Survey. It is carried on in arid regions, where water for irrigation is of the greatest value. In the middle west, where grazing and successful farming largely depend on it, and in the east, where an unpolluted supply for domestic and municipal use is yearly becoming a more serious problem.

LOUBAT PRIZES

THROUGH the generosity of the Duke of Loubat, whose interest in American studies is well known, two prizes, to be called the Loubat Prizes, have been established at Columbia University, to be awarded every five years for the best original works dealing with North America at any period preceding the Declaration of Independence. The value of the first prize is not less than one thousand dollars, and that of the second prize not less than four hundred dollars, and the competition is open to all persons, whether citizens of the United States or of any other country.

These prizes are offered in the year 1903, and the undersigned have been delegated to act as a Committee of Award. Original manuscripts, books, and pamphlets offered in competition may be sent to any member of the committee prior to June, 1903. The conditions of the award are as follows :

(*a*) That the work submitted shall treat of the history, geography, or numismatics of North America prior to 1776, or of some topic comprised within these general subjects.

(*b*) That it shall embody the results of original research, be written by a single person, and be submitted by the author himself.

(*c*) That it be written in the English language.

(*d*) That if a printed work, it shall have been published for the first time not prior to 1898, and if in manuscript, the author shall agree to publish the work within one year from the date of the award.

(*e*) That the committee is empowered to withhold one prize or both if no works, or but a single work, be deemed worthy of the award.

(*f*) That all works submitted shall be placed, after the award, in the library of Columbia University, and that five copies of the prize-winning works shall be presented to Columbia University for distribution according to the conditions prescribed in Mr. Loubat's deed of gift.

(*g*) It is furthermore requested that all copies printed subsequent to the award should bear upon the title-page the words :

LOUBAT PRIZE.
Columbia University, in the City of New York.

Competitors should address all communications to any of the undersigned:

Professor William M. Sloane, Columbia University (chairman)—History.

Dr Alexander Graham Bell, President National Geographic Society—Geography.

Dr George N. Olcott, Lecturer on Roman Archæology, Columbia University—Numismatics.

SUBDUING THE NILE

DECEMBER, 1902, marked the opening of the great Nile reservoir and dam, which will increase by one-fourth the farming land of Egypt. Stated differently, Egypt before the reservoir was built had about 10,500 square miles of arable land stretching along the Nile ; the resevoir will give her 2,500 square miles more, so that this great work will add an area twice the size of Rhode Island to the farming land of the country. Chalmers Roberts in "The World's Work" for December presents a capital article on this enormous engineering task so successfully achieved. The following paragraphs may be quoted: *

"It is estimated that the permanent benefit resulting will reach $100,000,000. There will be added to the revenue from the sale of water and from taxation on

* *The World's Work.* Vol. 5, No. 2. Subduing the Nile. By Chalmers Roberts.

the irrigated lands $10,000,000. The government will further realize considerable sums from the sale of reclaimed public lands and indirect revenues traceable to the country's augmented producing capacity. Egypt is virtually rainless, but wherever the Nile water can be regularly supplied to the soil the most beautiful crops follow, which, like cotton and sugar, command high prices because of their excellence. With a reliable water supply, farming in Egypt can be pursued with practically certain success. Four or five hundredweight of long staple cotton per acre may be expected, which, owing to its excellence, easily sells for two cents a pound more than American cotton sells for, which in its turn does not average two hundredweight to the acre. Even with the general depression of sugar in the world's markets Egyptian agriculture is confident of obtaining similar advantages for its cane product.

"It is useless to tell most people that the reservoir at Assuân will contain 1,000,000,000 tons of water. This reservoir, according to Sir Benjamin Baker, will hold more than enough water to make one year's full domestic supply to every city, town, and village in the United Kingdom, with its 42,000,000 inhabitants. During the three or four summer months when the Nile is low, and the needs of cultivators are greatest, the flow from the reservoir will be equivalent to a river double the size of the Thames in mean annual flood condition.

"Here will be created in the heart of the African desert a lake having two or three times the superficial area of Lake Geneva, in Switzerland, and throwing back water for a distance of 140 miles."

GOVERNMENT MAPS RECENTLY ISSUED

A NUMBER of topographic maps of portions of New York State have just left the press of the United States Geological Survey and are available to the public. They are maps of the Phelps, Weedsport, Morrisville, and Waverly quadrangles, in the central portion of the State; the Canajoharie, Willsboro (Lake Champlain), and Oyster Bay quadrangles in eastern New York, and the Lockport and Niagara Falls and vicinity quadrangles in the western portion.

The survey has also issued a new and accurate topographic map of portions of Sauk, Columbia, and Adams counties, Wisconsin, on either side of the Wisconsin River between Kilbourn and Portage. The map is known as that of the Briggsville quadrangle and is on a scale of about one inch to the mile. A map of portions of Marathon, Lincoln, and Langdale counties, in the center of the State, is now in press.

The Geological Survey has also reprinted its topographic map of part of the Lake Michigan shore known as the Racine sheet, which includes the cities of Racine and Kenosha and about ten miles of the country to the west. It is on the same scale as that of the Briggsville quadrangle and forms an exceptionally accurate map of the region.

TESTING THE CURRENTS OF LAKE ERIE.

THE past season 80 bottles have been set adrift in and near Sandusky Bay in order to learn about the currents. To attract attention, a small board, painted orange and black, was attached to each bottle, and inside a notice to the finder offering him a small reward to report place and time of finding; also a map of the bay and neighboring portion of Lake Erie, on which the finder could mark the spot.

So far, 44 of the bottles have been heard from. When found within two or three days, as frequently occurred, the course the bottle had taken could generally be accounted for by examining the wind record for the period it was floating and a day or two before. Inside the bay the course of the bottle depends largely on whether water is entering or leaving the bay, and this depends mainly on the direction and velocity of the wind compared with the way it has been blowing for some hours or days before.

The bottles displaced about 700 cubic centimeters and, except the first 26, were weighted with sand to make them sink beneath the board. In a few instances bottles one, three, and five feet beneath the surface were started simultaneously.

An account of these experiments will be published in the next annual report of the Ohio Academy of Science.

E. L. Moseley.

Sandusky, Ohio, December 15, 1902.

GEOGRAPHIC LITERATURE

The Uganda Protectorate. By Sir Harry Johnston. With 506 illustrations from drawings and photographs by the author, 48 full-page colored plates by the author, and 9 maps. Two vols. Pp. 1018. 8 x 10 inches. New York: Dodd, Mead & Co. 1902. $12.50 *net.*

This is one of the most important works relating to Africa that has been published in recent years. The completion of the Uganda Railway during the past year, opening this vast equatorial province to direct communication with the world, makes the work specially timely. Sir Harry Johnston describes the tremendous work done by the British government toward pacifying and educating the Uganda peoples. The task is costing many millions of pounds sterling, but the commercial profits that will ensue will, in his opinion, far outbalance the expense. The larger part of the two volumes is devoted to a description of the varied races, the animals, and the plant life in the protectorate. An unusual feature are fifty colored plates from drawings by Sir Harry Johnston and over 500 illustrations from photographs taken by him during his twenty months of exploration in Uganda. The following extract from the author's preface gives a very good idea of the protectorate:

"The territories which are comprised within the limits of the Uganda Protectorate during the time of my administration of that portion of the British sphere in East Africa certainly contain within an area of some 150,000 square miles nearly all the wonders, most of the extremes, the most signal beauties, and some of the horrors of the Dark Continent. Portions of their surface are endowed with the healthiest climate to be found anywhere in tropical Africa; yet there are also some districts of extreme insalubrity.

"The Uganda Protectorate offers to the naturalist the most remarkable known forms amongst the African mammals, birds, fish, butterflies, and earth-worms, one of which is as large as a snake and is colored a brilliant verditer-blue. In this protectorate there are forests of a tropical luxuriance only to be matched in parts of the Congo Free State and in the Cameroons. Probably in no part of Africa are there such vast woods of conifers. There are other districts as hideously desert and void of any form of vegetation as the worst part of the Sahara. There is the largest continuous area of marsh to be met with in any part of Africa, and perhaps the most considerable area of tableland and mountain rising continuously above 6,000 feet. Here is probably reached the highest point on the whole of the African continent, namely, the loftiest snow peak of the Ruwenzori range. Here is the largest lake in Africa, which gives birth to the main branch of the longest river in that continent. There may be seen here perhaps the biggest extinct volcano in the world—Elgon. The protectorate, lying on either side of the equator, contains over a hundred square miles of perpetual snow and ice. It also contains a few spots in the relatively low-lying valley of the Nile, where the average daily heat is perhaps higher than in any other part of Africa.

"Within the limits of this protectorate are to be found specimens of nearly all of the most marked types of African man—Congo pigmies and the low, apelike types of the Elgon and Semliki forests; the handsome Bahima, who are negroids as much related to the ancient Egyptians as to the average negro; the gigantic Turkana, the wiry, stunted Andorobo, the Apollo-like Masai, the naked Nile tribes, and the scrupulously clothed Baganda. These last again are enthusiastic, casuistic Christians, while other tribes of the Nile province are fanatical Mohammedans. The Bahima are, or were, ardent believers in witchcraft. The Basoga polytheists are burdened with a multiplicity of minor deities, while the Masai and kindred races have practically no religion at all.

"Cannibalism lingers in the western corners of the protectorate, while the natives of the other parts are importing tinned apricots or are printing and publishing in their own language summaries of their past history. This is the country of the okapi, the whale-headed stork, the chimpanzee, and the five-horned giraffe, the rhinoceroses with the longest horns, and the elephants with the biggest tusks."

Animals Before Man in America. By F. A. Lucas. Illustrated. Pp. 285. 5 x 7¾ inches. New York: D. Appleton & Co. 1902. $1.25 *net.*

So little is generally known of the animals that ages ago lived on the American continent that this book by Mr Lucas will be very welcome, especially as it is written in simple, untechnical language.

Europe. By Frank G. Carpenter. With maps and illustrations. Pp. 456. 5½ x 7½ inches. New York: American Book Co. 1902. 70c.

This volume is one of Carpenter's geographical readers for children. It is a simple, reliable, and interesting description of the countries of Europe.

A Ribbon of Iron. By Annette M. B. Meakin. Illustrated. Pp. 320. 5½ x 8 inches. Westminster: Archibald Constable & Co. New York: E. P. Dutton & Co. 1902. $2 *net.*

Miss Meakin describes the incidents and sights of a trip on the Siberian Railway in 1900, just before the Boxer troubles.

The Land of the Amazons. Translated from the French of Baron de Santa-Anna Nery by George Humphery. With illustrations and map. Pp. 405. 6 x 9 inches. London: Sands & Co. New York: E. P. Dutton & Co. 1901.

The first edition of this standard work on Brazil appeared in 1884; a second edition followed in 1899. The author gives a very complete account of the nature of the country, of the character and life of the inhabitants, native and foreign, and of the explorations of the Amazon. Mr Humphery has made such a free and smooth translation that the fact that the work is a translation does not appear.

Strange Lands Near Home. Illustrated. Pp. 138. Boston: Ginn & Co. 1902.

W. E. Curtis, H. Butterworth, Frederick Schwatka, and other entertaining authors contribute to this little volume brief sketches of Mexico, the West Indies, and South America. The book makes an attractive reader for young people.

William H. Alexander, Observer of the U. S. Weather Bureau, is the author of a bulletin entitled "Hurricanes, especially those of Porto Rico and St Kitts," recently published by the Bureau. The chapter headings are: Theories as to the Origin and Movements of Rotary Storms; Premonitory Signs of the Existence and Movement of a Hurricane; The Approach and Passage of a West Indian Hurricane — Suggestions Relative to Preparations for the Storm; Barometers, Their Care and Their Use; The United States Weather Bureau in the West Indies; Porto Rico and its Hurricanes; St Kitts and its Hurricanes; Brief Historical Notes on West Indian Hurricanes, Earthquakes, etc.

NATIONAL GEOGRAPHIC SOCIETY

November 21, 1902.— Dr G. K. Gilbert, of the Board of Manogers, in the chair. Mr O. H. Tittmann gave an address on the "Work of the U. S. Coast and Geodetic Survey," of which he is the honored Superintendent. The address is published in full in this number. At the conclusion of the paper Dr Gilbert stated that the address was so complete that he doubted whether there were any points upon which questions could be asked. If members present, however, had any questions to present, they were welcome to do so.

There being no questions, Dr Gilbert said that he would like to ask how the valuable charts and maps published by the Coast and Geodetic Survey could be obtained by the public. Mr Tittmann replied that a certain number of each edition were allotted to Congressmen and Senators for distribution among their constituents, and also a few copies were given to libraries. If a citizen was not able to obtain a map through his Congressman or Senator, he could purchase it from the Survey for a nominal sum.

November 14, 1902.—Vice-President W. J. McGee, LL.D, in the chair. Dr David T. Day, Chief of the Division of Mineral Resources of the U. S. Geological Survey, gave an illustrated address on "The Coal Resources of the United States"

November 22, 1902.—Dr G. K. Gilbert in the chair. Commander Robert E. Peary, U. S. N., gave an illustrated address on his "Explorations in the Arctics, 1898–1102"

ANNOUNCEMENTS.

REGULAR MEETINGS.

January 2.—Annual meeting. Reports and elections.

January 16.—"The Work of the Hydrographic Office, Navy Department." Commander W. H. Southerland.

January 30.—"The Work of the Office of Experiment Stations, Agricultural Department" Dr A. C. True.

February 13.—"The Work of the Census Office." Hon. William R. Merriam.

February 27.—"The Work of the Naval Observatory." Capt. Charles H. Davis.

March 13.—"The Work of the Geological Survey." Hon. Charles D. Walcott.

March 27.—"The Work of the Library of Congress." Hon. Herbert Putnam.

POPULAR LECTURES

January 9.—"The Turk and His Rebellious Subjects." Mr William E. Curtis. (Illustrated.)

January 23 —"The Tragedy of Saint Pierre." Mr George Kennan. (Illustrated.)

February 6.—"From New York to London by Rail via Bering Strait." Mr Harry de Windt.

February 20.—"The Geographic Distribution of Insanity in the United States." Dr W. A. White, Director of the Binghampton State Hospital, New York.

Provisional arrangements have also been made for lectures on Colombia and the Isthmian Canal; America Before the Advent of Man; Russia of Today (by Paul du Chaillu), and a lecture by Mr John Muir.

The Lenten Course of five lectures will be delivered in Columbia Theater, F street, near Twelfth, at 4.20 o'clock, on Wednesday afternoons of February 11, 18, 25, and March 4, 11.

The subject of this course and the speakers assigned for the special topics will be announced in a later program.

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(Corrected to December 1, 1902)

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*In May, 1902, by amendment to the by-laws of the Society, a class of Fellows was established. The election of Fellows is vested in the Board of Managers. No Fellows have yet been elected, nor will any elections be made before January 1, 1903.

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Andrews, Mrs Jennie Parker.	The Colonial Hotel
Aplin, S. A. (Stephen Arnold), Geol. Survey, 1330 F st.	1917 I street
Aspinwall, J. A. (John Abel), St. Thomas P. E. Ch.	17 Dupont circle

Austin, O. P. (Oscar Phelps), 1333 F st. (Bu. of Stat.). 1620 Mass. ave
Averill, F. L. (Frank Lloyd), Office Sup. Arch. 1479 Columbia road
Ayres, H. B. (Horace Beemer). U. S. Geological Survey
Ayres, Miss Susanne Caroline. 1813 13 street

Babb, Cyrus C. (Cyrus Cates), Geol. Survey. 1118 Rhode Island ave
Bacon, Samuel H., 404 7 street. 1326 Columbia road
Bailey, Chas. B. (Charles Brooks), 911 F street. 1424 Staughton street
Bailey, Mrs F. H. (Anna Bailey). 1815 Riggs place
Bailey, Lt. Cmdr. F. H. (Frank Harvey), Bu. Steam Eng. 1815 Riggs pl
Bailey, Vernon, Department of Agriculture. 1834 Kalorama avenue
Baird, Cmdr. G. W. (George Washington), Navy Dept. 1505 R. I. ave
Baird, James W. (James Wooster), War Dept. 734 Flint st., Brightwood
Baker, Frank, National Zoological Park. 1728 Columbia road
Baker, Marcus, 1439 K street. 1905 16 street
Baldwin, David H. (David Henry), Geol. Survey. 1000 24 street
Baldwin, M. W. (Marcus Wickliffe), Bu. Eng. and Pr. 3000 13 street
Baldwin, S. Torrey (Stephen Torrey), Navy Department. 925 S street
Baldwin, Wm. D. (William Dickson), 25 Grant place. 1734 Q street
Ballinger, M. F. or Minnie F. (Minnie Fazio). The Riggs House
Balloch, G. W. (George Williamson), 1006 F st. 2445 Brightwood ave
Barber, A. W. (Amherst Willoughby), G. L. Off. 703 East Capitol st
Barnard, E. C. (Edward Chester), Geol. Survey. 1807 G street
Barnard, Job, U. S. Court-House. 1306 Rhode Island avenue
Barnum, Miss Charlotte C. (Charlotte C——). Coast Survey
Barrington, Wm. L. (William Leadbeater). 3514 N street
Bartlett, Lt. Cmdr. Charles W., u. s. n. Navy Department
Bartlett, Miss Harriet. 122 East Capitol street
Bartlett, John R. (John Russell), Navy Department. 1622 21 street
Barton, L. Leland (Leslie Leland), 604 H street
Bassett, Frank H. (Frank Howard), War Department. 2209 13 street
Batten, R. Grosvenor (Robert Grosvenor), 1317 F street. 501 13 street
Bauer, L. A. (Louis Agricola), Coast and Geod. Survey. 1925 I street
Baylor, J. B. (James Bowen). Coast and Geodetic Survey
Beaman, George H. (George Herbert). 2232 Massachusetts avenue
Beaman, W. M. (William Major), Geol. Survey. The Maury, 19 & G sts
Bebb, E. C. (Edward Crosby), Geol. Survey. 1227 11 street
Beck, William H. (William Henry), 1424 N. Y. ave. The Bancroft
Becker, Edmund, Light-House Board. 1315 Yale street
Bell, Aileen A. (Aileen Adine). 1521 35 street
Bell, Alexander Graham. 1331 Connecticut avenue
Bell, A. Melville (Alexander Melville). 1525 35 street
Bell, Charles J., 1405 G street. 1327 Connecticut avenue
Bell, Bvt. Brig. Gen. Geo. (George). 1909 G street

Belt, E. Oliver, M. D. (Edward Oliver), The Farragut.	922 17 street
Benkert, M. V. (Melitta Viola), P. O. Dept., Room 222.	2010 35 street
Bennett, Frank V. (Frank Vincent).	The Arlington
Bennett, Walter J. (Walter James), 24 and M sts.	1248 Princeton st
Benson, Berry (Berry Greenwood).	341 Trumbull street
Bergmann, H. H. (Henry Hermann), 511 7 street.	1444 Bacon street
Bernadou, Lieut. J. B.	Navy Department
Berry, James, Weather Bureau.	14 3 street SE
Bickford, Capt. Nathan, 914 F street.	32 Quincy street
Bien, Morris, General Land Office.	Takoma Park, D. C
Bigelow, Frank H. (Frank Hagar), Weather Bureau.	1625 Mass. ave
Bigelow, Otis, Avenel, Md.	1501 18 street
Bingham, Judge E. F. (Edward Franklin), Court-House.	1907 H street
Bingham, D. J. (David Judson), U. S. A., retired.	
Bissett, Peter.	"Twin Oaks," Woodley lane
Black, H. Campbell (Henry Campbell).	2516 14 street
Blair, H. B. (Herbert Buxton), Geol. Survey.	3025 16 street
Blair, John S. (John Sylvanus), 1416 F street.	1820 I street
Blood, Ellen E. (Ellen Elizabeth), P. O. Dept.	516 East Capitol street
Blount, Henry F. (Henry Fitch), 1405 G st.	The Oaks, 3101 31 street
Blowers, Miss Etta (Miss Hosetta), Census Office.	602 M street SE
Boardman, Wm. J. (William Jarvis).	1801 P street
Boarman, Mrs. L. M. (L—— M——).	1104 Maryland avenue SW
Bond, Mary E. (Mary Eachus), Blake School.	818 New Jersey avenue
Bond, S. R. (Samuel Robert), 321 4½ street.	13 Iowa circle
Bottineau, John B. (John Baptiste).	315 A street NE
Bourgeat, Mrs B. K. (Bella Kilbourn), Lib. of Cong.	1629 R street
Bouldin, E. D. (Ellie Daniel), General Land Office.	1211 13 street
Bourquin, Katharine, P. O. Department.	2118 Wyoming avenue
Boyce, Lizzie F. (Elizabeth Ficklen).	The Grafton
Bradford, R. B. (Royal Bird), Navy Department.	1522 P street
Bradley, Geo. L. (George Lothrop).	1503 21 street
Bradley, Mrs Laura A. (Laura Ann).	936 I street
Brewer, Clara G. (Clara Gertrude).	The Stratford, Mt. Pleasant
Brickenstein, J. H. (John Henry), Patent Office.	1603 19 street
Bright, Rich'd R. (Richard Riggs), Navy Dept.	218 Maryland ave. NE
Bristol, Rev. Dr. Frank M.	330 C street
Britton, Alex. (Alexander), Glover Bldg., 1419 F street.	1836 S street
Brodie, Basil M. (Basil M——), Treasury Dept.	1330 New York ave
Brooks, Alfred H. (Alfred Hulse), Geol. Survey.	1320 Wallach place
Brooks, N. M. (Newton May), P. O. Department.	224 A street SE
Brown, Miss Rachel C. (Rachel Cuthbert), Bu. Ind. Aff.	1008 N st
Brown, Geo. H. (George Hay), Off. Pub. Bdgs. & Gds.	1357 Roanoke st
Brown, Geo. W. (George Whitfield), 1406 G st.	1710 Connecticut ave

Brown, L. K. (Lewis Kirk), Treasury Department. 134 C street SE
Brown, L. S. (Lorenzo Starr). 705 15 street
Browne, Aldis B. (Aldis Birdsey), 1419 F street. 1528 P street
Browne, Alice Key. The Portland
Brumbaugh, G. M., M. D. (Gaius Marcus). 905 Massachusetts avenue
Buck, Miss Ada P. (Ada Pamelia). 635 Maryland avenue NE
Buell, H. L. (Herbert Luther), Off. Chief of Engineers. 1701 V street
Bulkley, Barry, Bond building, 14 and N. Y. ave. Barton's, 15 st near H
Bumphrey, M. H. (Marvin H——), care J. C. Burrows, U. S. Senate
Bumstead, Albert H. (Albert Hoit), Geol. Survey. 734 12 street
Bunker, William Mitchell, Room 19, 1417 G street. Hotel Normandie
Burchell, N. L. (Norval Landon), 1325 F street. 1102 Vermont avenue
Burdett, S. S. (Samuel Swinfin), 925 F St. Glencarlyn, Va
Burdett, Walter W., 1307 F street. 1026 Vermont avenue
Burgess, C. H. (Charles Hyde), 1341 8 street. 1333 8 street
Burr, W. H. (William Henry). 1339 14 street
Burt, G. Rodney. 218 C street
Butler, W. H. (William Henry), 609 C street. 200 8 street SW
Bynum, Maud. 1742 Q street
Byrnes, Eugene A. (Eugene Alexander), Patent Office. 2539 13 street

Calef, Samuel Prescott, War Department. 1828 H street
Callahan, John, Wash. & Norf. Str. whf., foot 7 street. 2817 14 street
Calvert, Edgar B. (Edgar Bassett), Weather Bureau. The Landmore
Calvo, J. B. (Joaquin Bernardo), Costa Rican Legation. 2111 S street
Campbell, Miss Anna. 924 D street SW
Campbell, William S. (William Shaw). 1841 R street
Capps, Naval Constructor W. L. Navy Department
Carleton, M. A. (Mark Alfred), Dept. of Agric. 1715 Lincoln ave. NE
Carmody, John D. (John Doyle), 314 9 street. 1211 Vermont avenue
Carpenter, Frank G. (Frank George). 1318 Vermont avenue
Carr, Wilbur J. (Wilbur John), Department of State. The Gladstone
Carr, W. K. (William Kearny), 1008 F street. 1413 K street
Carroll, Mitchell (Alexander Mitchell), Columbian Univ. The Cairo
Carter, W. F., Treasury Department. 1320 Emerson street
Carver, Frank N. (Frank Noble), 1416 F street. 1431 L street
Catlin, Capt. Robert. 1428 Euclid place
Chamberlain, Miss Jane E. 3 Grant place
Chambers, Lieut. E. B. (Emmet Butler). 6 1 street NE
Chandler, G. V. (George Vose), Patent Office. 213 C street SE
Chapman, R. H. (Robert Hollister), Geol. Survey. 2033 Florida avenue
Cherry, Chas. H. (Charles Henry), Winder Building. 1115 S street
Chester, Major James, U. S. A., retired. 601 21 street
Chester, Josephine M. (Miss Josephine M.). 1016 11 street

Chickering, J. W. (John White). The Portner
Chilton, Robt. S. (Robert S.——), State Dept. 225 Delaware avenue NE
Chubb, Mrs C. F. (Caroline F——). 1721 Corcoran street
Claflin, Price Colby, 907 F street. 1117 O street
Clagett, Chas. W. (Charles William), 422 5 street. 803 A street SE
Clapp, J. M. (John Martin). 1024 Vermont avenue
Clark, Charles S. (Charles Shedd), Dennison School. The Manhattan
Clark, Egbert A., D. D. S. (Egbert Asahel). 600 13 street
Clarke, S. A. (Samuel Asahel), Law Librarian. General Land Office
Clay, Gen. Cecil, Department of Justice. 1513 S street
Cleaver, F. M. (Frank M.), Weather Bureau. 2311 M street
Cole, T. L. (Theodore Lee), 13 Corcoran Bldg. 1615 Florida avenue
Conger, Miss Florence W. (Florence West), Station C. 1141 N. H. ave
Coolidge, L. A. (Louis Arthur), 1403 F street. 1423 Welling place
Corea, Luis F. (Luis Felipe). 1704 Q street
Cornish, Major G. G. (G—— G——). 225 1 street SE
Corson, Geo. E. (George Edgar), War Department. 1154 17 street
Cotton, John B. (John B——). Sun building
Coville, Frederick V. (Frederick Vernon), Dept. Agr. 1836 California ave
Cowsill, Arthur, Wyatt building, 1403 F street. 634 I street NE
Cox, W. P. (William Porter), 532 17 street. 315 Florida avenue
Cox, W. V. (William Van Zandt), 2d Nat. Bk. Emery pl., Brightwood
Coyle, B. J. (Bernard J——). 834 13 street
Crane, Augustus, Jr., 604 14 street. 1344 F street
Crew, J. H. (James Hart), Room 510, P. O. Dept. 1532 9 street
Cridler, Hon. Thos. W. (Thomas Wilbur).
Crosby, Oscar T. (Oscar Terry), Atlantic Building. Cleveland Park
Cross, Whitman (Charles Whitman), Geol. Survey. 2138 Bancroft pl
Crowell, Mrs Anna S. (Anna Silliman). 938 I street
Culbertson, Mrs Anna G. 32 Grant place
Cummings, H. S. (Horace Stuart), Kellogg Building. 1756 K street
Curry, J. L. M. (Jabez Lamar Monroe). 1736 M street
Curry, W. W. (William Wallace), Pension Building. 1510 9 street
Curtis, Henry A. (Henry Adams), Winder Building. Takoma Park
Curtis, William E. (William Eleroy), Post Bldg. 1801 Connecticut ave
Cushing, S. C. (Sallie Corwin). 320 Indiana avenue
Custis, Geo. W. N. (George Washington Neale). 110 East Capitol street
Custis, J. B. Gregg (James Bayard Gregg). 912 15 street

Dall, Wm. H. (William Healey), Smithsonian Institution. 1119 12 street
Darton, N. H. (Nelson Horatio), Geol. Survey.
Daugherty, Rev. Jerome, S. J., Georgetown College. Georgetown Univ.
Davenport, J. L. (James La Roy), Bureau of Pensions. 2501 14 street
Davis, Arthur P. (Arthur Powell), 1330 F street. 2212 1 street

Davis, Mrs Jennie T. (Jennie Taylor), Geol. Sur. 3323 Holmead ave
Dawes, Charles G. (Hon. Charles Gates)
Dawson, Thos. F. (Thomas Fulton), Star Building. 2572 University pl
Day, David T. (David Talbot), Geol. Survey. 1302 R street
De Caindry, Wm. A. (William Augustin), War Dept. 914 Farragut sq
De Meritt, J. H. (John Henry). 1335 Vermont avenue
Detweiler, F. M. (Frederick May), 420–422 11 street. 504 I street
Devine, John T. (John T——). The Shoreham, 15 and H streets
Devereux, Mrs M. (Maria). 3016 Dumbarton avenue
Devitt, G. R. (G—— R——). 7 and D streets
Dewey, George. 1747 Rhode Island avenue
Dewey, Lyster H. (Lyster Hoxie), Dept. of Agric. 1337 Wallach pl
Dickins, Capt. F. W. (Francis William), U. S. N. 1334 19 street
Dickson, Med. Insp. S. H. (Samuel Henry), U. S. N., Marine Bar. 732 21 st
Diller, J. S. (Joseph Silas), Geol. Survey. 1454 Staughton street
Dodge, Arthur J. (Arthur J——), 1403 F street. Hotel Stratford
Doermann, Rev. J. E. A. (Rev. John E—— A——). 927 Westminster st
Donn, Edw. W. (Edward William), 913 G street. 1708 16 street
Dorrelle, Ed. (Edward), 721 14 street. 928 I street
Douglass, Mrs Helen. Cedar Hill, Anacostia
Downing, Mrs Mary. 1006 11 street
Doyle, John T. (John Thomas), Civil Service Com. 2104 Wyoming ave
Du Bois, Chas. L. (Charles Lamartine), Gen. Land Off. 1421 Chapin st
Duffield, Will Ward, Coast Survey. 1631 Q street
Dumont, Jas. A. (James Allen), Treasury Dept. 2009 Kalorama ave
Duncan, D. Wallace (David Wallace), Off. Aud. P. O. Dept. 115 5 st. NE
Duncanson, Chas. C. (Charles Coltman), 317–319 9 street. 1300 17 st
Dutton, Maj. Clarence Edward. War Department
Dye, P. E. (Peleg Edwin), 514 11 street. 1403 L street
Dyer, Miss Nellie C. (Ellen Cooper). 1702 9 street

Easterling, H. V. (Horace Virgil), War Department. 1541 9 street
Edson, Jno. Joy (John Joy), 900 F street. 1324 16 street
Edwards, Thos., Jr., 225 Pa. ave. SE. 18 North Carolina ave. SE
Eimbeck, William, Coast Survey. 1106 New York avenue
Eldridge, G. H. (George Homans), Geol. Survey. Chevy Chase, Md
Emmons, S. F. (Samuel Franklin), 1330 F street. 1721 H street
Enochs, Mrs Annie H.
Erbach, John, Geol. Survey. 122 3 street SE
Estabrook, Leon M. (Leon M——). 1026 17 street
Evermann, Barton W. (Barton Warren), Fish Commission. 412 T street
Ezdorf, Richard (Count Richard von). 918 N street

Fairfield, W. B. (Walter Browne), Coast Survey. 1717 De Sales street
Fairley, Frances S. (Frances Sarah). Ridge road East

FARABEE, L. T. (Louis T.), Bureau of Pensions. 313 East Capitol street
FARQUHAR, Henry, Census Office. 1615 Florida avenue
FFOULKE, Charles M. (Charles Mather). 2013 Massachusetts avenue
FISKE, Rev. A. S. (Asa Severance). 1340 Q street
FISCHER, E. G. (Ernst Georg), Coast Survey. 436 New York avenue
FISHER, Robert J. (Robert Strettle Jones), 614 F st. 1915 Kalorama ave
FITCH, C. H. (Charles Hall), Geol. Survey. 3062 Q street
FITCH, Henry W. (Henry Winslow). 1518 Connecticut avenue
FITCH, James E. (James Edwin), 1406 G st. 1747 Rhode Island ave
FLETCHER, Miss A. C. (Alice Cunningham). 214 1 street SE
FLETCHER, L. C. (Louis Cass), Geol. Survey. Chapin flats, 1415 Chapin st
FLETCHER, Robert, M. D., Medical Museum. The Portland
FLINT, Weston, Public Library. The Westover, 16 and U streets
FLYNN, H. F. (Harry Franklin), Coast Survey. 31 B street SE
FOOTE, Morris J. (Morris Julius), War Department. 1729 H street
FORNEY, Edward O. (Edward Otis), Patent Office. 514 E street
FORWOOD, Gen. W. H. (W—— H——). 1425 Euclid place
FOSTER, Miss E. B. (Ellen Burroughs). 1402 Binney street
FORSYTH, Geo. A. (George Alexander). 1509 Rhode Island avenue
FOSTER, John W. (John Watson). 1323 18 street
FOWLER, Edwin H. (Edwin Horatio), Coast Survey. 1126 East Cap. st
FRAILEY, L. A. (Leonard August), Navy Pay Office. The Gloucester
FRANKENFIELD, H. C. (Harry Crawford), Weather Bu. The Buckingham
FRENCH, Geo. N. (George Norris), Treasury Department. 1834 I street
FRENCH, Owen B., Coast Survey 2212 F street
FRISBY, Prof. Edgar. 1607 31 street
FULLER, Chf. Jus. M. W. (Melville Weston), Supreme Court. 1801 F st
FULTON, H. K. (Horace Kimball), 314 9 street. 1211 Vermont avenue

GAGE, N. P. (Nathaniel Parker), Seaton School. 1126 5 street
GALE, Thos. M. (Thomas Monroe), 1414 F street. 1314 L street
GALLAUDET, E. M. (Edward Miner), Gallaudet College. 1 Kendall Green
GANNETT, Henry, U. S. Geol. Survey. 1881 3 street
GANNETT, S. S. (Samuel Stinson), Geol. Survey. 2556 University place
GARNIER, Madeleine A. (Madeleine Adelaide), P. O. Dept. 1829 Oregon ave
GARRIOTT, E. B. (Edward Bennett), Weather Bureau. 1248 Princeton st
GARRISON, Miss Carl L. (Carl Louise), Phelps School. 1300 Lydecker ave
GATES, Merrill E. (Merrill Edwards), 1429 N. Y. ave. 1315 N. H. ave
GATSCHET, Albert S. (Albert Samuel), Bureau Ethnology. 2020 15 street
GIBSON, George, 13th street and Pennsylvania avenue. 1434 R. I. avenue
GILBERT, Mrs C. E. (C—— Evelyn). 1455 Missouri avenue
GILBERT, G. K. (Grove Karl), Geol. Survey. 1919 16 street
GILLAM, Frank, Weather Bureau. Cleveland Park, D. C.
GILLETT, Alfred S. (Alfred Silas), Philadelphia. 1614 20 street

Gilman, Daniel C. (Daniel Coit), 1439 K street. 614 Park avenue, Balto
Glover, C. C. (Charles Carroll), Riggs National Bank. 20 Lafayette sq
Glover, John J., Department of Justice. 1505 R street
Godfrey, E. D. (Eliasaph David), Pension Office. 942 Westminster st
Goldman, E. A. (Edward Alphonso), Department of Agriculture.
Goode, Rich'd U. (Richard Urquhart), Geol. Survey. Lanier Heights
Gorham, Geo. C. (George Congdon), Bond Building. 1763 Q street
Graham, Andrew B. (Andrew Butler), 1230 Pa. ave. 1407 16 street
Graham, Agnes M. (Agnes Montgomery). 1732 Connecticut avenue
Graham, Mrs J. A. (J—— A——). 2000 H street
Grandprey, Maj. Clement de. 1918 H street
Grant, Alex. (Alexander), P. O. Department. 1347 L street
Graves, Edward. 927 Massachusetts avenue
Greely, A. W. (Adolphus W.), War Department. 1914 G street
Green, Bernard R. (Bernard Richardson), Lib. of Cong. 1738 N street
Green, Darius A. (Darius Alonzo), Navy Department. 1123 17 street
Greene, Dr Edw. L. (Edward Lee), Catholic University. Brookland
Greene, Samuel H. (Samuel Harrison). 1320 Q street
Greene, Mrs Wallace (Josie Craig). 904 S street
Griswold, H. A. (Henry Adams). Maple avenue, Anacostia
Grosvenor, Gilbert H. (Gilbert Hovey), Corcoran Bldg. 1328 18 street

Hackney, Fielder Poston, 2806 Pa. ave. 2602 Pennsylvania avenue
Hagner, A. B. (Alexander Burton), Court-House. 1818 H street
Hague, Arnold, Geol. Survey. 1724 I street
Hall, C. L. or Cyrus L. (Cyrus Lyman). 1354 Yale street
Hall, Sam'l K. (Samuel Kellogg), Govt. Printing Office. 421 H street
Hall, W. L. Bureau of Forestry
Hamilton, Dr William, Bureau of Education. 1023 Vermont avenue
Hamlin, Teunis S. (Teunis Slingerland). 1306 Connecticut avenue
Hansen, John (J. A. H. John). 704 7 street
Harding, Miss Gena R. (Gena Russell). The Shoreham
Hardwick, S. H., Southern Railway Co. 1315 New Hampshire avenue
Harlan, Justice John M. (John Marshall), Sup. Court. 1401 Euclid pl
Harris, W. T. (William Torrey), Bureau of Education. 1303 P street
Harrison, Miss Carrie. 1322 14 street
Hart, A. (Abraham), 420 7 street. 2005 Kalorama avenue
Hart, Amos W. (Amos Winfield), 625 F street. 717 10 street
Harvey, Lt. Col. Philip F., Dep. Surg. Gen., U. S. A. Surg. Gen. Office
Haven, Henry L. (Henry Langdon), 623 F street. 2005 I street
Hawley, John M. (John Mitchell), Navy Department. 1514 R street
Hay, E. B. (Edwin Barrett), 1425 N. Y. avenue. 1512 Corcoran street
Hay, John, State Department. 800 16 street
Hay, W. P. (William Perry). 311 F street

Hayden, Lieut. Everett. Navy Department
Hayes, C. Willard (Charles Willard). Geological Survey
Hazard, Daniel L. (Daniel Lyman), Coast Survey. 1445 Mass. avenue
Hazlett, Isaac. The Hamilton, 14 and K streets
Head, J. F. (John Frazier). 2015 R street
Heard, Hon. A. (Augustine). 921 18 street
Hearst, Mrs Phebe A. (Phebe Apperson). 1400 N. H. avenue
Heaton, A. G. (Augustus George). 1618 17 street
Hedrick, Henry B. (Henry Benjamin), Naval Obser'y. 2301 32 street
Heger, Col. A. (Anthony). 2026 Hillyer place
Heilprin, Giles F. (Giles Fabian), 1203 F street. 926 B street SW
Henderson, C. W. (Charles W——), 507 12 street. The Chapin
Henderson, Julia (Julia Doty), Indian Office. 1826 G street
Henderson, John B., Jr. (John Brooks), 1416 F st. 1601 Florida ave
Henderson, Miss N. (N——). *Address unknown.*
Hendges, M. (Matthew), General Land Office. The Garfield, 901 13 st
Hennig, Frederick, Washington Barracks. 1831 5 street
Henry, A. J. (Alfred Judson), Weather Bureau. 1322 Columbia road
Henry, E. S. (Edwin Stanton), Patent Office. 1320 Columbia road
Herbert, Hon. H. A. (Hilery Abner), 1419 G street. 1612 21 street
Herron, Joseph S. (Joseph Sutherland), War Department. The Donald
Herron, Wm. H. (William Harrison), Geol. Survey. 1508 Q street
Heurich, Christian, 26 and Water streets. 1307 New Hampshire ave
Hickey, Susanna G. (Susanna Goode), Harrison School. 1202 Q street
Hicks, Frederick C. (Frederick C——). Library of Congress
Hieston, Mrs Walter. The Concord
Higginson, Rear Admiral F. J. Treasury Department
Hill, E. J. (Ebenezer J——), House Reps. The Cochran. Norwalk, Conn
Hill, David J. (David Jayne), Department of State. 1313 K street
Hindmarsh, W. B. (Walter B.), Light-House Board. 323 East Cap. st
Hislop, Dr William, 1400 H street. 1404 L street
Hitchcock, A. S. (Albert Spear), Dept. of Agric. 80 R street
Hitz, John, Volta Bureau. 1709 35 street
Hodges, J. W. (John Walter). 201 2 street SE
Hodgkins, W. C. (William Chandler), Coast and Geodetic Survey.
Hoegelsberger, Mrs Nora, Central High School. 924 Massachusetts ave
Holbrook, Theodore Lewis, 1420 New York avenue. Cleveland park
Holden, Henry P. (Henry Prichard), Bureau of Pensions. 1211 I street
Holliger, Frank S. (Frank Samuel), War Department. 1112 N. Y. ave
Holmead, Alfred H. (Alfred H——), Interstate Com. Com. The Iowa
Holmes, W. H. (William Henry), National Museum. 1444 Staughton st
Holt, H. P. R. (Henry Peter Renouf), Treasury Dept. Takoma Park
Hopkins, Archibald, Court of Claims. 1826 Massachusetts avenue
Hopkins, James H. (James Herron). 1324 18 street

Hopkins, Martha G., Bureau Engraving and Printing. 2034 G street
Hornblower, Jos. C. (Joseph Coerten), 1509 H street. 1402 M street
Hosier, F. M. (Francis Marion), Bu. of Nav., Navy Dept. 1204 S street
Hough, Franklin H. (Franklin Horatio), Atlantic Bldg. 1315 T street
Hough, Helen M. (Helen Maria), 1330 F street. 332 Indiana avenue
Hovey-King, Alvin, Bureau of Statistics. 1732 21 street
Howard, A. L. (Arcturus Lee). 124 S street
Howard, L. O. (Leland O.), Department of Agriculture. 1336 30 street
Howell, Edwin E. (Edwin Eugene), 612 17 street. 2032 G street
Hoyt, Henry M. (Henry Martyn), Dept. of Justice. 1516 K street
Hubbard, Mrs Gardiner Greene. "Twin Oaks," Woodley lane
Hutchins, Stilson. 1603 Massachusetts avenue
Hume, Frank, 454 Pennsylvania avenue. 1235 Massachusetts avenue
Hutcheson, David, Library of Congress. 401 B street NE
Hutchison, Miss Jessie E. (Jessie Elizabeth), P. O. Dept. 305 D street
Huxford, Maj. W. P. (William Pitkin), Atlantic Bldg. 1806 H street
Hyde, Miss E. R. (Eliza Reed), Off. Comp. Cur., Treas. Dept. 1326 I st
Hyde, John, Department of Agriculture. Lanier Heights
Hynson, Laurence M. (Laurence Maxwell), Corcoran Bldg. 623 S. C. ave

Ide, George R. (George Russell), Patent Office. 801 A street SE

Jackson, Sheldon, Bureau of Education. The Concord, 1701 Oregon ave
James, Mrs Sarah S. (Sarah Stubbs). 1517 O street
Janson, Ernest N., Navy Department. 802 Rhode Island avenue
Jewell, Claudius B. 1324 Vermont avenue
Johnson, A. B. (Arnold Burges), Treasury Department.
Johnson, Arthur E. (Arthur Edward), War Dept. 1833 Vermont ave
Johnson, Enoch G. (Enoch George), House of Reps. 1827 Corcoran st
Johnson, Frank E. (Frank Evan), Treasury Department. 1845 R street
Johnson, Theo. H. (Theodore Halfdan), Geol. Survey. 1115 S st
Johnson, Willard D. (Willard Drake), Geol. Survey.
Johnston, James M. (James Marion), Riggs Nat'l Bank. 1628 K street
Johnston, John A. (John ——). 1752 Q street
Jones, Dr E. S. (Edward Salmon), Treasury Department. The Cairo
Jones, Louise Tayler. 1340 21 street
Jones, Col. W. A. (William Albert), Balto. and Phila. 1800 Conn. ave
Judd, Geo. H. (George Herbert), 420–422 11 street. 511 3 street NE

Kasson, John A. (John Adam). 1726 I street
Kattelmann, Carl. 715 7 street
Kauffmann, S. H. (Samuel Hay), 1101 Pa. ave. 1421 Mass. ave
Keiller, Mrs William. The Portner, 15 and U streets
Kelly, Joseph T., D. D. (Joseph Thomas). 1367 Kenesaw street

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KENDALL, Frederick A. (Frederick Albert), 533 15 st. 1455 W street
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THE NATIONAL GEOGRAPHIC MAGAZINE

THE GREAT TURK AND HIS LOST PROVINCES

By William E. Curtis

THE next, like the last, battleground of Europe will be the Balkan Peninsula, a group of petty states lying in the southeastern corner of Europe, bounded on the north by the Danube River, on the south by Greece and the Ægean Sea, on the east by the Black Sea, and on the west by the Adriatic. It is one of the oldest, yet one of the most primitive, portions of Europe, comprising the ancient Macedonian Empire. The people are described by Pliny and Herodotus. They fought Darius the Persian, and Alexander the Great. Julius Cæsar was planning a campaign against them when he fell in the forum with the dagger of Brutus in his breast. The story of the adventures of the Emperor Trajan among them is carved upon that marvelous column in Rome. Theirs was the last province to be added to the Roman Empire and the first to go to its dissolution. They then fell into the hands of the Turks, and for century after century submitted to the yoke of the Sultan, and were gradually submerged in political, moral, intellectual, and commercial oblivion. The existence of this once powerful people was almost forgotten until the Bulgarian atrocities, as they were called, excited universal horror twenty-five years ago and Russia intervened on the pretext of racial and religious relationship and attempted to take them away from Turkey ; but the other powers of Europe prevented the Czar from enjoying the fruits of his victory over the Sultan and refused to permit him to have a port upon the Mediterranean. Ancient Macedonia was cut in half. The upper part was made an independent kingdom, called Bulgaria. The lower half, familiarly known as Macedonia, was restored to Turkey upon solemn stipulations that the people should have a Christian governor and a just and liberal government. That territory which appears upon the map as Eastern Roumelia, has recently attracted much attention from the civilized world because of the kidnapping of Miss Stone, an American missionary.

BOSNIA AS AN AUSTRIAN PROVINCE

Bosnia, the westernmost of the Turkish provinces, was placed under the protection of Austria, and has been the scene of a remarkable transformation from one of the most unhappy and hopeless places on earth to one of the most peaceful and prosperous. It is the more interesting because it happens to be the first Turkish province that was ever well governed. Nowhere else in Europe has there been so rapid an increase in population and wealth, and the picturesque old towns are taking on an air of activity. While subject to the Turks Bosnia practically vanished from the current of civilization until 1875, when, exasperated by extortion, robbery, rapine, murder, and religious persecution, the people rose in rebellion. The powers of Europe placed them under the protection of Austria, which has given the most remarkable exhibition of administrative reform known to modern history, and has demonstrated the possibility of governing alien races by justice and benevolence.

"Where the Turks are, there also are the wolves," is a Bosnian proverb. Another says: "Where the hoof of the Turkish horse strikes, the crops will come up very thin." Those proverbs were illustrated in an unmistakable manner in Bosnia, but one who visits that country today can scarcely believe that such conditions existed there only a short time ago. There were no railroads and few wagon roads. Brigandage was a recognized profession. Robbery was as common as lying. Murder was not considered a crime, and the number killed by the soldiers or by each other was not recorded. The British consul reported to his government that the average was ten thousand a year. Those who were compelled to travel went in large parties fully armed; farmers dared not build their cabins where they could be seen from the highway, and women never appeared in public alone, because it was unsafe. Today human life is as safe in Bosnia as it is in Illinois, and travel is even safer there, because there has never been a train robbery in that country. During the last ten years, out of a population of nearly two millions, the homicides have averaged only six a year, and in 1900 there were only two. There has been no case of highway robbery since 1895, and in 1900 but one case of burglary. Other crimes are equally rare.

The people are peaceful and contented. The cities are filled with new and handsome houses, factories have been built to utilize the water power, a university, colleges, schools of engineering, agriculture, and manual training have been established to qualify the people to make the most intelligent use of their opportunities. The population is almost evenly divided between the Moslem, Orthodox Greek, and Christian churches, with a few thousand Protestants and Jews. Members of the different religious mingle on amicable terms and show mutual respect and toleration. The courts are wisely and justly administered; justice is awarded to every citizen regardless of his religion, wealth, or social position; taxes are low and honestly collected and economically disbursed. The people have learned for the first time that honest complaints will be patiently listened to, and that wrongs will be remedied. Although the older peasants are still ignorant, backward, and distrustful, the younger generation show enterprise and ambition and are conducting their affairs with intelligence and order.

Enlightened Mohammedans have observed the advantages of the social, agricultural, and administrative reforms, and while no adult Moslem was ever converted to Christianity, they are adopting the customs and habits of the western world. The lives of the women are becoming enlarged. The wives and daughters of the Turks still wear veils in the streets, but are being released from the degrading position they occupy in all the lands of Islam.

Under Turkish rule all public worship was forbidden except that of Islam, and Christians and Jews were obliged to say their prayers in secret and pay blackmail to the local magistrates for the privilege. They were known as Rayahs—the word means ransomed—because, meriting death, they purchased permission to live by paying tribute. Western Christians do not appreciate the religious heroism which the poor peasants, not of Bosnia only, but of Bulgaria, Macedonia, and other Balkan provinces, have displayed during the long centuries they have suffered from the persecution of the Turks. They have lived in daily dread of martyrdom, yet have clung to their faith, when at any moment they might have secured safety, prosperity, and position by recanting and accepting the religion of their oppressors. These conditions still exist in Macedonia, and in Roumania the Jews are suffering more from the Christians than they ever suffered in Bosnia from the Turks. The Christians do not kill with the sword nor destroy with the torch, nor do they steal women for their harems, but they debar their Jewish fellow-beings from labor, drive them to distress and starvation, deprive them of education and the privilege of worship.

Through all the centuries that Bosnia was controlled by the Turks the people were without morality, education, arts, or sciences, and their industry was limited to the supply of their own wants, simply because when they possessed something they did not actually need, it attracted the rapacity of the officials. Occasionally some man like Nikola Tesla, the famous electrician, who is a native of Bosnia, broke through the restrictions and found an opportunity to develop his genius elsewhere; but under the Turks such cases were few.

Much of the cruelties endured by the people formerly were due to religious fanaticism. A peculiar sect of dervishes, called Ghazi, are holy men who go forth to slay the enemies of the Prophet until they are themselves slain, and as long as such fanatics are allowed to invade Christian communities, there can be no peace. Religious fanatics who commit murder for the faith in Bosnia are sentenced to have their bodies cremated after execution. This has driven them from the country. It is a punishment they dread more than death. To hang or shoot a Mohammedan is simply to send him to the paradise he is seeking, where he will rise again in his natural body in the presence of the Prophet. But if his body is burned or destroyed by any means, it is impossible for him to be translated, and his soul will remain forever in suspense.

Bosnia is broken by high peaks, deep glens, ridges, beautiful wooded hills, winding streams, and rich alluvial basins, which yield large crops of grain and are especially adapted to fruit. The landscape is a series of terraces which slope gradually southward and finally disappear in an archipelago of lovely islands, one of the most enchanting pictures in the universe, whose attractions have been the theme of poets ever since the days of Homer. It was on this coast during the Roman occupation that the Roman Emperor Diocletian erected his magnificent palace, which covered ten acres of ground, and for size, magnificence, and architectural display surpassed all human dwellings. The ruins are still sufficiently well preserved to fascinate the artist, the architect, and the archæologist, but the marble is being rapidly carried away to Italy and Austria for building material.

Sarajevo, the capital, is a city of 60,000 inhabitants, reached by a narrow-gauge road winding among the mountain gorges like the Colorado railways until it reaches the Adriatic at Metkovic, the port of Bosnia. The journey is interesting; the scenery is picturesque, but that which most attracts the American traveler is the transformation of medieval castles into paper mills, tanneries, cigarette factories, woolen mills, and other practical purposes. Most of these enterprises have been aided by government subsidies, for the Austrians have considered it wise to encourage the introduction of foreign capital and immigration by offering substantial inducements in the way of free land and buildings, exemption from taxation and financial assistance. In this way they have provided employment for the women and others who are incapable of manual labor, and have afforded a ready and profitable market for agricultural products. There is excellent water power everywhere. Very little raw material is now shipped from Bosnia. The hides are tanned at home; the wool is woven into blankets, rugs, and carpets; the tobacco is manufactured into cigars and cigarettes; the wheat into flour; the fruit and vegetables are preserved, and all other proceeds of agricultural labor are increased in value and manufactured into marketable merchandise before they leave the country. Prunes are the largest item of export, and $1,500,000 worth were sold in the European markets in 1901. Beet-sugar factories have now been erected, and experts have been brought from Italy to educate the natives in the cultivation of silk.

In Sarajevo the ancient and the modern meet; the East and the West touch hands; the oriental with eternal composure listens to the chatter of the Frenchman and regards the gesticulations of the Italian with supreme contempt. The town is half Turkish and half Austrian. The old part looks like Damascus and the new part like Budapest, which, in many respects, is the handsomest city in the world. I was told that Sarajevo contained a larger variety of types of the original oriental races than even Constantinople, and that in the bazaars may be seen daily examples of every national costume worn from the Straits of Gibraltar to the Yellow Sea of China; and they all live together in peace and harmony, each recognizing the scruples of the other, permitting him to practice in peace the creed and customs of his faith.

Sarajevo compares well in architecture and in other respects with any other city of its size in Europe or America, and will some time be a beautiful and popular place, for it is much favored by nature, and the inhabitants are rapidly accumulating wealth. There are mosques with minarets and domes, churches of every religion, fine office buildings, apartment-houses, government edifices, and public institutions. The city hall is a beautiful modern structure of the oriental type, and the *Scheriatschule* or law college is imposing.

The old part of the city consists of crooked and narrow streets, lined with shops and bazaars opening upon the sidewalks, as in all oriental towns. The merchants and mechanics squat on their haunches or sit cross-legged as they make and sell their wares, but it is not sage for a stranger to purchase souvenirs of the country in those shops unless he sees them made, because most of the stock comes from the factories of Germany, France, and Austria. The different trades are governed by guilds, as was formerly the rule throughout Europe. Each guild has a patron saint and a long list of officers, who fix prices and profits, regulate wages, appoint apprentices, and decide disputes; but there is no eight-hour law. The busy artisans keep at it from daybreak to bedtime, seldom knocking off except to say their prayers at the nearest mosque, or drink a cup of coffee and make a cigarette at the nearest café.

The population of Bosnia at the time of the revolution is unknown. There had never been a census. More than

A Jewish Cemetery, Bosnia

two hundred thousand people fled across the border during the ten years previous to the Turko-Russian war to escape the cruelties and extortions of the Turks, and at its close the inhabitants had probably been reduced to less than eight hundred thousand. In 1900 the population had increased to nearly two millions, and is growing at the rate of about ten per cent a year, including representatives of every religion, especially Jews from Russia and Roumania. The Jewish burying ground is a curious place, ordinary granite boulders being used for headstones. The government respects the religious scruples of every citizen, and adjusts its laws and judicial proceedings to the requirements of the different faiths. The Austrian statesmen who have solved the Bosnian problem recognized the importance of a fact which many rulers in all parts of the world and at all periods have forgotten or overlooked, that conscience and religion lie deeper than any other influences that affect human action.

One of the most novel peculiarities of paternalism is the erection of fine hotels in different parts of the province in order that people who visit the country may be made comfortable and leave with pleasant impressions. These hotels are well kept, charge reasonable rates, and have not only been one of the most effective influences in bringing capital and new enterprises into Bosnia, but have been a profitable investment to the government.

Government Hotels, Bosnia

Another interesting and novel feature of the administration concerns the military. Every young man must serve five years in the army. At eighteen he enters the active service for two years, and then serves for three years in the reserve corps, which is mobilized for two or three weeks annually for drill and instruction ; but no Bosnian soldier serves in his own country. He is sent to Austria or Hungary and stationed in some large town, where he can have an opportunity to rub up against the people and learn by imitation what he cannot be taught at home. If he marries an Austrian girl, he is allowed double pay, is exempt from certain guard duty, his wife is permitted to live in the barracks with him, and is employed as a cook or laundress or in some other capacity. Thus a great majority of the young men who leave Bosnia for military service return with Austrian wives and settle down as valuable citizens in the old towns. On the other hand, all military duty in Bosnia is performed by Austrian soldiers, who are offered similar inducements to marry Bosnian girls, and if they settle down in the province permanently, the government gives them farms or homes. Thus the country is not only being settled by an excellent class of young people, but the ties of relationship are linking it more closely to Austria every year.

One of the most interesting towns is Jajce, where St Luke is believed to have lived and died and to have been buried. Helena, the daughter of the last of the ancient kings of Bosnia, was given the remains of the apostle as a part of her dowry, and when Jajce was captured by the Turks, she escaped by a miracle and carried them with her to a convent at Padua, Italy.

BULGARIA

Bulgaria is about the size and shape of Pennsylvania, with nearly the same population, and its forests and rivers, the mountain ranges and rich valleys that lie between them remind one of the Quaker state. The Danube River forms the northern boundary and carries most of the commerce of the country, and along its banks are some fine old Roman ruins. Three-fourths of the population are engaged in agriculture and pastoral pursuits, cultivating little farms and following flocks and herds which graze at large. Theoretically all of the land belongs to the state, and those who occupy it pay one-fourth of all their produce for rent and taxes. The principal products are wheat, wool, and the oil of roses, which comes from the provinces bordering on the Black Sea. Philippopolis, a famous old town founded by Philip of Macedon 350 B.C., the second city in population and importance, is the center of the industry, and from that point eastward the entire kingdom is a rose garden. Roses are cultivated like grapes in France and Italy, so that all of the strength of the sap may go into the flowers, and in the summer women pluck the flowers as they reach maturity. Thousands of tons of rose leaves are gathered annually. The petals are carefully removed and the oil extracted from them by distillation. The oil sells from $50 to $100 a pound, according to its purity and specific gravity. A single drop will perfume a two-ounce bottle of alcohol.

The peasants of Bulgaria are industrious, ingenious, and intelligent. Both men and women are of fine physique, capable of great endurance, and few are idle, intemperate, or vicious. I saw but three or four beggars all the time I was in Bulgaria, and they were cripples. The women do their share of work on the farms, and never seem to be idle a moment. They spin as they walk along the highways and as they sit behind piles of fruit and vegetables in the markets. Most of the shepherds you see from the highways are women and children. The large herds in the mountains are kept by well-grown boys, who sleep in the open air with sheepskins wrapped around them.

Hospitality is based upon the ancient oriental laws. No stranger is ever turned from the door if he comes in peace. The poorest peasant will share blanket and bread without the asking, and no visitor leaves a cabin without being offered a bunch of grapes, a mug of milk, or at least a glass of water. Each family has at least one pair of oxen, forty or fifty sheep, besides cattle, goats, pigs, geese, and chickens. Fruit is plentiful. The southern slopes of the Balkan Mountains are clad with vines, and the grapes produce an excellent wine. Tobacco and cotton grow well and all the vegetables known to temperate zones.

The great majority of the people belong to the Orthodox Greek Church; not more than one-fifth are Moslems. Their patron saint is St John of Ryle, a monk, who lived in a hollow oak in the mountains. A monastery, built upon the site of his retreat, is an enormous building of medieval architecture, frequently visited by tourists, who are hospitably entertained by the monks. It received considerable notoriety lately because of a report that Miss Stone was concealed there, and a thorough search was made by the soldiers. This profanation of the holy place excited great indignation among the orthodox Greeks, who blamed the American missionaries and threatened reprisals.

Its picturesque walls have often sheltered brigands, and in olden times its secluded situation made it a convenient rendezvous for enterprising gentlemen when tempted by favorable opportunities or oppressed by necessity. In return for their hospitality the monks were liberally supplied with game from the mountains, and are supposed to have received liberal contributions from the booty of their guests.

Around the picturesque city of Philippopolis are many ancient ruins, which should attract the interest of archæologists, but have thus far received very little attention. Perhaps that is because they are so far away. In Philippopolis there is quite a colony of Protestants, which last year erected the largest and finest Protestant church in the Balkan States. In Sofia there is another prosperous Protestant church. The principal school is at Samakov, where Miss Stone had been attending a teachers' convention before her capture.

The most influential woman in Bulgaria is Mrs Ivan Kassuroff, a former pupil of Miss Stone, who is notable as the first woman of social position in that country to enter mercantile business. Her character and abilities have not only carried her through a trying ordeal, but she has gained the respect and confidence of the entire community and has opened the field of commerce for women. When her husband, who was the proprietor of the principal bookstore in Sofia, died, he left her nothing but the good will of his business, and she was compelled to carry it on or become dependent upon others. Although no woman had ever undertaken such a task in Bulgaria, Madam Kassuroff assumed the responsibility. Now every one admires her and is proud of her success, and every hat is lifted when she passes along the street. She is a typical example of what American ideas, introduced by American missionaries, have done for the emancipation and advancement of women in the East. The government, as well as the public, has expressed its approval, and Madam Kassuroff is now the official printer and bookseller.

Sofia, the capital, is a city of 45,000 inhabitants, situated at the base of Mt Bitosch, a beautiful peak, 7,800 feet high. It covers a considerable area, and looks as if a building boom had been suddenly checked, which is true. Under the reign of Prince Alexander and Stefan Stambuloff, Bulgaria made

The Ancient Greek Monastary of St John of Ryle, Bulgaria extraordinary progress, but under the present government very few improvements have been made. The business portion of the city will compare well with any place of similar size in France, Germany, or Austria. The business blocks are of modern architecture; the streets are wide and well kept; there are many apartment-houses similar to those in Vienna; the shops are filled with fine assortments of European goods—patent sweepers and furniture from Grand Rapids, agricultural implements and machinery from our factories, and Armour's canned goods; but what little commerce we have with the Balkan States is filtered through Austria.

Sofia, the Capital of Bulgaria

In the market places you see the costumes of nearly every oriental race. The Bulgarian is distinguished by the kalpak, a head-dress of lamb's wool, and the Turk by his fez. The Turkish women wear veils, but the Bulgarian women follow the European customs. The national costume is one of the most picturesque in Europe, and their outer garments are of wool grown and sheared upon their own farms, spun and woven in their own cabins, cut and made by their own hands. Formerly their cotton goods were imported from England and Germany, but the thrifty Bulgarians have learned the most valuable lessons of economy, and a little patch of cotton is now found beside nearly every cabin, which is planted, picked, ginned, spun, woven by the women like wool from their flocks. They are fond of bright colors, and the garments of both men and women are elaborately embroidered. A Bulgarian girl arrayed for her wedding or for a holiday is as pretty and picturesque an object as you can find outside of China or Japan, and a Bulgarian dandy is a delight. The sober-minded gentlemen wear long coats of white wool with full skirts and frogs, turbans of lamb skin, and high boots.

There is a fine club in Sofia, more imposing than can be found in any city of 46,000 population in the United States, and it is the center of social life. During the reign of Prince Alexander, a military barracks, public printing office, a technical school, a riding academy, and other creditable government buildings were erected. Several mosques have been converted into prisons, markets, warehouses, and arsenals. The largest, only a stone's throw from the palace, is now being fitted up for a national museum. There are two hotels with comfortable rooms and excellent tables; electric street cars run in every direction; the streets, public buildings, and houses of the rich are lighted with electricity, and other features of modern civilization are quite as advanced as may be found in any other city of Europe.

In the older quarters of the city are seen long rows of ancient wooden houses with latticed windows, and by that sign one may know the residence of a Turk, who thus shields the women of his family from the public gaze; but there are now comparatively few Moslems in Bulgaria, and they are leaving rapidly.

The Berlin conference told the people of Bulgaria that they might choose their own prince, and the National Assembly selected Prince Alexander of Hesse, a nephew of the Czar of Russia, a grandnephew of Kaiser Wilhelm the Great, and a brother-in-law of Queen Victoria's daughter Beatrice. He was a great favorite with everybody—brave, unselfish, patriotic, and ambitious to promote the welfare of the people, but too honest and candid to cope with the conspirators by whom he was surrounded. Russia was disappointed because the other powers had deprived her of the fruit of her victory over the Turks, and determined to obtain control of Bulgaria by intrigue. Anxious to preserve its independence, Alexander refused to comply with the Russian demands, encouraged the democratic spirit of the people, and assumed the leadership of the anti-Russian party. The Russians retaliated by one of the most scandalous conspiracies since the days of the robber barons. The Prince of Bulgaria was kidnapped in his own palace by his own officers, driven over the mountains, and placed upon a Russian yacht in the Danube. European sentiment compelled his restoration and the Czar evaded responsibility, but not one of the Russian officials engaged in the plot was ever even reprimanded.

Alexander was enthusiastically welcomed by the people, but, with characteristic frankness telegraphed the Czar that he had received his crown from Russia and was ready to surrender it whenever demanded. The Czar compelled Alexander to abdicate, but not until after he had given him a pledge that the Bulgarians would be permitted to manage their own affairs without interference—a pledge that has been daily violated.

Alexander's successor and the present Prince of Bulgaria is Ferdinand of Saxe-Coburg and Gotha, a grandson of Louis Philippe of France, and a cousin of nearly every crowned head in Europe. Ferdinand is the opposite of Alexander in character, motives, and ambitions. He is selfish, fond of display, of extravagant habits, and the gratification of his own vanity is of greater importance to him than the progress and welfare of his people. For the first two or three years he got on without friction, but his queen, Marie Louise of Bourbon, yearned for the social recognition of the court at St Petersburg and was ambitious for her children. Through her influence he yielded to the demands of the Czar, and the active ruler of Bulgaria has since been the diplomatic agent of Russia at Sofia, now Mr Bakhmeteff, a diplomatist of great talent and long experience, who is well known in Washington, having married the daughter of the late General Edward F. Beale.

Stefan Stambuloff was the greatest man the Balkan States ever produced, and was the Prime Minister of Bulgaria under Prince Alexander and Prince Ferdinand until the latter adopted a pro-Russian policy, when he retired and was succeeded by a man of Russian sympathies. He became the leader of a formidable anti-Russian party, until removed from the whirl of Bulgarian politics by assassination in July, 1895. The assassin was recognized as Michael Stavreff, a pro-Russian politician who was also accused of the murder in 1892 of Mr Vulkovich, a diplomatic agent of Bulgaria at Constantinople, second to Stambuloff in influence among the anti-Russian party. Until October last Stavreff was allowed to go unpunished, and was a familiar figure about the cafés of Sofia. He was pointed out to me and to every one as Stambuloff's assassin, and appeared to be proud of that notoriety.

In October, 1902, he was arrested, tried, convicted, sentenced to death for the two murders by order of Mr Ludskanoff, Minister of Interior and leader of the Russian sympathizers, who was banished by Stambuloff for treason. Immediately after the sentence of Stavreff, there appeared upon the streets facsimile copies of letters showing that Ludskanoff had employed him to commit the two murders, and similar facsimiles of other letters have appeared at frequent intervals since. It is the popular belief that Ludskanoff, fearing Stavreff's reckless tongue, attempted to put him out of the way, and that the latter's friends have disclosed the correspondence to involve the minister in the crime.

Stavreff has not been executed; the Prime Minister, Mr Karachoff, still permits Ludskanoff to remain in the cabinet; the government ignores the situation, and the friends of the minister claim that the general amnesty granted political exiles after Stambuloff's assassination was a full pardon for any crime in which he might have been involved before that date.

Stambuloff lacked polish and education; he was arbitrary and despotic, but his entire career is an example of unselfish integrity and patriotism. He lived and died for the independence of Bulgaria, and had the full confidence of Prince Alexander. Had those two men been permitted to carry out their plans, the country would have had peace, progress, and prosperity; but conspiracy triumphed, patriotism was repressed, and but for the strong hand of Russia its condition might have been worse than it is. The treasury is empty, the national credit is exhausted, and the hysterical emotions of sympathy that are stirred by the sufferings of their kinsmen across the border keep the people in continuous turmoil.

MACEDONIA

The Bulgarian atrocities have been repeated in Macedonia for over twenty-five years, and have grown worse and worse, until the country has been almost depopulated. Human life and property are held as worthless by the Turkish officials. No woman has been safe from their lust; no man has been allowed to save money or produce more than enough to supply his own wants. The Christian population have no standing in the courts, no remedy for injustice and extortion, and the world would be shocked if the truth were known; yet year after year the jealousy of the powers of Europe permit these conditions to continue.

An occasional insurrection or lawless incident in which a foreigner has been the victim, like the kidnapping of Miss Stone, has attracted public attention, and remonstrances are frequently filed at the Sublime Porte by the European ambassadors, in which the Sultan is warned that anarchy and barbarity will not be tolerated longer and admonished to repent and reform. It must amuse His Majesty to read the signature of the German ambassador at the bottom of these notes, and we can imagine his large, sad eyes grow merry at the farces so frequently enacted at the Yildiz Kiosk when the representatives of the powers appear in their radiant uniforms to remonstrate against his inhumanity to his Christian subjects. He realizes and he knows that they realize that the slightest interference by force on the part of any of their sovereigns will provoke an even more emphatic remonstrance elsewhere for fear some commercial or political advantage may be gained; and when his situation becomes serious he grants another profitable concession to some German syndicate as an additional policy of insurance against intervention. Germany is more culpable than any other nation, because its government sustains and protects the Sultan in his atrocious barbarisms not only in Macedonia but in all parts of the near East.

Von Moltke prophesied that a universal war would be fought under the walls of Constantinople, and the Bulgarians are trying to provoke it. What is known as the Macedonian Committee is an organization to which every Bulgarian belongs. Its headquarters are in one of the most conspicuous buildings upon one of the most prominent streets of Sofia. Its meetings are public. It issues a weekly newspaper in which its purposes are announced and its plans

House of the Sobranye (Bulgarian National Assembly), Sofia

Prince Ferdinand of Bulgaria

discussed. It is sustained and encouraged by the Bulgarian government and assisted by liberal contributions from Russia. The plot to kidnap Miss Stone was hatched in the Macedonian Committee, and her ransom, paid by the American people, was undoubtedly expended for arms and ammunition. The object was, first, to punish the American missionaries who had refused to contribute to the Macedonian cause; second, to attract the attention of the Christian world to the anarchy and barbarism that exist in Macedonia; and, third, to involve the United States government in hostilities with Turkey.

How long the powers of Europe will permit the Sultan to defy them is a question often asked, both in private and public, and never answered. It is probable that trouble will ultimately arise through collision between the Bulgarian patriots and the Turkish troops in Macedonia. They occur frequently. Scarcely a month passes without a battle on the border. If Bulgaria makes a complaint, Turkey replies that the government is trying to suppress brigandage. Some time, however, the Bulgarian people will not be satisfied with that answer. They will insist that their government demand reparation of Turkey and make a hostile demonstration that will attract the attention of Europe. This would have occurred long ago but for the inability of Bulgaria to raise funds to equip and pay an army, the indifference of Prince Ferdinand, and the lack of leadership.

In the meantime the Sultan is buying guns in anticipation of trouble. We often hear that the Sultan is insane, that he is suffering from a neurotic disease caused by insomnia, anxiety, and fear; yet no diplomatist of ancient or modern times has been more skillful or successful in playing upon the rivalries of his enemies.

SERVIA

The small but restless State of Servia obtained its independence from Turkey early in the nineteenth century, under the leadership of a nameless peasant. Because of his swarthy complexion and raven hair they called him Kara George, which means "Black George," and Karageorgeovitch is the name of his descendants. Milosh, a companion of Kara George in the fight for liberty, was a farm servant of a widow named Obren, whose name he adopted when he needed one, and Obrenovitch is the family name of the present king. The feud between the two families began in 1817, when a Turkish pasha hired Milosh to assassinate his friend as he slept, and the history of Servia has since been a continuous duel between their descendants, encouraged by Turkey and Russia, which have been contending for the control of the Balkan Peninsula.

The present king, a repulsive degenerate, and his queen, Draga, are boycotted by all the courts of Europe because of their immorality. The Karageorgeovitch family are in exile, Peter, the head of the house, being engaged in scientific pursuits in Switzerland. King Alexander looks as if he had escaped from an asylum for the depraved, but has a vigorous constitution, and on occasions has shown great nerve and power of command. Unfortunately he has inherited all the vices of his father, the late King Milan, who was the worst ruler Europe has seen for a generation. While getting his education in Paris he acquired habits which unfitted him for the responsibility of governing a primitive and restless people like the Servians. He squandered the public money and lost his private fortune at cards, and his wife, Natalie Keskho, daughter of a colonel in the Russian army, was compelled to leave him and finally obtained a divorce. She now resides at Biarritz, very much respected and beloved, although she made herself unhappy and excited the hostility of the Servian politicians by her unconcealed Russian sympathies. The scandals of the Servian court furnished gossip for all Europe, until finally, enervated by dissipation and despised by all his subjects, Milan abdicated in favor of his young son, Alexander, and went to Vienna to die.

King Alexander of Servia

Alexander was a precocious prince, and when only fifteen years old fell under the fascination of Madam Draga Maschin, who had been a lady in waiting to his mother and is about ten years older than he. She is an ambitious, brilliant woman, gifted with considerable beauty and a charming manner. Madam Draga had more influence with the King than his parents, the ministry, and the court, and when he was seventeen persuaded him to marry her and assume the reins of government. From that time until now the Servian court has been the scene of a series of sensations which are likely to continue indefinitely.

The palace, in the center of the city, is a pretentious structure, which rises next to the public street without grounds, and was built by Milan, the gambler king, with an eye to entertainment and display. Within is a series of magnificent apartments equal to those in the palaces at Berlin and Vienna, designed by a French architect, and furnished with an extravagance that threw the country almost into bankruptcy. The great drawing-room, in which the king received the officials, the diplomatic corps, and the public every Sunday morning, is one of the finest in the world.

You reach Servia by railroad through Hungary across a country that looks very much like Kansas and Nebraska. Servia is called a poor man's paradise, because the soil, climate, and other conditions are favorable to people of small means. Eighty-seven per cent of the 2,400,000 inhabitants are engaged in farming, and there is no country in which the land is so equally distributed, for there is one farm to every eight inhabitants. Fruit culture is the largest source of profit. The prunes of Servia are the most popular and bring the highest price in foreign markets. All other kinds of fruit are grown and preserved, and grains, vegetables, and dairy products are shipped in every direction. Flocks and herds are large and multiply rapidly, and the people are always prosperous except when a war or a revolution is on.

Belgrade, the capital, lies upon a promontory where the river Save joins the Danube. The modern part of the town is quite attractive; the ancient part, built centuries ago, during the Turkish dominition, is picturesque. The modern streets are wide and lined with fine buildings after the Austrian style of architecture. Some of the school buildings are excellent samples of modern constructien and show an educational enterprise that is creditable to the country. There is a compulsory education law, free schools, and free books; a number of academies, schools of commerce, agriculture and fruit culture, and a university with four hundred students. The government supports a museum, an art gallery, and a theater for the encouragement of native dramatists and opera writers. At the extreme point of the promontory, rising abruptly from the river to a height of 400 feet, is a citadel erected by the Romans before the time of Christ. The castle is in an excellent state of preservation, is used for a prison, a barracks, and a military school, and is the headquarters of the army. There are no paupers in Servia, and therefore no almshouses, but there is a free hospital for both military and civilian patients, which is well kept up. The Bourse is a fine building, also erected by a French architect, and reminds you of the modern structures of Marseilles and Havre. The fever of speculation is as great in Servia as anywhere, and exciting scenes are happening frequently on the Bourse, particularly when political disturbances occur.

The ancient part of the city has remained unchanged for centuries. The walls of the citadel were built by the Romans, and stand as they left them, after having sustained the attacks of hundreds of armies and some of the most famous sieges in history.

The political crisis in Servia just now is caused by the lack of a baby. In the absence of a natural heir the constitution of the country requires the King to designate his successor, and the neighboring powers are endeavoring to assist in the selection. The daughter of the Servian cattle dealer reached the throne by a series of sacrifices and intrigues more sensational than often occur outside of fiction; yet she is not happy, and never will be until she is socially recognized by the other royal houses of Europe, to whom this clever adventuress is offering the throne of Servia as the price of such recognition. Negotiations have been going on for a year or more with Russia. Queen Draga promises that the King will proclaim Prince Mirko, of Montenegro, heir apparent, provided she and her husband are invited to spend a few days in Russia as the guests of the Czar; but the Czarina, who is a pure woman, has absolutely refused to receive her.

Prince Mirko is a brother-in-law of the King of Italy, and two of his sisters have married Russian archdukes. He was educated at St Petersburg, is a great favorite of the imperial family, and Queen Draga could not have selected a candidate more agreeable to them or satisfactory to the other powers. Furthermore, another of his sisters married Prince Peter, the present head of the Karageorgeovitch family, which approves of his selection; and thus, if he were to reach the Servian throne, the feud that has wrecked that country might be permanently healed. The success of this arrangement, involving the peace of Servia, the supremacy of Russia in its government, and perhaps the political control of the Balkan Peninsula, is checked by the refusal of a good woman to receive a bad woman as her guest. Count Lamsdorff, the Russian Minister of Foreign Affairs, has recently visited Sofia and Belgrade, and the newspaper dispatches from those countries predict events of importance to occur soon.

THE WORK OF THE U. S. HYDROGRAPHIC OFFICE*

BY COMMANDER W. H. H. SOUTHERLAND, U. S. N., HYDROGRAPHER

I APPEAR before you this evening to describe the work of the U. S. Hydrographic Office, and in so doing I shall make an earnest effort to give you as definite an idea as possible of the character, mode of operation, and the valuable practical results of this the most unique and at the same time the least known of all the technical offices supported by our government—unique in that it is the only office on this continent which publishes charts, sailing directions, and other necessary aids to navigation relating to foreign countries, and little known in that its work is principally for a particular class—the seafaring class.

ORGANIZATION AND HISTORY OF THE OFFICE

Before proceeding with this description, a short résumé of the phases through which the office has passed from its inception to the present time may prove of interest.

Prior to 1830, whenever a naval vessel was in need of charts or nautical instruments it was the custom for the commanding officer to forward to the Board of Navy Commissioners a requisition for such of these articles as he deemed necessary. This requisition, when approved by the board, was sent to the navy agent at the port where the vessel was fitting out, who filled it as far as possible by purchase from foreign governments or from the few private dealers in this country. These purchases were afterwards supplemented during the vessel's cruise by such additions as were from time to time deemed advisable by the commanding officer; and at the end of the cruise, when the vessel was put out of commission, her charts and instruments were turned in at a navy yard, where they were stowed away and no further attention was paid to them until they might be needed again.

The result, of course, was that very often needed charts could not be purchased and delivered before the date of sailing, or instruments were placed on board without being adjusted or standardized, and it was very seldom that charts so purchased had been corrected up to date. In fact, no official means then existed by which mariners could

* An address before the National Geographic Society, January 16, 1903.

be informed of necessary corrections to their outfits of charts.

To obviate as far as possible the dangers to navigation resulting from such a lack of system and care, the Secretary of the Navy in 1830, upon a recommendation from the Board of Navy Commissioners, directed the establishment of a depot of charts and instruments, under the charge of the late Commodore Goldsborough, then a lieutenant. This was the inception of the Hydrographic Office, the province of which for the first five years of its existence was simply to purchase, correct, and keep on hand charts and instruments for our naval vessels only.

It was not until 1835 that any effort was made to construct our own charts. In that year a lithographic press was purchased, and in the following year the first charts actually executed by the depot appeared for issue to the service and merchant marine.

In 1842, the bureau system of the Navy Department was established by act of Congress, the depot of charts and instruments being attached to the Bureau of Ordnance and Hydrography, to constitute the hydrographic branch of that bureau.

Lieutenant Maury had in the meantime been detailed to duty in this depot of charts and instruments, and in 1844, upon the completion of the Naval Observatory building (which was afterward frequently officially designated as the Naval Observatory and Hydrographic Office), the depot of charts and instruments was moved into that building, Lieutenant Maury becoming the Superintendent of the Naval Observatory and Hydrographic Office.

Lieutenant Maury devoted the greater part of his energies to hydrographic subjects, and for the seventeen years during which he had charge of this office did more in the interest of the merchant marine than was accomplished by similar branches of all foreign governments combined. He began the collection of information from the logs of men-of-war and merchant vessels for the purpose of constructing nautical charts to show the prevailing winds and currents, their limits and characteristics, and, in general, the physical features of the ocean, and all facts of interest or value to the maritime community. This was continued during the seventeen years he remained in charge, and resulted in the issue of wind and current charts, track charts, trade-wind charts, whale feeding ground charts, thermal charts, storm and rain charts, and eight large volumes of sailing directions, all of which were concerned with the safe navigation of the known waters of the globe. In addition, there were issued nearly fifty charts of different sections of the world, which were printed from engraved copper plates.

On the breaking out of the civil war Maury cast his fortunes with the South, and his practical labors for the Navy and merchant marine ceased. He was succeeded by one of the most accomplished officers in the service, the then Commander Gillis, and the Hydrographic Office during the four years of the civil war gained an excellent reputation in and out of the service through its ability to keep our war vessels supplied with the latest charts, nautical publications, and other necessary aids to safe navigation.

The work of the office was so strictly navigational in character that shortly after the civil war began it was transferred to the Bureau of Navigation, under which bureau it remained until 1898, when it was transferred to the Bureau of Equipment, under the direction of which it now remains.

In 1866, the year after the ending of the civil war, the connection between the Naval Observatory and the depot of charts and instruments was severed by law. An act of Congress passed in that year established "A Hydrographic Office for the improvement of the means for navigating safely the vessels of the Navy and mercantile marine, by providing, under authority of the Secretary of the Navy, accurate and cheap nautical charts, sailing directions, navigators, and manuals of instructions for the use of all vessels of the United States, and for the benefit and use of navigators generally." The act further provided that the Secretary of the Navy be authorized "to cause to be prepared," in the Hydrographic Office thus created, such "maps, charts, and sailing directions, and nautical books relating to and required in navigation, and to publish and furnish them to navigators at the cost of printing and paper, and to purchase the plates and copyrights of such existing charts, maps, sailing directions, etc., as he may consider necessary."

The spirit and intent of this act of Congress have been carried out from that time to this with unceasing energy and with a degree of zeal, ability, and intelligence which would reflect credit upon any branch of our government, and this has been done at the minimum of cost and under difficulties which at times seemed almost insurmountable. From the small depot of 1830, with a working force of two officers and one nautical expert, it has expanded to an establishment with a working force of nearly ninety technical and skilled employees, supplemented by sixteen fully equipped branch offices at the most important points on our Atlantic, Pacific, and Gulf seaboards and on the shores of our Great Lakes.

SURVEYS BY OUR MEN-OF-WAR

No vessel starting on a voyage is properly equipped unless her navigational outfit includes accurate charts, sailing directions, light lists, and other necessary aids to navigation for all places to be visited. The Hydrographic Office is charged with producing this navigational outfit of necessary charts, sailing directions, etc., for all parts of the world not under the jurisdiction of the United States, and in performing this duty there is no quarter of the habitable globe the waters of some portion of which have not been surveyed by vessels of our own Navy.

In general, the charts referred to are constructed from surveys made by the officers and crews of men-of-war. As there can be no question as to the necessity for an accurate knowledge of the waters of the globe, our naval vessels are supplied with an outfit for hydrographic surveying. With their large crews, numerous boats, and with officers trained to the actual requirements of all practical navigational aids, it is clear that this service is one for which the Navy is particularly well adapted in times of peace—a service which, in general, can be performed without interfering with other naval requirements, and with results which inure to the benefit of all mankind. And it is a pleasure to state that the service is one which is not considered distasteful in the Navy. Frequently, due to the exigencies of diplomatic relations and for other reasons, our vessels are stationed in foreign waters for long intervals of time, during which the officers and crews generally welcome surveying work as a decided break in the monotony of their confinement to the limits of the ship. During the last fiscal year not less than 24 naval vessels engaged in practical surveying operations in many parts of the world, the results of which will be of incalculable benefit to our maritime and commercial interests. At the present time a number of our men-of-war are similarly engaged in very important localities.

In addition to the resulting benefit to our maritime interests, the naval service is also materially benefited. The work tends to bring out the officer's powers of observation of things nautical and to give him a familiarity with coast work which becomes invaluable in time of war.

This was well exemplified during our civil war, when the most successful blockade-runners were commanded by men, generally ex-naval officers, who had been engaged in the Coast Survey in the vicinity of their blockading operations. If this was then true of our own coast, how much more so will it be of foreign coasts in the event of any future war! This fact was also evidenced during the late Spanish-American war. Nearly all of the many officers who distinguished themselves during that period, particularly those who occupied ranking positions, had seen good surveying service either in the Navy or in the Coast Survey. This I have taken the liberty of demonstrating by the exhibition of a few charts—one the result of the work of Admiral Dewey, one that of Admiral Charles E. Clark, and one that of the late Admiral John W. Philip.

Lack of space only prevents exhibiting equally good work by many other of our prominent officers, but I cannot properly let the opportunity pass without calling attention to some of our many naval officers whose work in hydrographic surveying will never be forgotten: Commodore Wilkes on the Grand Banks and in the Pacific and Antarctic, Commodore Perry in the waters of Japan, Commodore Rodgers and Commanders Berry and Stockton in the North Pacific and in Bering Sea, Lieutenant Lynch in the Dead Sea, Admirals Belknap, Erben, Barker, and Tanner in the Pacific and elsewhere, and Brooke and S. P. Lee in the Atlantic. Captain Mahan, our most noted authority on naval subjects, was also an expert hydrographic surveyor. Admiral Porter and many of our most distinguished naval officers of the civil war had performed good work in the Coast Survey, and Pillsbury's work in the Gulf Stream is well known.

CHART CONSTRUCTION

I shall now briefly sketch the course of chart construction. In general, a preliminary sheet of the work done, prepared with accuracy and with a sufficient degree of delicate draftmanship to clearly demonstrate any inaccuracies as the work progresses, together with the records of astronomical observations, triangulation, topography, tides, currents, etc., is forwarded from the surveying vessel to the Hydrographic Office, where, in the Division of Chart Construction, now presided over by one of the most thoroughly equipped hydrographic engineers in this or any country, the work is carefully revised in every detail and a smooth sheet prepared, from which comes the working chart, either from an engraved copper plate or by a lithographic process. As soon as the finished chart is printed, all vessels of the Navy serving in the locality which it indicates are supplied therewith. The merchant vessels of all nations can obtain it by purchase from the Hydrographic Office or from any of its numerous agents.

As soon as received in the Hydrographic Office, the work is made a matter of record and the history of the chart commences, not to end until the chart becomes obsolete or is canceled by another. Every correction, alteration, or addition, with the names of all connected therewith, becomes a matter of record which is carefully guarded. While sometimes, for good and sufficient reasons, the legend on the chart does not show the authority, that information is contained in its record.

GENERAL CHARTS, COAST CHARTS, AND HARBOR CHARTS

And now let us see what these charts are, what they show, and of what use they are to the mariner. Generally speaking, navigational charts are of three classes — general charts, coast charts, and harbor charts—the coast charts occasionally being divided into special and general.

General charts, as the name implies, cover a large territory, and are principally for the use of navigators in the open sea, as in making long voyages. This class of chart is necessarily upon a small scale, and represents not only the character of the ocean bed as thus far delineated by deep-sea soundings obtained by vessels of the principal maritime nations, but also the shore lines with the most prominent topographical features, the principal seaports, the lighthouses which are of use in off-shore navigation, all dangers in the nature of shoals, reefs, and rocks, and the lines of equal magnetic declination or variation; compass stars, showing both true and magnetic directions in degrees and quarter points, are placed where it is thought they will be of the greatest use. On this chart the navigator plots his geographical positions as often as they are determined, and thus is able to keep as nearly as possible a direct course to his port of destination. This chart is kept in use until the vessel gets within the limits of the coast chart, when it is put away and replaced by the latter.

Coast charts, both general and special, delineate the coasts of all countries, and for each coast are consecutive and take in such sections of the coast as will permit of the use of a comparatively large scale. The coast line is accurately delineated, as are also the principal topographical features which can be used in navigation; all the lighthouses, with their peculiar characteristics; the life-saving stations, Weather Bureau stations, and all the features which in any way can enable an observer by bearings, or otherwise, to determine his position. The soundings are frequent and, in general, are run out to the 100-fathom curve. With the aid of this coast chart, the navigator pilots his ship along shore until within the limits of the chart of the harbor to which he is bound, when that replaces it.

The harbor chart is on a larger scale than the others and in greater detail. Every object on shore that can be used in piloting the ship in or out of the harbor is delineated in its correct position. Where possible, ranges to guide vessels in and out are determined and plotted upon the chart; lighthouses, range lights, buoys, beacons, and all day-marks are plotted; the positions of landing places, custom-houses, and public buildings of which the navigator may have occasion to know are plotted, where possible; curves of certain equal depths of water, quarantine stations and quarantine grounds, men-of-war and merchant ships' anchorages are also clearly indicated; the magnetic declination or variation is noted on one or more compass roses, and in addition the chart contains all necessary data as to the date of publication, the date of the latest correction, the character of the soundings, heights, signs, and abbreviations, and all necessary tidal information. On these charts, as on coast charts, the shore lines are made especially conspicuous, and the topographical features represented are such as will be of actual value as aids to navigation.

USE OF SURVEYS BY OTHER NATIONS

I have only referred to original surveys by our own vessels; but it must not be understood that the chart construction work of the Hydrographic Office ends with these. We all realize that in time of war it would be a difficult matter (perhaps an impossible one) to get correct navigational charts of foreign places against which our Navy might have to operate, and during peace periods it takes time to obtain the latest editions of foreign charts. All the great maritime nations recognize the fact that it is a matter of national moment for them to be possessed of all available charts of every part of the world, and for this reason they make it a practice to use the published surveys of other Powers as data for the construction of charts of their own. We are compelled to do likewise, and little by little are utilizing the surveys of those foreign nations, the work of which is known to be reliable. This is a matter of discrimination, but experience has shown the necessity for discrimination. Many charts of the Philippines, of Cuba, and of islands of the West Indies have been found to be inaccurate.

This use of foreign work is not only in the direction of a proper preparation for possible times of national peril, but in the end is a matter of economy. Were this practice not carried on, it would be necessary to purchase our charts from foreign nations—a source of supply which would be closed to us in time of war—and, when purchased, the corrections made necessary by newly discovered dangers and by changes in buoyage, ranges, lighthouses, etc., would have to be plotted by hand, which is more expensive than making the necessary changes on the plate from which the chart is produced.

AREA COVERED BY OUR CHARTS

At the present time the Hydrographic Office has in its possession nearly 1,200 engraved chart plates and about 50 photographic chart plates. These 1,250 plates have all been constructed from the results of original naval surveys; from geographical and cartographical data reported by the commanding officers of vessels in the naval service; from information collected by the branch hydrographic offices from incoming mariners of all nationalities, and also from the geographical information that comes into the custody of the Navy Department through the prosecution of surveys by foreign governments.

These charts represent about one-third of what are actually necessary for a complete set of navigational charts of the world for the use of the naval and shipping interests of the United States.

Besides the projecting, drawing, engraving, photographing, electrotyping, and printing, which constitute the central work of chart construction and chart correction, the functions of the Hydrographic Office embrace all that is kindred and contributory to the construction of charts, and hence include the mathematical computations for the projection, the adjustment of triangulations, the investigations of the tides, the discussion of observations of the magnetic elements of the earth in their bearing upon charts and navigation, the computation of navigational tables, and the designing of instruments and machines for securing maximum of economy.

Of the 1,250 or more charts that are now available for permanent issue, over 300 have been derived from original surveys by the U. S. Navy. These, added to the 450 or more charts that have been constructed from surveys by the Coast and Geodetic Survey, make a grand total of 750 or more navigational charts constructed from original United States surveys, a result which places our people ahead of most of the older countries and in the front rank of the most active nations in marine hydrographic work.

It must not be understood, however, that if we were to become possessed of engraved plates representing the charts now issued by all other nations we would be able to produce navigational charts covering the world's entire water area. Very much remains to be done before the hydrographic features of the world can be so charted as to warrant the statement that dangers to navigation due to lack of knowledge of geographic positions and correct soundings have been reduced to a minimum.

There are numerous places in the West Indies which we know to be inaccurately charted, and this same statement applies to locations in nearly all parts of the world. In the North Pacific Ocean alone there are thousands of reported dangers. Many of these are probably either inaccurately located or do not exist, but all the same they are a hindrance to navigation through the anxiety and loss of time which the fear of their possible existence causes to shipmasters. Fortunately, little by little the national vessels of the Great Powers are either accurately locating or disproving the existence of many of these. I am glad to say that our own naval vessels have done their share in this good work.

DEEP-SEA SOUNDINGS

Our knowledge of the depths of the sea is gradually increasing through the operations of deep-sea sounding expeditions undertaken by many nations. In this field of operations we hold a commanding position. From a scientific point of view, a knowledge of the physical characteristics of the ocean bed is most desirable, and no less so from a practical standpoint. No telegraph company would think of laying a submarine cable today without first selecting a desirable route as determined by deep-sea soundings. The soundings of the U. S. S. *Nero* in the Pacific two years ago determined the route since selected for the transpacific cable.

Deep-sea soundings are also of especial value to the mariner, inasmuch as from their results the existence of submarine dangers is frequently indicated. In the Atlantic the greatest accurately known depth in the fifties was obtained by the then Lieut. S. P. Lee, in the U. S. brig *Dolphin*, 3,825 fathoms (4⅓ miles). Only a year ago the now greatest known depth in the Atlantic, 4,662 fathoms (5¼ miles), was found by the present U. S. S. *Dolphin*, the first vessel of the new Navy. The greatest known depth in the world is in the Pacific, and is 5,269 fathoms (31,614 feet), 66 feet short of 6 statute miles. This depth was obtained by the U. S. S. *Nero* in 1900, and is greater than any elevation on our continent, or, as far as we know, in the world.

SAILING DIRECTIONS

The Sailing Directions, to which I have previously referred, can properly be designated as nautical guide books—in other words, nautical Baedeckers. The coasts of the world are divided up into numerous sections, for each one of which a book of sailing directions is prepared. Thus we have Sailing Directions of the East Coast of South America, etc. These seamen's guide books, when complete and used in connection with the corresponding navigational charts, are supposed to give the mariner all the information that he may require for safely navigating the part of the world considered, and for entering and leaving each harbor or anchorage therein. When corrected to date, they give him in as much detail as possible, a knowledge of the prevailing winds and weather for each season ; of the tides, currents, buoys, lights, and other day and night marks, and of proper anchorages. In addition, where possible, ranges to be used in entering and leaving port, both by day and night, are described ; prominent landmarks and other topographical features are noted in detail, and everything in the way of an aid to navigation is entered therein. They even go so far as to give him information in regard to port dues, local regulations of foreign governments, diplomatic customs of the local and state authorities, the facilities for obtaining provisions, water, and other supplies, and also as to obtaining necessary repairs.

There is no guide book known which contains so much of practical importance. In all nations these books are written by naval officers or by others who have followed the sea for a profession—men who have had sufficiently matured practical experience to enable them to exercise proper judgment in weighing the many varied sources of information, to reconcile conflicting statements, to set forth only the facts upon which the mariner can rely with confidence, and to exercise a care in their preparation commensurate with the interests of life and property at stake.

AIDS TO NAVIGATION

The aids to navigation required by mariners are numerous, but I shall only speak of those which are prepared and issued by the Hydrographic Office. With due regard to sequence, the Notices to Mariners issued weekly by the Hydrographic Office, which particularly affect the charts and sailing directions, should be considered first. These notices consist of a collection of statements pertaining to safe navigation, made up in pamphlet form, which are issued weekly by the Hydrographic Office. The statements are notices themselves pertaining to every matter which is of importance to the seaman and navigator. When a new rock, shoal, or other danger is discovered and reported to the Hydrographic Office, the information is immediately published, the source and its nature being clearly set forth. The same is true of the installation of new lights, changes in lights, alterations or changes in buoyage and other day marks in any part of the world, wrecks, and all subjects a knowledge of which would tend to lessen the dangers of navigation. These notices are issued in a convenient form for cutting out. They are distributed from the Hydrographic Office and from its numerous branch offices to all vessels of the Navy and to not less than 3,000 merchant vessels, officers of which at the present time are collecting information for the Hydrographic Office. When received, the immediate duty of the navigator or master is to enter the corrections by hand on the charts affected (these charts being designated in the notices), and, in addition, to cut out each notice and place it in its proper place in the Sailing Directions. You will be surprised to learn that notices affecting navigation issued by the Hydrographic Office now amount to about fifty a week, or over 2,500 a year. This does not seem so strange, however, when we take into consideration the amount of coöperation which the Hydrographic Office receives in this most important aid to mariners. Cordial coöperation is afforded by the United States Engineers, the U. S. Coast and Geodetic Survey, the U. S. Lighthouse Service, the U. S. Weather Bureau, the U. S. Life-saving Service, Fish Commission, United States Consuls, hydrographic offices of foreign governments, foreign astronomical and meteorological observatories, our own naval vessels, and something like 3,000 ships of various nations, in which are included men-of-war of some of those nations as well. Reports to this office come in as many as fourteen different languages.

In this day of high speed on the ocean you can readily understand the anxiety which the great shipping firms have in regard to the safety of their vessels, a feeling which actuates them as well as their governments to hesitate at no expense to obtain such information as is contained in these notices. It is not uncommon for the Hydrographic Office to get cablegrams from abroad giving information of serious dangers to navigation.

A glance through one of these pamphlets would give an inkling of the dangers to which those who go to sea are subject. A fair part of these notices come through the branch hydrographic offices, which are located in sixteen of our principal ports.

BRANCH HYDROGRAPHIC OFFICES

These branch offices, which are in charge of naval officers, with nautical experts as assistants, are veritable bureaus of nautical information. They receive and distribute information, visiting all incoming vessels for this purpose, and hold themselves ready to examine charts from any vessel, verifying the same or pointing out necessary corrections, examining and correcting instruments, explaining nautical subjects, and in any way possible giving aid to mariners. In many cases they have even adjusted compasses. At the present time the officers at three of them are giving night lectures on navigation to shipmasters. Many of these have been called as witnesses in admiralty cases, and in general their influence in improving the means of safe navigation has been most marked. A time-ball service is carried on at twelve of these offices, which is taken advantage of by the masters of vessels possessing chronometers, thus enabling them upon going to sea to feel sure of the error and rate of this most important navigational instrument.

These offices place within almost immediate reach of ship captains all the information contained in the main office and enable the main office to obtain, with accuracy and quickness, all important information brought by incoming vessels. They have been of great benefit to shipping firms, marine insurance companies, admiralty lawyers, and practically to all interests connected with maritime affairs.

In 1880 a commander in the British Navy examined the chart outfit of three steamers and found as follows :

On the first, 73 charts out of 93 needed renewal.

On the second, 39 charts out of 49 needed renewal.

On the third, 95 charts out of 104 needed renewal.

At the present time no vessel need leave a port in which there is a United States branch hydrographic office with incorrect charts unless the captain wishes to do so.

Other essential aids to navigation are published by the Hydrographic Office, but space will not permit of a detailed description. Amongst the most important can be mentioned the American Practical Navigator, a book on navigation which no navigator should be without. This is revised frequently and the call for it is continuous. Frequent issues of the Lists of Lights of the World are necessary, the changes in lights all over the world being frequent and often very radical. Azimuth tables for the use of the navigator in determining his compass error have been issued by this office for the last twenty-odd years. The International Code of Signals, which by law all mariners are compelled to have, is an issue of this office. Publications on great-circle sailing ; means of searching for isolated submarine peaks ; on the variation of the compass ; sunrise and sunset tables ; illustrated cloud forms ; matters pertaining to marine meteorology and to terrestrial magnetism are amongst the practically useful issues of this office, and all are prepared by its attachés. I can safely state that the great majority of deep-sea vessels now afloat possess some practical aid to navigation published by the U. S. Hydrographic Office.

PILOT CHARTS

The Pilot Charts of the North Atlantic and North Pacific, the permanent issue of which was inaugurated by the Hydrographic Office in 1883, are not navigational charts, strictly speaking, but are simply graphic illustrations of the conditions of winds, currents, wrecks, derelicts, icebergs, fogs, etc., which may reasonably be expected during the month for which the chart is issued. The primary credit for this practical aid to navigation is due to Lieutenant Maury. When, in the early forties, he started his system of collecting information in regard to winds, currents, and other matters pertaining to the ocean, it was with a view of eventually being able to predict to the mariner, with a reasonable degree of probability, all necessary meteorological data for any period of the year.

For convenience, we will only consider the Pilot Chart of the North Atlantic, the principal references to which will also apply to the chart for the North Pacific.

A short résumé of the manner in which information is collected for this chart, followed by a general description of the subject-matter, will give the best idea of its use and value. The data collected by Maury from 1844 to 1861 were, generally speaking, taken from the log books of vessels for individual 5° squares on the world's water surface, and in the majority of cases gave information for each hour of the day in whatever part of the world any observing vessel happened to be.

About twenty years ago it was deemed advisable to alter this system of collecting information, and the observers of the office were furnished with a blank observation book, in which the data required were to be taken by all observers only once a day and at the same instant of time—Greenwich mean noon. The observations thus recorded give the direction and force of the winds the reading of the barometer and thermometers, the temperature of the water, the character and percentage of cloud, visible, and the character of the sea. Immediately upon the arrival in port of a vessel taking such observations, these weather reports are sent either by mail or through the United States consul to the Hydrographic Office, where the information mentioned above is plotted on a synoptic chart. This chart is divided into squares of 5 degrees of latitude and 5 degrees of longitude, and each element of information previously mentioned, except clouds and the state of the sea, is indicated in its respective square by a particular symbol. Through inability to get the information quickly (as very frequently the record of a sailing vessel does not get to the Hydrographic Office until a long time after the observations were taken), it requires many months before all the records for any one year for each individual square can be collected and plotted. A separate synoptic chart is used for each day in the year. Eventually each element is averaged for each month of each year during which the observations have been taken, and a mean of each month of all the years is transferred to the pilot charts proper.

EXPLANATION OF NORTH ATLANTIC PILOT CHART FOR FEBRUARY, 1903

All the possibilities and recommendations for the coming month relating to winds, calms, fog, gales, weather forecast, barometric and thermometric data, and steamer and sailing-vessel routes are noted in blue. All matter noted in red relates to what has actually occurred in the past, and is variable in character and not possible of prediction with any degree of certainty. For instance, the red lines, of which there are so many on the accompanying chart,* represent the paths of the centers of storms which have actually occurred during the last five years. Derelicts and wrecks, drifting buoys, icebergs, and field ice which have been actually seen and reported during the preceding month are noted in red, the positions indicating to the mariner the region in which they are likely to be found.

This chart thus becomes a continuous warning to seamen for the month on the first day of which it is issued, and is of practical economic benefit, in that it operates to shorten ocean travel and to lessen dangers to life and property. The information given is considered so important that the agents of many of our great transatlantic liners telegraph

*The chart is issued as a Supplement to this number of the NATIONAL GEOGRAPHIC MAGAZINE.

the positions of wrecks, derelicts, and ice to their home offices as soon as they are informed thereof by the Hydrographic Office or by its branch offices along our Atlantic seaboard.

In order to still further aid navigators by giving timely notice of new dangers reported, it has been found necessary to supplement the Pilot Charts by the Hydrographic Bulletin, which is issued weekly and gives the latest information of wrecks, derelicts, ice, and other dangers to navigation.

It has been found advisable, in fact necessary, to have articles from time to time on the Pilot Chart treating of some essential for the navigator in the management of his vessel. Thus, during each of the cyclone months in the North Atlantic, an illustrated article is printed either on the face of the chart or, if there is not room there, on its back, explaining the nature of cyclones, the method of avoiding them, and, when caught in them, proper directions for managing a vessel. Articles on the use of oil at sea, which have been the means of saving valuable ships and of rescuing the crews of wrecked vessels; on the use of instruments necessary in navigation; on the features which cause disturbances of the compass, and on various methods for obtaining the positions of vessels at sea and for plotting the positions near a coast, are issued whenever space and time permit.

Until within the past year this Pilot Chart was unique in being the only thing of the kind published in the world; but its importance to maritime interests had been so thoroughly proved and the necessity for immediate notice of all dangers, particularly on frequently traveled routes, had become so evident that two other nations—England, the oldest sea power, and Germany, the youngest—took up the matter and are now issuing similar publications.

I know of no government publication of more interest to those who go to sea than this, and feel sure that you will agree with me after a short résumé of what it actually does for the mariner. Let us consider the chart for the month of February, 1903.

In the upper left-hand corner of the accompanying Pilot chart is a fog inset chart, which is divided into 1° squares, each one of which contains a number which indicates the percentage of days of each month—*i. e.*, the number of days in each one hundred—in which the weather may reasonably be expected to be foggy, these percentages being the result of thousands of observations for years back. They are only probabilities, but they are good probabilities, and the sailor makes use of them. But a short time ago the captain of the flagship *Brooklyn* told me that when conveying the remains of the late Lord Pauncefote to England last summer, the season of maximum fog frequency, he followed the fog forecast of the Pilot Chart for the month and found it reliable.

None but those in charge of vessels can understand what a fog at sea means. The sense is the nearest approach to that of blindness that I can imagine. One can see for some distance at night; but in a thick fog such as what is known as the blue fog of our northern waters—a fog which is said by old salts to be as thick as mud—the sense of sight fails and that of hearing is brought into intense play. But even the latter sense fails under certain circumstances, such as on a high-speed steamer, where the noise of the engines and the swash of the vessel's hull through the water shut off all but unusually loud sounds. In a late admiralty collision case — the cutting down of a sailing vessel by a steamer — the evidence showed that while the people on the sailing vessel had heard the steamer's whistle for 20 minutes before the collision, the officers of the steamer had at no time heard the fog-horn of the sailing vessel.

The same of the sub-chart of gales,

which is below that of fog, in which percentages for a force of 8 and over of the Beaufort's scale—from 40 to 100 miles an hour—are given in 5° squares. No vessel other than a regular high-powered liner, unless absolute necessity demands, takes a route in which such gales are frequent, on account of the danger to life and property, the wear on the vessel, and the consequent delay. This sub-chart tells them the only things they want to know—how to avoid the stormy area and what route to choose.

The best routes for low-powered steamers, from the English Channel to the Gulf and from Gibraltar to New York, are also shown. The latter, for instance, is longer in distance than a direct route. Experience has shown, however, that by reason of encountering more favorable winds, seas, and currents, it is shorter in time, with much less wear and tear on the vessel and crew.

Down in the lower left-hand corner are some red symbols to designate icebergs and field ice. No bergs or field ice were reported during January, so none are indicated on the accompanying chart. On the pilot charts of the summer months, however, the region above and about the Grand Banks is dotted with these little red symbols. If we were issuing a pilot chart of the south Atlantic Ocean for this month, these ice symbols would be very numerous in its southern portion.

You may remember that it was not many years ago that we had frequent reports of vessels colliding with icebergs; but such is now very much less the case, principally due, I feel that I can say with absolute truthfulness, to the efforts of the Hydrographic Office, as a result of which the transatlantic lines were, some years ago, induced to adopt regular lanes of transit to and from England and the United States—lanes which take them over a safer route, in that it is practically clear of ice.

Over on the right-hand side of the pilot chart is a sub-chart of isobars and isotherms for the month of February, showing the average heights of barometer and temperature to be expected, and indicating, by reference to the areas of low and high barometer, what movement of the atmosphere may generally be looked for. The intelligent mariner knows that any marked deviation from these normal values denotes a change in weather.

Above this sub-chart will be found a forecast—not a prediction—of the weather, the average of thousands of observations taken during the past fifteen years.

The main or sea part of the chart is divided up into 5° squares, in the center of each one of which will be found a small circle from which radiate arrows, each one pointing towards the center. These arrows indicate the direction in which winds may be expected to blow, the number of feathers indicating the force by Beaufort's scale. Take the example noted in blue under the heading of "Prevailing Winds and Calms," at the bottom of the chart on the left side. The arrows fly with the wind, and the number of hours in each one hundred during which the wind may be expected to blow from that direction is found by transferring the length of the arrow to the scale below, the number of feathers indicating the force. Thus, in this example, we will in each one hundred hours expect to find a northeast wind with a force of 3 for 18 hours; an east wind, force of 3 for 10 hours; a southeast wind, force of 4 for 24 hours; a south-southeast wind, force of 3 for 25 hours, and a southwest wind, force of 3 for 10 hours. The figure 13 within the central circle indicates 13 hours of calms, light airs, and variable winds.

The small black arrows point out the average set of currents, whether regular or drift.

The long red lines on the face of the chart represent paths of the centers of well-determined storms which have occurred in previous years during the month of February. Tropical cyclones do not occur on the north Atlantic during this month, but storms of great violence are frequent. From an examination it is plainly evident that an average storm track for the month would be of no practical value ; but these of previous years are most useful as, if from indications of weather, sea, and barometer, the seaman finds himself on or near the track of one of these, he has good reason to suppose that he will experience a similar one.

DERELICTS

Notice the symbols for derelicts and wrecks at the lower left-hand corner and observe the large number of these obstructions on the body of the chart. These, with icebergs and fogs, and particularly a combination of all three, give the mariner the greatest anxiety. Each one of these constitutes a menace to life and property, most dangerous because not plotted on any other chart nor marked in any manner. Those symbols on the chart which are bottom up give warning of especially dangerous derelicts, the kind that show so little surface above water as not to be seen, even in daylight, until close at hand. We read too often of vessels which have put to sea and never been heard of afterward, and we can easily imagine that some of them have been lost through collision with these floating dangers. A collision with an abandoned vessel laden with either coal, iron ore, or steel rails would materially damage any vessel afloat.

Only a few years ago a large Dutch transatlantic liner struck a submerged wreck which broke her propeller and probably stove a hole in her bottom. The steamer was abandoned in a sinking condition, but fortunately not before another steamer had come along and rescued the passengers and crew.

During one interval of seven years the total number of derelicts reported amounted to 1,628, of which 482 had been identified by name. This means an average of 19 per month —that is, it is reasonable to believe that there are never less than 19 of these floating dangers in the north Atlantic all the time, and the records of the Hydrographic Office show that the average time a derelict remains afloat is about thirty days. The identified ones are easily followed and their tracks plotted on the pilot chart from month to month. A few remarkable instances of ocean drift may be interesting.

A three-masted schooner, *The Fannie E. Wolston*, was abandoned on October 15, 1891, and frequently seen after that for 1,101 days—three years and six days—at the end of which time, after traveling about 9,000 miles, she was lost sight of.

Take the case of the lumber-laden schooner *W. L. White*. She was abandoned waterlogged about 80 miles off the capes of the Delaware during the great blizzard of March, 1888. She drifted 5,910 miles, following the Gulf Stream a good way across the Atlantic, and about eleven months later stranded on one of the Hebrides, having been sighted and reported forty-five times during the interval. For over six months of this time she was a constant menace to our transatlantic commerce.

And another interesting case is that of the ship *Fred B. Taylor*, which was cut in two by a steamer, the two parts remaining afloat. Strange to say, these parts separated, the stern drifting to the northward and going ashore on the Maine coast forty-six days later, and the bow drifting to the southward and being lost sight of off the Maryland coast seventy-two days later.

From September, 1889, up to the

present time the Hydrographic Office has received reports of 127 collisions with ice, derelicts, and wreckage in the north Atlantic alone, and others probably occurred which were never heard of.

The Navy Department exercises an espionage over all wrecks and derelicts on our Atlantic seaboard which are outside of the three-mile limit, and when deemed necessary sends vessels out to destroy them or tow them in. During the past year 38 dangerous obstructions were hunted for on our coast by vessels of the Navy, of which number 15 were located and destroyed. It is to be regretted that no international legislation provides for the destruction of such dangers in the broad ocean.

This pilot chart keeps our Weather Bureau's storm signals before the mariner, tells him where to find our branch hydrographic offices, and gives him no excuse for not knowing what charts are published, canceled, or extensively corrected.

THE VALUE OF THE PILOT CHARTS TO SHIPPERS

I think you will now admit that, as far as our government is concerned, the mariner is fairly well looked out for. Our Weather Bureau watches over him while in our home ports, and the Hydrographic Office does all possible to guide and guard him while at sea.

Many complimentary communications on the work of this office have been received from outside our own country, one of which I feel justified in reading to you, as it is from the highest maritime authority in the world — the British Lloyd's:

LLOYD'S, *18th July, 1902.*

SIR: I am instructed to express to you the best thanks of the Committee of Lloyd's for the Pilot Chart of the North Pacific, which is forwarded to this office periodically by your instructions. This chart is believed to be of great value to mariners navigating the waters of the North Pacific, and I am directed to inquire whether there is any intention on the part of the Hydrographic Bureau to have a similar chart constructed for the South Pacific.*

I am, sir, your obedient servant,

JAS. M. HOZIER,
Secretary.

The Chief of the Hydrographic Bureau, Washington.

Last month's Nautical Magazine contained a copy of a speech in the House of Lords by Lord Ellenborough, urging the printing of tables by which the centering error of a sextant could be determined at any time. In concluding this speech Lord Ellenborough quoted an extract from a letter from the late Captain Lecky, whose publication "Wrinkles in Navigation" made him famous. The quotation was as follows:

"I certainly think the Nautical Almanac ought to undertake the star distances; but you will probably find the United States Hydrographic Office will do it. They have no hesitation in undertaking anything they think worth doing, whereas our people take a few years to think about it."

Having thus sketched the work of the Hydrographic Office, it becomes my pleasure to say that the results achieved by this office are due to the intelligent, zealous, systematic, and painstaking efforts of as competent an office force as can be found in any similar office in any country. Some are graduates of the Naval Academy, and these, with many others, are practically devoting their lives to this good work.

In conclusion, I hope that I have made it clear that the mission of the Hydrographic Office is to provide for the safe navigation of American ship-

*The Hydrographic Office is considering the plan of publishing Pilot Charts of both the South Pacific and South Atlantic Oceans. It is hoped that in the near future it may be feasible to publish these additional Pilot Charts. Editor.

ping in all foreign waters by obtaining and disseminating necessary information on all nautical subjects, a knowledge of which tends to reduce the dangers of navigation to a minimum. This also means that its work is a practical preparation for war, inasmuch as the results form a safeguard for our Navy the importance of which cannot be overestimated.

There can be no question as to the necessity for this work when we consider that even now, with our far-reaching distribution of aids to navigation, no less than 5,000 lives, on an average, are lost at sea each year.

WHY GREAT SALT LAKE HAS FALLEN

By L. H. Murdoch

Section Director, U. S. Weather Bureau

THE rapid decline in the water level of Great Salt Lake during the past few years has caused the people of northern Utah, and more especially those of Salt Lake City, to feel considerable apprehension lest this remarkable body of water will soon be a thing of the past. The reading of the gage at Garfield Beach on December 1, 1902, was 3 feet 5 inches below the zero of the scale, showing a fall of 11 feet 7 inches since the close of 1886, the year in which the last rise terminated, and a level between three and four feet below that of 1847.

The water level of a closed lake may be affected by a change in the general inclination of its basin, and will fall as the result of increased temperature, decreased relative humidity, shortage in precipitation, or increased evaporation as a result of spreading the water from inflowing streams over the soil for irrigation or any other purpose.

The present fall in the lake is evidently due to a combination of shortage in precipitation and the loss of water through irrigation, but the shortage in precipitation is undoubtedly the predominating factor.

The present area of the lake is about 1,750 square miles, and its drainage basin is about twenty times that area. The normal annual precipitation for the entire drainage basin is about 14 inches, and the annual evaporation from the surface of the lake is about 5 feet. The report of the Twelfth Census shows that in 1899 the amount of land irrigated in the basin of the lake was 609 square miles, which is a trifle more than double that under irrigation in 1889.

Flynn's table giving the duty of water in irrigating shows that for Utah the duty is 2.38 acre inches for 10 days, which is 23.80 acre inches for 100 days, or the irrigation season. The writer is not aware that any experiments have been made in northern Utah to determine the loss of irrigation water by evaporation and percolation. The soil in the drainage basin of the Great Salt Lake is generally a sandy loam, which would favor quite rapid percolation, but not very rapid evaporation. Judging from the results obtained in other states, and making due allowance for the low relative humidity of this region, it is believed that 12 inches for evaporation and the growing plant is an ample allowance. This would leave 11.80 inches to be returned to the lake or its tributaries by subterranean courses.

The present area of the lake is nearly

three times that of the land under irrigation. With precipitation at normal, the loss of 12 acre inches of water by means of irrigation should therefore produce the first year a fall of four inches in the lake level, and a decreasing fall every year thereafter until a balance would be reached between the area of the lake and the amount of water it received, when no further fall would occur as a result of irrigation.

The problem is necessarily a very intricate one, and at best only general results can be obtained from the most careful calculations. The writer, however, feels confident that irrigation cannot be charged with more than three or four feet of the last decline in the lake level. It should be borne in mind that irrigation began in 1848, and was in operation during the years the lake rose rapidly and maintained a high level.

The precipitation data for Salt Lake City, including that for Ft. Douglas, are complete back to 1863, with the exception of 1866, and that has been approximated at 22.25 inches. The average precipitation for this locality, using all the data up to the close of 1901, is 16.65 inches.

From 1865 to 1886 a wet cycle prevailed, and during that time the average annual precipitation was 18.42 inches, or 1.77 inches above the normal. From 1887 to 1902 a dry cycle has prevailed, the average precipitation during this period, estimating the precipitation for December of 1902 at normal, being 14.80 inches, or 1.85 inches below normal.

During the wet cycle the lake rose rapidly from about 3 feet in 1864 to about 13 feet in 1868. A decline then followed, but the reading was nearly 13 feet again in 1876. The last rise terminated in 1886, when the level of 9 feet 2 inches was reached. Since 1887 there has been a steady decline in the level, the total fall from the close of 1886 to the close of 1902 being nearly 12 feet.

With the annual precipitation reduced to 14.80 inches at Salt Lake City, the lake would not fall without limit, but after a number of years, as in the case of the loss resulting from irrigation, a balance would be reached between the area of the lake and its inflow and the decline would thereupon terminate.

The fall in lake level has been much more rapid during the past three years than for any like period during the preceding years of drouth. This is mainly due to the fact that the deficiency in precipitation has been greater during this period than during any similar period of the present dry cycle. The precipitation record at Salt Lake City for 1901 does not fairly represent conditions for the entire basin. From May 2 to 4 4.08 inches of rain fell there, but the excessive rainfall covered only Salt Lake, Davis, and small portions of adjoining counties, about one-twentieth of the basin, while the rainfall for other portions was comparatively light. The rise in the lake during the two weeks ended May 15 was only 1 inch, no more than would be expected though no precipitation had occurred. If the precipitation at Salt Lake City for 1901 were to be approximated from that of the rest of the basin, it would have to be placed at about 13 inches. This would make the deficiency for the last three years alone over 13 inches.

The lake is not alone in showing the effects of the drouth. Streams, springs, and artesian wells are drying up, and those which continue active are discharging much less water than a few years ago.

While it is difficult to demonstrate mathematically just how much fall in the lake level is due to irrigation and how much to a shortage in precipitation, it seems to the writer that the large deficiency of 29.60 inches in precipitation during the past sixteen years, as shown by the Salt Lake City records, must be far more of a factor than any possible loss of water resulting from irrigating 609 square miles of land.

Drier weather than that which has prevailed during the past sixteen years has never been known in Utah, and this is a pretty good indication that the precipitation for the next sixteen years will not average less than for the past sixteen.

Even with precipitation continuing at about 15 inches, no further fall in the lake will occur, and if the annual precipitation is as much as 15 inches for the next three years, a slight rise may be expected.

Excessive precipitation is not drawn upon for irrigation, and its loss from evaporation is much less in proportion than that of normal or deficient precipitation. The result is that when excessive precipitation occurs the lake receives nearly all of the excess, and therefore rises rapidly.

The question naturally arises, How long will the present dry cycle continue? In an article entitled "Precipitation Cycles," recently published, the writer has pretty conclusively shown that weather about as dry as that in progress prevailed in Utah from about 1827 to 1864, a period of thirty-seven years. While it is known that a cycle of dry weather is followed by a number of years of excessive precipitation, and this in turn by another dry cycle, it is not believed that these recurring periods are of equal length. The past in this regard, with our present knowledge and accumulation of data, is therefore no index to the future. A wet cycle like that which began in 1865 may begin next year, or it may not begin for fifty or more years. When it does occur the lake will respond rapidly and reach levels nearly as high as those recorded in the sixties and seventies.

GEOGRAPHIC NOTES

AMERICAN CLAIMS IN THE ANTARCTIC

During the first half of the nineteenth century numerous American seamen explored portions of the South Polar regions and made many and important discoveries there. They named a number of places, and in several instances the lands they discovered were called after them. With the present reawakened interest in the Antarctic, it is imperatively necessary that American geographers should see to it that American Antarctic discoverers receive due recognition for their discoveries, and that American names should not be crowded off Antarctic charts. It is a pleasure to state that the British Admiralty, in its official charts Nos. 1238 and 1240, shows a desire to be perfectly fair to American explorers, a statement which unfortunately cannot be made of the authors of many semi-official or private English charts. For instance, on the charts in "The Antarctic Manual" of 1901, of all of Wilkes' discoveries only "Knox Land" is marked, and all other American names, including that of Wilkes, are omitted.

In East Antarctica the name "Wilkes Land," and also the names given by Wilkes, "Ringgold Knoll, Eld Peak, Reynolds Peak, Cape Hudson, Point Case, Point Alden, Piner Bay, Cape Carr, North Land, Totten Land, Budd Land, Knox Land," should certainly be marked on all atlases. In West Antarctica there are two American names which require prominent places, "Palmer Land and Pendleton Bay." Nathaniel B. Palmer was probably the discoverer, and certainly the first explorer of the north coast of West Antarctica, and Benjamin Pendleton, before 1828, discovered a great bay or strait on the coast which, not before 1832, received the name of Graham Land.

It would be a great help in obtaining justice for American explorers if an official chart of the Antarctic could be prepared by the United States Hydrographic Office, so as to place officially before the world American claims in the Antarctic, and the National Geographic Society could do no more important work in the next few years than to insist that proper recognition be given to distinguished American Antarctic explorers, and that their names be commemorated by remaining attached to their discoveries.

EDWIN SWIFT BALCH.

RECLAMATION OF ARID LAND IN CALIFORNIA

THE greatest opportunity for the reclamation of arid lands in California, and perhaps in the entire Southwest, has been found to lie in the utilization of the waters of the Colorado River on its adjacent lands in California and southern Arizona. As a result of an investigation along this river, made by the hydrographic branch of the United States Geological Survey, the extent of the alluvial bottom land between Camp Mohave and Yuma was found to be from 400,000 to 500,000 acres. Extended surveys were begun November 1, 1902, to determine the area and quality of these bottom lands, the possibility of diverting water to them, and the probable expense of their reclamation. To this end a hydrographic survey of the region was begun, including the gaging of the river, the location of canal lines, soil analysis, and the determination of silt and evaporation; and a topographic map of the lands upon which distribution systems may be considered was made. This map, on which the topographic features are clearly and accurately shown, will be of great value in assisting engineers to locate the main canal lines, and is essential to a comprehensive knowledge of the river as a whole. About one hundred men are engaged in these investigations for the United States Geological Survey, Mr E. T. Perkins being in charge of the engineering field work, Mr E. C. Barnard in charge of the topographic mapping, and Mr J. B. Lippincott, resident hydrographer for California, consulting engineer on investigations.

The demands for irrigation in the Colorado Valley are urgent. The average rainfall at Camp Mohave is only 5.99 inches per annum, and at Yuma it is 3.06 inches per annum, while the temperatures are such as to provide twelve growing months in the year. The Colorado River derives its principal source of water supply from the melting snow on the high mountains of Utah, Colorado, and Wyoming. It reaches the stage of maximum flow, approximately 50,000 cubic feet per second, in the months of May and June, when the demand for irrigation is normally the highest; its minimum flow, about 4,000 cubic feet per second, occurs in the months of January and February, at the time of least demand. The opportunities for storage on this stream are very great.

The silts of the river are difficult to handle in canals; but the fertilizing properties which they have are such that lands irrigated with these muddy waters will never require further fertilization.

Mr R. H. Forbes, of the Agricultural Experiment Station at Tucson, Ariz., who has made a study of the silt in the Colorado River, has pointed out that this stream resembles the Nile in many particulars. Like the great river of Egypt, the Colorado is subject to an annual summer rise sufficient to overflow the extensive areas of its borders and delta lands. These high waters are rich in fertilizing sediments, are exceptionally free from alkaline salts, and come at an opportune time for irrigation. Mr Forbes maintains that when the Colorado is understood and utilized as successfully as the greater and better-known Egyptian stream, it will be recognized as the American Nile—the creator of a new country for the irrigator, the mother of an occidental Egypt.

ALASKAN BOUNDARY DISPUTE

BY the terms of a treaty signed January 24 by Secretary Hay and the British Ambassador, the Alaskan boundary dispute is to be referred to a special commission or tribunal consisting of three jurists from the United States and three from Canada. The vote of four members of the commission will be a binding decision. This is the plan originally proposed by the American members of the Joint High Commission, but which was rejected at that time by the British Commissioners. The Senate will doubtless ratify the treaty, so that this vexing question of the interpretation of the treaty of 1825, raised by Great Britain for the first time in 1898 after the American interpretation had been accepted for 73 years without a protest or complaint, will soon be settled. In this connection attention should be again directed to the masterly discussion of the dispute by Hon. John W. Foster, ex-Secretary of State and of the Joint High Commission, in the November, 1899, number of the NATIONAL GEOGRAPHIC MAGAZINE.

RECENT MAPS AND PUBLICATIONS BY THE U. S. GEOLOGICAL SURVEY

THE latest and most complete representation of the physical features of southern Indiana are found in a series of topographic map sheets issued by the Survey and known as the Degonia Springs, Boonville, and Belton sheets—each sheet being named from a prominent place appearing on it—and covering portions of Warwick, Spencer, Dubois, Pike, Gibson, and Vanderburg counties.

As a part of its investigation of the coal-producing regions of the country, the Survey has also issued, as Geologic Folio No. 84, a series of maps covering the larger portion of the coal region included in the First Congressional District of Indiana. The quadrangular area covered embraces nearly 1,000 square miles, and includes parts of Pike, Vanderburg, Warrick, Spencer, and Dubois counties.

The Survey, in coöperation with the State of Maine, has recently issued a new map of the region surrounding the entrance to the Penobscot River, known as the Castine quadrangle. The map differs from the charts issued by the Coast and Geodetic Survey in giving the details of features on the islands and the mainland, whereas the latter maps are confined almost exclusively to the marine features of the region—soundings, channels, and the outlines of the coast.

A topographic map of the region embracing Ticonderoga, in New York and Vermont, has been issued by the Survey. It is the result of a survey made in coöperation with the State of New York.

A map of East Liverpool and Wellsville, Ohio, and vicinity will be issued at an early date. The surveys were in charge of Van H. Manning, topographer, who completed the mapping of an area comprising 225 square miles along the Ohio River, which will include portions of Ohio, West Virginia, and Pennsylvania.

A detailed topographic map has been issued of a portion of the San Bernardina Valley, California, noted as one of the most highly developed irrigation districts in the country.

A reprint has been made of the map covering the famous Franklin Furnace Mining region in New Jersey.

Recent publications by the Survey include:

"Development and application of Water near San Bernardino, Colton, and Riverside, California," by J. B. Lippincott, resident hydrographer for the State of California. Mr Lippincott presents some striking instances of what may be done by irrigation. On land that fifteen years ago was worth barely 75 cents an acre as a sheep pasture now flourish, as a result of irrigation, orchards of orange and citrous trees yielding a net revenue of $100 an acre.

"Sewage Pollution in the Streams Adjacent to New York City," by Marshall O. Leighton; a discussion of the incalculable damage to property along the Passaic River of New Jersey, and along the streams flowing into the upper Hudson by discharge of city sewage.

"The Possibilities of Increasing the Water Supply of Central Washingtou," by F. C. Calkins, of the hydrographic division of the Survey.

"Geology of the Globe Copper District, Arizona," by Dr Frederick L. Ransome.

TIMBER LINES

An interesting paper on "Timber Lines" was presented by Prof. Israel C. Russell to the recent meeting in Washington, D. C., of the Gelogical Society of America. The following is au abstract of the address :

"'Timber line,' as commonly defined, is the upper limit of arboreal vegetation on mountains. Its position is determined mainly by the occurrence of a mean annual temperature of about 32 degrees Fahrenheit, but locally its elevation is regulated by soil conditious and by differences between various localities in snow-fall, severity of winter storms, exposure to the sun, etc. It may with propriety be termed the 'cold timber-line.' Above it on high mountains there is commonly a region occupied by alpine flowers, and still higher a region of perpetual snow. When traced from warm to colder regions or, in general, from the equator toward either pole, it becomes lower and lower. In North America it descends nearly to sea-level in Alaska and northern Canada, where it defines the northern limit of the subarctic forest and becomes the 'continental timber-line,' to the north of which lie the barren grounds and tundras, which correspond to the zone of alpine flowers on lofty mountains in temperate latitudes.

"On some of the mountain ranges of the arid portion of the United States there is a lower limit of tree growth, the position of which is determined in the main by insufficient moisture, and locally by soil conditions, including the presence of alkali, hot winds, forest fires, exposure to the sun, etc. This may be termed the 'dry timber-line'. Below it are treeless, grass-covered plains and valleys. On the mountains of central Idaho, the cold timber-line is sharply drawn at an elevation of about 10,000 feet, while the dry timber-line, equally well defined, has an elevation of about 7,000 feet; between the two there is a belt of forest trees which encircles the mountains. In southeastern Oregon, Nevada, southern California, etc., where the climate is excessively arid, the dry timber-line is higher than in Idaho, and in certain localities meets the cold timber-line, and the mountains are bare of trees from base to summit. The dry timber-line decreases in elevation when traced from arid to humid regions. In the central part of the continental basin of North America, it defines the border of the treeless portion of the Great Plateaus and the prairie plains, and at the north coincides with the southern limit of the subarctic forest. On the borders of the treeless plateaus and the prairie plains the position of the margin of the encircling forest is determiued mainly by lack of moisture, but is varied locally by soil conditions, hot winds, forest fires, etc., in the same manner that the lower limit of tree growth on the mountains of arid region is regulated.

"When the humidity is sufficient for the growth of trees, as for example on the mountains of New England, the dry timber-line disappears. An arid region may be bordered at a lower elevation by a region with sufficient humidity to permit trees to grow, and may then be bordered both above and below by the dry timber-line, as is the case in southern Idaho. Where an arid region reaches sea-level, as in Arizona, southern California, and the west coast of Mexico, etc , there is no forest below the arid belt, and in certain localities the dry timber-line meets the cold timber-line, and the mountains are bare of trees from sea-level to their summits.

"There is also a third general cause which draws a limit to timber growth, namely, excessive humidity, as for example on the borders of swamps, the margins of lakes, etc., which may perhaps be termed the 'wet timber line."

RECLAMATION OF THE HIGH PLAINS

THE efforts of the hydrographic branch of the United States Geological Survey are being directed to the discovery of sufficient water to lead to the reclamation and habitation of that area of the Great Plains lying west of the prairies and east of the Rocky Mountains, commonly known as the High Plains. The section is admirably suited to agriculture and grazing except for its inadequate water supply, which is so uncertain that great areas of fertile land lie quite uninhabited.

This is especially true of the regions lying between the river valleys which cross it at wide intervals. These broad intervalley plateaus are practically waterless, but it has been discovered that water may be had from underground sources by wells and windmills, and it has been demonstrated that, while the region may not be largely reclaimable by irrigation, it may be successfully used for grazing by creating stock-watering points at comparatively close intervals. It will, however, be difficult, if not impossible, for the grazers to raise anything besides fodder cane of the drought-resisting varieties, such as Kaffir corn. Vegetables and other products will, for the most part, probably have to be grown elsewhere.

The river valleys, on the other hand, seem destined to be extensively cultivated by irrigation, the water for which will be pumped from the gravels of the river beds, where an underflow has been known to continue in the summer season after the rivers themselves have ceased to run. These areas will furnish garden produce for the ranches on the plateau, and in this manner make the region as a whole habitable. The details of this investigation, with exhaustive studies of the nature of the underground waters of the High Plains, appear in the Twenty-first and Twenty-second Annual Reports of the United States Geological Survey, the latter of which is now in press and will soon be issued.

Commander Robert E. Peary, at a recent meeting of the Geographical Society of Philadelphia, declared that he was willing to lead another expedition in search of the North Pole if some wealthy Arctic enthusiast was ready to put up $150,000 to finance the expedition. Mr Peary believes that by making Cape Hekla the base, as outlined in the last number of this Magazine, the Pole could be reached, but it would take two years to do it.

The U. S. Coast and Geodetic Survey Steamer Blake, commanded by Capt. R. L. Faris, arrived at San Juan, Porto Rico, January 27, and reports a successful series of daily magnetic observations aboard ship on the passage between the

Capes of the Chesapeake and San Juan, Porto Rico. These observations were made under the direction of Prof. L. A. Bauer, Chief of the Magnetic Division of the U. S. Coast and Geodetic Survey.

Mr William Ziegler authorizes this Magazine to announce that he intends to send forth another north polar expedition this summer. The party will go north on the *America*. The personnel of the expedition is not yet complete so that a list of the members cannot now be given.

Two maps of Guatemala, each on the scale of 12.5 miles to one inch, have recently been published by the Bureau of American Republics. In addition to names of towns, volcanoes, railways, telegraph stations, etc., one map shows the approximate location of minerals in Guatemala, and the other the general elevation and the agricultural features of the country.

The Carnegie Institution has made a grant of $5,000 for the purposes of exploration; also a grant of $12,000 for geologic exploration.

The report of the Brown-Howard Expedition to Labrador in 1900, by Prof. E. B. Delabarre, has been published by the Geographical Society of Philadelphia. It forms a handsome volume of 212 pages.

NOTICE

PERSONS who have copies of the following numbers of the NATIONAL GEOGRAPHIC MAGAZINE and who are willing to sell them will confer a favor by writing to the National Geographic Society :

Vol. I, nos. 2 and 4 and index.
Vol. II, no. 2.
Vol. IV, nos. 1, 2, 3, 4, 5, 6, 7.
Vol. X, no. 6 and index.
Vol. XIII, no. 1.

DECISIONS OF THE U. S. BOARD ON GEOGRAPHIC NAMES

December 3, 1902

Arabella; island (Canadian) in the St Lawrence River, near Clayton, Jefferson County, New York (not Ambella nor Amelia).

Behestian; township, Ouachita County, Arkansas (not Behrstian).

Brakel; creek, Chenango and Cortland Counties, New York (not Brackel nor Braket).

Canadarago; lake, Otsego County, New York (not Schuyler).

Cape Rosier; post-office, Hancock County, Maine (not Cape Rozier).

Catatonk; creek, post-office, and railroad station, Tioga County, New York (not Catatunk).

Channahatchee; creek, Elmore County, Alabama (not Cedar).

Diddell; post-office and railroad station, Dutchess County, New York (not Didell).

Freeo; bayou, Douglas and Ouachita Counties, and township, Ouachita County, Arkansas (not Frio).

Grenell; island in St Lawrence River, and post-office, Jefferson County, New York (not Grennell, Grinnell, nor Stuart).

Heart; island in St Lawrence River, Jefferson County, New York (not Hart nor Hemlock).

Ionia; post-office, railroad station, and village, Ontario County, New York (not Millers Corners).

Lake of the Isles; lake on Wellesley Island, St Lawrence River, Jefferson County, New York (not Waterloo).

Leek; island (Canadian), St Lawrence River, near Grindstone Island, Jefferson County, New York (not Leak nor Leaks).

Little Tobehanna; creek, Schuyler County, New York (not Little Tobyhanna).

Lounsberry; locality, post-office, and railroad station, Tioga County, New York (not Canfields Corners).

McGraw; post-office, railroad station, and village, Cortland County, New York (not McGrawville).

Millen; bay, St Lawrence River, Jefferson County, New York (not Mellen nor Millens).

Mud; lake, Jefferson County, New York (not Edmund nor Edmonds).

Nowadaga; creek, Herkimer County, New York (not Indian Castle nor Nouadaga).

Ocquionis; creek, Otsego and Herkimer Counties, New York (not Fish).

Osburn; post-office and railroad station, Shoshone County, Idaho (not Osborne).

Petri; post-office and railroad station, Hancock County, Kentucky (not Petrie nor Petri Station).

Philomel; creek, Jefferson County, New York (not Phileman nor Philemon).
Salubrious; point, Lake Ontario, Jefferson County, New York (not Vesuvius).
Savilton; locality and post-office, Orange County, New York (not Savil, Savill, nor Saville).
Shadow; brook, Otsego County, New York (not East Springfield).
Stanbro; village, Chenango County, New York (not Stambro).
Sterling; township, Vernon County, Wisconsin (not Stirling).
Socapatoy; creek, precinct, and village, Coosa County, Alabama (not Socapartoy, Soccopotoy, nor Sucapatova).
Terlingua; creek, post-office, and village, Brewster County, Texas (not Latis Langua, Tarlinga, Tasa Lingo, Terlinga, nor Terlingo).
Tobehanna; creek, Schuyler County, New York (not Tobyhanna nor Big Tobyhanna).
Travelers Rest; post-office and precinct, Coosa County, Alabama (not Travellers Rest).
Tygart; river, West Virginia (not Tygarts Valley nor Valley).
Vanduzer; post-office and railroad station, Ouachita County, Arkansas (not Vanduser nor Van Duzer).
Volcan; mountains, San Diego County, California (not Balcan nor Bolcan).
Wolfe; island (Canadian), St Lawrence River, near Clayton, Jefferson County, New York (not Grand nor Long).

GEOGRAPHIC LITERATURE

J. S. Diller is the author of two reports recently published by the U. S. Geological Survey—"The Geology of Crater Lake National Park" and "Topographic Development of the Klamath Mountains." The former tells the geological history of the only crater lake in the United States. The lake and surrounding country in May, 1902, was dedicated by Congress as a national park. The latter describes the development of the Klamath Mountains of California, a range which includes a number of peaks varying from 7,000 to over 9,000 feet. The reports contain some remarkably fine illustrations.

"Commercial India in 1902" is the title of a recent monograph prepared by the Treasury Bureau of Statistics. This report shows that the commerce of India in 1902 was larger than that of any preceding year in its history. India ranks sixth in the list of world's exporting nations. Its exports reached $382,000,000 in the fiscal year ending March 31, 1902.

India is one of the comparatively few countries of the world whose exports exceed imports, the exports of India in 1902 exceeding the value of its imports by $127,000,000, which is a larger excess of exports than that of any other country except the United States. The value of the imports in the fiscal year 1902 was $264,000,000, of which practically two-thirds were drawn from the United Kingdom and only 2 per cent from the United States. Of the exports, 25 per cent went to the United Kingdom and 12 per cent were sent to the United States. Of the exports, rice, hides and skins, jute, cotton, tea, opium, and oil seeds are the principal items in the order named. The principal imports are cotton manufactures, which form more than one-third of the total; metals, hardware and cutlery, sugar, oils, silk, raw and manufactured; woolen goods, and machinery of various kinds.

The U. S. Coast and Geodetic Survey has just published a List and Catalogue of all the publications of the Survey. It makes a quarto volume of 237 pages. The List is arranged chronologically and the Catalogue alphabetically, by authors, subjects, places, etc., with many cross-references.

"Paraguay" is the title of a very valuable brochure of 187 pages recently published by the Bureau of American Republics. The book contains an excellent map, some good illustrations, and many interesting facts about the country and people of the South American Republic.

NATIONAL GEOGRAPHIC SOCIETY

The proceedings of the Society during December, 1902, and January, 1903, will be published in the March uumber.

Regular Meetings.

February 13.—"The Work of the Census Office." Hon. William R. Merriam.

February 27.—"The Work of the Naval Observatory." Capt. Charles H. Davis.

March 13.—"The Work of the Geological Survey." Hon. Charles D. Walcott.

March 27.—"The Work of the Library of Congress." Hon. Herbert Putnam.

This is the last meeting of the season.

Popular Lectures.

February 6.—"From Paris to New York Overland." Mr Harry de Windt. (Illustrated) This is the account of a remarkable journey of 18,000 miles by land from Paris to New York via Bering Strait.

February 21.*—"Tropical Development, a Temperate Zone Problem." Hon. O. P. Austin. (Illustrated.)

March 6.—"The Geographic Distribution of Insanity in the United States." Dr W. A. White, Director of the Binghamton State Hospital, New York.

March 20.—(The last lecture of the season.) "Captain John Smith and Old Virginia." Mr W. W. Ellsworth, of the Century Company. (Illustrated.)

As Mr Paul du Chaillu has not yet returned from Russia and will probably not return for some months, contrary to his original plans, his lecture before the society on "Russia of Today" has been postponed until next winter.

The Afternoon Course of Lectures. In Columbia Theatre at 4.20 p. m.

The general subject of the course is "The United States." During recent years our country has been advancing by leaps and bounds, until today it is the most wealthy of nations. New York is now practically the financial center of the world. American capitalists have within the last four years floated loans for Mexico, Germany, England, and Russia, and have placed hundreds of millions of dollars in investments abroad. The question now in every mind is, What elements in the United States have helped us to earn this tremendous national wealth and power and have won for us commercial supremacy in the markets of the world? To partially answer this question is the aim of the present series of five lectures. In other words, the subject of the course is "The Basis of the Wealth and Power of the United States."

Diagrams and illustrations will be used very freely, but statistics and tables will be avoided as far as possible. The lecture committee desire to have the subject treated in a popular way rather than from a statistical or technical point of view.

* Please note that this is Saturday.

1. "Lands and Waters." The first lecture in the series will treat of the unexcelled natural features of the United States—our deep, secure harbors on the Atlantic, Gulf, and Pacific seaboards, our great rivers which penetrate into the heart of the country, our vast fertile plains and lofty mountains, in which are buried untold mineral wealth, and our inland lakes, all seemingly ranged in most fortunate conjunction to mutually help each other, and the elements and routes of commerce. Lecturer, Mr Cyrus C. Adams, the noted writer and lecturer on geographical themes. February 10, 1903.

2. "The Soil and its Products." The second lecture will deal more particularly with the land and the products of the land—agriculture. Twenty billions of dollars are invested in the agricultural interests of the United States. We raise annually two billion bushels of corn and reap every year a larger crop of wheat than the combined wheat crops of Argentina and Russia.

In 1901 the United States sent nearly one billion dollars' worth of food—wheat, pork, beef, etc.—to the people of Europe. We are literally the storehouse of Europe. Lecturer, Secretary of Agriculture, Hon. James Wilson. February 18, 1903.

3. "The Industries." The third lecture will treat of the industrial wealth of the United States. The value of our manufactures exceed that of any other nation. In the manufacture of steel we lead the world, and in cotton and woolen fabrics we are eclipsed by no one. Our railways—two hundred thousand miles of them—penetrate to every corner of the country, binding the whole nation into one compact unit. Our telegraph and telephone systems enable men to communicate instantaneously though thousands of miles apart. Lecturer, Hon. O. P. Austin, Chief of Bureau of Statistics, Treasury Department. February 25, 1903.

4. "Mines and Mining." The fourth lecture will treat of the mineral wealth of the United States. During each of the last three years we have produced more coal than England; in 1902 we produced more than one-half of the refined petroleum; more than one-third of the world's production of iron ore in 1902 was obtained from the United States mines; three-fifths of the copper output for the same year came from the United States. Lecturer, Mr. Charles Kirchoff, editor of *The Iron Age*. March 4, 1903.

5. "The Men Who Make the Nation." The fifth and last lecture will treat of the people of the United States. The mingling of races and peculiar conditions have bred a distinct and original people, who mould the gifts of nature to their will. The inventive genius of the American has enabled him to iucrease many times the resources nature has given him. The typical American has not yet been bred, but we may prophesy what he will be and what place he will hold in the world. Lecturer, W J McGee, LL. D., Vice-President National Geographic Society. March 11, 1903.

Office Hours: 8.30 A. M. to 5 P. M. Telephone, Main 471

NATIONAL GEOGRAPHIC SOCIETY

OFFICES Rooms 107, 108 Corcoran Building
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Recommendation for Membership in the

NATIONAL GEOGRAPHIC SOCIETY

The following form is enclosed for use in the nomination of persons for membership

Please detach and fill in blanks and send to the Secretary

DUES: Annual membership, $2; Life membership, $50. If check be enclosed, please make it payable to order of the National Geographic Society, and, if at a distance from Washington, remit by New York draft or post-office money-order.

____________________ 1903

To the Secretary, National Geographic Society, Washington, D. C.:

Please propose ______________________________

address: ______________________________

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PRESS OF JUDD & DETWEILER, WASHINGTON, D. C.

THE NATIONAL GEOGRAPHIC MAGAZINE

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE CANADIAN BOUNDARY

A Review of the Methods by which the Line has been Adjusted and Marked

By Hon. John W. Foster, Ex-Secretary of State

In view of the interest which has been awakened in the boundary question by the Hay-Herbert treaty, recently ratified, for the settlement of the line between Alaska and Canada, I have been asked by the editors to furnish for the National Geographic Magazine a review of the history of the delimitation of the boundary line between the United States and Canada since the independence of our country.

The treaty of peace of 1783, between the United States and Great Britain, sought to fix with accuracy the boundaries of their respective possessions. These boundaries are laid down in detail in Article II of the treaty, the opening words of which are as follows: "And that all disputes which might arise in future, on the subject of the boundaries of the said United States may be prevented, it is hereby agreed and declared, that the following are, and shall be their boundaries," etc.

Notwithstanding the good intentions of the negotiators, the provisions as to the boundary proved to be a source of disagreement, and sometimes of violent dispute, for nearly a century. The disagreements arose mainly from a want of correct geographic knowledge on the part of the negotiators. For example, the initial point on the east was fixed at the mouth of St Croix River in the Bay of Fundy. But when it was sought to establish the boundary line, it was found that there was no river in that locality popularly known as the St Croix, but that there were two considerable rivers emptying into the Bay of Fundy, both of which had other names than that mentioned in the treaty. The United States claimed that the most eastern of these was the river designated in the treaty as the St Croix, and Great Britain claimed the western river as the treaty boundary.

Throughout almost the entire length of line of contact with Canada laid down in the treaty, geographic difficulties of interpretation have arisen, and the inaccuracy of knowledge of the negotiators is especially conspicuous in their provision as to the (then) western termination of the line. It was traced through the Lake of the Woods to the most northwestern point of that lake, "and from thence on a *due west* course to the River Mississippi." They and the cartographers of that day supposed that the source of the Mississippi was in Canadian territory, northwest of the Lake of the Woods, whereas, it was a considerable distance south of that lake.

It was thought at the time that if the disputed question as to the St Croix River and the eastern boundary should be adjusted, the remainder of the line described in the treaty could be amicably demarked. It was accordingly agreed in the treaty of 1794, negotiated by Mr Jay, that this question should be submitted to arbitration by a commission composed of one American, one Englishman, and one umpire selected by the two. The commission rendered a unanimous award, describing with precision which was the river intended by the treaty to be the eastern boundary, and the award was accepted by both nations.

This arbitration, however, was far from settling the boundary questions. Four distinct controversies arose over different parts of the divisory line. The first was as to the ownership of the islands in and near Passamaquoddy Bay, a part of the Bay of Fundy. The second was as to the line from the source of the St Croix River along the Maine-New York frontier; the third as to the ownership of the islands in the St Lawrence River and the Great Lakes; and the fourth as to the line from Lake Superior to the northwestern corner of the Lake of the Woods.

Various efforts were made after the date of the award as to the St Croix River, in 1798, to adjust these questions by diplomatic negotiations, especially the first two, and a treaty to that end was signed but never ratified. In the negotiations which resulted in the treaty of peace of 1814 these subjects were considered and provision was made for their definitive settlement. This treaty was signed on the part of the United States by John Quincy Adams, Henry Clay, James A. Bayard, Jonathan Russell, and Albert Gallatin. It provided that the ownership of the islands in Passamaquoddy Bay should be passed upon by a commission composed of one American and one Englishman, and if they failed to agree they should report to their respective governments the points of disagreement and the grounds thereof, and the governments were to refer the points of disagreement to the arbitration of some friendly power. The commissioners were able to agree upon all the questions submitted to them, and there was consequently no arbitration.

The second question whose adjustment was provided for in the treaty of 1814—the line from the source of the St Croix River along the Maine-New York frontier to the St Lawrence—was likewise submitted to two commissioners, under the same terms as to arbitration in case of disagreement as just stated respecting the islands in Passamaquoddy Bay. This proved to be the most irritating, difficult, and tedious of all the subjects of dispute between the United States and Great Britain. The two commissioners first met at Portland, Maine, in 1816, and held various other sessions at different points in Canada and the United States adjacent to the region in dispute. They also caused elaborate surveys to be made and charted. After five years of vain efforts to reach an agreement, they adjourned in 1821, submitting to their respective governments their divergent views.

This threw the subject back into diplomacy for the naming of the arbitrator and fixing the terms of arbitration. Six years elapsed before these were consummated, and meanwhile the situation was further aggravated by the acts of conflicting authorities in the disputed territory. Finally, in 1827, it was agreed that the matter should be referred to the arbitrament of the King of the Netherlands. In 1830 the King rendered his award, not accepting the line contended for by either party, but recommending a compromise boundary or a line of convenience. The American minister at The Hague, without instructions from Washington, protested against the award on the ground that it was a departure from the powers delegated to the arbitrator. The British Government manifested a disposition to acquiesce in the award, but intimated that its acceptance would not preclude the two governments from modifying the line. President Jackson was at first inclined to accept it, and it is said that he afterwards expressed regret that he had not done so; but he finally submitted the question of acceptance to the Senate, and that body advised him that it was not obligatory, and that new negotiations should be opened.

The British Government consented to this latter alternative, with the understanding that meanwhile the boundaries actually possessed should be observed by the authorities. The negotiations dragged along through several years, and new surveys were ordered; but it was not possible for the people on the border to observe the temporary boundary understanding. Strife occurred, a state of border warfare was created, Congress authorized the President to call out the militia, and voted $10,000,000 for public defense.

An open conflict between the two nations seemed imminent; the Commander-in-Chief of the Army, General Scott, was dispatched to the frontier, and through his interposition a temporary border truce was arranged.

In 1841 Mr Webster became Secretary of State. He was well acquainted with the controversy and possessed the confidence of those most interested—the people of New England. Lord Ashburton was sent to Washington by the British Government as a special plenipotentiary to adjust this long-pending and vexatious question. The result of their negotiations was the treaty of 1842, by which the line in controversy was definitely agreed upon and fixed. It was, however, a no more advantageous settlement for the United States than would have been secured by the award of the King of the Netherlands, and the prolongation of the dispute kept the border in a state of turmoil for more than ten years, brought the two countries to the verge of war, and caused a heavy outlay from the national treasury. In addition to the military and diplomatic expenditures, Congress voted to the States of Maine and Massachusetts the sum of $300,000 as compensation for the territory claimed by them, but conceded to Canada.

The third question respecting the Canadian boundary, for which provision was made for settlement by the treaty of 1814, was that relating to the line extending through the St Lawrence River and the Great Lakes, and the ownership of many islands along the route. The commissioners were to be appointed, with provision for arbitration in case of disagreement. They held their first meeting in 1816, and they spent a period of six years in causing surveys to be made, in visiting in person the entire line, and in conferences at different cities in the United States and Canada, and in the end were enabled to reach a harmonious decision in 1822. By this decision various islands which had been claimed and occupied by Canadians were transferred to the American side of the line, and others claimed by Americans were placed on the Canadian side.

The fourth question which was sought to be adjusted by the treaty of 1814 was the boundary line from Lake Superior to the northwestern point of the Lake of the Woods. This was entrusted to the same commission which had successfully fixed the boundaries of the St Lawrence and the Great Lakes. After they had concluded their labors under Article VI of the treaty of 1814, they began the work of delimitation of the frontier to the extreme of the Lake of the Woods. Their first session in discharge of this duty was held in 1822, and the work of survey and conference extended until 1827, when they adjourned *sine die*, with a disagreement upon the entire line from St Marys River, between Lakes Huron and Superior, to the western limit of the Lake of the Woods, and after an expenditure of more than $200,000. Under the treaty this disagreement should have been followed by a reference to a friendly sovereign as arbitrator ; but the experience in the arbitration of the northeastern boundary did not encourage such a course, and the agitation over that subject overshadowed the less important question at that day of the extreme northwestern frontier. It was allowed to remain in a state of quiescence until the Webster-Ashburton negotiations, in 1842. After fifty years of diplomatic and arbitral controversy, the two governments had reached a state of political complaisance, and the large tracts of territory which had been the subject of disagreement on the northwest border were, in a spirit of mutual concession, divided by the treaty of 1842, and the line was marked out upon the maps made by the surveys of the commission. But even this settlement has not proven entirely complete, as some portion of the water boundary in the lakes is yet in doubt, and it is charged by Canada that the United States Land Office has surveyed, platted, and sold to Americans a considerable extent of land on the Minnesota-Wisconsin frontier which really belongs to Canada. The Government of the Dominion has sought on its own account to survey and mark the boundary in that region without the coöperation of the American authorities, but our Government has not accepted this survey.

The uncertainty as to the true boundary west of the Lake of the Woods, as described in the treaty of 1783, was removed by the treaty of 1818, Article II of which provided that from the lake the line should be drawn westward along the 49th parallel of latitude to the "Stony" or Rocky Mountains.

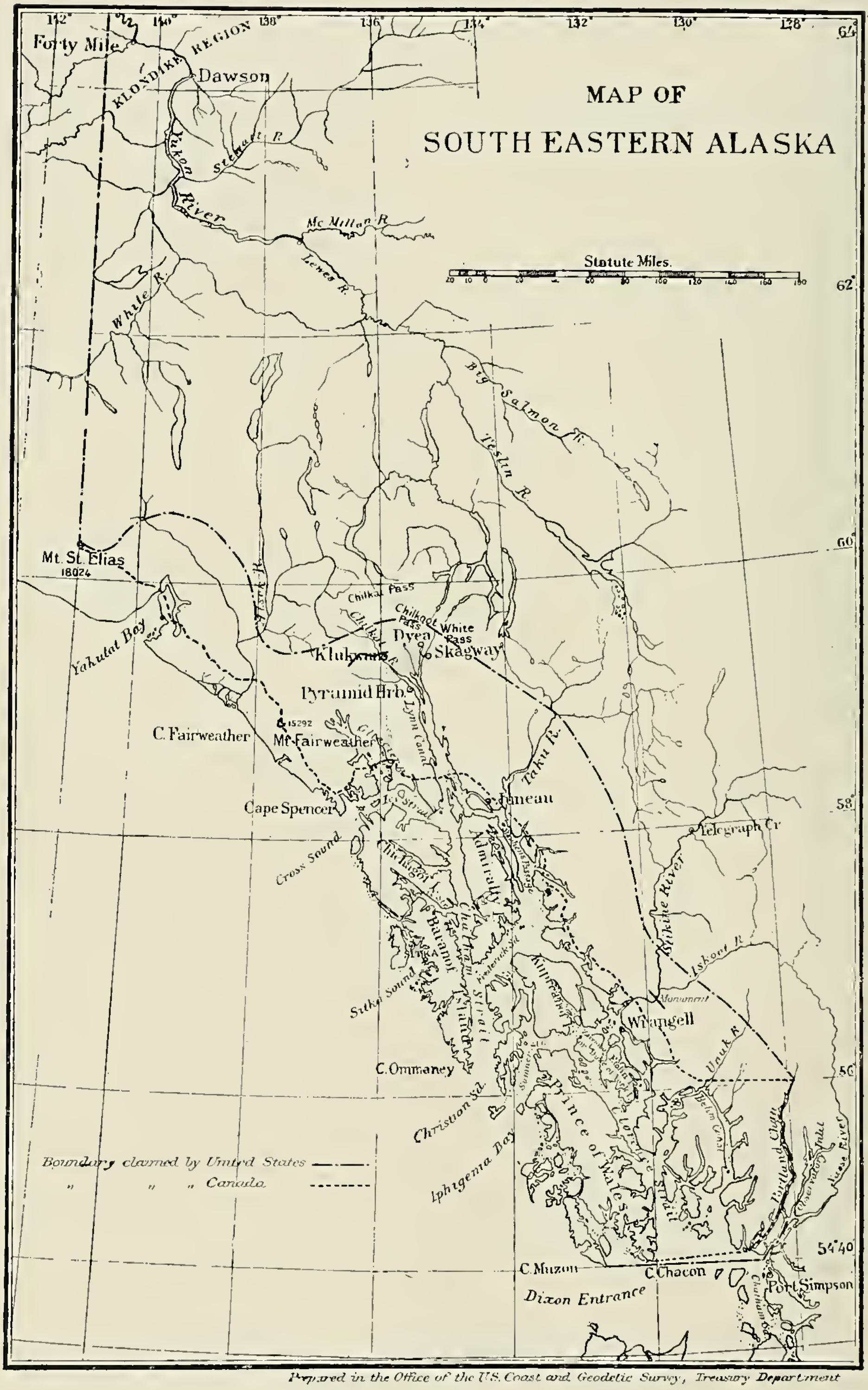
The line from the Rocky Mountains to the Pacific Ocean remained for forty years a subject of controversy. It engaged the attention of successive administrations up to the presidency of Mr Polk, various treaty and arbitral propositions being advanced only to be rejected by one or the other of the two nations. Our claim to the whole territory on the Pacific coast, from California to the Russian possessions at 54° 40', was asserted by the Democratic National Convention of 1844, and entered largely into the campaign which resulted in Mr Polk's election. In his first message to Congress he declared our title to this region to be "clear and unquestionable," and he recommended to Congress to extend our laws and jurisdiction over it. John Quincy Adams, who was recognized as the highest living American authority on international questions, held with President Polk that our title to the territory up to 54° 40' was complete and perfect.

Congress, acting upon the President's suggestion, passed a joint resolution authorizing the President to give notice to Great Britain of the termination of the joint occupation. This brought about an energetic protest from Great Britain, and the country was awakened to the danger of hostilities ; but the two nations found a better way of reconciling their differences, and after anxious deliberations Mr Buchanan, the Secretary of State, and the British Minister signed a convention in 1846 whereby the line of the 49th parallel was extended from the Rocky Mountains to the waters of the Pacific Ocean. By this act the vast domain now embraced in British Columbia was yielded to Great Britain, although our title to it had been declared unquestionable by a national convention, by the President in his annual message, by Congress through joint resolution, and by some of the highest authorities on international law.

Still one more step was necessary before our chain of title to a fixed and unquestioned line from the Atlantic to the Pacific Ocean should be complete. In describing the Oregon boundary, Article I of the treaty of 1846 provided that the line should be "along the 49th parallel of north latitude to the middle of the channel which separates the continent from Vancouver's Island; and thence southerly through the middle of the said channel, and of Fuca's Straits, to the Pacific Ocean." The treaty had hardly been proclaimed before this water boundary began to be a matter of dispute. Between the Gulf of Georgia on the east and the Straits of Fuca on the west lie a number of islands, and it was not clear what was "the middle of the channel" among these islands. In this state of uncertainty the islands were being populated by both Americans and Canadians and conflicts of authority arose. Efforts were made to reach an agreement as to the channel by diplomatic negotiations, but they failed. In 1856 Congress passed an act authorizing a commissioner on the part of the United States to act with one to be appointed by Great Britain. These commissioners met, and after visiting in person the region in question were unable to reach an agreement. The subject went back into diplomacy, and for more than ten years it was a frequent topic of discussion, but no method of settlement could be attained.

In 1859 the settlers on San Juan Island came into conflict, the troops of the two countries became involved, and a collision seemed imminent. A second time the services of General Scott were invoked, and he arranged for a joint and peaceful occupation by troops of the two nations, but with difficulty were they able to prevent conflicts of the civil authorities. Finally, when the Joint High Commission met in Washington in 1871, the question of the true channel was submitted to the arbitration of the Emperor of Germany, and he rendered an award in favor of the contention of the United States.

The foregoing review shows that ever since the independence of the United States the boundary with Canada has been a subject of almost constant consideration between the United States and Great Britain, and that every step of the frontier line from the initial point on the Atlantic coast to the last water channel on the Pacific has been a matter of controversy, and sometimes of such bitter contention as even to threaten war. It also shows that three courses of action have from time to time been taken by the Government of the United States, to wit, treaty adjustment, joint and equal commissions, and arbitration. In the case of the important question of the northeastern boundary, resort was had successively to all three of these methods. It is seen that where adjustment by treaty has failed, a resort has been had to either joint commissions or to a foreign and neutral arbitrator. Treaty adjustment has not always been found the most acceptable method in popular estimation, as instance the Oregon boundary treaty. We have suffered less, in loss of territory claimed, by the action of joint commissions and by arbitration than by treaty settlement. Our public men and the Government have not found a strong title to territory a bar to the submission of boundary questions to the adjudication of a commission or an arbitrator.



Map Showing Different Alaskan Boundary Lines Claimed by United States and Canada

MOUNTAINS ON UNIMAK ISLAND, ALASKA*

By Ferdinand Westdahl

Assistant, U. S. Coast and Geodetic Survey

Shishaldin volcano is the highest mountain on the island,† and it vies with Mt St Helens, in Washington, in being in outline the most regular cone I know of on the Pacific coast of the United States. It is an active volcano, and the discharges from its crater come in puffs like steam at first and rising probably 100 feet or more above its summit, then turn darker in color and stream off horizontally with the direction of the wind. In calm weather the continuous discharges are seen to rise in a column more than 1,000 feet above it and gradually spread out in a dark cloud. When the wind blows hard over the summit the smoke is beaten down and follows the slope on the lee side of the peak. The snowy mantle of the mountain becomes dark after several days of calm weather, then clouds envelop it, snow falls and the mountain again emerges, clad in pure white. ‡ The snow line reached on September 21, 1901, down to an estimated height of 2,800 feet above the sea. At about 3,000 feet below the summit the regular cone begins to spread out, and at 4,000 feet there is a projecting spur to the westward. Glacier-carved canyons begin at about 4,000 feet or more below the summit, and from them

* This article consists of extracts from a report made in February, 1902, by Assistant Westdahl, commanding the Coast Survey Steamer *McArthur*, while engaged in a survey of that region. The extracts refer to certain interesting geographical features of Unimak Island, Alaska, and are published here, together with the accompanying photographs, by permission of the Superintendent of the Coast Survey. Unimak is one of the Aleutian Islands, about which very little is known, and therefore the description of the mountains as seen by the writer and recorded by the camera is especially interesting. Excerpts are also given from Mr Westdahl's description of the south shore of the island.

† "The island is uninhabited, and has been in that condition for the greater part of the present century, though it is richer than many other islands of the Aleutian chain in natural means of sustaining life.

"Foxes are quite plentiful here and sea otters frequent the reefs and points, but ever since—nearly 100 years ago—almost all the inhabitants of four or five populous villages were massacred by the Russian promyshleneks, a superstitious dread seems to prevent the Aleutian from making a permanent home at Oonimak (Unimak)." Ivan Petroff, p. 77, in "Narratives of Military Explorations in Alaska," compiled under the direction of "The Committee on Military Affairs" of the Senate. Government Printing Office, Washington, 1900.

‡ Miners bound for Cape Nome and whalers or sealers on their way to Bering Sea as they sail through Unimak Pass can see Shishaldin in the distance. When the air is clear the mountain presents a majestic spectacle, which is described by John Burroughs in the following words:

"Before nightfall we passed two more notable volcanic peaks, Isanotski and Shishaldin, both of which penetrate the clouds at an altitude of nearly 9,000 feet. These are on Unimak Island at the end of the peninsula. Our first glimpse was of a black cone ending in a point far above a heavy mass of cloud. It seemed buoyed up there by the clouds. There was nothing visible beneath it to indicate the presence of a mountain. Then the clouds blotted it out; but presently the veil was brushed aside again, and before long we saw both mountains from base to summit and noted the vast concave lines of Shishaldin that swept down to the sea, and that mark the typical volcanic form.

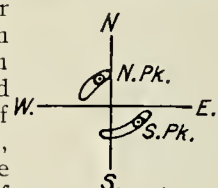
"The long, graceful curves, so attractive to the eye, repeat on this far-off island the profile of Fuji-Yama, the sacred peak of Japan. Those of our party who had seen Shishaldin in previous years described it as snow white from base to summit. But when we saw it the upper part, for several thousand feet, was dark—doubtless the result of heat, for it is smoking this year" (1899). From "Alaska," vol. 1, p. 90. "Alaska," the report of the Harriman Alaska Expedition. Edited by Dr C. Hart Merriam. New York: Doubleday, Page & Co., 1901.

Outline Map of Unimak Island

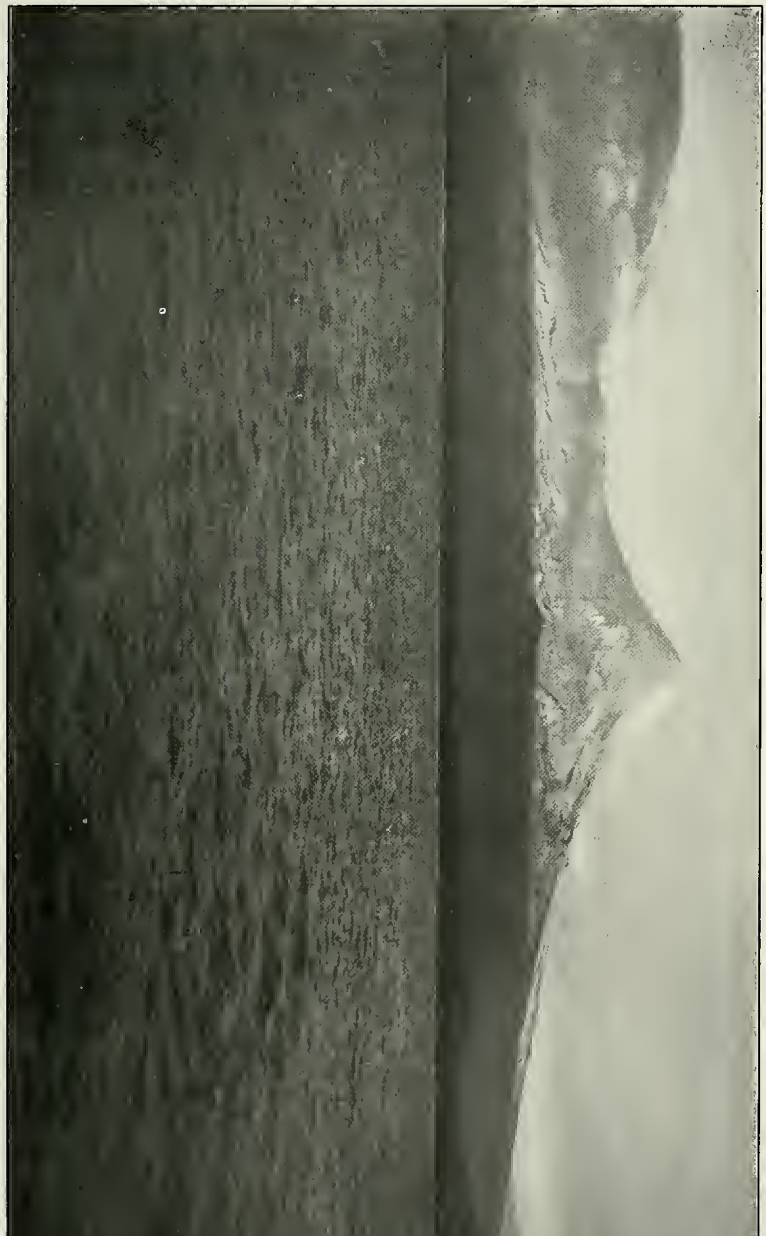
issue at a much lower level streams which spread out into broad and shallow water-courses (apparently dry at this season of the year) over the very gentle slopes to the sea. These lower slopes seem to be covered with ashes and scoriæ, and when the wind blows clouds of dust are driven along with them. The ridge connecting Shishaldin with its neighbor to the eastward is probably not more than 2,000 feet above the sea.

ISANOTSKI PEAKS

Eight and a half nautical miles east-northeast from the summit of Shishaldin are the double peaks of Isanotski Mountain. When these peaks are closely studied in their varying aspects, from broad to slender, from Ikatan Bay and around to the westward of them in Unimak Bay, they are seen to be the remains of the rim of a crater disposed something like this.



The points determined in the triangulation are the very highest pinnacles on the two remnants of the rim. If this theory is right, the mountain may at some time have rivaled Shishaldin in



Beginning of Pinnacles Ridge

Shishaldin from Anchorage Just West of Pinnacles

View from Near Pankof △

The long streamers of smoke from Shishaldin shown in the illustration can sometimes be seen on a clear day. The picture shows very distinctly the double peaks of Isanotski height. Its sides are extremely rugged and apparently somewhat concave near the summit, as if the mountain had been hollow and the accumulation of ice and snow about it had crushed its sides inward. In broaching this theory to Mr Applegate, he informed me that an old native, recently dead, claimed to have seen this mountain crumble. I can scarcely believe that such a catastrophe, if it has taken place at all, happened at so recent a date without attracting the attention of some of the Russian traders living among the natives. The fact that the mountain is still so rugged, that the chasms created by the supposed caving in are not yet filled by the annual accumulations of snow, as on both of its neighbors, would seem to favor a comparatively recent date.*

Five miles northeastward from Isonotski is probably also an extinct volcano. It is apparently the highest of a group of peaks on the northeast end of Unimak Island, and has a rounded broad summit of snow and ice, through which only here and there is seen a projecting dark mass of rock even in midsummer.

POGROMNI VOLCANO

Pogromni volcano is the highest peak in the mass of mountains forming the western end of Unimak Island. It does not seem to rise from the main ridge, however, but from the eastern slope of it. A short distance to the eastward of it is seen a much lower peak, almost its exact counterpart in appearance, but much smaller in dimensions. Pogromni is a regular cone in outline, but its sides seem more angular and rugged than Shishaldin and its rocky ribs and projections more numerous and bare. We saw no smoke issuing from it at any time this season, but we have not seen much of the mountain, except while making this reconnaissance. I have a faint recollection of having seen smoke issuing from it in August, 1866.

Faris* and Westdahl* are two snow-covered peaks, apparently rising from the main ridge of this part of the island to the southward of Pogromni.

THE SOUTH SHORE OF UNIMAK

The region to the northward of Cape Lazaref consists of isolated mountainous elevations, knit together by low level land, composed largely of sand. The northern slopes, however, were not seen from the ship. That this low land extends back of the mountains forming Cape Lazaref is inferred from what was seen by the officer who occupied several triangulation stations on the coast. These low lands, like those of the Ikatan Peninsula, are probably covered with lakes, as many small streams issue through their sandy margins into the sea. Cape Lazaref, or the rocky mass so named on the chart, consists of three high points, which, for convenience, might be designated as east, middle, and west Cape Lazaref. The east cape is highest and broadest toward the sea, the middle next in height, but not projecting so prominently, and the west cape the lowest and sharpest. The east cape has a few rocks close under its extreme point, one of which is about 30 feet high and shows prominently from the anchorage in Otter Cove. There

* Less than 200 miles from Shishaldin are two volcanoes, known as Old and New Bogoslof. The first was born a little more than a century ago, rising from the depths of the ocean; the second rose from the deep probably not more than 30 years ago. Old Bogoslof was reported in 1832 to have had a height of 1,500 feet, but is now only half that height. Both volcanoes are constantly disintegrating and wearing away. For the remarkable history of the two Bogoslofs, see the article on "Bogoslof, Our Newest Volcano," by Dr C. Hart Merriam in "Alaska," the report of the Harriman Alaska Expedition, vol. II, pp. 291–336; New York, Doubleday, Page & Co., 1901.

* Named by the Superintendent of the Coast and Geodetic Survey, Mr O. H. Tittmann, after the officers who first determined their geographical position.

are also some scattered low rocks close under the cape all along its seaward face. The middle cape is clear of rocks, except a high pinnacle, so close under its southeast face as to seem a part of the rocky cliff, except from certain directions. The west cape, or Lazaref proper, has a reef projecting one and one-tenth miles southeastward from its extreme point, consisting of two high rocks, one about 150 feet above the sea and one about 70 feet midway between them, all showing as pinnacles from the southeastward, but broad from all other directions, and a multitude of low rocks quite close together. This reef forms a fairly good protection in westerly winds for an anchorage to the eastward between the outer high rock and a small bunch of rocks lying one and three-tenths miles from the eastern face of the cape.

The sandy shore is continued to the westward of Cape Lazaref, with somewhat higher dunes upon it immediately back from the beach. Six-tenths of a mile from this beach and 1½ miles westward from the cape lies a small rocky island about 130 feet above the sea and having a smooth, grassy top. At 3½ miles westward from Cape Lazaref the low shore, forming the sea frontage of the broad valley or flat back of the rocky masses which constitute the cape, ceases, and a high spur from Isanotski Mountain reaches almost to the sea, there being but a narrow fringe of sand beach in front of this 2½-miles-wide sea face of the mountainous projection. This sand beach is of comparatively recent formation. The cliffs of the face of this spur show evidences of wave action, and are in shape and color similar to the cliffs of Cape Lazaref. From aloft on the ship it could be seen that this is true also for many miles of the east side of this spur bordering on the low land.

At a point eight miles westward from Cape Lazaref the sandy beach is broken by the toe of a lava flow, probably from Shishaldin volcano, about one mile wide on its sea face, about 20 to 30 feet in height, and consisting of black, very jagged, and forbidding-looking rocks. Immediately back from the sea face the lava is covered with sand and thin vegetation. The sand beach is again broken through at 6¾ miles from this lava flow by a low ridge, about 2½ miles long and in a southwest aud northeast direction, and rising into three conical hills, of which the northeasternmost is the highest, the middle the lowest, and the southwesternmost the only one whose base is washed by the sea and formed into several columnar rocks, of which only the outermost is entirely surrounded by water at low tide.

RUKAVITSIE CAPE

From Rukavitsie Cape there is an unbroken sweep of low sand beach, backed by low sandy bluffs and dunes for 13 miles, first southwestward, then curving gradually until its final direction, for two miles before it ends, is south. This forms the northwestern shore of Unimak Bay. Back from this beach from 1½ to 3 miles, in the most receding part of this bight, are hills rising from several hundred to 1,400 feet, and farther back seemingly still higher ones, all comparatively solitary, from a plain 100 to 200 feet above the sea and sloping gradually upward to the ridge projecting westward from Shishaldin Mountain. To the westward of these hills, between them and the mountain mass forming the southwestern end of Unimak Island, is a broad valley, drained by a river which empties into Unimak Bay at a point of the sand beach distant 1½ miles from its southwestern end. Looking into this valley, at an estimated distance of three or four miles from the beach is seen a lava flow, apparently from the southwest toward the northeast, reaching more than half

View from West Side of Otter Cove

View of Pogromni, Faris, and Westdahl Peaks from Unimak Pass way across the valley, with the water making a great bend around the foot of it. Examined through a telescope, it seems to consist of a jungle of sharp-cornered rocks, like gigantic pieces of broken glass, of a dull gray color, sloping very gradually toward the northeast.

The sand beach ends against the table-land about 350 feet high, projecting in an east-southwest direction from the mountain mass behind it, and forming at its extremity a small semicircular cove not quite half a mile across and open toward the north. We noticed two small houses in the cove, apparently close under the bluff, and also a small sloop, hauled out of the water beyond the reach of the surf, near them. There are some rocks close under the extremity of the point. Applegate has anchorages marked on either side of this point, I believe, and I have been informed that vessels have anchored in both places. The cove to the northward of the point is much more protected, and I have learned from a shipmaster well known to me that he has anchored there and had protection from southerly winds, but not from the swell which rolls around the point. The bottom is sandy and shoaling toward the beach very gradually. At the southern end of the broader bight, to the southward of the point, there is a high table-land, 540 feet above the sea, and with an ocean face of one mile in length in an approximate northwest and southeast direction.

OPENING OF THE ALASKAN TERRITORY*

By Harrington Emerson

THE West, the old West of boundless natural resources and pathless solitude, to yield homes for millions yet unborn, is not exhausted. Governments and peoples do not realize it, but it lies there to reward the pioneer with greater and quicker returns than have been given by any part of western Europe or of temperate North America. The new and unsubdued West today is Alaska, almost to a mile one-half larger than the thirteen original American colonies, very nearly twice the size of California, Oregon, and Washington, as large as Great Britain, Denmark, Sweden, Norway, and the German Empire, and with a better climate and greater natural resources than an equal area of northern Europe supporting 10,000,000 inhabitants.

The Yukon, the fourth largest river in the world, navigable for more than 2,000 miles above its mouth and running in a great semicircle from southeastern to northwestern Alaska, forms a natural highway. All this was known long ago, but it was not known that the interior contained thousands of square miles of farming lands and almost limitless areas of the richest mineral lands in the world. It is in this unsubdued country that thousands of miles of railroad must be built, that great areas will open for settlement, absorbing and keeping busy 2,000,000 workers as fast as they choose to go.

Had it not been for the natural summer highway of the Yukon, there never could have been such a camp as Dawson. The head passes of the Yukon and the river itself were at that time the only possible direct road to the Klondike.

* This article was published in *The Engineering Magazine* for February, 1903, and is reprinted here in somewhat curtailed form by courtesy of the editors of that magazine.

Courtesy of The Engineering Magazine

Winter Freighting Overland, Dawson, Yukon Territory

Courtesy of The Engineering Magazine

Landing Through the Surf at Nome

Under such conditions the pack horse adds little to the solution of the problem. He cannot both work and forage. Men "packers" were at one time paid as high as 60 cents a pound for packing over the Chilcoot Pass, but the rate had been 10 cents. Over the White Pass, where horses could be used, the rates were never lower than 10 cents, and often 20 cents. Horse trains were maintained only by a constant fresh supply of horses from the south, few animals surviving more than two or three trips. Of 3,800 horses taken north in 1897, all but 30 died on the trail. To cheapen transportation a wagon road was hastily built in 1898 and a toll levied of 2 cents a pound. In 1899 this was succeeded by a railroad, and freight rates have fallen from the original maximum of 60 cents a pound for 40 miles, from water to water, to $3.75 to $5.50 per hundred pounds for the 2,500 miles from San Francisco or Puget Sound to Dawson. It is 112 miles by rail from tide water over the 2,800-foot pass to White Horse, below the dangerous rapids of the upper river, and to Dawson by the river it is 451 miles further. The fare from Skagway is $70, and the fastest time made, 32 hours.

In the year 1901 the White Pass Railroad carried 33,471 tons of freight and 16,472 passengers, receiving from passenger traffic $252,932.71, and from freight, express, mail, and telegrams, $1,505,132.64, an average for freight of $43 a ton for 112 miles. Operating expenses, naturally heavy, were 42.42 per cent of the receipts. The first cost of this road, including many expensive franchises and the buying up of possible rivals, was $4,250,000, and in the first season its gross receipts were officially reported to exceed $4,000,000, with operating expenses of about $1,000,000. The actual facts as to this highway into Alaska and the Yukon Valley are given to show the great difficulties and expense of transportation in opening up a new country, where in spite of a rapid fall in rates after the first season, a successful transportation enterprise will usually pay for itself with one year's earnings.

It causes regret to Americans that this brilliant undertaking, conceived and executed by American engineers, could find no American backers—that London, unhampered by the timidity which afflicts New York in presence of a new region, boldly and promptly investigated, financed, and carried it through. The headquarters of the road have been moved from the United States to Vancouver, and the great bulk of the freight is no longer from the United States, but almost wholly from Canada.

Besides having enjoyed thus far the monopoly of the shortest entrance to the Yukon Valley, the White Pass will remain the only approach to the rich Atlin country, a lake region just beyond the coast range, which is slowly but surely developing, producing this last season nearly $1,000,000 in gold. Atlin and the Upper Yukon country will always be exclusively tributary to this road. As there is no other pass through which a road can be built, for an indefinite period the revenues of the White Pass route may be counted on to increase, but of the rich Klondike region with Dawson as its center it is likely very soon to be dispossessed. From the Stewart River 72 miles above Dawson to Nulato below the Koyukuk River, a distance of just a thousand miles, there are nearer and better seaports than Skagway. The best of these is the bay of Valdes, 10 miles long and 3 wide, as protected and beautiful as a Swiss lake, and nearest of all salt-water harbors to Dawson.

In 1900 and 1901 Major Abercrombie built a government trans-Alaskan military trail from Valdes into the Copper River Valley. Last winter over this road the freight rate to Copper Center, 103 miles, was 48 cents by dog team; during the summer by pack horse it rose to

$1.50 per pound, as mud is much more difficult traveling than snow and ice. In October, 1900, the mail schedule from Valdes to the American Yukon was reduced to twenty days, and in April, 1901, the trip was made by the mail carriers in thirteen days. Beginning the first of January, 1903, the mail contractors put on a weekly stage, four trips each way monthly between Valdes and Dawson. This winter, for the first time, it will be possible for American mails and American passengers to go to the American Yukon as quickly and as cheaply as over the Canadian route.

Five large ocean steamers, besides many sailing vessels, run each month between Puget Sound and Valdes, which is also connected by telegraph line with Eagle, Dawson, and the outside world. The increase of travel by this route is due to the discovery that the Copper River valley promises to be a great agricultural region, capable of affording homes to thousands of settlers, who will go there not because they can start bonanza wheat farms, but because the proximity of the great mining camps will give them a very high return for all they can raise. Fresh milk and butter, eggs, and poultry, fresh beef and mutton, hay and oats for animals, fresh vegetables for men, command fancy prices. John F. Rice, quartermaster's clerk, in his official report to Major Abercrombie, states that the city of Eagle is second only to Dawson in importance; that the route from Eagle to Valdes presents no such obstacles as routes through the Rocky Mountains or Cascades; that there is an abundance of grass from May until October; that the natural food resources of central Alaska are caribou, moose, brown and black bear, mountain goat, geese, duck, grouse, salmon, pickerel, perch, bass, whitefish, trout, pike, and grayling.

Courtesy of The Engineering Magazine

Hauling the United States Mail with Reindeer, Nome, Alaska

It is, however, not the agricultural resources that will immediately attract the largest influx of population and capital. About 140 miles from Valdes, in the Chitina Valley, are very great

Copyrighf, 1898, E. A. Hegg Courtesy of The Engineering Magazine

Winter Freighting on the Ice, Lake Linderman

copper deposits, which during the last season have been visited by many experts. Some of the ores run 85 per cent copper, and there are many thousand tons in sight assaying 16 per cent. A great mountain slide has occurred in this region, revealing, it is claimed, as much as 40,000,000 tons of high-grade copper ores. Valdes Bay and the lower pass north of it are the American gateways to the Yukon Valley, and already a railroad has been surveyed and partially graded to the interior, for the copper, which, though it can be quarried like the iron ores of Lake Superior, without a railroad will remain worthless. The railroad itself is assured an unlimited tonnage. It is the shortest line to Dawson and the Yukon Valley, and, what is of more importance, it can carry supplies delivered at Valdes from sailing vessels or deep-draft ocean steamers in all the months of the year, with only one break of bulk at Valdes, and also reach the deep navigable Yukon and the Koynkuk a month earlier than by the Yukon mouth, which is closed by Bering Sea ice until July 1. As shown in the history of the White Pass Railroad, the ingoing traffic would be in itself sufficient to warrant a railroad, but from Dawson the only export is gold, about 70 tons a year, while this road will not only carry all the United States Government troops and supplies, for which many hundred thousand dollars are spent, but it will have the unlimited outbound tonnage of high-grade copper ores, which, with a freight rate of $2 a ton from Valdes to the smelters of Puget Sound, will scarcely be treated in the interior.

It is not too much to expect that improvement in transportation facilities alone will convert central Alaska into as densely a populated and prosperous a region as Colorado, as the Black Hills of South Dakota, as the rich mining region of British Columbia.

There is another part of Alaska waiting for transportation facilities. It is not so dazzling as the Klondike nor as

Courtesy of The Engineering Magazine

Freight Boat on the Niukluk River—Carries 7 Tons

The horse tows it upstream, riding down in the boat

vast as central Alaska, but it is perhaps richer than either of them.

Far to the northwest lies the Seward Peninsula, suggesting on the map an animal's head snarling across Bering Strait at the nearby Siberia. By rivers and sea it is almost wholly separated from the mainland, and though comprising but 3 per cent of the area of Alaska, or 20,000 square miles in 600,000, it has yielded for the last three years nearly 75 per cent of the gold output, in spite of the increasing yield of the great quartz mines of the southeast, near Juneau.

Although the most distant region of North America, 2,700 statute miles from Puget Sound, it owes the rapid exploration and development of its coast to the fact that an all-water route was open to its shores, and that freight still costing a minimum of $70 a ton into Dawson is being landed on the Nome beach for $10 a ton. Passenger rates, higher in the first rush, have fallen to $40 and $50 first class and $20 or $25 steerage. Owing to the freedom from hardships, as well as the low coast and shortness of time required, impelled by stories that were indeed true of rich golden beaches, about 25,000 people and their chattels landed on the low sandy spit at Nome and were left to the mercy of surf and storm. The Eskimo, very numerous along this coast, who have none of the aloofness of the Indian, came in their umiaks, big skin boats that can carry fifty people and all their belongings, and made camp with the whites; but the Eskimo, needing no barometer, intuitively flee several days before a storm. Not so the whites, who every year have been caught. In September, 1900, when there were more than 12,000 campers along the beach, the surf rolled in, wrecked much of the shipping in the offing, and destroyed about $1,500,000 of miscellaneous property on the beach, and every year since, similar if not so severe disasters have occurred. Driftwood, piled high landwards from Nome, shows that on occasion the sea sweeps the whole site of the present city.

This is not the only danger. Another is fire. The streets are narrow, and the houses—flimsy wooden structures—stand in serried rows. Because of the cold, there are hot fires everywhere. There are few brick chimneys, and in winter there is no water supply. If a serious fire should occur in midwinter, destroying shelter, food, and fuel, no relief could reach the stricken people. The nearest open port on the Pacific is 500 miles to the southeast. It is 1,711 miles from Dawson, with no roads to either place. Bering Sea is in the same latitude as the Baltic, and, like the Baltic, is shallow and brackish, owing to the many rivers which empty fresh water and silt into it. In winter surface ice readily forms, extending 300 to 400 miles south of Nome, effectually isolating the city from November 1 until June 1.

This is unendurable, and three projects are under consideration to effect communication throughout the whole year. The simplest is to maintain in Bering Sea an ice-breaker of the *Admiral Ermak* type, an easy task, as the ice is not as thick and solid in Bering Sea as in the northern Russian ports. The second project is to build a railroad from Cook Inlet or Prince William Sound on open Pacific waters to Nome by way of St Michael. The third plan is to connect Nome by railroad with the lower Yukon River, and ultimately effect a junction with the railroad from Valdes to Eagle. To complete this project would require about 900 miles of track.

The gold yield of the Nome region has hitherto come from the sea beaches and from gulches and beaches at most 10 miles from water transportation. Even 10 miles has proved almost prohibitive. In winter the placers are not worked and the camps are closed. No advantage can therefore be taken of the smooth snow and ice roads. In summer the tundra is two or three feet of mud, with a bottom of frozen ground. The services of teams are worth from $20 to $40 a day, and it takes a whole day to haul 1,500 pounds 10 miles. The lowest rate is three times as much as the minimum from Puget Sound to Nome, 2,700 miles, and twice as much as the rate from San Francisco or Puget Sound to Dawson. So prohibitive were the natural conditions that Mr Chas D. Lane, of the Wild Goose Company, considered it wise economy to devote 90 per cent of the output of certain placer claims to a transportation system, thus reducing cost of exploitation for all future output to 10 per cent, rather than indefinitely to spend 90 per cent of the yield for transportation alone.

The Wild Goose Railroad, 7 miles long from Nome to Anvil Creek, earned its total first cost within thirty days of its opening and shows increasing earnings each year. From Council City, on the Niukluk River about 90 miles from Nome, Mr Lane has built a second road, also 7 miles long, connecting Council with Ophir Creek, and this road has also paid for itself in one season. Council is 55 miles from the nearest seaport, up a shallow, winding river. That part of the Seward Peninsula on which Nome is located, a part about 5,000 miles in area, was, geologically speaking, very recently an island. A deep indentation of the ocean runs 50 miles inland from Port Clarence, northwest of Nome, and Golofnin Bay, about 70 miles east of Nome, also extends many miles inland. These two bays are joined by a deep valley, so that 60 miles north and inland from Nome it is possible with one short portage to go from sea to sea. Council City lies in this depression, Ophir Creek and innumerable other rich creeks emptying into it from both sides. Gold has been found in paying quantities on nearly all of them, but it is impossible yet to develop them, owing solely to the cost of transportation.

Owing to the absence of transportation facilities, nothing is being done further inland, but a railroad from the nearest port to the interior, a narrow-gauge railroad, should pay for its cost each season for many years to come. There are no heavy grades, no mountain work, and for many miles it runs through a heavily timbered country, but west of Council there is no timber, and both lumber and fuel are exceedingly high in price. There is not only gold here, but also what gives promise of being one of the richest lead and silver districts in the world. Seventy miles inland from the ocean, up the Fish River and its tributary, Omilak Creek, less than 50 miles by railroad survey, silver and lead ore has for 18 years past been quarried out, the ore running from 70 per cent to 80 per cent lead and about 120 ounces of silver to the ton. Much ore lies sacked on the dump, but in small quantities of several hundred tons it costs more to move it than it is worth, although its smelting value exceeds $100 a ton. From Golofnin Bay there is a freight rate of $3 a ton to the Tacoma smelter, but the wagon haul to the river and the transportation down the river is as yet prohibitive. This one quarry, if properly equipped and opened, should yield a minimum of 10,000 tons a year.

For Pacific Coast maritime evolution Alaska has been of inestimable advantage. The Dawson rush of 1897 and 1898 impressed every available boat, and when it was over left well established lines with almost daily service. The Nome rush of 1900 again caused a demand for all available craft, and in summer the regular service keeps a fleet of more than a dozen ocean steamers busy. The Valdes developments even now justify weekly sailings. All the worn-out dilapidated craft of American register drift into these runs, and as the Alaskan coast is for the most part uncharted, unbuoyed, and unlighted, many of them find their graves in northern waters.

The export trade from Alaska for four months ending October 31, 1902, exceeded $20,000,000, and was equal to that from Hawaii (for ten months ending the same date), was three times that of the Philippines, and more than double that of Porto Rico. The island dependencies of the United States are densely populated, small in area, and fairly well developed. They are in the tropics, and unfit for white men and their families. Alaska needs 10,000 miles of railroad, 20,000 miles of wagon roads and telephone lines, and can, as fast as transportation is available, give homes and employment to a population of 10,000,000.

THE FORESTS OF CANADA

THE immense forest resources of Canada are not generally realized outside the Dominion. Hence the statements contained in a recent report from U. S. Consul Henry S. Culver, at London,* Ontario, about the Canadian forests are specially striking. The following is abstracted from the report :

There are three great timber belts in the Dominion : The northern or spruce belt, the southern or commercial belt—both east of the Rocky Mountains—and the British Columbia belt, west of the Rocky Mountains. These belts do not

* "Advance Sheets of Consular Reports," January 31, 1903 (No. 1559).

include, however, the forests of the maritime provinces, which are extensive and valuable, covering about one-tenth of the area of Ontario and Quebec, or the forests of New Brunswick and Nova Scotia, which may be compared in a general way to those of Maine.

FORESTS OF BRITISH COLUMBIA

The western or British Columbia belt is far superior to either of the eastern areas, for the reason that the climate, tempered as it is by the warm waters of the Pacific Ocean, promotes a more perfect growth and development of the different species. Here is found not only the valuable red fir or Oregon pine, generally distributed throughout the entire province along the coast and on the mountains, but also the red cedar, the western spruce, the yellow cedar, the hemlock, the balsam fir, the western white pine, the western yellow pine, the maple, and the western oak in such quantities as to make this the most valuable timber belt on the North American continent. This belt extends from the forty-ninth parallel north to the sixtieth parallel, a distance of some 770 miles, and is from 200 to 300 miles wide. The best timber does not extend to the extreme north. That portion is covered with black and white spruce, and constitutes a very extensive pulp-wood range.

But this region, because of its great distance from the markets in the East and the lack of cheap transportation, will remain comparatively in its primeval state until the eastern forests are nearly exhausted or until better transport facilities are afforded.

THE NORTHERN FORESTS

The northern belt is perhaps greater in extent than all the other timber belts and reserves of Canada combined. According to the best authority, it extends from the eastern coast of Labrador north of the fiftieth parallel in a northwesterly direction to Alaska, a distance of some 3,000 miles, with an average width of perhaps 500 miles. This vast strip of timber land, if placed upon the territory of the United States, would extend from Maine to California and from the southern shore of Lake Erie to the northern boundary line of Georgia. It is known as the spruce forest of the Dominion, the great bulk of the timber being of that species, black and white, the other important trees being larch and poplar.

Although this belt has been but partially explored, it is claimed that many of the trees in the southern portion are of a lumber-producing size, but the greater portion is fit only for pulp.

When it is considered that spruce is distributed in vast quantities through all the forests of Canada, and that an almost incalculable amount will be produced in this great northern belt, it is hardly exaggeration to say that the Dominion possesses an inexhaustible supply of pulp wood.

Dr Robert Bell, Director of the Geological Survey of Canada, says of the area of the forests :

"The area of our northern forests may be reckoned as forty-four times as great as that of England. Any one of these forty-four parts will produce wood enough to supply the ordinary demands of the present population of Canada—that is, 5,000,000 people could get what is required for mining, fuel, etc., by taking the timber from a space the size of England—and would be able to allow the other forty-three equal parts to be in reserve or used for export."

The railway being built from Sault Ste. Marie to Hudson Bay will make available the timber growing around the bay and along the line of the road, and may possibly provide a more accessible field of pulp wood than can be obtained in any other way for the rapidly growing industries of the Soo.

THE SOUTHERN BELT

The southern or commercial timber belt spreads over a very wide territory. It comprises that portion of Ontario and Quebec lying between the forty-fifth and fiftieth parallels of latitude and bounded on the east by the St Lawrence River and on the west by the Great Lakes and Manitoba. Great interest centers in this great timber region by reason of its proximity to the manufacturing centers of the United States and because it contains the most valuable timber for lumber east of the Rocky Mountains.

It is not, however, a compact and unbroken belt of first-class timber. Climatic conditions seriously interfere with the development and growth of some of the best species of timber that inhabit this region, for none of the best ones extend farther north than the watershed between Hudson Bay and the Great Lakes, approximately the fiftieth parallel of latitude, and many of them find their northern limit far south of this parallel. The composition and extent of this timber belt can be better understood by taking a map of the Dominion and tracing its boundaries and noting the northern limit of the most valuable species. The forty-fifth parallel cuts out entirely one very valuable species—the black walnut—whose northern limit of growth is the latitude of the city of Toronto, while a few miles north of this parallel is the northern limit of red cedar and white oak. A line drawn from the city of Quebec to Sault Ste. Marie will designate the northern limit of beech, while a line drawn from the northern part of New Brunswick to the north shore of Lake Superior will mark the northern boundary of sugar hard maple. Two other species which have their northern limit within this belt are elm and birch.

The king of the northern forests is white pine, which has its northren limit, as have also white cedar and red pine, at this fiftieth parallel of latitude. This region is now virtually its only home in the Dominion of Canada. It was at one time supposed that it had a very extensive northern range, but Dr Bell states that its distribution is comparatively southern, very little being found north of the fiftieth parallel.

This belt would furnish an enormous supply of excellent timber but for the destruction wrought by forest fires.

Dr Bell calculates that about one-third of this territory may be considered as under a second growth up to about 10 years of age, one-third as intermediate, and one-third including trees of 100 years or more, and this applies doubtless to all the forest areas of Canada ; to this particular belt, which lies at the very doors of the great manufacturing establishments of the United States, and is the one foreign timber region upon which we rely, the available supply of first-quality timber is alarmingly limited.

The Canadian forests have never been called upon to pay the enormous tribute to multiplying industries that our forests have ; but they have been decimated by the speculative lumberman and the improvident settler, and ravaged by fire until those which are most accessible bear little resemblance to their primeval state.

But it is not too late for the Canadian people to preserve what is left of their great timber reserves, and by a vigorous and judicious system of reforestation, they may be able to meet every demand for their best timber for a long time to come. They are awake to the responsibility, and are taking measures to preserve what is left and to reforest the waste places.

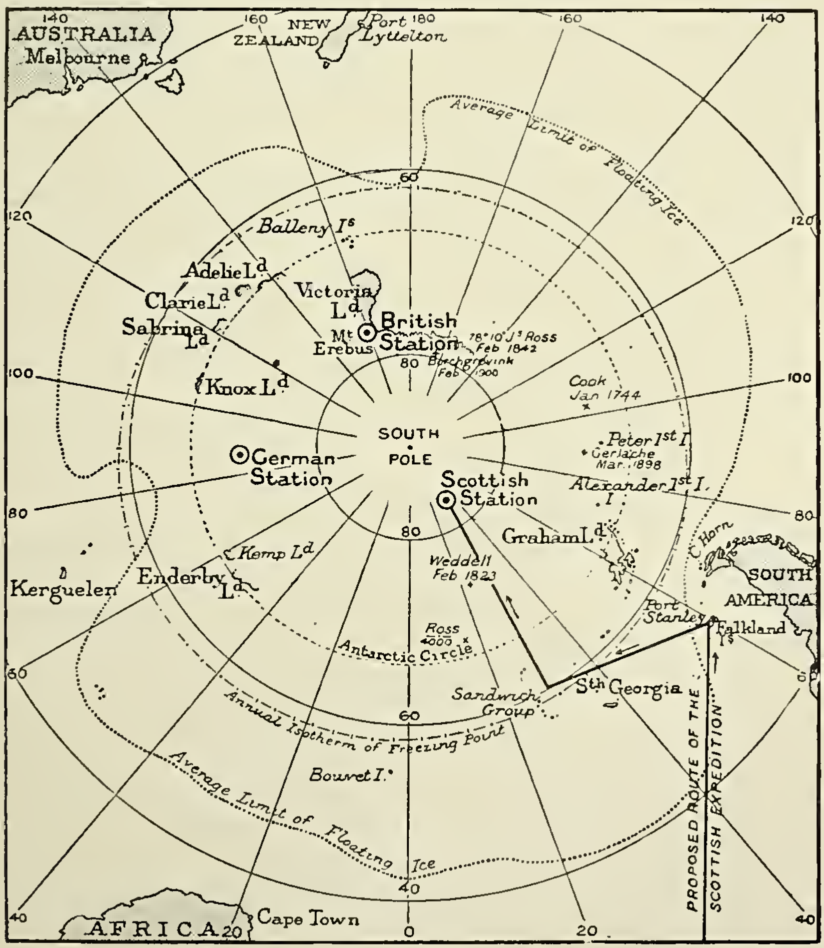
WORK IN THE FAR SOUTH

THERE are four expeditions at present exploring the far south whose unknown area is greater than twice Europe. The outline map shows the base of operations of three of the parties—the English, the German, and the Scottish; the fourth party, the Swedish, have their base near the Falkland Islands.

Nothing has now been heard from the German expedition for more than a year. They are amply equipped and provisioned and did not expect to send word of their doings before June, 1904.

An auxiliary vessel, the *Morning*, recently entered the Antarctic regions, carrying additional equipment for the British expedition, which is exploring south of New Zealand.

The Scottish expedition, under the command of W. S. Bruce and on board the *Scotia*, sailed from the Falkland Islands for the far south in January, 1903. The other three expeditions have had a year's start of the Scottish expedition, but the latter has an able leader and staff, and will doubtless do equally important work.



Courtesy of The Geographical Journal

THEORIES OF VOLCANIC ACTION

IN an address recently before the Swiss Society of Natural Sciences, M. A. Rossel presented certain considerations regarding volcanic action based on experiments with the electric furnace. *The Literary Digest* gives the following summary of the address :

"A quartz crystal heated in the electric furnace at the relatively low temperature produced by 70 volts and 400 to 500 ampères is completely volatilized ; it is even easy to vaporize lime, magnesia, and in general all compounds containing oxygen, such as silicates, carbonates, etc.

"Nevertheless, these may undergo a process of reduction ; when we heat in the electric furnace silica with alumina, carbon, iron, etc., new refractory substances are formed, which remain in the furnace while the oxygen is disengaged in the gaseous state. These stable compounds are carbids, silicids, phosphids, etc., which resist high temperature, but are all decomposable by water.

"If we apply this reaction to the formation of the earth by cooling, we must admit that the first minerals produced were compounds of elements . . . free from oxygen. These minerals remained in this condition, forming the first terrestrial stratum, until circumstances permitted the formation of water or water vapor ; as soon as they came in contact with this, a very active reaction must have taken place, whose result was the formation of oxids—lime, alumina, magnesia, etc., together with inflammable gases, whose combustion then gave rise to other reactions. . . .

"There were thus formed, on the one hand, earthy metallic oxids, and, on the other, the oxids that form the acids of the important earths—silicic and carbonic acids. The explanation of the formation of the silicates and carbonates is hence not far to seek.

"Now we may apply what precedes to the explanation of certain volcanic phenomena.

"The earth cools progressively. This cooling gives rise to folds in the terrestrial crust, and fissures may result. Through these fissures water is introduced and minerals containing water of hydration may penetrate to a great depth. Then very energetic chemical reactions take place, producing gases that will burn in air, and also metallic oxids. These reactions may cause earthquakes and volcanic eruptions.

"In any case, M. Rossel regards it as certain that if the earth has reached its present state by progressive cooling, and if the interior of the globe is now at a sufficiently high temperature to volatilize oxygenated bodies, oxygen should be entirely wanting at these depths. The oxygen will all be found at the surface of the globe, in the atmosphere and in combination in water and oxygenated minerals, which are all decomposed volcanic ashes. It would then seem inexact to say that the globe is composed of about four-fifths oxygen and one-fifth other elements. Besides, this hypothesis is not in harmony with what is known of the earth's specific gravity."

M. STANISLAS MEUNIER contributes an interesting and suggestive paper on the theory of volcanic outbursts to the *Revue Scientifique* of August 2, of which this abstract is published in *The Geographical Journal* for December, 1902, He assumes that from the surface down to a certain limited depth, determined by the temperature, all rocks are saturated with water, while beyond that depth the heat is too great for water to penetrate. A fracture of the nature of a reversed fault, caused by thrusting, would place a hot, dry layer below the critical level in contact with a moist layer above it, with the result that the rocks along a part of the line of contact would have their melting point lowered, and would take up water in combination, tending to increase in bulk, and forming a mass having many of the properties of ordinary lavas. The swelling of the mass at a line of weakness would tend to fracture the superincumbent rocks. The relief of pressure so obtained would set free large quantities of the occluded gases and vapors, and these would bring with them rock materials in a solid and molten state. A close analogy occurs in the case of a bottle of soda water when the cork is taken out, the sudden liberation of the gas in solution driving part of the water out of the bottle. Thus volcanic lava, so far from being a material distributed as a continuous layer in all parts of the earth, is a special product of regions which have just undergone profound geological changes, and the significance of this in relation to the geographical distribution of active volcanoes is very great. Again, it becomes evident that the depths at which centers of activity—*i. e.*, "pockets" of swelling or expanding material—are developed may vary considerably, and we are able to account for the fact that volcanoes near one another may be quite independent, while others, more distant, may act sympathetically. Finally, lavas may originate in rocks of widely different constitution—from crystalline rocks to the carboniferous clays which produce anorthite lavas. The indispensable factor, the tendency to increase in volume, may of course be supplied by other substances than water, as, for example, by chlorides, like masses of rock-salt, which would explain the emanations from exceptional volcanoes, like those of Hawaii, where the place of water vapor is taken by hydrochloric acid or by sulphates or combustible carbon compounds.

GEOGRAPHIC NOTES

THE FOUNDER OF THE SMITHSONIAN INSTITUTION

WORD has been received that James Smithson, the founder of the Smithsonian Institution, must be turned out of his grave in Genoa, Italy, to make room for a quarry.

Smithson died at Genoa in 1829, and was buried in a small and isolated British cemetery on the heights of San Benigno. The cemetery is under the care of the British consul at Genoa, but the land belongs to the Italian Government. Near by is a quarry, from which the city gets the stone for its works. Much more stone is now needed for the extensive harbor improvements which have been begun, and hence all the graves in the cemetery must be removed.

Smithson left his entire estate of over half a million dollars to "the United States of America to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men."

The princely legacy came as a surprise to the United States. He had never visited this country, nor had he any American friends or, as far as we know, any correspondents across the ocean. His plan was unique and has given the United States a scientific institution such as no other nation in the world possesses. Today the institution which bears Smithson's name, in addition to the income of the Smithsonian fund proper, which amounts to about $30,000 yearly, has charge of the expenditure each year of $450,000. Exploration and all branches of geographical science have been generously encouraged and assisted by the institution during the half century of its existence.

The nation to whom he was so generous ought to insist in honoring the memory of their great benefactor by bringing him to this country and giving him a permanent resting place in the grounds of the institution which he founded. It would be base ingratitude on our part to bury him again in Genoa, in another cemetery, where, as time goes on and the city grows, he will be again disturbed. We should place him where he may rest in peace, not for another seventy-five or one hundred years, but for as long time as the great nation lives in which he showed such complete confidence and respect.

GAZETTEER OF THE PHILIPPINES

A "PRONOUNCING Gazetteer and Geographical Dictionary of the Philippine Islands" has been prepared by the Bureau of Insular Affairs of the War Department, and issued as Senate Document No. 280, Fifty-seventh Congress, first session.

The gazetteer proper contains 264 pages, including the index, while the geographical dictionary occupies 668 pages, exclusive of the maps, charts, and illustrations.

The work contains the most recent and authoritative information, from official and other sources, concerning the islands, relative to their geography, physical features, areas, communications, population, towns, resources, wealth, products, industries, commerce, finance, social economy, natural history, military occupation, and civil government, followed by an alphabetically arranged descriptive list of the islands, provinces, districts, pueblos, cities, towns, mountains, volcanoes, rivers, seas, straits, gulfs, bays, lakes, capes, light-houses, and other mapped objects and places to the number of 10,300.

The work is so extremely valuable that it is unfortunate the edition is so limited that only a few copies can be obtained by the public. Persons who are unable to obtain a copy from a Senator or Representative may purchase one from the Superintendent of Public Documents, Washington, D. C., for $1.75.

THE DEVELOPMENT OF CUBA

IN a previous number of this Magazine mention has been made of the very complete telegraph system constructed in Cuba by the U. S. Signal Corps since the Spanish-American war.* The system was turned over to the Cuban government when the United States withdrew from the island.

Another important work was completed recently when the railroad was opened that binds together the ends of the island. An English-American syndicate built the line. H. I. Davies, writing in *The Scientific American*,† has this to say of its value :

The railroad is of standard gage, and its bridges are of steel and masonry ; its equipment will be similar to that of the best American railways, and it is intended to run through sleeping cars between Havana and Santiago de Cuba, a distance of nearly 900 miles.

Along the main line are to be found great areas of land of the richest description, well watered and in most cases well wooded, suitable for sugar cane, tobacco, Indian corn, cotton, coffee, cacao, and all of the fruits of the tropical and sub-tropical regions. Other districts are peculiarly adapted to cattle;

*See NATIONAL GEOGRAPHIC MAGAZINE, p. 407, December, 1902 ; also report of the Chief Signal Officer, Gen. A. W. Greely, for 1902, pp. 11–17.

†January 24, 1903.

Courtesy of The Scientific American

Diagram Showing the Railways of Cuba

cattle do well everywhere, for the grasses are luxuriant and highly nutritious, and there is usually an abundance of water. Around the coast are to be found many excellent harbors, and it is reported and believed that the unexplored part of the island contains much hidden mineral wealth.

The interior, which is sparsely populated, is comparatively level, and largely covered with hardwood timber, and while the soil of the different districts is generally of extraordinary fertility, some places are more desirable than others, both in this respect and in regard to healthfulness. For the tropics, the climate is a tolerable one, and the island will soon be rendered. more healthy by foreign irrigation, drainage, and an improved system of sanitation. The northern employes of the Cuba company have as a rule been free from illness of any kind, notwithstanding their employment on railway construction under conditions not always favorable to health. Unlike many of the West India islands, Cuba is entirely free from poisonous reptiles, and has fewer mosquito and similar pests than any other southern regions.

There are no obtainable government lands in Cuba ; practically all of the lands are held by individuals, and in the eastern half of the island they are usually held in large areas. No systematic land survey has yet been made, and the large tracts are mostly in irregular forms and their boundaries are difficult to define and trace ; land titles in the unoccupied and in the newly settled parts of Cuba are in many cases defective and need investigation, though the government has recently taken steps toward the perfection of titles.

TIMBERLINE

IN the last number of the NATIONAL GEOGRAPHIC MAGAZINE* the distinguished geologist and physiographer, Prof. I. C. Russell, discusses the subject of timberline, and suggests the use of the term in at least three different senses. It is seldom that I find myself called upon to differ from this eminent authority, but in the present instance I feel it my duty to file a protest.

The term "*timberline*" has come to have a perfectly definite and well-understood meaning, accepted by naturalists the world over. *It is the upper or boreal limit of tree growth as determined by temperature.* To use the term in other senses, as for upper limits of tree growth *not* dependent on temperature, for lower or austral limits of tree growth on mountains or other slopes, for the line where

*Nat. Geog. Mag., vol. xiv, no. 2, pp. 80–81, February, 1903.

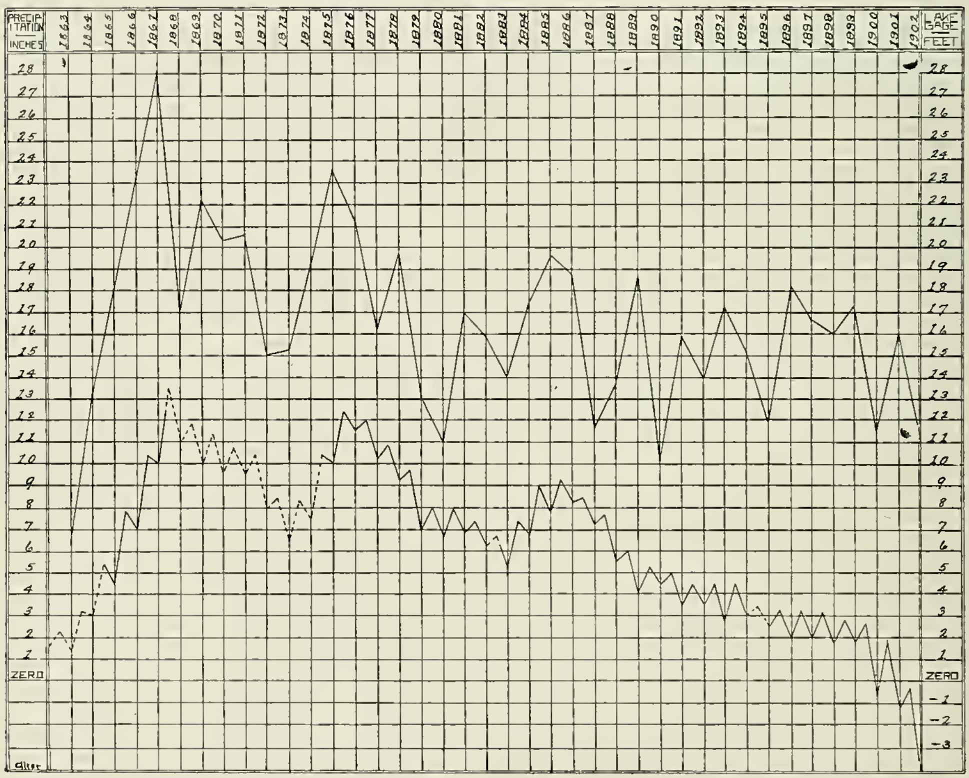


Chart Showing Annual Precipitation at Salt Lake City and Water Level of Great Salt Lake

EXPLANATORY NOTES.

The upper line indicates the precipitation and the lower one the lake level.

Broken lines indicate periods of no authentic observations, or that the data have been approximated.

This chart was prepared by Mr L. H. Murdoch to illustrate his article on "Why Salt Lake has Fallen," in the last number of this Magazine.

certain trees stop because of excess of water in the soil, and so on, is depriving the term of its fixed and definite value.

While on the subject of Professor Russell's note, I may be permitted to suggest further that the lower limit of tree growth in many parts of the West is determined by temperature rather than aridity, though in some cases aridity is the controlling factor. To avoid misinterpretation, it may be well to call attention to the self-evident fact that the temperature along the lower limit of timber on our western mountains is not, of course, too high for all tree growth, but too high for the particular kind or kinds of trees which flourish in that particular region. Thus the lower limits of the yellow pine and of the several species of juniper and nut pine are determined by definite temperatures. Other kinds of trees flourish at higher temperatures, but these trees have not access to the region.

C. HART MERRIAM.

BUREAU OF FORESTRY

THE work begun in 1902 by the Bureau of Forestry to check the advance of the sand dunes along the southeastern coast of the United States and in other sections of the country is being continued this year.

In southern Virginia and northern North Carolina a chain of immense sand dunes stretches north and south along the coast. These dunes are moving slowly landward, and within the last few years have become dangerous to the United States life-saving stations and to private property of large value. Some time ago, at the request of a number of private owners, the Bureau made an examination of a district in Currituck County, N. C., and began work at one point to fix the drifting sand sufficiently to permit forest planting. In coöperation with the owners of the land, board fences and other structures were erected to alter the course of the most threatening dunes. The work was so successful that last spring the ground was in condition for the planting of beach grass, which is being used temporarily as a cover. With a fair growth of grass this season, forest planting on from 30 to 50 acres may be begun this year. The forest, besides protecting the buildings, will yield a much-needed supply of fuel. At other points in the same district, which extends 30 miles along the coast, the Bureau is now giving similar aid.*

An investigation is also being made of the dunes formed by the drift sand along the Columbia River in Washington and Oregon. The dunes are destroying valuable orchards and rich agricultural lands. They form serious hindrances to transportation along the lines of the Northern Pacific Railway and the Oregon Railroad and Navigation Company. After a careful examination the Bureau will attempt to devise methods for controlling the movement of the sand. The Oregon Railroad and Navigation Company is assisting in the investigation.

ARGENTINA-CHILE BOUNDARY AWARD

THE decision rendered in the Argentina-Chile boundary dispute by King Edward VII is in the nature of a compromise. Argentina receives about 15,600 square miles of the disputed territory and Chile about 21,000. The area acquired by Argentina is the more fertile and valuable agriculturally and includes the upper valleys of several rivers flowing into the Pacific. Chile gains a large area of forest country and many square miles of upland, where large flocks of sheep can roam. The results of this dispute have been the

* See "Report of the Forester for 1902," by Gifford Pinchot. Pp. 135.

careful exploration and mapping of the bouudary for nearly 1,000 miles. The decision of Edward VII is printed in full in the "Bulletin of the Bureau of the American Republics" for January, 1903.

Hon. John W. Foster, at the request of President Roosevelt and Secretary of State Hay, has taken charge of the presentation of the United States case in the Alaskan boundary dispute. Mr Foster will be assisted in the work by Mr Robert Lansing, who was one of the junior counsel in the Bering Sea Arbitration at Paris in 1893 and associate counsel of the United States in the Bering Sea Claims Commission of 1896. Secretary of War Root, Senator Lodge, and Senator Turner, of Washington, will represent the United States on the Commission.

"Wind Velocity and Fluctuations of Water Level on Lake Erie" is the subject of a bulletin by Prof. A. J. Henry issued by the U. S. Weather Bureau. The heavy westerly winds that sweep across Lake Erie from end to end pile the water high up in the harbor of Buffalo and leave low water in the channel at the mouth of the Detroit River at the other end of the lake. Shipping is much inconvenienced by such changes in level. Professor Henry, as a result of his study of the variations in the water level, believes that it is possible to predict extreme high water at Buffalo, so that in case of a severe seiche property-owners along the wharves could be warned iu sufficient time to remove their goods. A series of diagrams show the wind velocity and water level hourly fluctuations on the lake from December 1, 1899, to November 30, 1900.

The Pittsburg Coal District.—The first of the series of new maps which are being prepared by the Geological Survey in coöperation with the State of Pennsylvania, has recently appeared as the Masontown-Uniontown Geologic Folio, No. 82. The area covered by this folio, which is named from two of the leading towns in the district, includes 458 square miles and lies mainly in Fayette County, although also including portions of Greene and Washington counties. The folio includes 8 maps, showing the hills, streams, roads, houses, mines, coals, geologic formations, and the details of geologic structure. In addition to the maps, there are 21 large-size pages of description written by Mr Marius R. Campbell, in which the geology of the region is described in detail. Many sections showing thicknesses and the character of the coals are given.

Thomas Willing Balch, of the Philadelphia bar, will shortly have ready a monograph entitled, *The Alaska Frontier*. He will give in it reproductions of 28 maps, discuss the international law bearing on the boundary question, and bring out much new evidence. Mr Balch has collected his facts in Alaska, Saint Petersburg, Berlin, Paris, London, Edinburgh, and many other places.

In the London Times for December 16 and December 27, 1902, are published two long letters from Edward Whymper, the well-known mountaineer, describing some explorations he made among the Canadian Rockies in 1901 aud 1902.

The Division of Hydrology, a new division, has recently been organized in the hydrographic branch of the United States Geological Survey. The work of this division will include the gathering and filing of well records of all kinds, the study of artesian and other problems relating to underground waters, and the investigation of the stratigraphy of the water-bearing and associated rocks. In additiou to the gathering of statistics relating to the flow, cost, etc., of the wells, it is hoped in the future to give especial attention to the geologic features which govern or which are related in any way to the supply of water.

The division will be subdivided into two sections, the eastern and the western, the first embracing the Gulf and Mississippi River States and the States to the east, and the second embracing the remaining "reclamation" States and Territories, or those having public lands. The charge of each section has been assigned to a geologist, the western section to Mr N. H. Darton, and the eastern to Mr M. L. Fuller. The office details are in charge of Mr Fuller.

Dr Hugh M. Smith is the author of an illustrated report on the "Herring Fisheries of England, Scotland, and Holland," recently issued by the U. S. Fish Commission. The report is based on the observations made by Dr Smith during a visit in 1900 to the principal herring-fishing centers of the countries named. The herring is today a leading fish in the United States, Canada, Newfoundland, England, Scotland, Ireland, Holland, France, Norway, Sweden, and Russia. A species very similar to that of the Atlantic Ocean is found in the North Pacific Ocean, and is caught in large quantities in Japan and Alaska. In point of number of individual fish taken for market, no species exceeds the herring. The annual value of the herring fisheries is $25,250,000, representing 1,500,000,000 pounds of fish.

The Naval Hydrographic Office has issued a fourth edition of "The Navigation of the Gulf of Mexico and Caribbean Sea" (volume 2), embracing the coast of the mainland from Key West, Florida, to the Orinoco River, Venezuela, with the adjacent islands, cays, and banks.

One phase of the English interpretation of the Alaskan boundary is seen by following their proposed line in the map on page 90. Promontories belonging to the United States would be cut off from the mainland like islands, and have no communication with each other except through foreign land or by water. In other words, the English contention would establish a series of artificial islands along the Alaskan coast. The English interpretation contradicts the intent of all boundary lines, which are designed to follow a natural and convenient dividing line.

Dr J. L. M. Curry, a member of the National Geographic Society for many years, and distinguished as a statesman, educator, and author, died in Asheville, N. C., February 12. Dr Curry was born in Georgia 78 years ago. During the years 1857 to 1861 he was a member of Congress, and from 1861 to 1865 a member of the Confederate Congress and a lieutenant colonel in the C. S. A. From 1865 to 1881 he held chairs in Howard College and Richmond College. In 1885 President Cleveland appointed him Minister to Spain, where he represented the United States for four years. Of late years Dr Curry has been the general agent of the Peabody and Slater educational funds. He has always been closely identified with all educational movements for and in the Southern States. He was the author of several books and many articles dealing with problems of the South.

The proceedings of the Section of Geology and Geography of the American Association for the Advancement of Science, for the Washington meeting, December 26–January 3, are published in *Science* for February 6, 1903, pp. 217–229.

The article by Hon. O. P. Austin on "Problems of the Pacific—the Commerce of the Great Ocean," published in the August, 1902, number of this Magazine, has aroused much interest in the Far East. It has been translated into Japanese and published in Tokyo, and into Russian and published at Vladivostok. It is at present being rendered in Chinese, and will soon be read in Chinese characters by the enterprising merchants of China.

Map Sheets of New York State. Among the latest which have come from the press of the Geological Survey are those of the Clayton and Grindstone quadrangles, which embrace portions of the State along the St Lawrence River in the vicinity of Clayton and the Thousand Islands, and those of the Ticonderoga and Mettawee quadrangles which cover sections of northeastern New York along the Vermont boundary. The Ticonderoga sheet shows the historic region at the northern end of Lake George and the southern end of Lake Champlain and includes the eastern foothills of the Adirondack Mountains and a portion of Addison County, Vt. The Mettawee sheet covers a part of Washington County, N. Y., and the rugged region in western Bennington and Rutland counties, Vt.

A Map of the Philippines is now on the press and will be issued during March by the Military Information Division of the War Department. The map includes the results of practically all explorations and surveys to the close of 1902. It is in four sheets, each sheet being 30 x 46 inches, and on the scale of 1:800,000. The size of the entire map is thus 5 x 7 feet 8 inches.

The American Museum of Natural History has sent Dr E. O. Hovey to the Lesser Antilles to continue his studies of the volcanic disturbances on Martinique and St Vincent. Dr Hovey plans to spend at least two months on the islands. After an examination of the present condition of La Souffrière and Mont Pelée, he will visit in turn each volcanic island in the group, taking photographs of their craters and solfataras, and making collections for the Museum.

The family of S. A. Andrée, the Arctic aeronaut, have finally admitted that their last hope of his being still alive is gone. Andrée's brother, Capt. Ernst Wilhelm Andrée, of the Swedish army, has applied to the courts to declare him dead, in order that he may obtain the small property willed him by the lost explorer.

Mr E. J. Moura, Secretary of the Geographical Society of the Pacific, announces that as the Merchants' Exchange Building will soon be torn down to give space for another structure, the Council of the Society decided to remove the library and office of the Society to other quarters. The new location is 419 California street, corner of Leidesdorff street. This is the center of the city's banking and insurance business, and convenient of access to the members, as well as to newspaper men who wish to consult charts of the U. S. Coast Survey, or desire information upon rivers, harbors, and mountain ranges. The latest maps of Alaska and the Philippines will be open to inspection. Letters and packages for the Society should be addressed to 419 California street, San Francisco, Cal.

Commander J. F. Moser, U. S. N., is the author of a report on "The Salmon and Salmon Fisheries of Alaska," the result of exhaustive investigations by the Fish Commission in 1900 and 1901. Many illustrations and maps of streams and bays accompany the text, making an exceedingly handsome and useful publication.

A. B. Alexander is the author of an illustrated bulletin issued by the U. S. Fish Commission describing the boats and fishing methods of the natives of the South Sea Islands. The bulletin contains much that is interesting about the inhabitants of these South Pacific islands.

Commander Robert E. Peary has been elected President of the American Geographical Society of New York, succeeding the Hon. Seth Low who resigned several months ago.

GEOGRAPHIC LITERATURE

Handbook of Birds of the Western United States. By Florence Merriam Bailey. With 33 full-page plates by Louis Agassiz Fuertes, and over 600 illustrations. Pp. xc + 512. 8 x 5½ inches. Boston: Houghton, Mifflin & Co. 1902. $3.50 *net.*

Only minute study and infinite patience, added to a personal acquaintance with nature and with practically every bird described, big or little, could make this book possible. The volume cannot be too strougly commended. The person who knows nothing about birds is fascinated by the simple living descriptions, while the specialist gains a fuud of information from the careful and systematic classification.

The introduction of over 90 pages includes articles on "Collecting and Preparing Birds' Nests and Eggs," by Vernon Bailey; "Bird Protection," by T. S. Palmer, local lists of birds found in different sections of the West, and a handily arranged bibliography, followed by a key to families of water birds.

The biography of each bird opens with a brief description of the principal characteristics of the bird, its plumage, size, distribution, where it builds its nest, and the color of its eggs. This is followed in every case by an account of the bird's habits and life. Mrs Vernou Bailey has a delightful style and gives a personal interest to the subjects. The following random selection is cited as an example:

"In the stillness of the high mountain forests your ear sometimes catches the thin, finely drawn pipe of the brown creeper, and if you watch patiently on the dark-shaded boles of the lofty trees you may discover the little dark-colored creature—seeming small and weak in the great solemn fir forest—creeping up the trunks, examining the cracks with microscopic care as he goes. If he feels that his work has not been done thoroughly enough he drops back aud does it over again; and when one tree has been gone over to his satisfaction, he often flies obliquely down to the bottom of another trunk and creeps patiently up that. On Mount Shasta, where the firs are decorated with yellow moss, the Sierra creeper goes around its pads when he comes to them, but works carefully over the dark lichen-covered branches. Sometimes he lights upside down on the under side of a branch, and clings like a fly, but with the aid of his pointed tail well pressed against the bark."

Mr Vernon Bailey is the author of a number of the biographies, and others who helped Mrs Bailey to make the book a success are Dr C. Hart Merriam, Mr R. Ridgway, Dr A. K. Fisher, Mr E. W. Nelson, and Dr T. S. Palmer.

The Tragedy of Pelée. By George Kennan. Illustrated. Pp. 257. 5½ x 8 inches. New York. The Outlook Co. 1902 $1.50 *net.*

Mr Kennan went to Martinique on the *Dixie* as the special representative of *The Outlook.* This volume includes his letters to that journal revised and much enlarged.

For vivid description some of the chapters in the volume are surpassed by few things in literature. In chapter IV, "In the Track of the Volcanic Hurricane," an account is given of a long interview with Ciparis, the negro criminal who imprisoned in an underground dungeon escaped the deadly blast of May 8, and whom Mr Kennan had the enterprise to hunt up and personally interview. The testimony of this man is of great importance in explaining the causes of death on May 8. Ciparis was waitiug for his breakfast, when suddenly it grew very dark, and also immediately after hot air mixed with fine ashes came in through the grating and burned him. He heard no noise, saw no fire, smelled nothing "except what he thought was his own body burning." There was no smoke, and the hot air came in through the grating without any appreciable rush or blast. His clothing did not take fire, and yet his back was very severely burned under his shirt.

An interesting phenomenon noted by Mr Kennan was the stellar lightning which characterized the night eruptions. Several illustrations of this are given.

The chapter on "Causes of the Catastrophe" is worthy of a professional geologist, something that Mr Kennan does not profess to be. His belief is "that the volcanic discharge which destroyed St Pierre came from a lateral fissure near the summit of the mountain; that it did not contain any considerable amount of gas; that it did not burst into flame, and that it did not cause death by asphyxiation." The death-dealing blast, according to Mr Kennan, was composed of superheated steam charged with fine dust. The weight of the dust carried by the steam depressed the blast so that it followed the slope of the mountain. The dust was hot enough to set fire to inflammable objects inside the houses, which did not catch fire from the outside, but from the inside.

The volume is graphically illustrated from drawings by George Varian and from photographs by the author.

The American Cotton Industry. By T. M. Young. Pp. 146. 5 x 7½ inches. London: Methuen & Co. New York: Imported by Charles Scribner's Sons. 1902. 75c. *net.*

The author in the spring and early summer of 1902 visited the cotton-manufacturing districts in New England and in the Southern States. He had been sent from England by the cotton manufacturers of Manchester, who desired a careful investigation and comparison of the cotton spinning and weaving industry in England and the United States. It has been generally known for some years that the American cotton factories were outstripping those in England. Mr Young, as a result of his study, does not think the American weaver is more intelligent or better paid than the British weaver, but that our advantage is (1) because American management is more economical of labor—that is, we do not divert a skilled man's attention and time to the small things which an unskilled man can do just as well, and (2) because the American manager is alert for the newest invention, and adopts even inventions made in England before the English manager considers them.

Year-book of the Department of Agriculture, 1901. Edited by Geo. Wm. Hill. With plates and maps. Pp. 846, 6½ x 9½ inches. Washington: Government Printing Office, 1902.

The Year-book for 1901 teems with important geographic material. The report of the Secretary takes 115 pages, and is followed by 33 articles on special topics, of which the following may be mentioned:

"The Purpose of a Soil Survey." Milton Whitney.

"Insects as Carriers and Spreaders of Disease." L. O. Howard.

"The Future Demand for American Cotton." J. L. Watkins.

"The Timber Resources of Alaska." Wm. L. Hall.

"Progress in Plant and Animal Breeding." Willet M. Hayes.

"Agricultural Seeds—Where Grown, How Handled." A. J. Pieters.

"The Prairie Dog of the Great Plains." C. Hart Merriam.

"Grazing in the Forest Reserves." Filibert Roth.

"Agriculture in the Tropical Islands of the United States." O. F. Cook.

"Little-Known Fruit Varieties Considered Worthy of Wider Dissemination." Wm. A. Taylor.

"Two Vanishing Game Birds—The Woodcock and the Wood Duck." A. K. Fisher.

"Experimental Work with Fungous Diseases of Grasshoppers." L. O. Howard.

"The Hemp Industry in the United States." Lyster H. Dewey.

"Wheat Ports of the Pacific Coast." Edwin S. Holmes, Jr.

Many handsome full-page plates and maps illustrate the text.

BOOKS RECEIVED

THE following new books have been received and will be reviewed in due course:

"Mont Pelée and the Tragedy of Martinique." By Angelo Heilprin. With many illustrations. Pp. XIII+337, 6½ by 9½ inches. Philadelphia: J. B. Lippincott Co. 1903. $3.50 net.

"Birds of the Rockies." By Leander S. Keyser. With illustrations by Louis Agassiz Fuertes and Bruce Horsfall. Pp. 355, 6½ by 9 inches. Chicago: McClurg & Co. 1902. $3.00 net.

"The Conquest." The true story of Lewis and Clarke. By Eva E. Dye. Pp. 443, 5½ by 8 inches. Chicago: McClurg & Co. 1902. $1.50.

"United States Magnetic Declination Tables and Isogonic Charts for 1902, and Principal Facts Relating to Earth's Magnetism." By L. A. Bauer. With maps and illustrations. Pp. 405, 8 by 11½ inches. Washington: U. S. Coast and Geodetic Survey. 1902.

"Mountaineering in the Sierra Nevada." By Clarence King. Pp. 378, 5½ by 7¾ inches. New York: Charles Scribner's Sons. 1902. $1.50. New edition.

"Japanese Girls and Women." By Alice Mabel Bacon. Pp. 337, 5½ by 8¼ inches. With illustrations. Boston: Houghton, Miflin & Co. 1902. Revised and enlarged edition.

"The Question of the Pacific." Translated and enlarged from Dr Victor M. Maurtua, by F. A. Pezet, Secretary to the Legation of Peru at Washington. With map. Pp. 312, 6½ by 9½ inches. Philadelphia: George F. Lasher. 1901.

"Some By-Ways of California." By Charles F. Carter. Pp. 189, 5½ by 7½ inches. New York: The Grafton Press. 1902.

"Complete Geography." By Ralph S. Tarr and Frank M. McMurry. With many maps and illustrations. Pp. XI+478+X, 6½ by 8½ inches. New York: The Macmillan Co. 1902.

"The Physical Geography of New York State." By Ralph S. Tarr. With many maps and diagrams. Pp. 397, 6½ by 9 inches. New York: The Macmillan Co. 1902. $3.50 net.

"Asiatic Russia." By George Frederick Wright. With many maps and illustrations. 2 vols: XIII+290, XII+291–637. New York: McClure, Phillips & Co. 1902. $7.50.

"The Travels of Pedro Teixeira, with his 'Kings of Harmuz' and extracts from his 'Kings of Persia.'" Translated and annotated by William F. Sinclair, with further notes and an introduction by Donald Ferguson. Pp. C+292, 6 by 9 inches. London: Printed for the Hakluyt Society (series II, vol. 9). 1902.

"Report of Alfred C. Lane, State Geologist of Michigan, for 1901." With many maps. Pp. 304, 6 by 9 inches. Published by the State. Lansing, 1902.

"Antarctica." By Edwin Swift Balch. With maps. Pp. 230, 7 by 10 inches. Philadelphia: Allen, Lane & Scott. 1902.

"American Diplomacy in the Orient." By John W. Foster. Pp. XIV+498, 6 by 9 inches. Boston: Houghton, Mifflin & Co. 1903. $3.00 net.

"Unknown Mexico." By Carl Lumholtz. 2 vols. Pp. 1,600. With over 530 illustrations and maps, 6½ by 9½ inches. New York: Charles Scribner's Sons. 1902. $12.00 net.

"The Great Mountains and Forests

of South America." By Paul Fountain. With illustrations. Pp. 306, 6 by 9 inches. New York: Longmans, Green & Co. 1902. $3.00.

"Economics of Forestry." By Bernhard E. Fernow. Pp. 520, 5½ by 8 inches. New York: Thomas Y. Crowell & Co. 1902. $1.50 net.

"A Tour in Mexico." By Mrs James Edwin Morris. With illustrations. Pp. 322, 5½ by 8 inches. New York, London, Montreal: The Abbey Press. 1902.

"The Elements of General Method." By Charles A. McMurry, Ph. D. Pp. 331, 5 by 7½ inches. New York: The Macmillan Co. $0.90.

"Lakes of Southeastern Wisconsin." From Wisconsin Geological and Natural History Survey. By N. M. Fenneman, Ph. D. With illustrations. Pp. 178, 6 by 9 inches. Published by the State. Madison, 1902.

"Red-men's Roads." By Archer Butler Hulbert. With illustrations. Pp. 37, 6 by 9 inches. Columbus, Ohio: Fred J. Heer & Co. 1900.

"Commercial Geography." By Walter H. Olin, Superintendent City Schools of Ottawa, Kansas. With many illustrations. Pp. 260, 8 by 10 inches. Topeka: Crane & Co. 1902.

"Highways and Byways in London." By Mrs E. T. Cook. With illustrations by Hugh Thomson and F. L. Griggs. Pp. 472, 5½ by 8 inches. New York: The Macmillan Co. 1902.

"The Egregious English." By Angus McNeill. Pp. 210, 5½ by 8 inches. New York: G. P. Putnam's Sons. 1903.

"The Discoveries of the Norsemen in America, with Special Relation to Their Early Cartographical Representation." By Joseph Fischer, S. J. Translated from the German by Basil H. Soulsby, B. A. With illustrations. Pp. 140, 7 by 10 inches. St Louis, Mo.: B. Herder. 1903.

Japanese Oyster Culture, by Bashford Dean, Assistant professor in Zoölogy in Columbia University, and published by the Fish Commission, contains the results of a study of the Japanese oyster by the author in 1900–1901. In artificial oyster culture Professor Dean concludes the Japanese are considerably ahead of the United States, but behind France and Holland. Whether the Japanese oyster can be cultivated successfully along our Pacific coast may only be answered by experiment.

RECENT PUBLICATIONS BY THE U. S. GEOLOGICAL SURVEY.

"A GAZETTEER of Texas." Henry Gannett. Pp. 164. With colored charts showing mean annual temperature, wooded areas, density of population, etc., and a large map of the state, prepared under the direction of Robert T. Hill.

"A Gazetteer of Cuba." Henry Gannett. Pp. 112. With colored charts and a map.

"Fossil Flora of the John Day Basin." Frank Hall Knowlton. Pp 154. With many illustrations.

"The Berea Grit Oil Sand in the Cadiz Quadrangle, Ohio." W. T. Griswold. Pp. 42. With illustrations.

"Tests for Gold and Silver in Shales from Western Kansas." Waldemar Lindgren. Pp. 19.

"Results of Primary Triangulation and Primary Traverse, fiscal year 1901–02." H. M. Wilson, J. H. Renshawe, E. M. Douglas and R. U. Goode. Pp. 164. With illustrations.

"Reconnaissance of the Borax Deposits of Death Valley and Mohave Desert." Marius R. Campbell. Pp. 22. With illustratiou.

"Geology and Water Resources of the Snake River Plains of Idaho." Israel C. Russell. Pp. 192. With many illustrations.

"Bibliography and Index of North American Geology, Paleontology, Petrology and Mineralogy, for the year 1901." Fred Boughton Weeks. Pp. 144.

"Structural Details of the Green

Mountain Region, and in Eastern New York." T. Nelson Dale. Pp. 22. With illustrations.

"North American Geologic Formation Names, Bibliography, Synonymy, and Distribution." Fred Boughton Weeks. Pp. 448.

Appalachian Forest Reserve. One of the most handsome of recent government publications is the large quarto volume containing the "Message from the President of the United States transmitting a Report of the Secretary of Agriculture in Relation to the Forests, Rivers, and Mountains of the Southern Appalachian Region," issued by the Government Printing Office (1902). The report is an overwhelming array of facts showing the imperative necessity of making a great forest reservation of the Southern Appalachian region.

NATIONAL GEOGRAPHIC SOCIETY

Lack of space makes it necessary to postpone publication of the proceedings of the Society until next month.

REGULAR MEETINGS.

March 13.—"The Work of the Geological Survey." Hon. Charles D. Walcott. Cosmos Club, 8 p. m.

March 27.—"The Work of the Library of Congress." Hon. Herbert Putnam. Cosmos Club, 8 p. m.

This is the last meeting of the season.

POPULAR LECTURES.

March 4.—"The United States—Mines and Mining." Mr Charles Kirchoff, editor of *The Iron Age*. Illustrated. Columbia Theater, 4.20 p. m.

March 6.—"The Geographic Distribution of Insanity in the United States." Dr W. A. White, Director of the Binghamton State Hospital, New York. National Rifles' Armory, 8 p. m.

March 11.—"The United States—The Men who Make the Nation." Vice-President W J McGee, LL. D. Columbia Theater, 4.20 p. m.

March 20.—(The last lecture of the season.) "Captain John Smith and Old Virginia." Mr W. W. Ellsworth, of the Century Company. Illustrated. National Rifles' Armory, 8 p. m.

BY-LAWS OF THE NATIONAL GEOGRAPHIC SOCIETY.

ADOPTED MAY 16, 1902.

ARTICLE I.—*Name.*

The name of this Society is *The National Geographic Society.*

ARTICLE II.—*Object.*

The object of the Society is the increase and diffusion of geographic knowledge.

ARTICLE III.—*Membership.*

SECTION 1. The Society shall consist of members, honorary members, fellows, and patrons.

SEC. 2. Members shall be persons interested in geographic science.

SEC. 3. Honorary members shall be persons who have attained eminence by the promotion of geographic science. They shall not be members of the corporation, nor shall they vote or hold office.

SEC. 4. Fellows shall be persons engaged in scientific work pertaining to geography. They shall be members of the corporation.

SEC. 5. Patrons shall be persons interested in geography who have contributed one thousand dollars or more to the objects of the Society; they shall be entitled to all the privileges of membership for life.

SEC. 6. The election of members, honorary members, fellows, and patrons shall be entrusted to the Board of Managers.

ARTICLE IV.—*Officers.*

SECTION 1. The administration of the Society shall be entrusted to a Board of Managers composed of twenty-four members or fellows, eight of whom shall be elected by the Society at each annual meeting, to serve for three years, or until their successors are elected Of the eight members or fellows elected at each annual meeting, not less than four nor more than six shall be residents of the District of Columbia. A majority of the votes cast shall be necessary for election.

SEC. 2. The Board of Managers shall elect annually from their own number a President and a Vice-President, and shall elect annually a Treasurer and a Secretary.

SEC. 3. The President shall preside at the meetings of the Society and of the Board of Managers, or may delegate this duty. The President and the Secretary shall sign all written contracts and obligations of the Society.

SEC. 4. In the absence of the President his duties shall devolve on the Vice-President.

SEC. 5 The Treasurer shall have charge of the funds of the Society, under the direction of the Board of Managers, and shall make collections and disbursements and render an annual report, and his accounts shall be audited by a committee of the Society, not members of the Board, annually and at such other times as the Board may direct.

SEC. 6. The Secretary shall record the proceedings of the Society and of the Board of Managers, conduct correspondence, and make an annual report.

SEC. 7. The Board of Managers shall fill vacancies arising in the Board.

SEC. 8. All officers shall serve until their successors are chosen.

ARTICLE V.—*Committees.*

SECTION I. The Board of Managers shall select annually from its own number an Executive Committee.

SEC. 2. There shall be standing committees on Publications, Communications, Admissions, Research, and Finance, whose chairmen shall be members of the Board of Managers. These committees shall be appointed immediately after the annual election of the President, to serve until their successors are designated.

SEC. 3. The committees of the Society and of the Board of Managers shall be appointed by the President except when otherwise provided. The President shall be a member *ex officio* of every committee.

ARTICLE VI.—*Finances.*

SECTION I. The fiscal year of the Society shall begin on the first day of January.

SEC. 2. The annual dues of members shall be two dollars, payable in January.

SEC. 3. Fellows shall pay an initiation fee of ten dollars on notice of election.

SEC. 4. Members or fellows may commute annual dues and acquire life membership by the payment at one time of fifty dollars.

SEC. 5. Members or fellows whose dues remain unpaid on March 1 shall be notified by the Treasurer that unless the dues are paid within one month they will be in arrears and not entitled to vote at the annual meeting, to receive the publications of the Society, or to purchase lecture tickets on members' terms. Members or fellows one year in arrears shall, after formal notification, be regarded as having withdrawn from the Society.

SEC. 6. The funds of the Society may be invested and loans may be negotiated in the interests of the Society, and any other financial business germane to the purposes of the Society may be transacted, by the Board of Managers.

ARTICLE VII.—*Meetings.*

SECTION I. Regular meetings of the Society shall be held on alternate Fridays from November until May.

SEC. 2. Special meetings may be ordered by the Board of Managers or called by the President.

SEC. 3. The annual meeting shall be held in the District of Columbia on the second Friday in January.

SEC. 4. Twenty members or fellows shall constitute a quorum.

SEC. 5 Regular meetings of the Board of Managers shall be held on the same days as the regular meetings of the Society; special meetings may be held at the call of the President or on notice signed by five members of the Board: *Provided*, That for any of its own meetings the Board may substitute meetings of the Executive Committee.

SEC. 6. Lectures and lecture courses may be provided by the Board of Managers. Free admission to such lectures shall not be a prerogative of membership, but tickets shall be sold to members and fellows on more favorable terms than to non-members: *Provided*, That each life member who acquired life membership prior to the year 1901 shall be entitled to two admissions to each lecture and course.

ARTICLE VIII.—*Publications.*

The Society shall publish a journal or periodical under the title, *The National Geographic Magazine*, which shall be sent to all members and fellows of the Society not in arrears, and may be placed on sale.

ARTICLE IX.—*Amendments.*

These By-Laws may be amended by a two-thirds vote of the members present at any regular meeting, provided the proposed amendments are reported by the Board of Managers, and provided that notice thereof has been sent to all members of the Society not less than ten nor more than sixty days before the meeting. The publication of proposed amendments in The National Geographic Magazine shall be deemed a notice within the meaning of this article.

The Popular Science Monthly

Entered in the Post Office at Lancaster, Pa., as second-class matter

Contents of January Number

Contents of February Number

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CONTENTS

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WASHINGTON, D. C.

From a photograph by Chief Engineer H. W. Spear, R. C. S.

Herd of Reindeer Crossing a River in Siberia

Vol. XIV, No. 4 WASHINGTON April, 1903

THE NATIONAL GEOGRAPHIC MAGAZINE

REINDEER IN ALASKA

By Gilbert H. Grosvenor

TWELVE years ago Dr Sheldon Jackson brought his first herd of 16 reindeer across Bering Strait from Siberia and started his reindeer colony at Unalaska, off the bleak coast of Alaska. Many then smiled at the experiment and declared his plan for stocking the great barrens of northwestern Alaska with thousands of the animals which for centuries had been indispensable to the natives of Lapland and Siberia was impracticable and wasteful of time and good money. But the experiment prospered from the very first. Other reindeer, numbering nearly 1,000 in all, during the succeeding years were brought over from Siberia. Today there are nearly 6,000 head in the various herds distributed along the Alaskan coast from Point Barrow to Bethel. The existence of the 20,000 natives of northwestern Alaska, as well as the success of the miners who are beginning to throng into the interior of the territory in the far north, are dependent upon these domestic reindeer; their clothing, their food, their transportation, their utensils, and their shelter are all furnished them by the reindeer.

The reindeer enterprise is no longer an experiment although still in its infancy. There are 400,000 square miles of barren tundra in Alaska where no horse, cow, sheep, or goat can find pasture; but everywhere on this vast expanse of frozen land the reindeer can find the long, fibrous, white moss which is his food. There is plenty of room for 10,000,000 of these hardy animals. The time is coming when Alaska will have great reindeer ranches like the great cattle ranches of the southwest, and they will be no less profitable.

The story of the inception and growth of the reindeer enterprise in Alaska is very interesting and is not generally known. During an extended trip of inspection of the missionary stations and government schools in Alaska in the summer of 1890*, Dr Sheldon Jackson was impressed with the fact that the natives in arctic and subarctic Alaska were rapidly losing the sources of their food supply. Each year the whales were going farther and farther north, beyond the reach of the natives who had

* Dr Sheldon Jackson first visited Alaska in 1877, in the interest of schools and missions. He made a second trip in 1879. Other visits followed, and since his appointment as General Agent of Education in Alaska in 1885 he has made annual visits to the territory.

From a photograph by R. N. Hawley, M. D.

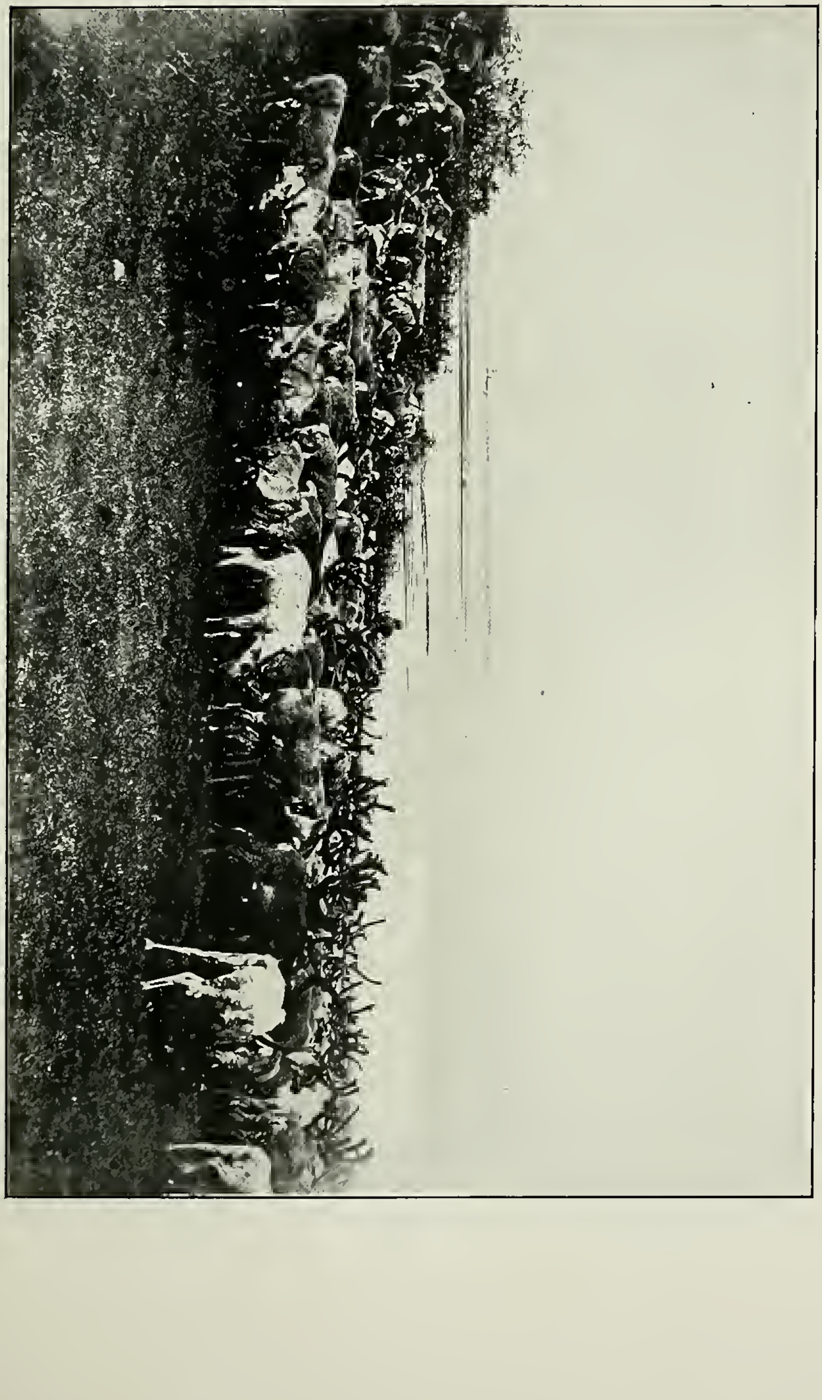
Reindeer on the Siberian Beach, Hobbled, waiting to be Loaded on the *Bear* for Transportation to Alaska

For 20 years the revenue cutter *Bear* has been engaged in Arctic work. It has saved the lives of hundreds of wrecked whalers, and contributed more to the comfort and safety of the settlements along the Alaskan coast than any vessel in the service.

no steamships in which to pursue them; the walrus, which formerly had been seen in herds of thousands, were disappearing; the seals were becoming exterminated, and in winter the Eskimo had to tramp 15 to 20 miles out on the ice before he could catch one. The modern hunter, with his steam launches and rapid-fire guns, had found the whales, walrus, and seals such easy prey that he was ruthlessly destroying them. Also the wild caribou, that the native had easily captured before, had been frightened away and was rarely seen.

Not only was the Eskimo losing his food, but what in an arctic climate is no less important, his clothing as well. The whalebone, the ivory tusks of the walrus, the seal skin, and the oil had given him means of barter with the Siberian traders across the Strait, from whom he obtained reindeer skins to keep him warm in winter.

Dr Jackson saw that unless something was done at once the United States would have to choose between feeding the 20,000 and more natives or letting them starve to death. The latter course was impossible; the former rather expensive, as supplies would have to be carried some 3,000 miles from Seattle. The more enterprising Siberian, living on the opposite side of the Strait under practically the same conditions of arctic cold, got along very nicely, as he had great herds of domestic reindeer to fall back upon when game was scarce. The same moss which covered so many thousands of miles of the plains of arctic Siberia was seen everywhere in Alaska. The tame reindeer of Siberia was practically the same animal as the wild caribou of Alaska, changed by being domesticated for centuries. Could not the Eskimo be made self-supporting by giving him reindeer herds of his own?



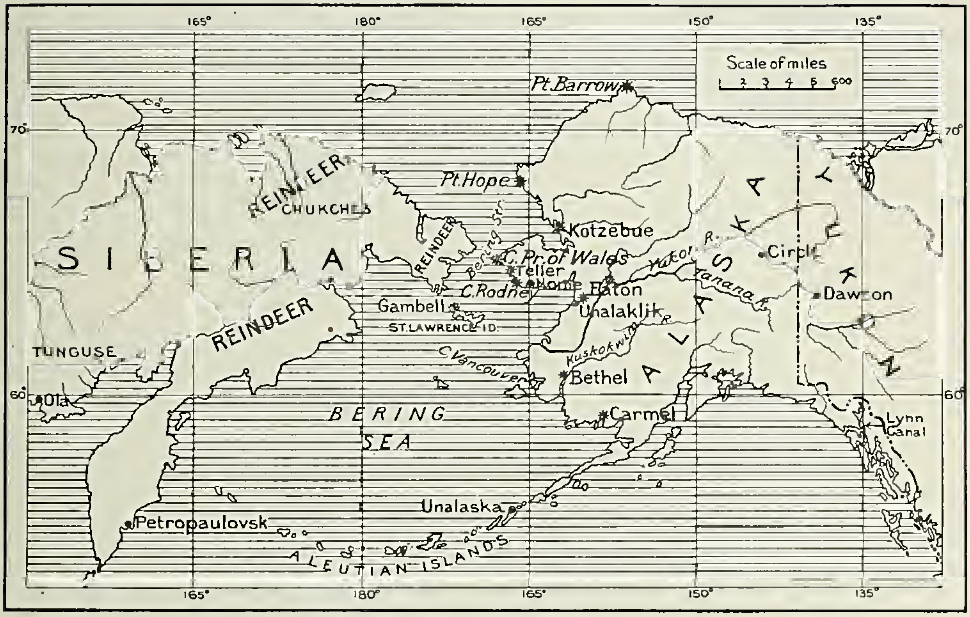
From a photograph by A. Weeks, M. D.

Reindeer Herd, Siberia

U. S. Revenue Cutter *Bear* in the offing

From a photograph by H. W. Spear, R. C. S.

Unloading Reindeer, St Lawrence Island, Alaska



Outline Map Showing Government Reindeer Stations in Alaska

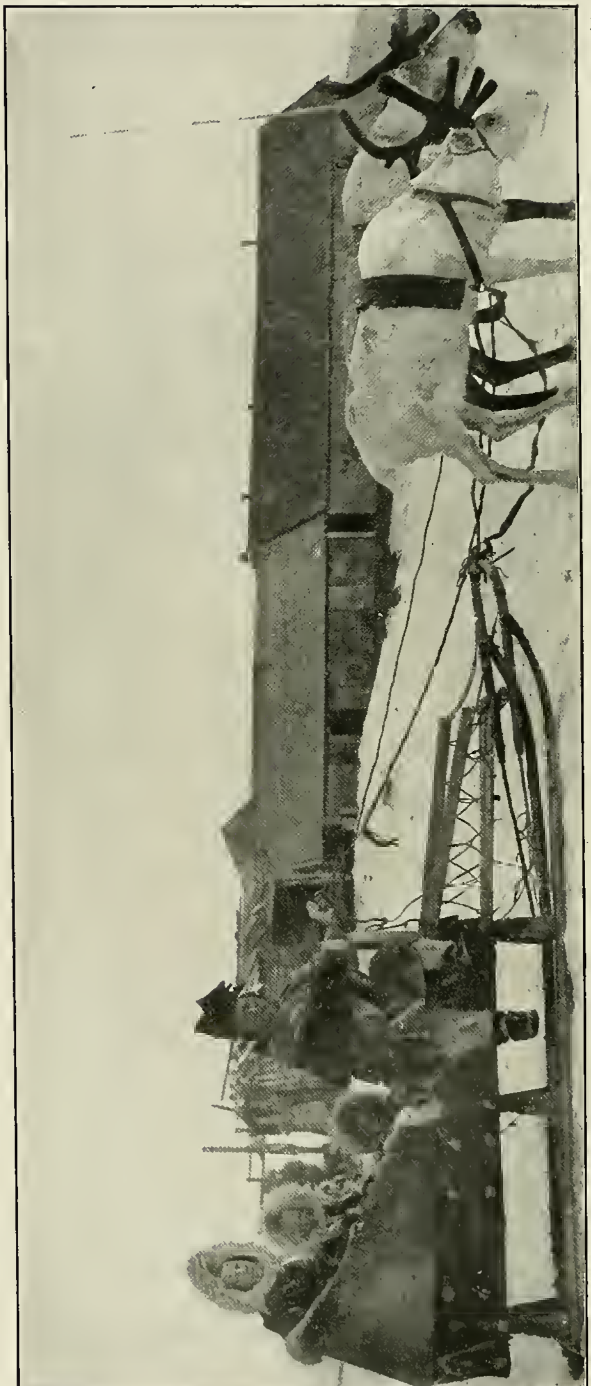
On his return to the United States, during the winter of 1891, Dr Sheldon Jackson, in his annual report to Congress, asked for an appropriation to provide the money for importing a few deer. Congress was not convinced of the wisdom of such action, but several private persons were so interested that they placed $2,000 at Dr Jackson's disposal to begin the experiment; the first deer were brought over that year. It was not long, however, before the government realized the importance of the movement, and in 1894 appropriated the sum of $6,000 to continue the work. Later the appropriation was increased, and during the last several years has amounted to $25,000 annually.*

The Siberians were at first unwilling to part with any of their reindeer. They were superstitious and above all afraid of competition and loss of trade across the strait. Capt. M. A. Healy, who was commissioned to purchase the deer in 1891, was obliged to sail from village to village for 1,500 miles along the Si-

* Congressional appropriations for the introduction into Alaska of domestic reindeer from Siberia are as follows:

1894......	$6,000	1900.......	$25,000
1895.......	7,500	1901.......	25,000
1896.......	7,500	1902.......	25,000
1897.......	12,000	1903.......	25,000
1898.......	12,500		
1899.......	12,500	Total..	$158,000

Congress entrusts the general charge of the work to the Bureau of Education, of which Dr William T. Harris is the distinguished head; the formulation of plans and their execution is entrusted to Dr Sheldon Jackson, general agent of education in Alaska. Dr Harris, in his annual reports to Congress, has vigorously urged the importance of the work, and to him credit is due for a large share of its success. Capt. M. A. Healy and the many officers of the revenue cutter service, whose vessels have year after year carried the agents of the bureau back and forth and brought the reindeer from Siberia without charge, have also contributed to the success of the reindeer enterprise.



From a photograph by Kleinschmidt

Mr T. L. Brevig Starting on a Family Sleigh Ride, Teller Reindeer Station berian coast before he found an owner willing to barter his reindeer for American goods. None would sell the deer for cash. Of recent years the Siberians have been but little less reluctant to part with their deer though they could easily spare many thousands from their vast herds without knowing it.

The first deer brought over were from the Chukches herds—a tough and hardy breed. Two years ago Lieutenant Bertholf was commissioned to go to Siberia and try to purchase some of the Tunguse stock, which are larger, stronger and sturdier. Starting from St Petersburg, after a long journey across Siberia, much of it by sled, he succeeded in purchasing several hundred Tunguse near Ola, hired a steamer, embarked the reindeer at Ola with 2,500 bags of reindeer moss, and finally landed 200 of the animals in good condition at Part Clarence. His experiences during his remarkable journey were most interesting, and are admirably described in his report to Dr Sheldon Jackson, published in 1902.*

From a photograph by E. P. Bertholf

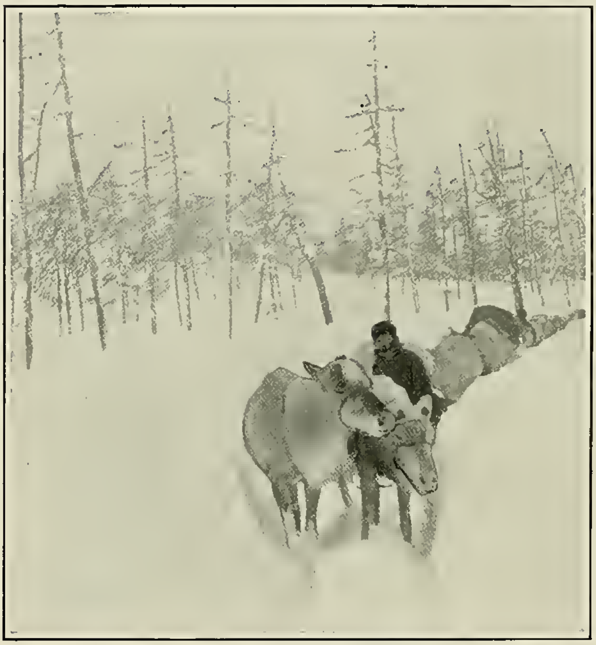
Traveling With Reindeer in Summer

THE ESKIMO AS HERDERS

With careful training the Eskimo make excellent herders. They are by nature good imitators, though not inventive, and readily learn how to take care of the reindeer, to throw the lasso, to harness and drive the deer, and to watch the fawns. Siberian herders were at first imported to teach them, and later the more intelligent and efficient Laplanders, who have learned by centuries

* "Report on the Introduction of Domestic Reindeer into Alaska." By Sheldon Jackson, LL. D., 1901. Appendix, Expedition to Siberia, report of Lieutenant E. P. Bertholf, pp. 130–168.

of experience to give to the breeding of reindeer the care that we give to the breeding of cattle. In the winter of 1898 sixty-three Laplanders and their families volunteered to go to Alaska, the U. S. Government paying the expenses of their long journey of 10,000 miles. When their term of enlistment expired some reënlisted, some of them went home again, but the majority turned miners. Every one will be glad to know that at least two-thirds of the whole number made large fortunes in the Cape Nome gold fields.



From a photograph by E. P. Bertholf

Breaking a Path Through Deep Snow

The reindeer herders have to be watchful. Now and then reckless miners try to plunder the herds, or by their carelessness set fire to the moss. A fire will sweep over the moss barrens, licking up every fiber of the moss, as it sweeps over our western prairies. A moss fire is even more destructive, for many years pass before the moss will grow again.

At the end of a year's service the government makes a gift to deserving herders of two or more reindeer.

REINDEER RAISING AS AN INDUSTRY

When one considers that raising reindeer in Alaska is simple and the profits enormous, one is surprised that as yet no one has really gone into the reindeer business, especially at Dawson, where a rich market awaits the reindeer farmer.

A fawn during the first four years costs the owner less than $1 a year. At the end of the four years it will bring at the mines from $50 to $100 for its meat, or if trained to the sled or for the pack, is easily worth $100 to $150.

The fawns are very healthy and but few die; the does are prolific, and after they are two years of age add a fawn to the herd each year for ten years. Last year, out of 50 does two years and more of age in one herd, 48 had fawns, and of these only five died, three of which were lost through accidents or by the carelessness of the herder.

The reindeer are so gregarious and timid that one herder can easily guard 1,000 head. The herder knows that if a few stray off he need not look for them as they will soon become frightened and rejoin the main herd.

The does make almost as good sled deer as the bulls and geldings. They are slightly smaller and less enduring.

The Chukches deer cost in Siberia about $4.00 a head for a full-grown doe or bull. The fawns born in Alaska are larger and heavier than the parent stock.

Milking Reindeer, Teller Reindeer Station

From a photograph by Tappan Adney

Freighting with Reindeer—Cape Prince of Wales

From a photograph by E. P. Bertholf

Traveling Deerback Through Deep Snow

The Tunguse deer cost nearly $7.50 apiece. By the addition of the Tunguse breed it is hoped that the Alaska stock will be improved and toughened.

The reindeer cow gives about one teacupful of very rich milk, nearly as thick as the best cream, and making delicious cheese. Mixed with a little water, the milk forms a refreshing drink. The Siberians and Laplanders save the blood of slaughtered deer and serve it in powdered form. From the sinews tough thread is obtained.

REINDEER EXPRESS

The Alaskan reindeer can hardly equal the speed of the Lapland deer, which Paul du Chaillu* describes as making from 150 to 200 miles a day, and sometimes 20 to 25 miles down hill in a single hour. A pair of them can pull a load of 500 to 700 pounds at the rate of 35 miles a day and keep it up weeks at a time. W. A. Kjellmann drove his reindeer express one winter 95 miles in a single day.

Reindeer teams during the past winter carried the United States mail from Nome to Candle City, on the Arctic Ocean, a distance of 260 miles. The teams had heavy loads of passengers and freight and made the distance in eight days. Dog teams would have required fifteen to twenty days for the trip.

The reindeer can travel at night as well as in the daylight, and thus during the long Arctic night when dogs are inefficient transportation is always possible with a reindeer team.

The reindeer make good packers in summer. One hundred and fifty pounds is a fair load. They also can be ridden

*"The Land of the Long Night," Paul du Chaillu. Chas. Scribner's Sons.

in the saddle, but not with much comfort until the rider learns how to adjust himself. In the Tunguse country the natives use their deer in summer as we would a mule or horse. It is no uncommon sight to see a Tunguse trotting along the shore deerback.

Lieutenant Bertholf describes the caravans of reindeer sleds in northeastern Alaska. Over 1,000 sleds leave Ola (see map) during the winter in caravans of about 100 each. A caravan of 100 sleds is managed by 10 men. Some years ago the Russian Government used horses on the caravan route from Ola to the Kolima River, but recently substituted reindeer, and now saves $60,000 yearly by the change.

From a photograph by E. P. Bertholf

Riding in Summer

The illustration* on page 134 shows the leaders of Lieutenant Bertholf's party breaking a path through snow that reached to the belly of the deer. A strong wiry deer, unmounted, was driven first. In the deep snow he could advance only by jumps, but his leaps broke the way somewhat for the next few deer, who were also unmounted. After a dozen or more unmounted deer had passed by, deer ridden by a boy and girl broke the path still further until deer with heavy loads could pass. Lieutenant Bertholf in this way broke his path for 160 miles through the deep snow.

When the caravan halts the deer are turned out to pasture untethered and allowed to wander as they will. The driver uses a switch to touch up the slothful, but "some of the old deer do not seem to mind a switch any more than does an army mule."

The illustration on page 142 shows a number of reindeer digging up the snow with their powerful hoofs to get at the moss beneath the snow. As soon as spring comes the deer abandons his diet of moss, which seems to be most nutritive in winter, for willow sprouts, green grass, and mushrooms. The hoof of the reindeer is as wide as that of a good-sized steer and prevents him from settling down into damp snow or miry soil.

* For the exceedingly interesting series of illustrations that accompany this article, the NATIONAL GEOGRAPHIC MAGAZINE is indebted to Dr Sheldon Jackson and Dr William Hamilton.

Tethered During a Halt

From a photograph by A. Weeks, M. D.

A Siberian Woman and Daughter

REINDEER LOANED BY THE GOVERNMENT

The U. S. Government loans a certain number of the reindeer to the mission stations, or to individuals who have shown their ability, reserving the right, after three or five years, of calling upon the mission station or the individual for the same number of deer as composed the original herd loaned. In 1894 the Congregational mission at Cape Prince of Wales was granted the loan of 100 deer. The mission has since paid back the loan, and now possesses in its own right one thousand head.

A few of the herds, notably that at Cape Prince of Wales, have grown so large that the owners are able to kill off some of the extra males for food for the families of the herders, and to sell others to the butchers in the neighboring mining camps. Last year deer for slaughter brought from \$60 to \$100 each, while for male deer trained to harness miners gave as much as \$150 apiece. The herders at this same station earned last winter \$600 in gold for freighting with their reindeer to the mining camps. The deer were worked in double trace harness like horses, and hauled on sleds 790 pounds each.

Of the 60 individual owners of domestic reindeer in Alaska today, 44 are Eskimo. Most of them have served a five-year apprenticeship, and having earned their deer are competent to care for them.

Each owner has his own individual mark, which is branded on the left or right ear of each of his deer.

IMPORTANCE OF REINDEER TO MISSION STATIONS

The Bureau of Education hopes that in time each mission station will possess a herd of at least 5,000 head. A reindeer herd at a mission station in arctic or subarctic Alaska means, says Dr Jackson:

Lieutenant Bertholf Mounted on Reindeer, Showing the Ability of the Reindeer to Carry 210 Pounds

First. The permanence of the mission. Without it the natives are away from home a larger portion of the year in search of food, and, since the advent of the miners, are inclined to leave their

Reindeer Digging Up the Snow to Get the Moss Beneath

Republished from "Land of the Long Night," by Paul du Chaillu, by courtesy of the publishers

homes and congregate in the American villages at the mines, where they live by begging and immorality and soon disappear from the face of the earth.

Second. It affords the missionary the opportunity of rewarding and encouraging those families that give evidence of being teachable by establishing them in the reindeer industry, and thus greatly promoting their material interests.

Third. With the increase of the herd it becomes a source of revenue through the sale of the surplus males at remunerative prices to the miners and butchers. In a few years this revenue should be sufficient to entirely support the mission and thereby relieve the treasury of the central Missionary Society.

Fourth. The possession of a herd insures to the mission family a continuous supply of fresh meat. This to a family which is compelled to live largely upon salted and canned meats and canned vegetables is of no small benefit, promoting their comfort, health, and usefulness.

Fifth. Reindeer trained to harness and sleds greatly increase the efficiency and the comfort of the missionary in ministering to outlying native settlements.

REINDEER FROM LAPLAND

The vast majority of the American people have an idea that the reindeer experiment in Alaska proved a failure long ago, simply because of the widely advertised unsuccessful attempt in 1898

From a photograph by A. Weeks, M. D.

A Siberian, the Owner of 10,000 Head of Reindeer, and a Cossack Official

From a photograph by Bernardi

Pupils of Public School, Cape Prince of Wales, 1902 of bringing deer from Lapland. Only once have reindeer been brought from Europe for Alaska, and that attempt was unsuccessful, not because the reindeer could not live in their new home, but because of the wretched transportation given them from Seattle to their Alaskan destination.

In December, 1897, rumors were started that American miners in the Yukon Valley were in danger of starvation. Congress appropriated a large sum for their relief, and commissioned Dr Sheldon Jackson to go to Norway and Sweden to purchase 500 reindeer broken to the harness, with sleds, harness and drivers, for hauling supplies from the head of Lynn Canal to the destitute miners, 1,000 miles away.

Dr Jackson reached Europe in January, purchased 526 trained deer, gathered 68 Lapp drivers with their families, embarked them all on one ship, and sailed for New York from Trondhjem, February 4. Only one deer died on the voyage of 24 days, though the trip was a most tempestuous one and the deer in pens on the deck were drenched day and night by the seas that broke over them. At New York special trains met the expedition and carried them across the continent to Seattle without the loss of a single deer. Then the troubles began. The supply of moss brought from Norway became exhausted, and the deer did not like the grass of Seattle. There was delay in securing a vessel to transport the expedition to the head of Lynn Canal, and further delays at Lynn Canal and no moss to be found there.

Nearly 300 of the reindeer died of starvation before the moss fields at the head of the Chilkat River, about 50 miles from Lynn Canal, were reached. The remaining 200 were too weakened to endure the long journey to the Yukon Valley, and the relief expedition had to be abandoned, but fortunately not before the country had learned that the miners in the Yukon had abundant supplies, and that the relief expedition had been unnecessary.

The Laplanders who had been brought over were distributed among the reindeer stations and employed to teach the natives.

RELIEF OF WHALERS AT POINT BARROW

The first forcible realization of the wisdom of the government in stationing reindeer herds in Alaska came to the American people in the winter of 1897–'98. In the fall of 1897 word was received that eight whaling ships had been imprisoned in the ice near Point Barrow, and that the 400 American seamen aboard were stranded without food for the long winter till the ice should open in July. No vessel of relief could get within 2,000 miles of the party, or nearer than Denver is to Boston. There was no known method by which provisions could be dragged overland. If the government had not five years before commenced the introduction of the reindeer, most of these 400 men would have starved to death before help reached them. Fortunately there were large herds of reindeer at Cape Nome and at Cape Rodney, over one thousand miles by land from Point Barrow, or farther than Chicago is from New York. The government hurried the revenue cutter *Bear* north from Seattle, carrying three brave volunteers—Lieut. David H. Jarvis, Lieut. Ellsworth P. Bertholf, and Dr Samuel J. Call. The three men were landed December 16, 1897, at Cape Vancouver, obtained some dog teams from the natives, and commenced their dreary journey of 2,000 miles through the Arctic night to Point Barrow. They collected about 450 reindeer from the herds at Rodney and Nome, and then, with reindeer instead of dog sleds and with Mr W. T. Lopp, agent of the American Missionary Society at Cape Prince of Wales, and Charley Arisartook, a native, and several herders, they pushed on through the storms and bitter cold of an Arctic winter, driving the deer before them. After a journey of three months and twelve days, on March 29, 1898, they reached the destitute whalers, just in time to save them from great suffering and death.

In heroism, pluck, and endurance the journey of these men has rarely been equaled. Congress voted its thanks to the gallant rescuers and awarded them special medals of honor, but in the excitement aroused throughout the country by the rapid succession of events of the Spanish-American war their work was almost unnoticed.

Since that time a reindeer herd has been kept at Point Barrow so there is no longer danger of ice-imprisoned whalers perishing from starvation. The experience also showed the faithfulness of the Eskimo. Mr Lopp had left his wife at his station, the only white person among 400 natives, but during his absence of nearly five months she received nothing but constant courtesy and kindness from them.

DEVELOPMENT OF ARCTIC AND SUBARCTIC ALASKA DEPENDENT ON THE REINDEER

The original motive in bringing the reindeer to Alaska was purely philanthropic—to give the native a permanent food supply.

Since then the discovery of large and valuable gold deposits upon the streams of arctic and subarctic Alaska has made the reindeer a necessity for the white man as well as for the Eskimo. Previous to the discovery of gold there was nothing to attract the white settler to that desolate region, but with the knowledge of valuable gold deposits thousands will there make their homes, and towns and villages are already springing into existence.

But that vast region, with its perpetual frozen subsoil, is without agricultural resources. Groceries, breadstuffs, etc., must be procured from the outside. Steamers upon the Yukon can bring food to the mouths of the gold-bearing streams, but the mines are often many miles up these unnavigable streams. Already great difficulty is experienced in securing sufficient food by dog-train transportation and the packing of the natives. The miners need reindeer transportation.

Again, the development of the mines and the growth of settlements upon streams hundreds of miles apart necessitate some method of speedy travel. A dog team on a long journey will make on an average from 15 to 20 miles a day, and in some sections cannot make the trip at all, because they cannot carry with them a sufficient supply of food for the dogs, and can procure none in the country through which they travel. To facilitate and render possible frequent and speedy communication between these isolated settlements and growing centers of American civilization, where the ordinary roads of the states have no existence and cannot be maintained except at an enormous expense, reindeer teams that require no beaten roads, and that at the close of a day's work can be turned loose to forage for themselves, are essential. The introduction of reindeer into Alaska makes possible the development of the mines and the support of a million miners.

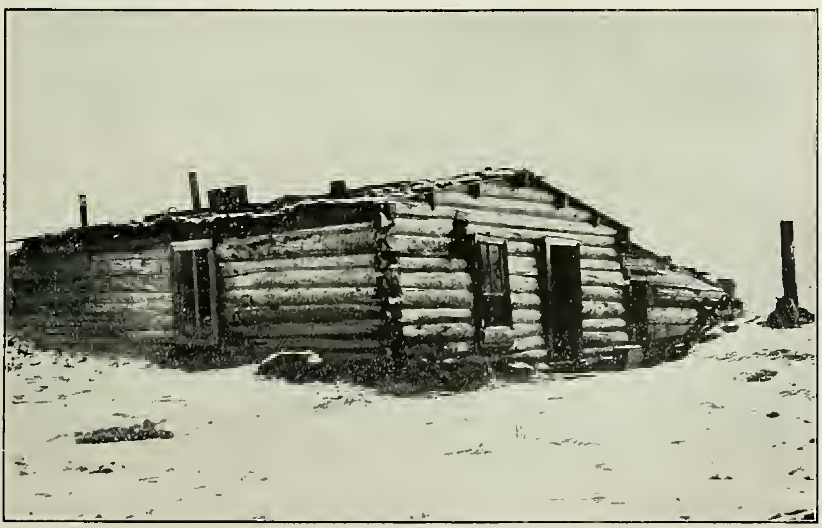
The reindeer is to the far north what the camel is to desert regions, the animal which God has provided and adapted for the peculiar, special conditions which exist. The greater the degree of cold, the better the reindeer thrives. Last winter a party with a reindeer team made a day's journey with the temperature at 73 degrees below zero. On a long journey through an uninhabited country a dog team cannot haul sufficient provisions to feed themselves. A deer with 200 pounds on the sled can travel up and down the mountains and over the plains without a road or trail from one end of Alaska to the other, living on the moss found in the country where he travels. In the four months' travel of 2,000 miles, from Port Clarence to the Kuskokwim Valley and back, by Mr W. A. Kjellmann and two Lapps, with nine sleds, 1896–'97, the deer were turned out at night to find their own provisions, except upon a stretch of the Yukon Valley below Auvik, a distance of 40 miles.

The great mining interests of central Alaska cannot realize their fullest development until the domestic reindeer are introduced in sufficient numbers to do the work of supplying the miners with provisions and freight and giving the miner speedy communication with the outside world.

The reindeer is equally important to the prospector. Prospecting at a distance from the base of supplies is now impossible. The prospector can go only as far as the 100 pounds of provisions, blankets, and tools will last, and then he must return. With ten head of reindeer, packing 100 pounds each, making half a ton of supplies, he can go for months, penetrating regions hundreds of miles distant.

FUTURE OF REINDEER INDUSTRY

Even if no more reindeer are imported from Siberia, if the present rate of increase continues, doubling every three years—and there is no reason why it should not—within less than twenty-five years there will be at least 1,000,000 domestic reindeer in Alaska. This is a conservative estimate and allows for the deer that die from natural causes and for the many that will be slaughtered for food. In thirty-five years the number may reach nearly 10,000,000 head and Alaska will be shipping each year to the United States anywhere from 500,000 to 1,000,000 reindeer carcasses and thousands of tons of delicious hams and tongues. At no distant day, it may be



From a photograph by R. N. Hawley, M. D.

Formerly the residence of Rev. W. T. Lopp, Congregational Missionary, Cape Prince of Wales, Alaska, who for ten years labored at this settlement. Now the residence of Hugh T. Lee, who in 1895 accompanied Peary on his second advance across the Greenland ice cap to Independence Bay.

safely predicted, long reindeer trains from arctic and subarctic Alaska will roll into Seattle and our most western cities like the great cattle trains that now every hour thunder into the yards of Chicago. Before the end of the present century Alaska will be helping to feed the 200,000,000 men and women who will then be living within the present borders of the United States.

* REFERENCES: For further information on the introduction of domestic reindeer into Alaska, consult the annual reports of Sheldon Jackson, LL. D., General Agent of Education in Alaska, for 1891–1902. The reports contain much interesting matter about Alaska as well. They may be obtained from the Superintendent of Public Documents, Washington, D. C., for a small sum.

Special mention may be made of the following articles included in the reports:

"Domesticated Reindeer, with Notes on the Habits and Customs of the Eskimo and Life in Arctic Alaska," including many quaint native drawings, by Miner W. Bruce, pp. 25–117, 1893.

"The Itinerary of 1895" (describes a tour of inspection), by Dr William Hamilton, Assistant General Agent of Education in Alaska, pp. 21–41, 1895.

"Report of Wm. A. Kjellmann Describing a Trial Trip of 2,000 Miles with Nine Reindeer Sleds," pp. 41–71, 1897.

"The Lapland Reindeer Expedition of 1898," pp. 32–46, 1898.

"Expedition to Siberia," by Lieut. E. P. Bertholf, describing the purchase of Tunguse reindeer in Siberia, pp. 130-168, 1901.

"Reindeer in Siberia," pp. 168–175, 1901.

Mention should also be made of:

"The Cruise of the U. S. Revenue Cutter *Bear* and the Overland Expedition for the Relief of the Whalers in the Arctic Ocean, November 27, 1897, to September 13, 1898," including reports of Lieut. D. H. Jarvis, Lieut. E. P. Bertholf, and Surgeon S. J. Call. Government Printing Office, 1899.

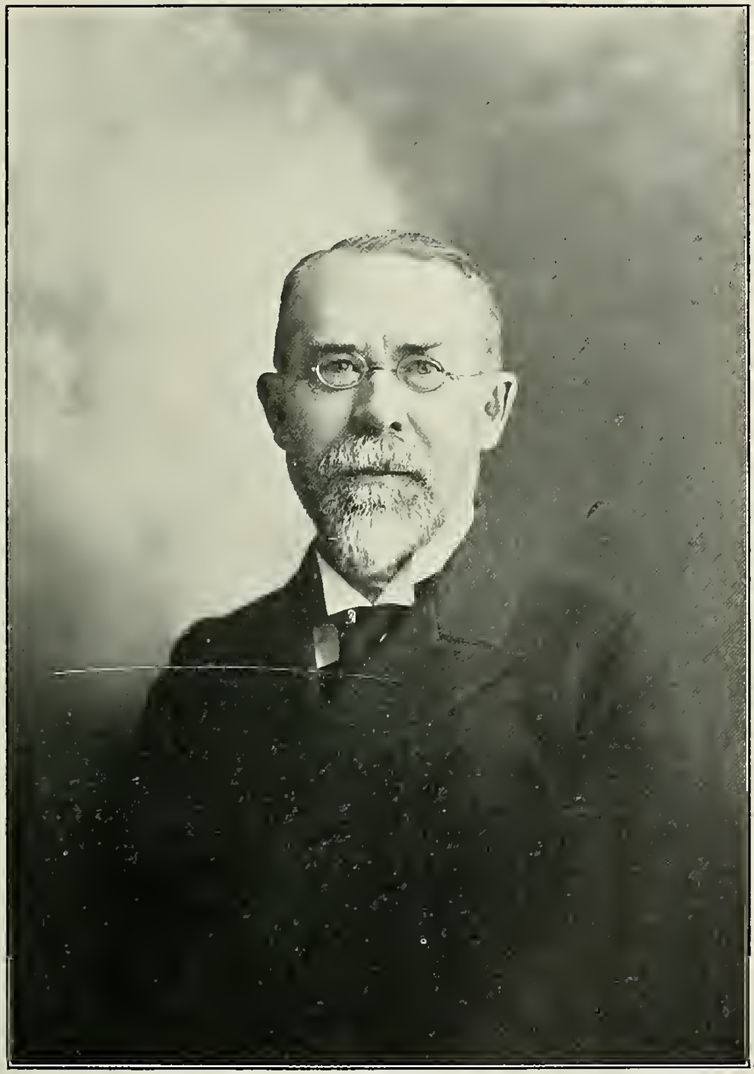
"Commercial Alaska in 1901," by O. P. Austin, Bureau of Statistics, Treasury Department, pp. 3985–3989.

Raleigh Rock—N. E., 3 miles.

Latitude, 25° 57′ 40″ N.
Longitude, 124° 43′ E.

RALEIGH ROCK

THE accompanying photograph of Raleigh Rock was taken by Capt. J. J. Gilbert, commanding the U. S. Coast and Geodetic Survey steamer *Pathfinder*, while on a voyage from Japan to Manila. Raleigh Rock is in latitude 25° 57′ 40″ N. and longitude 124° 43′ E. These rocks have been long known, but different names have been assigned to them under slightly different geographical positions. If the convenient camera had been in use in early days as it is now, the identity of the rocks would easily have been established by shipmasters. So far as known, this is the first photograph of Raleigh Rock that has ever been published.



Sheldon Jackson, LL D.

General Agent of Education in Alaska Since 1885

HENEQUEN—THE YUCATAN FIBER

By E. H. Thompson,

U. S. Consul at Progreso, Mexico

IN ancient times the agave, or henequen,* was one of the most important plants of the peninsula. At a time when most of Europe was in the pall of utter darkness, when the "Parisii" lived in caves and the Gauls in "wattled huts," the priests and rulers of Yucatan lived in stone temples and palaces. Up the steep sides of the myriad pyramids were carried great blocks and sculptured columns.

To move these mighty masses of limestone no powerful engines were at hand, but the Batabs of Yucatan, like the rulers of ancient Egypt, had little use for mechanical devices. Human muscle and ropes of agave (henequen) were all-sufficient. If ten ropes and a hundred slaves were not enough, a hundred ropes and a thousand slaves were not lacking. The ancient artists made use of the fiber in their work. They were not content to make the figure; they made the skeleton, and upon the bones and in the flesh, like the cords and muscles of the body, they placed cords and plaited bands of fiber. Close examination indicates that the fiber used was that of the yaxci plant. Over the imbedded muscles and flesh they placed a thin, hard wash of stucco to represent the skin and surface pigments. The writer has examined many dozen specimens of the broken figures of stucco wherein are plainly shown the casts and the knots and braid, even the very character of the fiber.

The primeval inhabitants probably did not at first attempt to extract the fiber from the thick pulp, but took the leaf and wilted it in the fire, then split it, and used the splits as thongs. The leaves so treated make thongs of great strength, and as they dry they bind with wonderful force. In the primitive forms of habitation in the region, the mud and wattle "nás" are bound together by these shreds of fiber-wilted leaves. They are shapely, water-tight, and durable, and the native builder's only tool is a heavy, sharp-edged knife. Not a spike or nail or metal of any kind enters into the building.

Later the people found that if they cleaned off the thick pulp and the green corrosive juice they could get a firmer hold and so bind tighter. Then they learned to twist the shreds, and this idea led to the making of ropes and cords.

Toward the end of the eighteenth century, when there happened to be a scarcity of hemp for the cordage of the Royal Spanish Navy, search was made for a new material to eke out the supply from Manila. Some one told of the fiber used by the Campeche people in Yucatan. A royal commission was ordered to investigate, and its report, made in 1783, gave unstinted praise to the fiber.

For a few years quite a little henequen was sent to Europe. Then with the collapse of Spanish commerce the demand for it ceased and for half a century its existence seems to have been forgotten by the world.

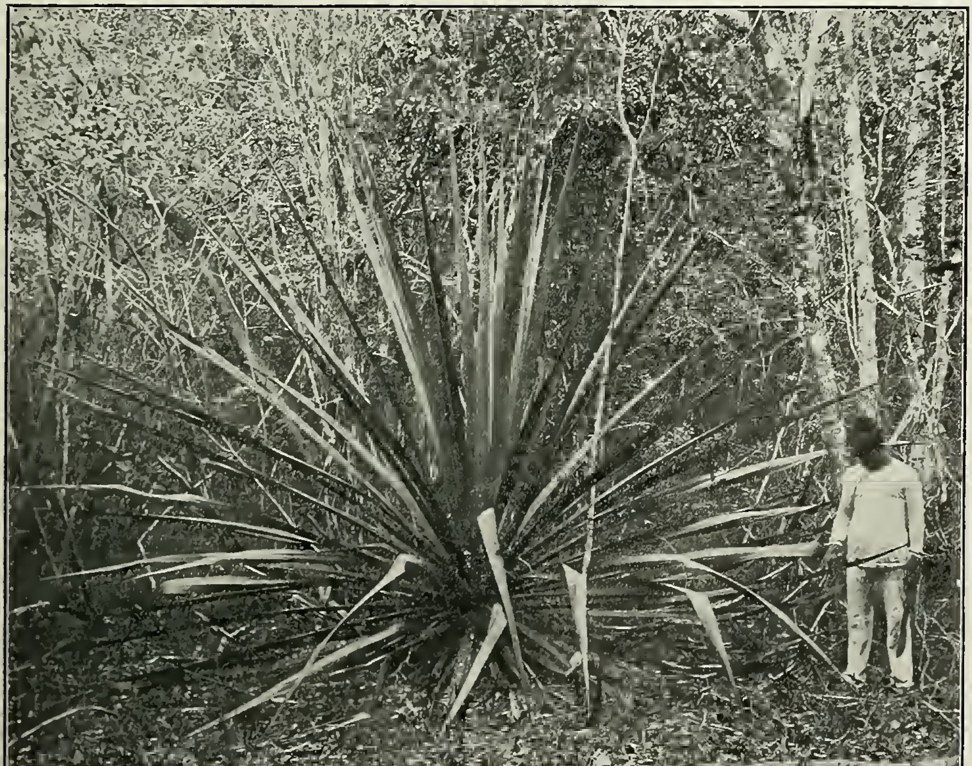
Meanwhile the people of Yucatan grew poorer and poorer until, in their desperation as to how to get money to buy the necessities of life, some bright merchants thought of the fibrous plant which fifty years before had had commercial value. An association was formed and they began to experiment

* The fiber is often called Sisal grass or Sisal hemp, though it is neither a grass nor a hemp. The name "Sisal" was applied to it because it originally reached the outer world through the port of that name.

with the plant. A quantity of fiber was rudely cleaned by native instruments, and, packed in loose bales of about 200 pounds each, was sent to New York. It found a market, but the price was such that there was but scant gain for the seller. The methods of cleaning the fiber were so slow that even with the small wages of the day, the cost per pound to the planter was discouraging. The state government, recognizing the great need of a suitable machine to clean the fiber, offered a gratuity of $10,000 Mexican to the person inventing an apparatus capable of producing a stated output per hour. This finally resulted in the "raspador," the device of a Franciscan friar, which was used for many years.

The raspador marked a new era for the commerce of Yucatan. With the aid of this machine, two men could clean in one day more than forty could with the tonkas and pacché. Its use became extended, and henequen farms began to multiply and become prosperous. Today, half a dozen machines are in the market, some of them marvels of design and potency.

The natives of the interior, however, still use the ancient, triangular, sharp-edged piece of wood called the pacché. An able-bodied person can clean with the instrument from 6 to 9 pounds of fiber a day. The fiber obtained thus possesses qualities which that cleaned by machines does not have. In the hammock-making districts of Yucatan



From a photograph by E. H. Thompson

A Wild Variety of Agave Found in the Deep Forests of Yucatan

From a photograph by E. H. Thompson

A Field of Young Sisal Plants—Two Years Old

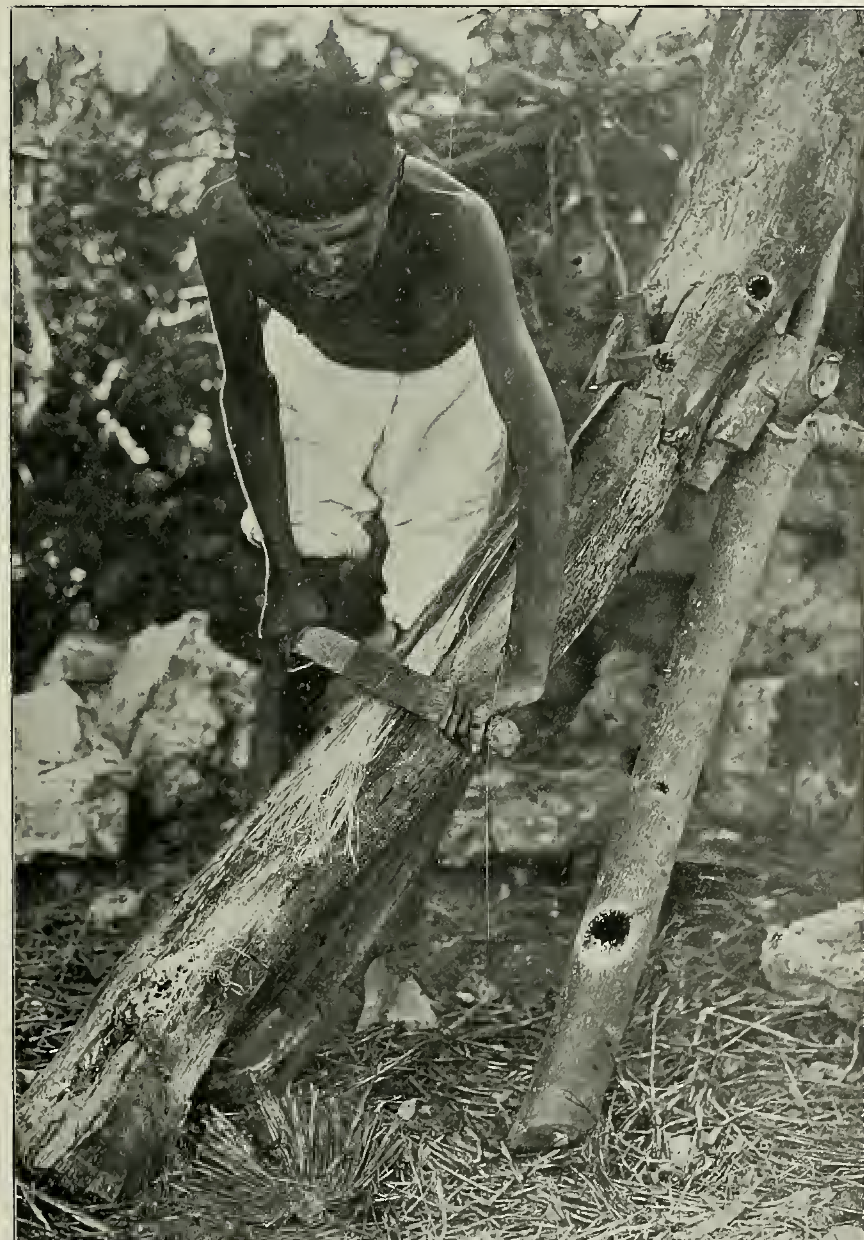
the leaf is cleaned in the ancient method (see illustration on next page), and the makers of the finest hammocks, those worth their weight in silver, will not use a fiber produced by any other method.

THE AGAVE PLANT

The agave is one of the most characteristic plants of Mexico. One of the family, the *Agave americana*, produces the pulque, the intoxicating drink of the country. Great fields are covered with this plant upon the Mexican tableland, and long "pulque trains," like the milk trains of the United States, roll daily into Mexico city.

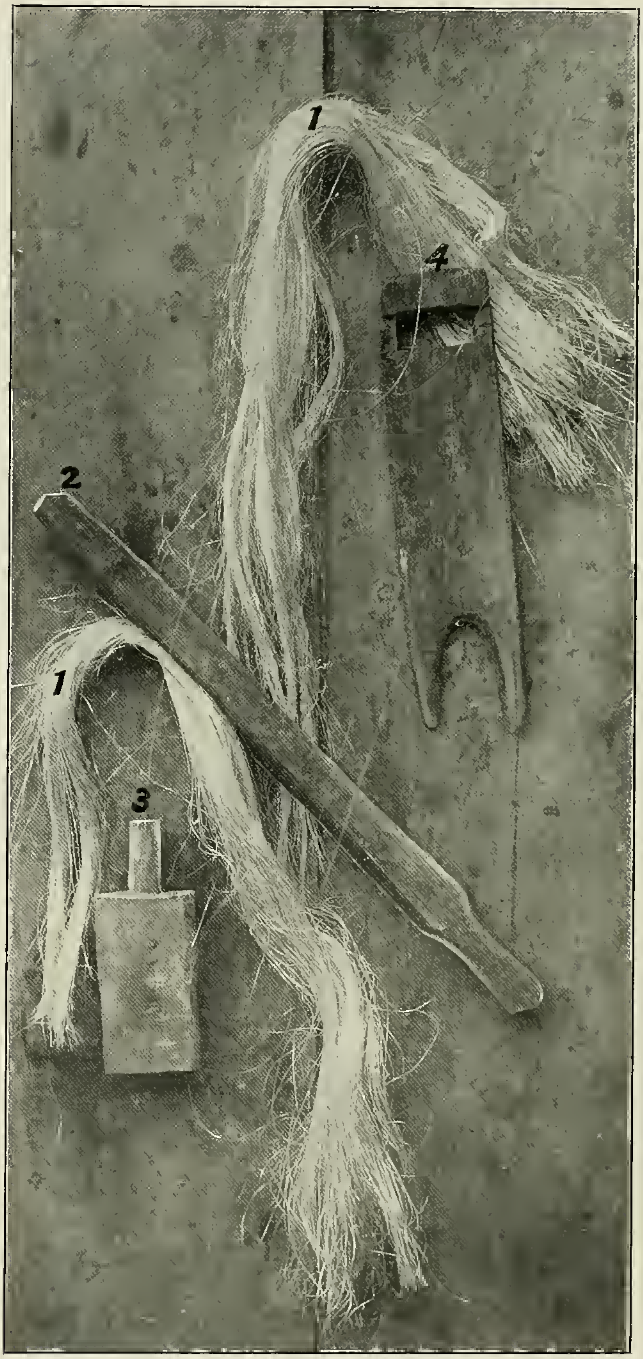
This beverage is practically unknown to the inhabitants of Yucatan, and the variety that produces it is to be seen only as an exotic in the gardens and parks. Its place is taken by another member of the family, whose importance is more far-reaching. The *Agave sisalensis* furnishes a fiber that not only helps to knit firmer the commerce of the whole world, but binds the sheaves of wheat so that the price of bread in every land is made cheaper for its use.

To the casual observer a field of the pulque plant and one of the fiber plant are very similar in appearance. Both show the same peculiar green, the same many-thorned leaves, but a nearer view soon shows the difference.



From a photograph by E. H. Thompson

A Native in the Interior Cleaning the Fiber by the Ancient Method



From a photograph by E. H. Thompson

1. Tresses of the Sisal Fiber Cleaned by the Pacché (see page 153).
2. Pacché. 3 and 4. Native Implements for Cleaning Fiber

There are three known varieties of the species growing wild in the forests of Yucatan—the chelem, the cahum, and the citamci—and I think that I have found a fourth wild variety during my explorations in the interior. There are also two varieties of the cultivated plant—the yaxci or green fiber, and the sacci or white fiber. The last-named plant is the most cultivated and the one producing the sisal hemp, or henequen, of commerce.

CULTIVATION

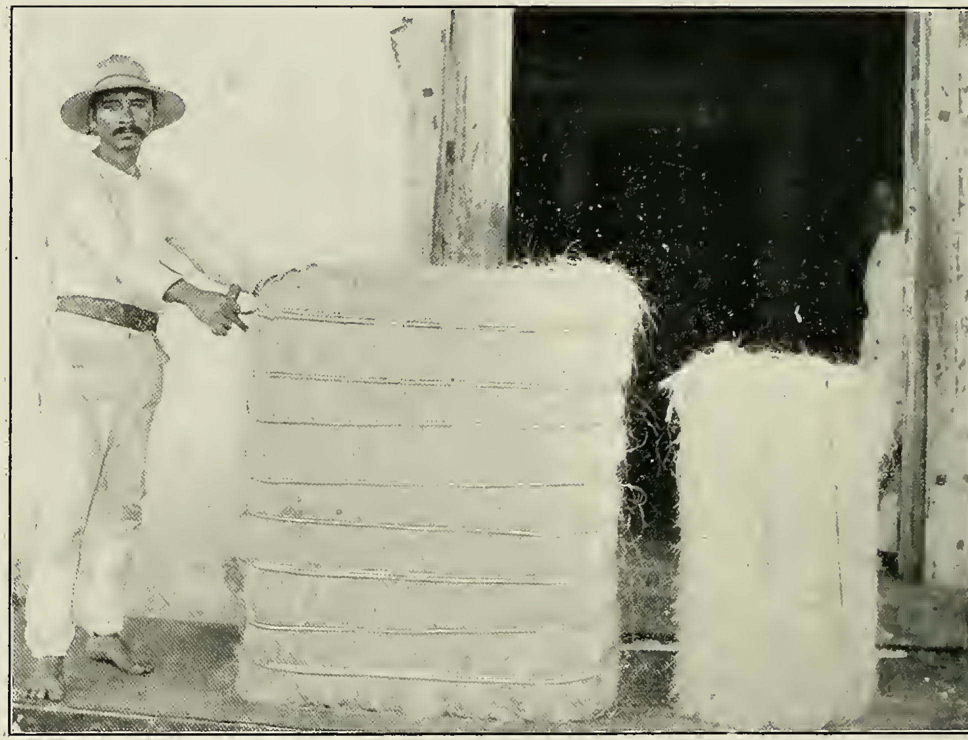
A thin, rocky limestone soil is generally supposed to be the best for the growth of the sacci plant. Experience indicates that the fiber grown upon this class of soil has a percentage of tensile strength greater than that produced on the richer lands, though the last is more flexible and is longer. The percentage of safety allowed by the cordage-makers is so high that I doubt if the diminished tensile strength of the rich-land hemp would seriously affect the quality of the output. Contrary to the general idea, a poor sandy soil is not congenial to the growth of a large, full-sized fiber plant. Few, if any, good-sized, well-formed plants grow very near the coast line. The best Yucatan fiber plant seems to be produced in a zone or belt following the coast, about 12 miles away from it and 70 miles wide.

The plant can be propagated in various ways—by seeds, by cuttings, and by scions or suckers. The first-mentioned method is now never undertaken. Very few of the abundant seeds are fertile, and the time lost in raising the seedlings is great. The second method—by cuttings—is frequently undertaken; the top of an old, nearly worn-out plant is taken just before the long pole that should bear the flowers shoots up. It is cut off and trimmed of all save the newest leaves, and then planted in the ground as though it were a scion. These plants are said to produce earlier than others.

The general method, however, of producing a field of the sisal plant is as follows: A field is cut and the refuse burned; then a month or so before the rainy season the "hijos," or scions of

From a photograph by E. H. Thompson

Drying Sisal Fiber at One of the Large Plantations—Yucatan



From a photograph by E. H. Thompson

Bales of Sisal Fiber Ready for Shipment

sisal, that have sprouted under the shelter of the parent plant, are rooted out of the ground when they get to be 18 or 20 inches high, and thrown in a heap. There they lie for two or three months exposed to the sun and the weather. Just before the rainy season, when they seem to be dried up and decayed, they are carried to the cleared fields and planted in rows. Formerly they so planted the young plants that they were separated by spaces of barely 2 yards, but of late years it has been found best to space them so that they will be in lines, each plant separated from the one preceding it by a space of 1½ yards and the lines 4 yards apart (about 1,100 plants to the acre). Thus, long and wide lanes are formed between the rows that facilitate cutting and carriage of the leaves, and also lessen the wounding of the leaves by the spines and thorns of their neighbors.

Previous to 1889 but little attempt was made to grade the hemp. Yaxci, sacci, short staple, long staple—all went as "sisal." Now, a fine, white fiber, well cleaned and baled, can command a notably better price than mixed fiber, ill-cleaned and badly baled.

The hope of the future is in the careful selection of hemp plants. Many plantations, more by good fortune than otherwise, are stocked with fiber-producing plants of a high order; others are handicapped by plants producing a meager fiber. The quality of the soil in both cases seems to be the same; the difference is in the class of plants. This phase is a comparatively new one on the plantations of Yucatan fiber and has only recently been taken into serious consideration.

The scion when planted ("anchored" would perhaps be the better word, as it is more often held by heavy stones than by the earth around it), needs no special care or irrigation. Once or twice a season the fields are roughly weeded. The plant thrives, and generally in about five years the earlier leaves commence to extend themselves laterally at right angles to the trunk of the plant. This is nature's signal that the fiber has reached its highest point of tensile strength and that the leaves are ready to be cut. The native cutters then throng the field, and with their corbas deftly cut the leaves close to the trunk, trim off each line of side thorns at a single stroke, snip off the horny end, and bind up the leaves in bundles. Tram cars take these bundles and carry them to the cleaning machine.

THE ENEMIES OF THE PLANT

Fire is its greatest enemy. Hot seasons do not affect it. In fact, the heat of the sun, especially when accompanied by dampness, seems to act as a tonic. It is then, if ever, that the plant recovers from its injuries. The greatest heat experienced in Yucatan for the last ten years was in July, 1900, when the thermometer reached 119° F. in the half shade of a veranda; 147° F. has been experienced in the sun on the principal street of Merida. Long droughts may delay its development, and by wilting the mature leaves cause them to double and injure the fiber, but it cannot stop the ultimate growth of the healthy plant, once it is well rooted. Rainy seasons do not seriously affect the plants, except those in stagnant water. This weakens the plant, but this condition is not common. Cold seasons of the kind that Yucatan experiences do not seriously affect the plant. The coldest known period was in February, 1899, when the thermometer registered 47° F.

But fire conquers it. Let a spark from a locomotive, the lighted end of a cigarette, or the embers of a fire made to heat the bread of the native workers start the flames in an ill-cleaned field, and nothing but a miracle can save the crop from total loss. It is said that some planters in the past have taken advantage of the susceptibility of the plant to artificial heat, and when young plants were desired for export, they were doctored before delivery by having their roots heated over heated embers or dipped into boiling water. The effects of this treatment are not perceptible for a time, and possibly this fact may make clear to some enthusiastic foreign planter why his scions, purchased with so much care and expense, never grew and prospered. Naturally, the Mexicans do not desire to have the plant that is such a valuable product of their country made common.

Next to fire, a large, long-nosed black beetle is the greatest enemy of the cultivated sisal. It is known to the natives as the "max." Dr Gaumer, an American physician residing in Yucatan, whose studies and writings upon the fauna and flora of Yucatan have made his name familiar to naturalists everywhere, at my request writes of the insect:

"The female insect lays its eggs on the trunk of the henequen plant a few inches above the ground. When hatched the larva burrows into and through the outer bark to the harder fiber of the interior, when it generally takes an upward direction and burrows from 6 to 12 inches during its larval existence. When full grown it works its way to the bark, where it changes to a pupa and so remains for some months, when it hatches into the adult beetle and emerges from the plant, which it leaves injured and weakened, but rarely kills. Three or more larvæ in the same plant will surely destroy it, but that number is of very rare occurrence."

The life of the plant can be greatly prolonged. I have seen fields old at 10 years, and others vigorous and hearty at 19 years. The plants should be originally healthy scions, the leaves must be cut at just the right time, and the long pole must be nipped off before it has become more than a mere protuberance. Once the pole has grown, the plant ages rapidly.

VALUE OF HENEQUEN

The export of henequen is making Yucatan one of the richest states of Mexico. In 1902 the state sent out nearly six hundred thousand bales, or ninety thousand tons, worth $14,000,000. Most of it went to the United States, where it is used for sacking, cordage, and binders' twine.

There will be a falling off in the supply for the season of 1903. The causes of this diminishing output, despite the high prices that prevail, will be the decreasing acreage of new fields. Laborers are scarce, and the great majority of planters dislike to stop cleaning fiber long enough to plant new fields or replant old ones.*

* For the illustrations that accompany this article the NATIONAL GEOGRAPHIC MAGAZINE is indebted to Hon. Frederic Emory, Chief of the Bureau of Foreign Commerce, State Department.

A REPORT OF THE ERUPTION OF THE SOUFRIERE OF ST VINCENT, 1812

FROM THE EVENING NEWS OF JUNE 30, 1812*

THE Soufrière mountain, the most northerly of the lofty chain running through the center of this island, and the highest of the whole, as computed by the most accurate survey that has yet been taken, had for some time past indicated much disquietude; and from the extraordinary frequency and violence of earthquakes, which are calculated to have exceeded 200 within the last year, portended some great movement or eruption. The apprehension, however, was not so immediate as to restrain curiosity, or to prevent frequent visits to the crater, which of late had been more numerous than at any former period, even up to Sunday last, the 26th of April, when some gentlemen ascended it, and remained there for some time. Nothing unusual was then remarked, or any external difference observed, except rather a stronger emission of smoke from the interstices of the conical hill at the bottom of the crater. To those who have not visited this romantic and wonderful spot, a slight description, as it lately stood, is previously necessary and indispensable to form any conception of it and to the better understanding the account which follows, for no one living can expect to see it again in the perfection and beauty in which it was on Sunday, the 26th instant. About

* This account has been copied from the reprint of the original article as published in "An Account of the Eruptions of the Saint Vincent Soufrière," by P. Foster Huggins. The account is of the highest interest and value as showing the exact parallelism between the eruptions of 1812 and 1902. The "lava" streams mentioned here were mud flows. Mr Huggins' pamphlet was printed at the *Times* printing office, Kingstown, St Vincent, July, 1902.—E. O. HOVEY.

2,000 feet from the level of the sea (calculating from conjecture on the south side of the mountain) and rather more than two-thirds of its height, opens a circular chasm, somewhat exceeding half a mile in diameter and between 400 or 500 feet in depth. Exactly in the center of this capacious bowl rose a conical hill about 260 or 300 feet in height, and about 200 in diameter, richly covered and variegated with shrubs, brushwood, and vines about half way up, and for the remainder powdered over with virgin sulphur at the top. From the fissure in the cone and interstices of the rocks, a thin white smoke was constantly emitted, occasionally tinged with a slight bluish flame. The precipitous sides of this magnificent amphitheater were fringed with various evergreens and aromatic shrubs, flowers, and many Alpine plants. On the north and south sides of the base of the cone were two pieces of water, one perfectly pure and tasteless, the other strongly impregnated with sulphur and alum. This lonely and beautiful spot was rendered more enchanting by the singularly melodious notes of a bird, an inhabitant of those upper solitudes, and altogether unknown to the other parts of the island; hence principally called or supposed to be invisible, though it certainly has been seen, and is a species of the merle. A century had now elapsed since the last convulsion of the mountain, or since any other elements had disturbed the serenity of this wilderness, than those which are common to the tropical tempest. It apparently slumbered in primeval solitude and tranquillity, and from the luxuriant vegetation and growth of the forest which covered its sides from the base nearly to the summit, seemed to discountenance the face and falsify the records of the ancient volcano. Such was the majestic, peaceful Soufrière of April 27th ; but we trod on *ignes suppositos cineri doloso*, and our imaginary safety was soon to be confounded by the sudden danger of devastation.

Just as the plantation bells rang twelve at noon, on Monday, the 27th, an abrupt and dreadful crash from the mountain, with a severe concussion of the earth and tremulous noise in the air, alarmed all around it. The resurrection of this fiery furnace was proclaimed in a moment by a vast column of thick, black, ropy smoke, like that of an immense glass house, bursting forth at once, and mounting to the sky, showering down sand with gritty, calcined particles of earth and favilla mixed, on all below. This, driven before the wind towards Wallibou and Morne Ronde, darkened the air like a cataract of rain, and covered the ridges, woods, and canepieces with light, gray-colored ashes, resembled snow when slightly covered by dust. As the eruption increased, this continued shower expanded, destroying every appearance of vegetation. At night a very considerable degree of ignition was observed on the lips of the crater, but it is not asserted that there was as yet any visible ascension of flame. The same awful scene presented itself on Tuesday, the fall of favilla and calcined pebbles still increasing, and the compact, pitchy column from the crater rising perpendicularly to an immense height with a noise at intervals like the muttering of distant thunder. On Wednesday, the 29th, all these menacing symptoms of horror and combustion still gathered more thick and terrific for miles around the dismal and half-obscured mountain. The prodigious column shot up with quicker motion, dilating as it rose like a balloon. The sun appeared in total eclipse, and shed a meridian twilight over us that aggravated the wintry gloom of the scene now completely powdered over with falling particles. It was evident that the crisis was yet to come; that the burning fluid was struggling for a vent, and laboring to throw off the superincumbent strata and obstructions which suppressed the ignivomous torrent. At night it was manifest that it had greatly disengaged itself from its burden by the appearance of fire flashing now and then, flaking above the mouth of the crater.

On Thursday, the memorable 30th of April, the reflection of the rising sun on this majestic body of curling vapor was sublime beyond imagination. Any comparison of the glaciers of the Andes or Cordilleras with it can but feebly convey an idea of the fleecy whiteness and brilliancy of this awful column of intermingled and wreathed smoke and clouds. It afterwards assumed a more sulphureous cast, like what we call thunder clouds, and in the course of the day a ferruginous and sanguine appearance with much livelier action in the ascent, a more extensive dilation, as if almost freed from every obstruction. After noon the noise was incessant and resembled the approach of thunder, still nearer and nearer, with a vibration that affected the feelings and hearing; as yet there was no convulsive motion or sensible earthquake. Terror and consternation now seized all beholders. The Caribs, settled at Morne Ronde at the foot of the Soufrière, abandoned their homes with their live stock and everything they possessed, and fled precipitately towards the town. The negroes became confused, forsook their work, looked up to the mountain, and, as it shook, trembled with dread of what they could neither understand nor describe; the birds fell to the ground, overpowered with the showers of favilla, unable to keep themselves on the wing; the cattle were starving for want of food, as not a blade of grass or a leaf was now to be found; the sea was much discolored, but in nowise uncommonly agitated, and it is remarkable that throughout the whole of the violent disturbance of the earth it continued quite passive, and did not at any time sympathize with the agitation of the land. About 4 o'clock p. m. the noise became more alarming, and just before sunset the clouds reflected a bright copper color, suffused with fire. Scarcely had the day closed when the flame burst at length pyramidically from the crater through the mass of smoke; the rolling of the thunder became more awful and deafening; electric flashes quickly succeeded, attended with loud claps, and now indeed the hurly-burly began. Those only who have witnessed such a sight can form any idea of the magnificence and variety of the lightning and electric flashes; some forked zigzag playing across the perpendicular column from the crater, others shooting upwards from the mouth-like rockets of the most dazzling luster, others like shells with their trailing fuses flying in different parabolas, with most vivid scintillations from the dark, sanguine column which now seemed inflexible and immovable by the wind.

Shortly after 7 o'clock p. m. the mighty cauldron was seen to simmer, and the ebullition of lava to break out on the northwest side. This, immediately after boiling over the orifice and flowing a short way, was opposed by the activity of a higher point of land, over which it was impelled by the immense tide of liquefied fire, that drove it on forming the figure V in grand illumination. Sometimes when the ebullition slackened, or was insufficient to urge it over the obstructing hill, it recoiled back, like a refluent billow from the rock, and then again rushed forward, impelled by fresh surprise, and scaling every obstacle, carrying rocks and woods together in its course down the slope of the mountain, until it precipitated itself down some vast ravine concealed from our sight by the intervening ridges of Morne Ronde. Vast globular bodies of fire were seen projected from the fiery furnace, and bursting, fell back into it, or over it, on the surrounding bushes, which were instantly set in flames. About four hours from the lava boiling over the crater it reached the sea, as we could observe from the reflection of the fire and the electric flashes which attended it.

About half-past one another stream of lava was seen descending to the eastward towards Rabacca. The thundering noise of the mountain and the vibration of sound that had been so formidable hitherto now mingled in the sullen monotonous roar of the rolling lava, became so terrible that dismay was almost turned into despair. At this time the first earthquake was felt. This was followed by showers of cinders that fell with the hissing noise of hail during two hours. At three o'clock a rolling on the roofs of the houses indicated a fall of stones, which soon thickened and at length descended in a rain of intermingled fire that threatened at once the fate of Pompeii and Herculaneum. The crackling and coruscations from the crater at this period exceeded all that had yet passed. The eyes were struck with momentary blindness, and the ears stunned with the glomeration of sounds. People sought shelter in cellars, under rocks, or anywhere, for everywhere was nearly the same, and the miserable negroes, flying from their huts, were knocked down or wounded and many killed in the open air. Several houses were set on fire. The estates situated in the immediate vicinity seemed doomed to destruction. Had the stones that fell been proportionally heavy to the size, not a living creature could have escaped without death. These having undergone a thorough fusion, they were divested of their natural gravity, and fell almost as light as pumex, though in some places as large as a man's head. This dreadful rain of stones and fire lasted upwards of an hour, and was again succeeded by cinders from three till six o'clock in the morning. Earthquake followed earthquake almost momentarily, or rather the whole of this part of this island was in a state of continued oscillation, not agitated by shocks vertical or horizontal, but undulated like water shaken in a bowl. The break of day, if such it would be called, was truly terrific. Darkness was only visible at eight o'clock, and the birth of May dawned like the day of judgment. A chaotic gloom enveloped the mountain and an impenetrable haze hung over the sea, with black sluggish clouds of a sulphureous cast. The whole island was covered with favilla, cinders, scoria, and broken masses of volcanic matter. It was not until the afternoon the muttering noise of the mountain sunk gradually into a solemn yet suspicious silence.

GEOGRAPHIC NOTES

EXPLORATIONS AMONG THE WRANGELL MOUNTAINS, ALASKA

Messrs T. G. Gerdine and D. C. Witherspoon, of the U. S. Geological Survey, as one of the results of their topographic work in the Copper River basin, Alaska, during the seasons of 1900 and 1902, have developed some most interesting facts concerning a great group of peaks called the Wrangell Mountains, whose slopes are drained by tributaries of the Copper, the Tanana, and the White rivers. The western end of this group was located roughly by Lieut. Allen in 1885, in connection with his reconnaissance through central Alaska, and his descriptions gave the first conception of the altitude and importance of the group.

Messrs Gerdine and Witherspoon, however, have mapped accurately and in detail the entire range. They have determined incidentally that it includes at least eight peaks, with altitudes of 12,000 feet or more, and several other summits which rise to above 10,000 feet. Two of these peaks, Mount Blackburn and Mount Sanford, are over 16,000 feet in height, but the most interesting of all is perhaps the active volcano, Mount Wrangell, 14,000 feet high. This peak is a great, flat volcanic dome, whose crater near the summit is 8,000 feet above the line of perpetual snow. At irregular but frequent intervals, puffs of steam and smoke, with showers of fine cinder, issue from this crater, and as a result many of the glaciers flowing from its southwestern slope are black with the included soot and ash instead of being clear blue, like glacial ice generally.

Detailed topographic maps, showing the location, relative positions, forms, and altitudes of the various peaks of the range, are in course of preparation and will be issued soon with geologic reports of the region. A table of altitudes of a few of the highest peaks is presented :

Mt Sanford	16,208
Mt Blackburn	16,140
Mt Wrangell	14,005
Mt Regal	13,400
*Mt Jarvis	12,230
Mt Drum	12,002

SCOTTISH ANTARCTIC EXPEDITION

THE Chief of the U. S. Weather Bureau has just received a letter from the Scottish Antarctic Expedition, dated January 24th at the Falkland Islands, acknowledging the receipt of assistance from the Weather Bureau. The writer, Mr R. C. Mossman, meteorologist to the expedition, states : "We leave here tomorrow on the Antarctic ship *Scotia* for the Weddell Sea,* pushing south along the 30th parallel of west longitude and wintering in the ice. We do not expect to return here before February or March of next year (1904). I hope to be able to contribute something to the United States Monthly Weather Review. We shall concentrate on kite work as much as circumstances permit, as we have a complete outfit of meteorographs, kites, etc., on board. (This outfit is modeled after that of the U. S. Weather Bureau.) There is, we believe, some possibility of losing a record by the freezing of the ink, as we have not the newly invented ink containing tonsol."

SURVEY OF THE GRAND CANYON

THE demand from scientists and tourists for an accurate and detailed map of the famous Grand Canyon of the Colorado has led to a resurvey of this region by the United States Geological Survey, under the charge of Francois E. Matthes, topographer. The Grand Canyon, formerly reached only by a stage route over a desert country, has recently been made accessible by a branch line from Williams, and during the one year that this road has been in operation the canyon has been visited by thousands of tourists.

The survey plans to publish a series of atlas sheets covering the entire extent of the Grand Canyon proper and

*Named for Lieut. David H. Jarvis, Collector of Customs, Sitka, Alaska, and leader of the Point Barrow overland expedition of 1897-'98.

*The Weddell Sea, so named after Captain James Weddell, who made numerous sealing voyages and wrote on the possibility of reaching the South Pole According to the eminent geographer, E. S. Balch, of Philadelphia, in his latest book, "Antarctica," Weddell Sea was originally called George the Fourth's Sea by Captain Weddell. He sailed over it in 1823 and found not a particle of ice, and he thought it a portion of the Antarctic Polar Sea. It probably represents only the southern end of the Atlantic Ocean, between the meridian of Greenwich and longitude 60° W. According to Weddell's voyage, this region was all open water as far south as latitude 75° south.

considerable areas of the high plateaus on either side. The first of these sheets, known as the Bright Angel, will be available to the public some time this summer. It includes almost all of the scenery visible from the Bright Angel Hotel, familiar to every visitor. The new map will be on a scale of one mile to the inch, and the contour interval will be 50 feet. It will show every pinnacle, spur, and gully in its true proportions, and each line of cliff and terrace may be traced along the canyon walls.

The dimensions of the Grand Canyon have been the subject of much discussion ever since it was first explored. It is therefore interesting to see some of the figures of this latest survey. The average width from rim to rim does not exceed 10 miles throughout the Kaibab, or widest section of the canyon, and frequently narrows down to 8 miles. The river does not occupy the middle of the gigantic trough, but flows at a distance varying between 1 and 3 miles from the south side. Practically all of the magnificently sculptured pinnacles and mesas (the so-called temples) lie north of the river, and at distances of from 5 to 7 miles from the view-points usually visited by tourists. The depth of the Grand Canyon, in one way, has been overstated, in another understated. Measured from the south rim, the total depth is considerably less than a mile. From the rim at the Bright Angel Hotel, where the altitude is 6,866 feet above sea-level, to the high-water mark of the river at the foot of the tourist rail, the drop is 4,430 feet. The highest point on the south rim at the Grand View Hotel is 7,496 feet, about 4,900 feet above the river. From the north side, however, the drop to the water level averages considerably over a mile, and in many places even exceeds 6,000 feet. It may be stated in a general way that the north rim is from 1,000 to 1,200 feet higher than the south, thus producing that high, even skyline so striking in all views. These figures are based on spirit-levels run in connection with the map work. They are the first that have ever been run to the bottom of the chasm, and the high standard of accuracy maintained throughout will cause them to be considered authoritative and final.

GEOGRAPHY IN THE UNIVERSITY OF CHICAGO

THE University of Chicago has established a Department of Geography, and Prof. Rollin D. Salisbury, of the Department of Geology, has been placed at its head. The arrangement between the Departments of Geology and Geography is such that Professor Salisbury retains his connection with the former, as heretofore, at the same time that he assumes the headship of the latter. The close connection of the two departments appears from the fact that Professor Salisbury will also act as head of the Department of Geology when Professor Chamberlin is not in residence, and Professor Chamberlin will act as head of the Department of Geography in Professor Salisbury's absence.

The Department of Geology has heretofore offered courses, both elementary and advanced, in physical geography, and elementary courses in meteorology. Other courses of a geographic character have been offered by other departments, notably geographic botany by the Department of Botany, zoögeography by the Department of Zoölogy, and commercial geography by the Department of Political Economy. These courses will continue to be given as heretofore by these several departments, except that meteorology will be under the auspices of the new department. The new department will not duplicate the geographic courses already given, but will, at the outset, provide courses which supplement those already established. The immediate aim of the new department will be to occupy the ground intermediate between geology and climatology, on the one hand, and history, sociology, political economy, and biology, on the other. The courses offered at the outset will be those for which, within this field, there is greatest demand.

John Paul Goode, Ph. D., in charge of the work of geography in the Wharton School in the University of Pennsylvania, has accepted an assistant professorship in the Department of Geography, and will begin his work the second term of the summer quarter (July 27, 1903). No other appointment will be made this year. During his first year Dr Goode will be in residence during the second term of the summer quarter, and during the autumn and spring quarters. The courses which he will give during the first year will include courses on the economic geography of (1) North America, (2) Europe, and (3) tropical countries. The central theme of these courses will be the influence of the physiography, the climate, and the natural resources of these lands on their settlement, development, and present commercial and industrial status. Research courses will also be offered for advanced students.

The geographic work of the university during the coming year will include the following courses, in addition to those given in the Department of Geography :

I. In the *Department of Geology*.—1, an elementary course in physiography each quarter ; 2, a local field and laboratory course, first term, summer quarter ; 3, two field courses in geology and geography about Devils Lake and the Dells of the Wisconsin, in Wisconsin, one month each, commencing June 18 and July 27 respectively; 4, a course in advanced physiography, autumn quarter ; 5, a field course (for advanced students) in the Wasatch Mountains of Utah and vicinity.

Other courses which, while primarily geological, are fundamental to the proper conception of the evolution of the present geography of the continents, will also be given in this department.

II. In the *Department of Zoölogy*.—Courses in zoögeography, summer and spring quarters.

III. In the *Department of Botany*.—1, an elementary course in plant geography (time not announced) ; 2, an elementary course in ecology, summer and spring quarters ; 3, elementary and advanced courses in field botany, summer and spring quarters; 4, advanced courses in geographic botany, winter quarter ; 5, a course in physiographic ecology, summer and spring quarters.

IV. In the *Department of Political Economy*.—Courses in commercial geography, summer, autumn, and winter quarters.

School of Education.—In addition to the foregoing, courses in geography will be given by Miss Baber in the School of Education (the Normal Department of the University). These courses are planned primarily with reference to the needs of teachers in the grades. Miss Baber will also conduct a field course of one month's duration during the second term of the summer quarter, beginning July 27.

THE ASCENT OF MT EVEREST

A SERIOUS attempt is about to be made, writes Herbert C. Fyfe in the *Scientific American*, to ascend the highest mountain in the world, Mt Everest, which rears its stately head 29,002 feet above the level of the sea.

The highest point to which man has so far climbed is 23,080 feet. This is the height of Aconcagua, the loftiest summit of the main cordillera of the Andes. Aconcagua was scaled by the famous guide, Mathias Zurbrigger, and

Mr Vines, two members of the expedition sent out by the Royal Geographical Society in 1887 under Mr E. A. Fitzgerald, who himself failed to reach the summit. Before this event the record was held by Sir William Martin Conway's expedition, which in 1892 climbed a mountain in the Karakoram Himalayas 22,600 feet high. Mr W. Graham in 1883 claimed to have ascended Kabru (24 015 feet), but his claim is generally disallowed. The new expedition, which has just started for the Himalayas, is under the direction of Mr Eckenstein. Very few details regarding the plan of operations can be ascertained, but it is known that Mr Eckenstein and his companions have set before themselves the task of ascending to the loftiest peak of the two highest mountains not only in the Himalayas, but also in the world, Mt Everest (29,002 feet) and "K 2" (28,250 feet).

There is nothing impossible in scaling Mt Everest. Two things are wanted, time and money; and provided these are forthcoming, success may very well be looked for.

Most of the great climbers of today agree in affirming that man could exist at an altitude of 29,000 feet, provided of course that careful precautions were taken and that all the details of the expedition were worked out in a thoroughly practical manner. The climber must not attempt to ascend Mt Everest right off. He will have to take some years over it, climbing each year to a certain height and resting weeks here and there on the road in order to accustom his body to the unwonted altitudes. Supplies will be a great problem, but if he can manage to insure food, clothing, and other necessaries reaching him at the various camps at which he will be forced to remain for some little time, and if he is strong enough to withstand the cold and the rarefied atmosphere, it is possible that one day his ambition will be satisfied and that he will be able to take his stand on the highest point of the earth's surface and to rejoice in the fact that he has accomplished something which no one else has ever done since the world began.

IRRIGATION PLANS IN FIVE STATES

SECRETARY HITCHCOCK, of the Department of the Interior, on the recommendation of the Director of the Geological Survey, has granted authority for the acquisition of necessary property, rights of way, etc., preliminary to the construction of irrigation works in five localities under authority of the reclamation act approved June 17, 1902.

The construction is, of course, conditional on the department obtaining the necessary rights and adjusting private claims in such manner as to comply with the provisions of the act. The five projects referred to are as follows:

Wyoming—Sweetwater dam.
Montana—Milk River project.
Colorado—Gunnison tunnel.
Nevada—Truckee project.
Arizona—Salt River reservoir.

These projects are estimated to cost $7,000,000 and will provide for the irrigation of about 600,000 acres of arid land. The examinations of all these projects have been made in sufficient detail to justify estimates of cost and results. Several other projects in other states are well advanced, and it is expected that further recommendations can be made after the close of the coming field season.

The Secretary has also authorized the expenditure during the present calendar year of $450,000 upon surveys, borings for foundations, and other examinations which will be carried on in all of the states and territories included within the provisions of the law. There is now in the Treasury about ten million dollars obtained by the sale of public lands since July 1, 1900, and available for the reclamation of arid lands in the thirteen states and territories named in the reclamation law.

INTERNAL COMMERCE OF THE UNITED STATES

THE internal commerce of the United States for 1902 reached twenty billions of dollars, or, in other words, equaled the entire international commerce of the world. This is the gratifying estimate of the Treasury Bureau of Statistics, whose duty it is to gather the facts and figures of our enormous internal trade. Hon. O. P. Austin states that in arriving at this estimate of $20,000,000,000 for the internal commerce of the United States, the Bureau includes only one transaction in each article produced, while in fact a very large number of the articles produced pass through the hands of several "middlemen" between those of the producer and those of the consumer. The estimate is based upon the figures of the census, which put the total value of manufactures in 1900 at $13,000,000,000, those of agriculture at nearly $4,000,000,000, and those of minerals about $1,000,000,000. Adding to these the product of the fisheries, the total value of the products of the great industries in 1900 would be eighteen billions of dollars, and the rapid growth in all lines of industry since 1900, especially in manufacturing, seems to justify the conclusion that even a single transaction in all the products of the country would produce an aggregate for 1902 of fully twenty billions of dollars. Our internal commerce was ten times larger in 1902 than in 1850, while our population was only three and one-half times as great.

RECLAMATION IN WYOMING AND COLORADO

MR FRED BOND, state engineer of Wyoming, in his latest official report describes some experiments being made in Colorado and Wyoming to grow wheat without irrigation.

In 1886 Mr Robert Gauss advanced the theory that wheat could be acclimatized and made to thrive under the arid conditions of Colorado, and some years later began conducting experiments to test his theory. In 1896 he planted some improved Fife wheat, but secured at harvesting time but little more than seed enough for the following year. This seed was planted and the experiment continued each year with better and better results. In the spring of 1902 Mr Bond obtained a pint of this seed and planted one-half near Cheyenne at an altitude of 6,050 feet above sea-level, and the remainder near Buffalo, Johnson county, at an altitude of 4,700 feet. From the harvest of the first lot Mr Bond obtained 9½ pints, a yield of nineteenfold, and from the second lot 21½ pints, or about forty-threefold, although there had been no irrigation of either lot. The effective precipitation at Cheyenne had been 6.38 inches and at Buffalo 4.90 inches.

If experiments on a larger scale are equally successful, if as good wheat and as great results are obtained in practical farming, Mr Gauss has reclaimed an area of nearly 400,000 square miles, stretching from the southern boundary of Kansas and Colorado to the Canadian boundary.

DEPARTMENT OF COMMERCE AND LABOR

THIS new department, after June 30, 1903, will include the following bureaus:

Bureau of Statistics;

Coast and Geodetic Survey;

Bureau of Immigration;

Bureau of Navigation;

Light-House Board and Establishment;

Steamboat Inspection Service;

U. S. Shipping Commission;

National Bureau of Standards, transferred from the Treasury Department;

Census Office, transferred from the Interior Department;

Bureau of Foreign Commerce, transferred from the State Department;

The unattached bureaus of the Fish Commission and the Department of Labor;

And the newly created Bureaus of Manufactures and of Corporations.

The law which created the Department of Commerce and Labor also gave the President authority to transfer to the new department from the other departments, excepting the Agricultural, any statistical or scientific bureau.

THE POSSIBILITIES OF SOUTHERN APPALACHIAN STREAMS

OWING to the growing importance of the Southern Appalachian Mountain region as a source of supply for many streams upon which depend important industries of the South, the United States Geological Survey has been making a systematic study of the water-courses which there take their rise. No other region in the eastern part of the United States is so important as a gathering ground for widely distributed streams. Its copious rainfall, amounting in places to 72 inches, with an average for the whole region of about 53 inches, together with its steep grade and large proportion of forests, makes it a unique gathering ground for streams which flow eastward into the Atlantic and westward and southward into the Gulf of Mexico. The work of the Survey has been directed to the measurement of all the important rivers of the district, including the New, Yadkin, Catawba, Broad, Saluda, French Broad, Nolichucky, Watauga, Holston, Big Pigeon, Nottely, Chestatee, Toccoa, Conasauga, Coosawattee, Cartecay, Ellijay, Hiwassee, and Etowah.

In the study made of these watersheds special attention was given to the normal flow and the yearly variations in the discharge of the streams, the developed and undeveloped water powers, the springs in the basins, the sources and quality of the water, and the general characteristics of the topography, rocks, and soil. Consideration was also given to the minerals, mines, forest areas, rainfall, and climate, as well as to the means of lumbering and of transportation. The data thus collected will be made available for engineers, manufacturers, and others needing information concerning the water resources of the region.

MONT PELÉE

REPORTS from Martinique indicate that Mont Pelée continues active. Prof. Angelo Heilprin states that between the time he left the island, September 6, 1902, and December 16, 1902, the mountain increased in height bodily about 950 feet according to measurements which have been sent him. During January a severe eruption occurred which tore away the larger part of this increase, but since then the mountain has been steadily gaining in height again. A notable phenomenon about the volcano is a narrow obelisk which has been thrust forcibly and gradually through the throat of the volcano to a height of some 200 feet. The obelisk is incandescent, pointed like a needle, and would appear from Lacroix's observations to be of a lavæ-form nature. Mont Pelée has now been in a state of unceasing disturbance, more or less active, since the great catastrophe of May 8, 1902—in fact since several weeks before that day.

Professor Heilprin plans to return to Martinique shortly to continue his personal examination of the volcano. He is at present engaged in enlarging his volume, "Mont Pelée and the Tragedy of Martinique," for a second edition.

The Census of China, recently completed, shows the enormous total population of 426,447,000, according to the cabled reports. The number of inhabitants in Manchuria, Mongolia, Tibet, and Turkestan were only estimated. Thus more than one-fourth of the inhabitants of the world are contained within the Chinese Empire. Even the British Empire with its vast possessions on every continent has 30,000,000 less inhabitants than China. In 1890 Mr E. G. Ravenstein estimated the inhabitants of the earth at 1,487,900,000. Since then the number has increased at least 62,100,000, making a present total of 1,550,000,000.

The British Empire, including India and the recently acquired possessions in South Africa, contains 396,105,000 people; the Russian Empire comes next, with less than one-third as many, 129,004,000; the United States, including our island possessions, numbers about 89,000,000; France and her colonies have 65,166,000, and the German Empire 56,367,000. No other country passes the fifty-million mark.

The San Jose Scale, which is so destructive to fruit trees in certain sections of the western United States, was the subject of a recent lecture by Charles L. Marlatt before the Biological Society of Washington. Mr Marlatt was sent to Japan and China by the Department of Agriculture to study this pest and to discover some means of checking it. In Japan he found the scale only in those parts where trees had been imported from American nurseries. In China, however, around Tientsin and Pekin and along the northern coast, he found the scale on nearly all the trees, and as it existed in parts where there had been no importations from America, he concluded that it was a native of China. Further studies convinced him that the scale was held in check by a red-spotted beetle, which ate the insects. Mr Marlatt wisely arranged for the capture of a great many of the red-spotted beetles, which were brought to the United States and distributed among those sections that were specially infested by the scale. It is hoped that the beetles will increase rapidly enough to check the spread of the scale.

The Outing of the Mazamas for 1903 will be held at the Three Sisters, a triple peak in Lane County, Oregon, with an elevation of nine thousand feet. Members of the club rendezvous at Portland, leaving that city July 8 and Eugene July 9. The ascent of the peak is planned for July 13 or 14. The party return via Clear Lake and Lebanon (the old Military Road) in time for those who wish to join the Sierra Club in the ascent of Mt Shasta on July 25. It will be remembered that the requirement for admission into the Mazamas is the ascent of at least one snow-capped peak of formidable height.

Bingham, Utah, Mining District.—The report of the U. S. Geological Survey on the areal and economic geology of the Bingham Canyon district, Utah, by Arthur Keith and J. M. Boutwell, is now nearing completion. It embodies four main parts, which are devoted to history and development, surface geology, economic geology, and detailed descriptions of mines. Bingham is the oldest camp in the state and the only one in which placer mining has proved successful.

A map of the dairy region of New York State has been published by the Geological Survey. It is called the Norwich sheet, and includes the thriving city of Norwich and the towns of Smyrna and Plymouth, as well as portions of the towns of North Norwich, Sherburne, Otselic, Pharsalia, McDonough, and Preston. A narrow strip of the southern part of Madison County, including parts of the towns of Hamilton, Lebanon, and Georgetown appears on the northern part of the sheet.

The country is very hilly and the scenery picturesque. The character of the region is so accurately shown on the map that by the contour lines it is easy to pick out the elevation above sea-level of any particular house, as well as of the hills about it.

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____________________*1903*

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From a photograph taken by Mr Bailey Willis

Wapitus Lake and Dutch Miller Pass, Washington

"Our scenery from the White Mountains to the Pacific Coast Ranges may be included among our resources, as substantial a source of gain, as the Alps of Switzerland, which bring into that country millions of dollars every year."

Vol. XIV, No. 5 WASHINGTON May, 1903

THE NATIONAL GEOGRAPHIC MAGAZINE

"THE UNITED STATES—LAND AND WATERS"*

By Cyrus C. Adams,

Author of "Commercial Geography," etc., etc.

MANY foreigners who cross our country are impressed by two facts: its vast extent and its very apparent sparsity of population away from a few great centers. We are among the most populous nations in the world but our domain south of Canada is so great that with all our 77,000,000 people we have an average density of population of only about twenty-eight to the square mile, in which respect we are comparable with Norway, one of the most thinly peopled countries of Europe. That part of Great Britain occupied by England is one of the most densely peopled regions in the world; but if England had only our density of population its inhabitants would number less than one-fourth the number in Greater London.

GREAT DENSITY OF POPULATION

We have really no conception derived from our experience at home of what great density of population means. Perhaps the following facts may give a vivid idea of it. If we were to crowd our 77,000,000 people into Texas and add to them 40,000,000 more we should have a density of population in that state comparable with that of the lower Yangtse valley and the great eastern plain of China between the Yangtse and the Hoang rivers. But human experience has recently recorded a still greater density of population than this, and the following is deduced from the census taken last year by the Chinese government and already accepted by statisticians as a fair approximation of the number of persons in China. If we were to place in Texas double the population of the United States, or, say, 150,000,000 persons, we should have in that state approximately the density of population that is to be found in the Shantung province. Our nation may never be called upon to confront

*An address before the National Geographic Society, February 10, 1903. This is the first of a series of articles on the United States which are to be published in the succeeding numbers of this Magazine.

the problems growing out of such a prodigious congestion of humanity as this; and these illustrations of great density of population are given here only to show one aspect of our enormous territory. China is not half so large as our country and its natural resources, area for area, are no greater than our own; so the 408,000,000 souls in China proper at least give emphasis to the thought that we have as yet scarcely began to scratch the surface of the capacity of this country to support many times its present number of inhabitants.

OUR DIVERSITY OF CLIMATE AND PRODUCTS

Another influence of our vast area is permanent, far-reaching and most significant. The United States extending from ocean to ocean reaching far into the north and far into the south, with vast areas only 1,000 feet or less above the sea and others of high altitude, has great variety of climatic conditions and therefore great diversity of products; so that we grow nearly all the commodities of the temperate and subtropical zones, and not a few products of the tropical zone. We raise the citrus fruits of the Mediterranean, the figs of Smyrna and the dates of the Persian Gulf. We find that we can grow the famous Sumatra tobacco which we still import to the amount of millions of dollars every year; that we can produce Egyptian cotton, and Egypt does not raise all that the world would like to consume of that unique and superior fiber. This diversity of products and our large mineral resources make the country practically self-sufficient. No nation can become self-sufficient unless it reaches across a continent and embraces a wide latitude like the Russian Empire, Australia and the United States. We really need to import very little except certain raw materials from the tropics which our own colonial possessions may some day supply.

SOME ADVANTAGES OF OUR GEOGRAPHIC POSITION

We may properly treat not only the vast extent of our country, but also its situation with respect to other nations as among the geographic elements that have helped our material development, which is the topic assigned to me. It is to our advantage that we are on the same side of the tropics with the nations that are the greatest buyers of the bread and meat stuffs and other commodities we have to sell. It is a great disadvantage to be compelled to carry perishable commodities across the tropics. India raises large quantities of wheat and Europe would have been glad, many years ago, to buy Indian wheat; but before the Suez Canal was built India could not export this breadstuff to Europe. Steamers could not carry the wheat because, to double the south end of Africa, they had to recoal at St. Helena or Cape Town and coal was very dear for it was brought from Europe 5,000 or 6,000 miles away; the cost of the trip was very high and wheat being a cheap and heavy commodity can never be transported far at high freight rates. Wheat often sells for sixty cents a bushel in Chicago, and unless rates are cheap it cannot be moved. Neither could sailing vessels carry the Indian crop because they moved slowly through the hot latitudes both of the Indian and Atlantic Oceans and by the time the long journey was over the deterioration of the grain rendered it almost unsuitable for flour. But when the Suez Canal was opened India could send her wheat to Europe by steam and the problem was solved.

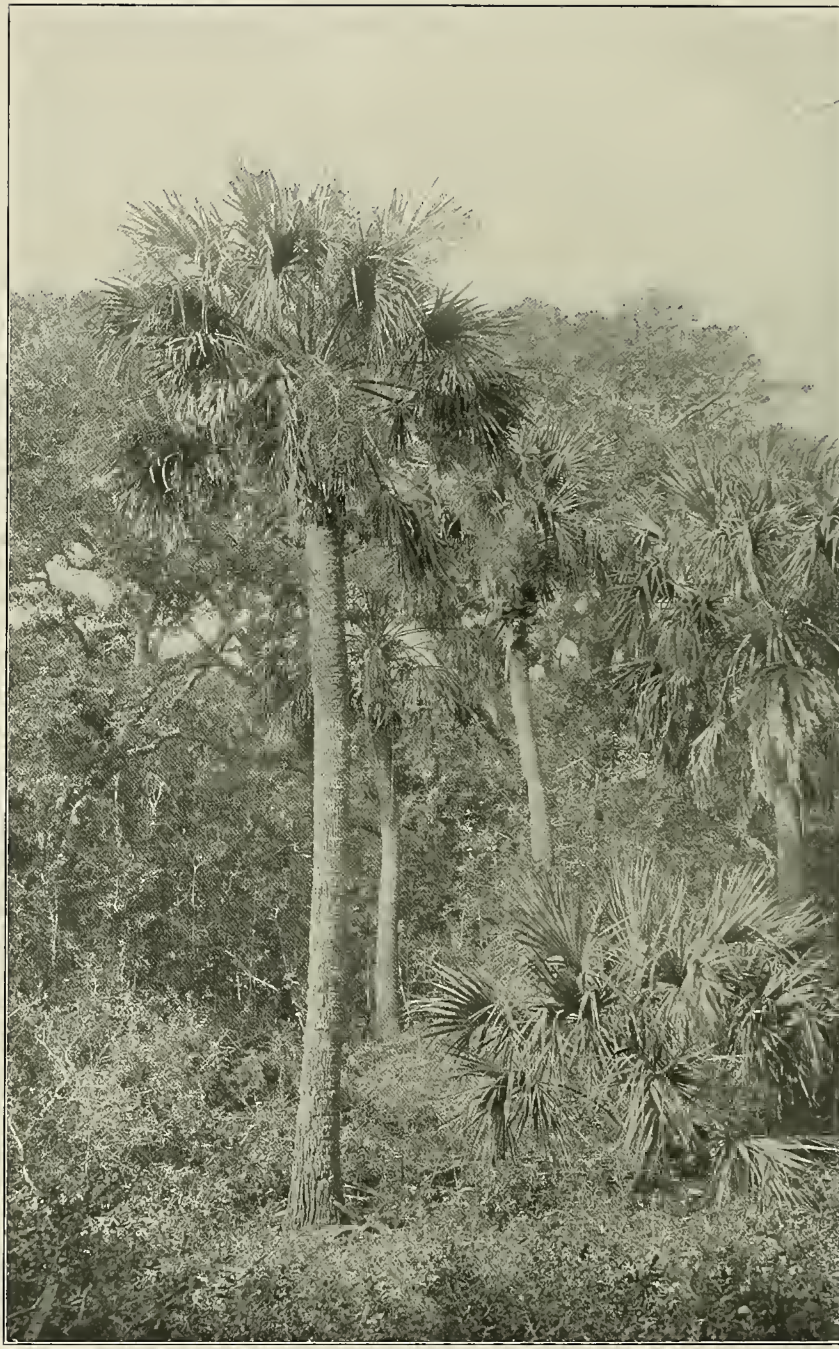
Before the days of refrigeration meat could not be sent to markets across the tropics; but even with refrigeration it is a great disadvantage to be compelled to freeze meats solidly in order to insure their good condition upon reaching the consumer. There is much prejudice against frozen meats in some parts of Europe, particularly in Germany, but consumers there are willing to buy enormous quantities of our chilled meats, which, they assert, are superior in quality to the frozen article. We are not compelled to freeze our meats to send them to Europe but the consignments are placed on steamships in chilled rooms whose low but not freezing temperature keeps them in good condition. When we remember that our foreign meat trade is a very important element in our commerce we can realize the inestimable advantage of not being compelled to carry this commodity across the tropics.

The United States, as well as all the other greatest commercial nations, fronts on the Atlantic making that ocean the preëminent highway of sea trade. A few years ago, a patient and laborious German set himself the task of ascertaining approximately the amount of business activity on the Atlantic. After collecting many facts he reached the conclusion that there are always afloat on that ocean about 50,000 vessels of one sort or another and that its floating population is constantly about 300,000 human beings. The value of the Atlantic for sea trade is increased by the fact that most of the great navigable rivers belong to the Atlantic drainage basin. All the great rivers of Europe, except the Volga, of Africa, except the Zambesi, and of America south of Alaska are tributary to the Atlantic. The Yangtse of China is the only river of the first class and of great commercial importance that is tributary to the Pacific. The Indian Ocean finds feeders for its trade in the Menam, the Irawadi, the Ganges and the Indus; but the great rivers of northern Asia are frozen two-thirds of the year and empty into seas that are likely to be ice-choked at all seasons. We shall see a little later how wonderfully helpful are our rivers in contributing to our large share in the sea trade of the Atlantic.

HARBORS OF THE UNITED STATES

We are blessed with an abundance of good natural harbors to serve our commerce on this highway. Most of the largest and best of them are exactly where they may best serve our trade—on our northeast coast fronting the greatest commercial nations of Europe, with whom we have the largest dealings. On the whole, our harbors are naturally better than those of Europe; the result is that though nearly all harbors require large expenditure to fit them for shipping and to make good the deterioration that is constantly in progress, our disbursements for these purposes are not nearly so great as they are in Europe. Since the Coast and Geodetic Survey was organized New York Bay has been resurveyed five times to indicate the positions of needed improvements. The work of deepening and extending the channels of New York Harbor in progress for several years past may cost from $7,000,000 to $8,000,000 before it is completed ; but Liverpool Harbor has cost, from first to last, over $200,000,000, more than half of which has been expended in the last forty-five years.

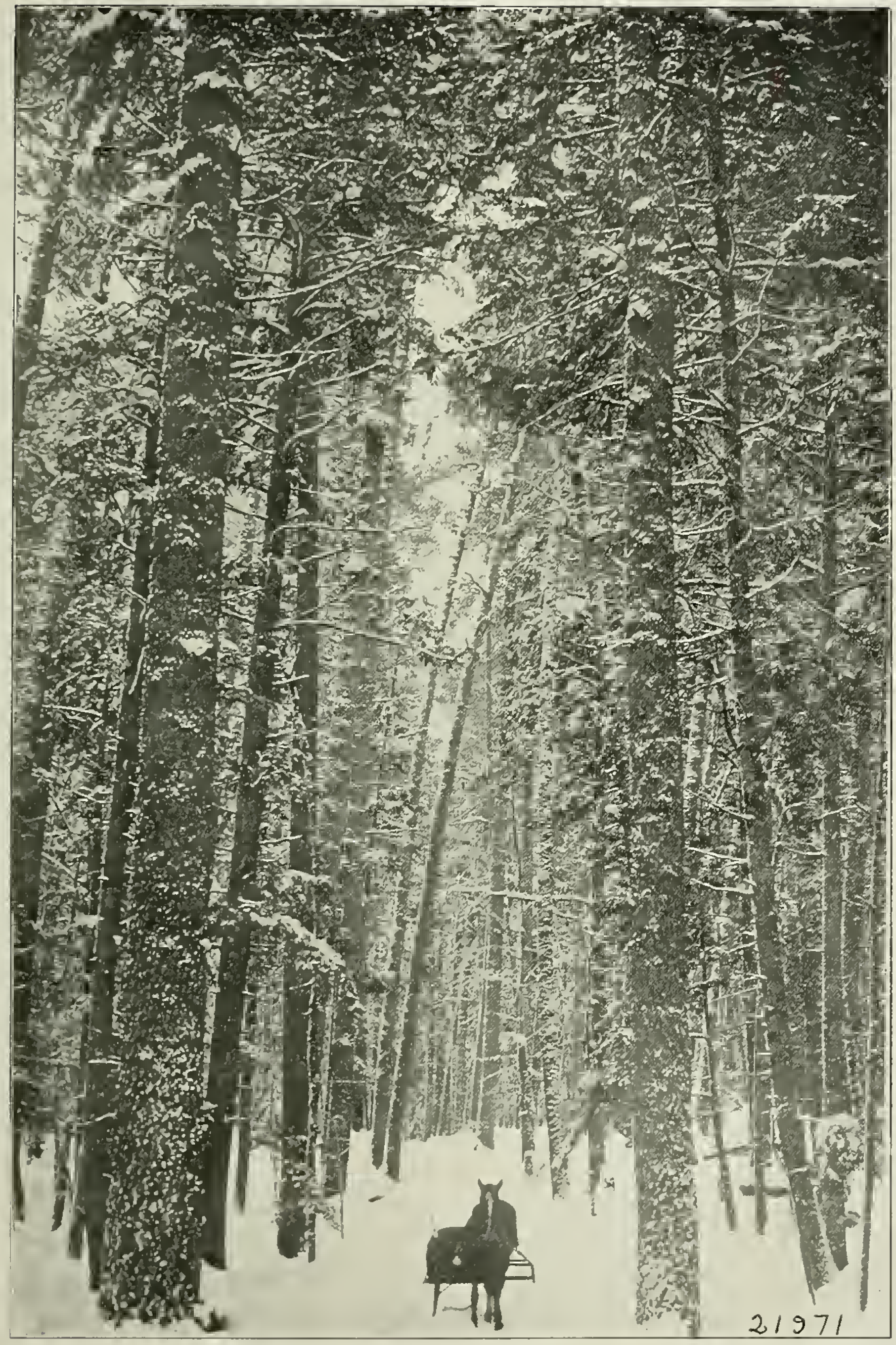
The great distinction between our leading seaports and those of Europe is that we have only to improve our natural harbors while the nations over the sea must make their great ports. Europe can show no ports like those of Puget Sound and San Francisco which will admit the largest vessels without deepening the channel ; and our other largest ports may attain the same degree of efficiency at a total cost that seems small in comparison with the vast sums spent at Liverpool alone. London, Newcastle and Cardiff, as seaports, are largely artificial creations, the result of improvements made at enormous cost. The port of London extends from London Bridge to the mouth of the Thames but no vessel drawing more than 26 feet can ascend to London except at high tide ; at other times large ships must stop at Tilbury Docks, 35 miles down the river. Glasgow deepened and widened the little ditch of the Clyde till



From Gilbert and Brigham's "Introduction to Physical Geography," D. Appleton & Co.

Among the Palmettos of Florida

The great diversity of our climate is well illustrated by the contrast of this and the succeeding picture



From U. S. Census Office

In the White Pine Forests of Michigan

it was transformed into a ship-floating river. All the Baltic ports of Germany are more or less obstructed by ice in winter, nor do her great North Sea ports always escape this inconvenience; for this reason Hamburg and Bremen require outports and Bremen must have an outport all the time because the larger vessels cannot ascend to the city. We have no port like that of Valparaiso, Chile—a splendid harbor save for the vital defect that the entrance from the sea is so wide that storms invade it and endanger shipping. We have no need for such a splendid example of engineering art as the great breakwater at Cherbourg which without this protection would be a dangerous roadstead. The North American seaboard shows no conspicuous example of the artificial harbor so common in other countries except at Vera Cruz which has just been turned by the labor of years into a good and commodious port.

TYPES OF HARBORS

Most of our Atlantic coast is low and presents all the prominent types of natural harbors. We know that large areas of the earth's surface are very slowly subjected to vertical movements, being uplifted above their former level or depressed beneath it; and that these movements are best observed along the margins of the sea. We speak, for example, of the uplifting of a part of the coast of Scandinavia, and of the sinking of the coast of New Jersey. In the course of the depression of the coast line the sea invades the valleys, widening and deepening them, and turning some of them into deep water harbors which are called Drowned Valley Harbors. When the sea burst over the barrier at the Golden Gate it turned the valley on which San Francisco stands into one of the finest drowned valley harbors in the world. New York is another example of a drowned valley harbor, which, wherever found, are among the best natural harbors. We see another form of the drowned valley harbor in the fiords of the Maine coast, long, narrow and deep, with this disadvantage that, when their entrances are funnel-shaped, the incoming tide rises very rapidly and high so that the difference between mean high and low tide in some of our Maine ports is as much as 20 feet which is an inconvenience to shipping. The difference between mean high and low tide at New York is only a little over 4 feet.

The barrier harbor is also well represented on our eastern seaboard; thus we may speak of Boston harbor as being protected from sea storms by the cluster of islands at its mouth; and of the numerous smaller ports of the south Atlantic coast as sheltered from the ocean by the sand reefs that extend brokenly along the front of our coast from Long Island to Florida.

River ports such as Philadelphia and New Orleans and ports at the head of deep embayments, as Baltimore, permit ocean vessels to penetrate a considerable distance into the land which is an advantage because ocean freights are cheaper than those of the land routes. Baltimore, 140 miles from the sea, is nearer to the Mississippi valley than is New York.

Our Pacific coast, unlike our eastern seaboard, is high and rocky and has only four fine harbor centers but they are so distributed as to serve adequately all the purposes of our Pacific trade. Puget Sound, one of the most useful of inlets, has scores of miles of shoreline along which the water is so deep that docks might be built anywhere for the largest vessels. The fine river port of Portland supplements the Puget Sound ports in the northern trade, San Francisco is the great central gateway of the Pacific commerce and San Diego, at the extreme southwestern corner of the country, with a landlocked harbor in which the government has been making great improvements, is nearest to the cotton-fields and is becoming important in the shipment of raw cotton and cotton fabrics for the Oriental market.

When a steamship leaves Seattle in summer the crowded decks and docks resemble the busy and inspiring scene upon the departure of an Atlantic liner at New York. The fact that most of those passengers are not going to seek gold should convince us that it is time to count scenery among the important assets of the country. Every year increasing crowds are drawn to Alaska by the mighty glaciers, the rugged fiords, the snow mountains and the splendid, bracing air in that part of our domain. Among our western mountains men are now building hotels, making roads, cutting paths and procuring guides, so that scenery may be enjoyed to the best advantage and under comfortable circumstances. Our scenery, from the White Mountains to the Pacific coast ranges, may be included among our resources, as substantial a source of gain as the Alps of Switzerland which bring into that country millions of dollars every year.

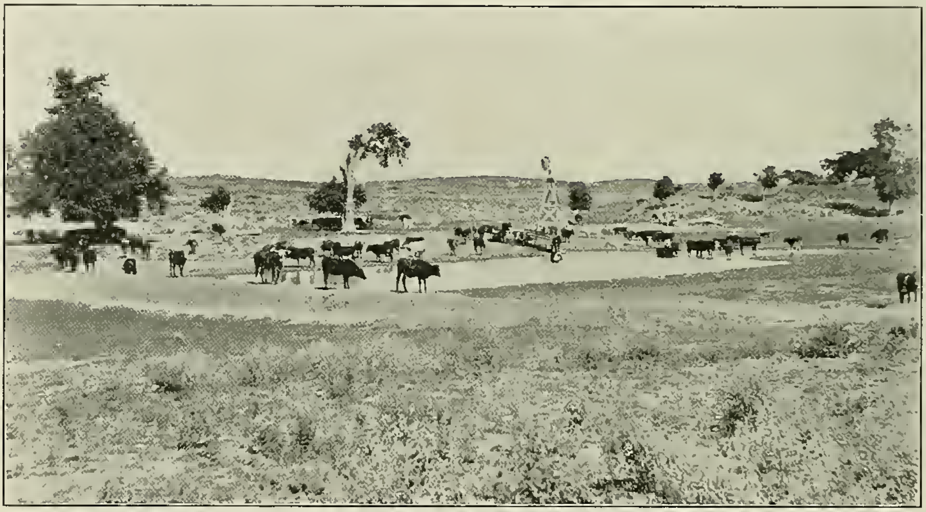
From Geo. M. Weister

Portland, Oregon, Mt Hood in the Distance

"Our Pacific coast, unlike our eastern seaboard, is high and rocky"

OUR COASTAL PLAINS

The United States, in the main, is a great central plain bordered on the east by mountains of no great elevation, and on the west by plateaus and mountains of high elevation; with narrow eastern and broad southern coastal plains; with most of the rivers that are important in an economic sense confined to the eastern half of the country; and with inland seas providing the cheapest transportation known excepting on the oceans. All these topographic features have had a profound influence in distributing our industries and shaping our development.



From Willard D. Johnson, U. S. Geological Survey

On the High Plains, Western Kansas

Large areas of our high plains are being reclaimed by artesian wells, which enable ranchmen to establish stock-watering points at comparatively close intervals

Probably no other coastal plain has so advantageous a position and so many elements that conduce to prosperity as the plain along our Atlantic seaboard. The waste brought down from the mountains on the west has contributed to its fertility and made it a meridional zone of fruits and vegetables, cereals and hay. At its western edge are the clays used in the development of the largest pottery industries of the country. Nearer the sea is the long sandy zone which, south of Virginia, supplies large quantities of lumber and naval stores; and on the sea edge are the swamps which, when reclaimed, are extremely fertile. Where the softer plain joins the harder rocks of the Appalachian belt the rivers crossing from the harder to the more yielding rocks have made a line of waterfalls beside which many thriving towns and cities have been reared to use this power in manufacturing; and along these narrow belts of manifold resources and industries extend railroads easily built because they met few natural obstructions and leading straight to the great cities of the north that are the preëminent markets for most of these commodities.

THE GREAT VALLEY, PLAINS, AND PLATEAUS

The broader southern plain along the Gulf is a great region of the lumber industry with a product of nearly $2,000,000 a year, of agriculture and chiefly of cotton-raising for this is a part of the great cotton belt. The plain merges with the Mississippi Valley which from our northern border to the Gulf is the preëminent agricultural zone of the country, the northern part of it, mantled with the fertile rock mixtures of the glacial drift, the richest area of wheat and maize in the world; the southern part, included in the cotton belt, which supplies nearly three-fourths of the world's cotton; and in the border lands between them a zone of tobacco cultivation, our largest area devoted to this crop.

have been much impaired by overgrazing and must be nursed back to their former productivity. Just as the nibbling sheep have destroyed all verdure on the mountains of Greece so they have been very effective in killing out much of the nutritious bunch and other grasses on the plains and among the mountain pastures farther west. The plains gradually rise till they merge with the Great Plateaus which embrace about a third of the country and with their surmounting mountains extend nearly to the Pacific. They are the largest sources of our precious metals

From Willard D. Johnson, U. S. Geological Survey

A Field of Watermelons, Western Kansas

West of the Great Valley the plains begin to rise midway between the two oceans. It is to be observed that the main axes of all our predominant topographic features extend north and south excepting the Great Lakes whose main axis is east and west. The plains extending from Canada to Mexico and gradually rising to the western plateaus are the largest field of the grazing industry which has long supplied most of our export beef though not our export cattle, the greater number of which are fattened in the corn belt. The plains

in whose production we have for many years usually surpassed other nations.

UTILITY OF OUR MOUNTAINS

We must count mountains as among our greatest blessings. While our valleys and plains are the sources of most of the food for man and beast it is from the mountains that we derive a very large part of our metals and other minerals. If we had a great mountain wall stretching from east to west we might be shielded from the Arctic blasts that sweep down from the plains of Canada

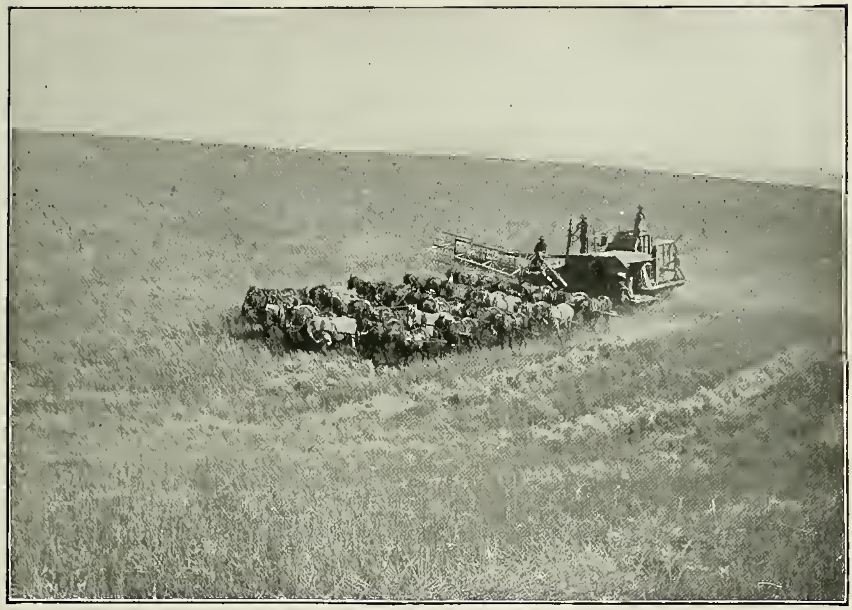
From F. H. Newell, U. S. Geological Survey

A Band of About 2,000 Sheep Grazing on the Mountain Slopes of Oregon, About 6,000 Feet Above Sea-level

"Our mountains, though of little use for agriculture, provide a large amount of fine grazing land."

in winter and chill us to the bone. We know that northern India is thus protected by the Himalayas and northern Italy by the Alps so that the average winter temperature on the French and Italian Riviera is warmer than at Rome. It is questionable however whether such a climatic barrier would be of any advantage to us as a people for our diversity of climate tends to intensify stamina and energy. Our mountains are the largest sources of water power which is more valuable than ever now that electricity is used for the transmission of power. They add largely to our timber resources and though of little use for agriculture they provide a large amount of fine grazing land. Their rock waste is spread over the surrounding plains to their enrichment and they husband our water resources where they are most needed. It is among the mountains that reservoirs are to be built to conserve water from the melting snows and glaciers and advantageously distribute it over the regions to be irrigated which, it is estimated, may reclaim 50,000,000 acres to fertility.

Our mountains are partly responsible for the prevailing aridity of the plateau region for though the Pacific coast from Puget Sound to a little south of San Francisco has abundant precipitation the rain clouds are wrung nearly dry among the mountains so that there is little moisture left to distribute over the plains east of them ; but nearly half of our Pacific coast to the south of San Francisco is in the zone of the northeast trade winds which girdle the world in the Northern Hemisphere, blowing most of the time as dry winds off the land instead of coming to the land as moist winds from the sea; so that even if there were no high mountains in the southern part of California the adjacent country



From M. A. Carleton, U. S. Department of Agriculture

Combined Harvester-Thresher on One of the Vast Wheat Fields of the West

would derive little rain from the Pacific. We are indebted to these southwestern Cordilleras for the fact that the rainfall they conserve may be led down to the California valleys turning them into areas of wonderful fertility, the great centers of our home production of semi-tropical and some other fruits. We remember the time when the "Great American Desert" was spread over most of the western part of our maps. It has now shrunk to very small proportions indeed; and the drier regions of the country will some day be eliminated as far as water can be obtained for their reclamation.

DISTRIBUTION OF RAINFALL

At least 20 inches of rainfall a year are required to make farming fairly profitable and this is a scanty supply. Nearly double that quantity falls in the half of the country lying east of the 100th meridian and along the northern three-fifths of the Pacific coast, and to these regions is confined nearly our entire development of agriculture excepting where stock is fed on the plains or crops are irrigated. The profound influence which this unequal distribution of rainfall has had upon our lordship over the domain committed to us is shown on many maps. A map showing our density of population usually leaves white most of the vast region west of the 100th parallel; a map showing the distribution of our swine industry shows its western frontier in central Nebraska, Kansas and Texas because we fatten hogs on maize which requires abundant moisture; a map illustrating cattle industries shows, the limit far to the west of the region of swine for cattle can thrive on grasses of the plains though we drive many of them into the corn belt to fatten. A map showing the larger phases of our manufacturing development practically coincides with those colors on a density-of-population map showing forty or more inhabitants to a square mile. Naturally we have not developed large manufacturing in areas that average a fewer number of persons. If we look at a map of our irrigation centers we may see today a large number of them scattered over the plateau region. But those dots represent only small areas of irrigated land. Perhaps we shall never see the irrigation centers largelyincreased in number but many of the dots on the present maps will spread out into broad or long patches of color representing very important areas of reclaimed lands.

RIVER VALLEYS AS LINES OF DEVELOPMENT

River valleys have always facilitated the advance of man into the interior of the continents and for this reason the Nile, the Euphrates, the Ganges and other great rivers are spoken of as the creators of history. Exploration is usually retarded wherever physical obstacles make it very difficult to ascend the rivers, such as the rapids of the Mekong and the Congo; the latter river was known less than 200 miles from its mouth until Stanley launched his boats on the upper river and floated down the stream. Our rivers also have been the creators of history. Just as the Jesuit Fathers paddled their canoes up the St. Lawrence and the Ottawa, carried them across portages to rivers leading to the Great Lakes, followed up the western tributaries of Lake Michigan and finally pushed their little craft into the current of the Mississippi, so our forefathers used the rivers and lakes to push their hamlets and their farm lands inland; and reaching out on both sides of the waterways they found new opportunities for settlement and enterprise. The old Dutch burghers lined the Hudson with their farms and villages. In the course of time the settlements spread farther and farther from the river edge. The pioneers, for example, pushed up on the great limestone plateau of the Catskills to see what they might find. They discovered fine forests of hemlock and the day came when immigrants from Connecticut and other regions went to the Catskills for the primary purpose of using hemlock bark to turn into leather the hides produced by farmers. As the population of the valley steadily increased it was certain that a town would rise at the head of navigation on the Hudson; for wherever an important amount of transshipment of freight between land and water is made there must be freight handlers, blacksmith shops, living accommodations, and fodder and shelter for animals; a town is sure to rise at such a place and thus Albany and Troy were founded at the head of navigation. The valley of the Mohawk was discovered opening an easy route of penetration to the west. The gradually growing stream of immigrants pushed westward clearing farms and founding settlements along the Mohawk; following up a little tributary of the river some of them made their way into the forests of Fulton county where, finding plenty of deer, they began to dress buckskin and make gloves for which they found a ready market. The farmers' wives and daughters took up the industry in increasing numbers and finally skilled labor from Europe came over and taught better methods of glove-making; so the industry grew until today we have Gloversville and the towns around it, the greatest centers of glove-making in the country.

Entering the Onondaga valley from the Mohawk the pioneers found the salt springs of Syracuse, long the largest source of salt in the country; Oswego on lake Ontario is one of the oldest settlements in New York because the early farmers found along the Oswego river a natural route of penetration from Syra-

From "Commercial Geography," by Cyrus C. Adams. D. Appleton & Co.

On the basis of three feet as the minimum depth of navigability, the rivers of the United States afford over 14,000 miles of navigation, measured in straight lines, and much more following the sinuosities of the streams.

cuse to the lake. Farther west they came to the Genesee river which they followed scores of miles to the south making its valley, for many years, the largest region of wheat in the country; so they pushed steadily westward opening farms and planting towns along the lakes and the rivers flowing into them.

The facts of nature pointed unmistakably to the appropriate sites for towns. As the pioneers floated down the Ohio they came to the great bend of the river where it changes its course from northwest to southwest. When settlement spread away from the river not all the freight floated down the stream was destined for places farther southwest. There were towns to the northwest to be supplied and transshipment of freight to land routes was necessary; at this place of transshipment the city of Cincinnati arose. Still farther down the Ohio the river was impeded by rapids making another transshipment of freight necessary and this fact resulted in the city of Louisville.

If we were to trace the history of our entire material progress we should find that the waterways of the eastern half of the country have been the main factors in determining the lines of development. Those persons who were able to interpret the meaning of the natural facts presented for their study have reaped large rewards. A young farmer started from St. Paul one day on a little steamer that was to be pushed as far up the Minnesota River as possible. He was looking for some very desirable preëmption claim on which to begin farming. When the steamer finally stuck in the mud he said to himself: "It is right here that I want my 160 acres." He filed his claim and farmed the land till he sold it about ten years later for $25,000 to be divided into lots for the town of St. Peter which was rising at the head of navigation.

No great country, however extensive its railroad facilities may be, can afford to neglect its water highways. Notwithstanding our river and harbor bills and our Mississippi Commission we know little as yet of the scientific development of waterways for commercial purposes as it is understood in all the countries of northwestern and north-central Europe where boats freighted on the Vistula in Russia may reach, through rivers and canals, all the leading ports of the Baltic and North Seas. Increasing density of population and towns and cities more thickly scattered over our domain will impress us, as Europe has been impressed, with the absolute necessity of supplementing our railroads with the fullest possible development of our water routes. In the past few years we have seen the Mississippi transforming New Orleans into one of the great wheat ports as well as the greatest cotton port of the world. We see the Ohio and the Mississippi carrying coal, iron and lumber 2,000 miles at a cost very little in excess of ocean freights; and though the Erie Canal, which provides the port of New York with a continuous waterway to Duluth is antiquated and inadequate, it has made the Hudson River, with its 18,000,000 tons of freight a year, the largest commerce carrier among the rivers of America; it was the leading factor in giving to New York a commercial movement nearly equal to that of London. We have witnessed the development of our marine on the Great Lakes where marvelously cheap freights have helped us to compete with the world in iron and steel goods though we carry most of our iron ore nearly 1,000 miles to the coke and limestone required to smelt it.

OUR TOPOGRAPHY FACILITATED RAILROAD DEVELOPMENT

A country as vast as ours and with as small a density of population could not so early have attained its present development if our enormous system of communications had not afforded the lowest land freight routes in the world. A good topographic map shows us that the topography of the country was very favorable for the building of the vast systems of railroads whose mileage, extending to the neighborhood of most of our farms, would stretch nearly from the earth to the moon. There are gateways through our mountain ranges so that none of them is a barrier to commerce. We have no obstacle like the Pyrenees which so completely walls France from Spain that the land traffic between them must be deflected from straight lines to circumvent the extreme ends of the mountains at the edge of the seas. The comparatively level surface of our plains and plateaus, the predominating easy gradients and the mountain passes have helped to cheapen railroad construction and transportation so that commodities may be cheaply moved. Argentina raises its export wheat within fifty miles of tidewater. We send our export wheat 1,000 miles to tidewater but the price of freight has been so cheap that we are able to compete with any nation in the world in exporting this commodity.

What a reservoir for future harvests of breadstuffs is our hard wheat region of Minnesota and the Dakotas, a part of the central plain of North America that is twice as large as Great Britain and Ireland or as New York and New England together, and larger than the German Empire. These three states are producing much more than one-half of the spring wheat of the country and we know that their capacity for production may be more than doubled. The Canadian northwest is boasting that its younger wheat fields are yielding twice as much grain to the acre as our lands; England with less favorable conditions for wheat culture than we enjoy raises more than double the quantity of grain to the acre than we produce.

We may say of our entire agricultural interest that we shall double our production when we improve our methods. We cannot measure yet the potential benefits which our Agricultural Department and the agricultural schools will confer upon the nation by their persistent teaching of scientific methods of tillage. A man near the east end of Long Island is demonstrating every year that the highest grade of farming gives the best profits. He spends money without stint for fertilizers; all his operations are kept to the highest point of efficiency and he is selling his crop of vegetables, the product of 80 acres, at an average figure of $20,000 a year. He is making as much money from the soil as he could from any other business with the same amount of capital.

The mistake is sometimes made of attributing to one factor more than its due share in bringing about the advanced stage of development we have reached. The attention of no American audience, however, needs to be called to the fact that in this nation of highly intelligent laborers, of inventive genius and of boundless energy and ambition, the geographic conditions that have so wonderfully helped us and some of which have been the topic of this brief discourse are only one of the all-potent influences which have advanced us to the rank we occupy among the great nations.

THE CONQUEST OF BUBONIC PLAGUE IN THE PHILIPPINES

THE United States has driven the bubonic plague out of the Philippines as completely as it has swept yellow fever out of Cuba.

The ravages of Asiatic cholera, which have claimed 100,000 victims in the islands, have diverted public attention from a fight against the bubonic plague waged by the health officers of Manila. This remarkable fight has no precedent in the history of the plague. If it had not been for the tireless vigilance and ceaseless war on rats and filth by Dr Meacham and his subordinates a wave of the plague would have swept over Manila and the islands as destructive of life as the cholera itself.

The plague is always present at Hongkong. There is not a day in the year when some plague-stricken wretch is not trying to hide in the densely packed quarters of that city. Manila, 600 miles across the sea, must therefore be constantly on her guard lest the plague slip in on one of the many vessels plying between the two ports.

The day after Christmas, 1899, a man was found in the streets of Manila dead from bubonic plague. The disease had invaded the city and began to spread.

How the plague was fought and beaten is told by Hon. Dean C. Worcester, Secretary of the Interior of the insular government, in his report to the Philippine Commission for 1902.

Bubonic plague was discovered at Manila December 26, 1899, and slowly but steadily increased up to December, 1901.*

The deaths in 1900 numbered 199, and in 1901 reached a total of 432. The disease was at its worst each year during the hot, dry months of March, April, and May, nearly or quite disappearing during September, October, November, and December. It will be noted that the number of cases in 1901 exceeded that in 1900 by 200, while the number of deaths was about two and a half times as great, and the percentage of mortality among persons attacked increased from 73.4 in 1900 to 91.7 in 1901.

This heavy increase in plague for the year 1901 justified the apprehension that a severe epidemic would occur in 1902. Strenuous efforts were made to improve the general sanitary condition of the city, but the habits of the Chinese residents and the lower class of Filipinos were such as to render the enforcement of proper sanitary regulations well-nigh impossible.

On account of the important part which house rats are known to play in the distribution of bubonic plague, a systematic campaign was inaugurated against these rodents in Manila. Policemen, sanitary inspectors, and specially appointed rat-catchers were furnished with traps and poison, and both traps and poison were distributed to private individuals under proper restrictions. A bounty was paid for all rats turned over to the health authorities, and stations were established at convenient points throughout the city where they could be received. *Each rat was tagged with the street and number of the building* or lot from which it came, was dropped into a strong antiseptic solution, and eventually sent to the Biological Laboratory, where it was subjected to a bacteriological examination for plague. During the first two weeks 1.8 per cent of the rats examined were found to be infected. This proportion steadily increased, reaching the alarming maximum of 2.3 per cent in October. At this time numerous rats were found dead of plague in the infected districts, and, in view of the fact that epidemics of plague among the rats of a city in the past have been uniformly followed by epidemics among human beings, the gravest apprehension was felt, the rapid spread of the disease among the rats after the weather had become comparatively dry being a particularly unfavorable symptom.

It was deemed necessary to prepare to deal with a severe epidemic, and a permanent detention camp, capable of accommodating 1,500 persons, was accordingly established on the grounds of the San Lazaro Hospital. Hoping against hope, the board of health redoubled its efforts to combat the disease. The force of sanitary inspectors was greatly increased, and under the able supervision of Dr Meacham their work was brought to a high degree of efficiency. Frequent house-to-house inspections were made in all parts of the city where the disease was known to exist. The sick were removed to the hospital if practicable; otherwise they were cared for where found and the spread of infection guarded against.

Plague houses were thoroughly disinfected, and their owners were compelled, under the direction of the assistant sani-

* The deaths by months were :

Months.	Cases.		
	1900.	1901.	1902.
January	18	7	....
February	48	27	1
March	64	63	2
April	54	111	....
May	22	137	....
June	19	35	....
July	13	39	....
August	18	34	....
September	6	8	....
October	7	8	....
November	1	....	....
December	1	2	....
Total	271	471	3

tary engineer, to make necessary alterations. Cement ground floors were laid, double walls and double ceilings, affording a refuge for rats, were removed, defects in plumbing were remedied, whitewash was liberally used, and, in general, nothing was left undone that could render buildings where plague had occurred safe for human occupancy. Buildings incapable of thorough disinfection and renovation were destroyed. *Buildings in which plague rats were taken were treated exactly as were those where the disease attacked the human occupants. The bacteriological examination of rats enabled the board of health to follow the pest into its most secret haunts and fight it there*, and was the most important factor in the winning of the great success which was ultimately achieved.

With very few exceptions, there was no recurrence of plague in buildings which had been disinfected and renovated. As center after center of infection was found and destroyed the percentage of diseased rats began to decrease, and in January, 1902, when, judging from the history of previous years, plague should have again begun to spread among human beings, there was not a single case. In February one case occurred. In March there were two cases, as against 63 in March of the preceding year, and before April the disease had completely disappeared.

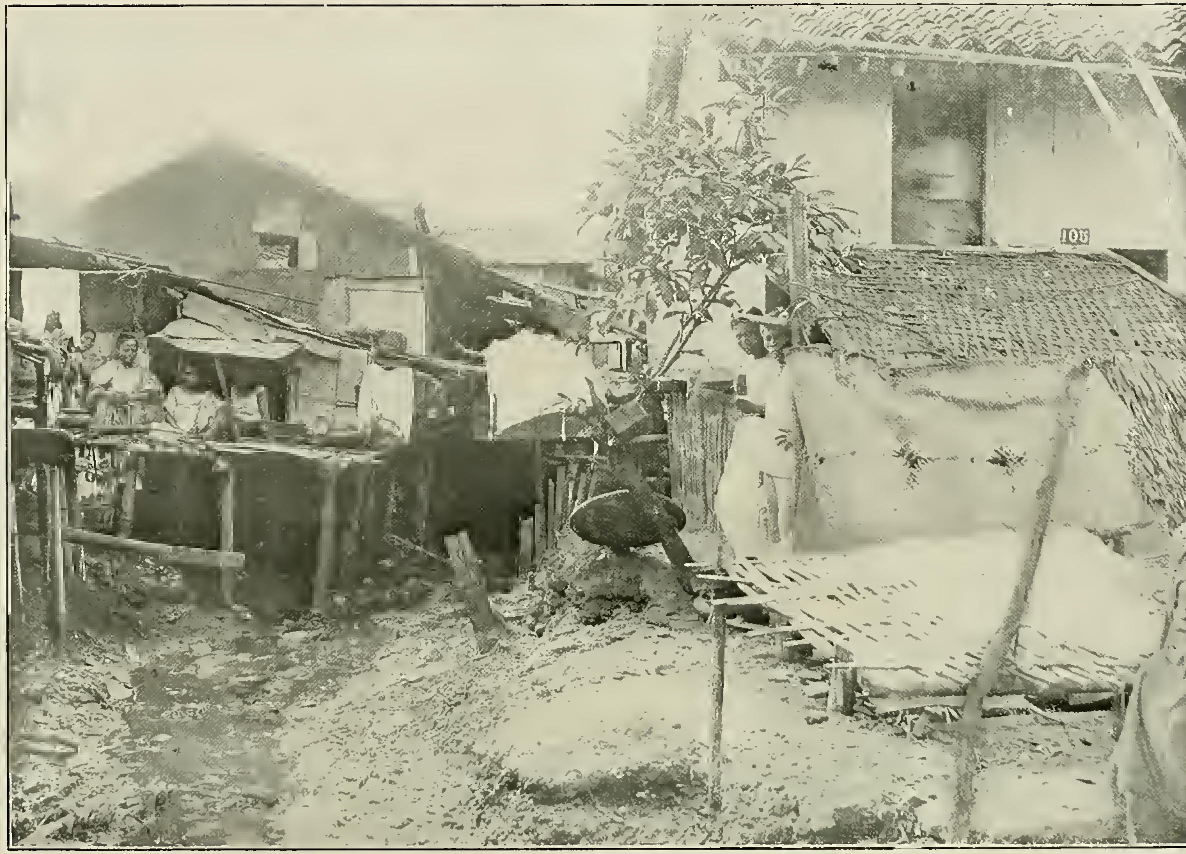
This result, brought about at a time when the epidemic would, if unchecked, have reached its height for the year, marked the end of a fight begun by the board of health on the day of its organization and prosecuted unremittingly under adverse conditions for seven months with a degree of success which *has not been equaled under similar conditions in the history of bubonic plague.*

Especial credit is due to Chief Health Inspector Meacham for the ingenuity which he displayed in devising means for the destruction of rats and for the tireless energy with which he devoted himself to securing their adoption, and to increasing the efficiency of his force of inspectors, as well as to Drs. J. W. Jobling and Edward A. Southall and their assistants, who worked unremittingly at the uncongenial and dangerous task of making a bacteriological examination of rats, a large proportion of which were putrid, while not a few of them were infected with one of the most fatal of diseases. This work was of necessity conducted in the inadequate building in which it has been necessary temporarily to house the bureau of government laboratories, in close proximity to the civil hospital. The fact that not a single case of infection occurred among the laboratory force or the inmates of the hospital is sufficient commentary upon the care with which it was performed.

During 1901 plague appeared at several points in the provinces near Manila. Agents of the board of health were promptly dispatched to the infected municipalities and radical remedial measures were adopted, including in several instances the burning of infected buildings, the result being *the complete disappearance of plague in the provinces as well as in Manila.**

A few figures will still further impress the American with the magnitude of this fight by his representatives in the Philippines. Of the 60,000 rats caught, tagged, and sent to the laboratory, 40,666 were examined microscopically for bacilli, and of these 242 were found infested with plague. During one month 65,379 traps were set and 403,789 plates of rat bane placed by the rat-catching squads, who had a special uniform and cap. The kind of poison had to be frequently changed, as the rats were very wary and suspicious. It is estimated that several hundred thousand rats were killed by the poison;

* Report of the Philippine Commission for 1902, vol. I, pp. 263–265. Government Printing Office, 1903.



TYPICAL CHOLERA HOUSE, OVER FILTHY OPEN DRAIN.

No. 1.—This picture and the several succeeding illustrations show the abominable shacks—hot-houses for bubonic plague and Asiatic cholera—which form such a large proportion of the habitations of Manila. There are 18,463 buildings in the city, of which 3,739 are good, 1,135 bad, 1,472 small, and 12,117 classed as shacks.

TYPICAL NATIVE WATER-CLOSETS.

No. 2.—Manila has no sewage system, though it has a population of 250,000. When the Americans assumed control all drainage was by open conduits. Many of these conduits have since been covered over. Arrangements like those which are shown here occur at frequent intervals along the shore, and are breeding places of disease.

A TYPICAL CHOLERA CENTER.

No. 3.—When the cholera invaded the city these pestholes were burned, the owners being in every case reimbursed for their loss.

FAROLA DISTRICT AFTER BURNING OF INFECTED BUILDINGS.

No. 4.—The municipal authorities are making the experiment of building model tenement-houses on some of these burned areas. The people pay the same rent that they formerly did in their wretched shacks.

NATIVE MARKET, SHOWING "SHACKS" BACKING UP AGAINST FILTHY OPEN DRAIN.

No. 5.—It is believed that cholera was introduced into Manila in some vegetables imported from China. Market places like this quickly helped to spread the disease. The authorities caused them to be abandoned and remodeled or rebuilt them.

DIVISORIA MARKET.

Completed November 11, 1901. Cost $155,469.50.

No. 6.—The municipal authorities have built four new markets in Manila, of which the Divisoria is the largest. The markets are not only sanitary, but are sufficiently profitable to pay interest on the money spent on their construction.

BOARD OF HEALTH FOR THE PHILIPPINE ISLANDS AND PRESIDENTS OF PROVINCIAL BOARDS OF HEALTH.

No. 7.

600 houses were remodeled, cleaned, and made habitable, and hundreds of shacks burned to the ground. In addition to all this, a systematic effort was made to immunize the susceptibles of Manila against bubonic plague by means of the Shiga antipestic vaccine. The work was begun on the 15th of January, 1902. From that date until the 15th of March over 25,000 persons were inoculated. The lower classes, including the Chinese, cocheros, laborers, servants, peddlers, etc., with their wives and children, who are the occupants of the lower floors and nipa houses, were especially selected for immunization. The government laboratory furnished from two to three hundred doses of the antipestic vaccine daily, but on account of the large number requiring immunization, it was necessary to cable Professor Kitasato, of Tokyo, for additional vaccine, and 50,000 doses were received from that source. The work was performed by native physicians, under the direction of Dr J. V. Tormey, medical inspector.

This long fight without rest day or night had told on Dr Meacham. When the battle was over and the plague had been driven from its last haunt, he collapsed. His strength was exhausted, he was unable to fight for himself, and died on April 14, 1902. It is unfortunate for the United States that the man who freed the Philippines of bubonic plague, Dr Franklin R. Meacham, and the man who freed Cuba of yellow fever, Dr Walter Reed, should both pass away the very moment their great work had been accomplished.

The plague had barely been defeated when Asiatic cholera attacked the city. Strict quarantine of infected districts and the burning of them when the disease became too violent, the closing of wells, a careful inspection of all vegetables, and a continuation of the cleansing of the city habitations checked the ravages of the disease, but could not prevent its spread. The water supply was kept from contamination by the rigid patrol of the United States Army, or conditions would have been many times worse. Several thousands died in Manila and about 100,000 in the provinces where the disease could not be controlled.

IMPROVEMENTS IN THE CITY OF MANILA

NO city was ever more in need of playgrounds or recreation fields. The natives of the islands take readily to games, and with little encouragement would become keen rivals in many of the sports at the present time confined to the American and foreign population. Owing to the lack of ordinary healthful exercises and diversion, the great army of clerks and officials and the rapidly increasing American and foreign population find but little to do after office hours beyond going to clubs or driving, and both are expensive amusements.

The board of public works is preparing plans for converting the large field in front of the Luneta, known as Camp Wallace, into a recreation ground open to everyone, where such sports as baseball, football, cricket, polo, and lawn tennis may be enjoyed. A part of the field will be devoted to a children's playground, modeled as nearly as possible after similar places in the United States. There is in preparation a plan for a city park, laid out with broad drives and walks, and also an aviary and zoölogical reserve, and all other elements of a modern park. With

STREET WORK, CARRIED ON BY FILIPINOS UNDER AMERICAN INSPECTORS, SHOWING HEAVY STONES USED IN RAISING THE STREET ABOVE THE LOW GROUND.

No. 8.—All the streets in Manila have been reconstructed since American acquisition. New roads and new bridges are being built wherever practicable. Harbors are being dredged, and breakwaters and other safeguards to shipping being constructed. All the funds for these improvements come from the insular revenue, which has been considerably increased by a slight land tax. Recently franchises were granted an American syndicate to put in an electric car and lighting service for Manila. The work is to be completed in two years. The fire department has been improved, and will soon compare favorably with the systems in the United States.

the building of the electric railroad such places will be accessible to every-one.

The botanical gardens on the Paseo de Bagumbayan have been improved and extended until they approach their former state under Spanish management. Originally this park had many beautiful trees and plants and a splendid collection of orchids, but nearly all of these, with the exception of the larger trees, were destroyed during the siege of the city and the insurrection. During the last few months the deer park has been completed, neatly fenced with wire, and stocked with a number of deer of different kinds from the various islands of the archipelago. There is also a monkey cage, and from time to time the animals and buildings are being added to. This is a very popular resort with all classes, especially the Filipinos.

The department of public works in Manila employs about 1,714 officers, mechanics, and laborers. Laborers are paid $1, 80 cents, and 60 cents per day, while a few subordinate assistants receive 50 cents and 40 cents a day. Wages are paid monthly. Ordinary labor is plentiful, while skilled labor is scarce. On the whole, Filipino labor has been very successful, but its value has been considerably hampered by the numerous fiestas and the after effects, such as laziness and extended absences. No Chinese are employed. The day consists of eight hours' work. The labor costs about 25 per cent more than it does in the United States, and is of an inferior quality.

AMERICAN DEVELOPMENT OF THE PHILIPPINES

GOVERNOR TAFT, in his last annual report, states that "the wealth of these islands must always be their agricultural products." Formerly the Filipinos produced enough from their fields and forests to be self-supporting; but as a result of long years of internal disturbances, the loss of 90 per cent of the carabaos from the rinderpest, and the recent devastation by cholera, most of the rice fields and farms have become overgrown with rank vegetation, and lately there has been widespread famine. Congress at its last session appropriated $3,000,000 to relieve the distress in the islands. Half of this sum will be used immediately to import thousands of carabaos from Ceylon and India to be sold to the people at cost price.

Meanwhile experts of the insular government have been devising means to help the farmers. A serum has recently been discovered which will protect the carabao inoculated with it from the rinderpest, so that carabaos may now be safely imported. Tubes of locust fungus, obtained from Dr L. O. Howard, of Washington, have been distributed and have checked the plagues of locusts. In one instance 64 bushels of dead locusts were found in the vicinity of a place where eight or ten locusts, infected with the fungus, had been released, and the remainder of the swarm had disappeared. A soil survey has been organized and has begun to examine the land in different sections of the islands to see whether new varieties of plants may not be introduced. Other experts have been trying to improve the native varieties by careful selection. Already the government has received applications asking for information from more than one thousand persons, mainly Filipinos, distributed throughout the archi-

CARRETÓN OR FREIGHT CART DRAWN BY A "CARABAO," DRIVEN BY A NATIVE "CARRETONERO" OR CARTMAN.

The baskets on the cart are made of cane and are called "báquit."

No. 9.—The carabao or water buffalo is the draught animal of the Philippines. He was probably imported originally from India. He is very dependent on his daily mud bath, and will seldom work without it for more than a couple of hours during the heat of the day. He is a wonderful swimmer, and does not hesitate to cross 10 miles of open sea. His hide is exceedingly tough, and a valuable leather is prepared from it, but the flesh is not highly esteemed,

HARROWING A FIELD FOR RICE.

No. 10.—Plowing the rice fields is too heavy work for the small Filipino pony, so the carabao is the only animal available for this purpose in the Philippines. The carabao has not, however, the strength and endurance one would expect from an animal of such huge bulk. If pushed too hard, he is apt to collapse and die of the heat.

STACKING RICE.

No. 11.—Dean C. Worcester states that the carabao has a great prejudice against the smell of a white man, and that in a secluded native village he has sometimes stampeded half the buffaloes in a place by simply walking along its main street.

pelago. Eighteen thousand two hundred and fifty packages of field and garden seeds, including 134 varieties, have been distributed to them. It has been proved that fairly good Irish potatoes and peas will grow in the lowlands near Manila. Beets also do well in the same locality, and radishes are ready for the table in three to four weeks after planting. Improved varieties of oranges and lemons brought from California are flourishing. A new species of wild grape has been discovered in the island of Negros. An effort is being made to improve it sufficiently for cultivation, as no grapes to speak of have heretofore been grown on the islands. Fifty-two fiber-producing plants are known to exist in the Philippines, but only two of these have been of commercial value. Experts are experimenting to see whether some of the other fifty varieties may not also be profitable.

These are only some of the practical devices of the government to better conditions. The wasteful methods of the different industries—such as the gutta-percha, the tobacco, the sugar cane, and the hemp—at present causing a loss of fully 50 per cent in the product, are being corrected by educating the Filipino to a more economical and hence more profitable system.

An experiment station for the growing of rice on a large scale is being established. The present Filipino method of rice growing seems ridiculously antiquated. Every blade of the millions of stalks on a large rice plantation is now planted by hand. The labor is most exhausting, since it must be done in stooping posture, either under the burning sun reflected from the muddy water or under a mighty downpour of rain. Looking over the paddy fields in the month of October, it seems incredible that every blade was planted by hand. An effort is to be made to introduce the American drill for planting. Modern farming implements are being introduced and their use taught the natives. An extensive stock farm for the breeding of draft and dairy animals is also being established. The funds for these experiment stations are advanced by the government, but the stations are intended to be and will doubtless soon become self-supporting.

Professor Worcester believes that the agricultural opportunities in the Philippines for young Americans are considerable. Only a small part of the soil capable of producing sugar, hemp, and tobacco is under cultivation. Large areas of government lands are admirably adapted to the cultivation of cocoanuts, for which there is a large and profitable demand. The trees can be grown readily and with comparatively little danger of loss. Under existing conditions, the minimum annual profit from a fairly good bearing tree is $1 Mexican, and frequently two or three times this amount is realized. Other crops, such as Indian corn and alfalfa, can be grown between the rows of cocoanut trees while the latter are maturing, and used to fatten hogs, which always bring a good price in the Philippine market. The demand for copra in these islands is greatly in excess of the supply and is steadily increasing, while cocoanut oil now sells readily in Manila at $1.25 Mexican per gallon.

The lands along the coast of Mindanao and Paragua are particularly favorable to cocoanut growing, and in the latter island trees are said to come to bearing in four years.

No other country has climate and soil so favorable to cacao growing as Mindanao. The cacao now produced in that island is of superior quality and is nearly all bought up for shipment to Spain, where it brings an especially high price. There are numerous other regions in the islands where cacao can be raised to great advantage, but there is not today a cacao plantation in the archipelago, the Filipinos having almost invariably con-

PRIMITIVE AGRICULTURE. TAGBANUA WOMEN HARVESTING RICE, CALAMINANES ISLANDS.

No. 12.—The inhabitants of the Calaminanes group spend most of their time in gathering edible birds' nests, sea cucumbers, turtles, shells, and a few pearls, which they sell to passing vessels. Their agricultural methods are exceedingly backward, though the soil of their islands is very fertile.

tented themselves with planting a few scattering bushes, which are left practically without care, to be swamped by brush and preyed upon by insects. Proper harvesting and curing methods are not employed. The fruits are torn from the bushes, injuring the bark and leaving the way open for the attacks of injurious insect pests.

An especially fine coffee is grown in the mountain regions of Benguet and Bontoc and in the province of Lepanto. The bushes yield heavy crops and the unhulled coffee at present sells readily in Manila at $35 Mexican per cavan, for consumption in these islands or for shipment to Spain. Coffee bushes come to bearing in Benguet in three years. There is no region in the United States which has a more healthful or delightful climate than is afforded by the Benguet highlands, where a white man can perform heavy field labor without excessive fatigue or injury to his health.

It is almost impossible to secure in Manila the milk needed by the sick. Fresh milk sells for 75 cents Mexican per wine quart. A dairy on the outskirts of the city, with 95 animals, including several bulls, was netting $5,000 Mexican per month when the animals were attacked by rinderpest.

Fresh meats to the value of $609,664 per annum, exclusive of that used by the Army and Navy, are being imported each year into Manila. There is no reason why in time the islands should not supply this meat. The pastures of Benguet, Lepanto, and Bontoc afford one vast well-watered cattle range, where improved breeds of horned cattle could be successfully introduced, while in the lowlands there are vast stretches of grazing lands suitable for raising cattle and carabaos. The latter are at present worth $150 to $300 Mexican per head in the Manila market. Properly conducted cattle ranches will certainly yield very handsome returns.

Excellent native oranges are produced in the province of Batangas, in the Calamianes Islands, and elsewhere. The trees, which are often large and vigorous, seldom receive any care, nor has any systematic effort been made to improve the quality of the fruit, which sells readily at a good price. There is every reason to believe that improved citrus fruits can be successfully introduced.

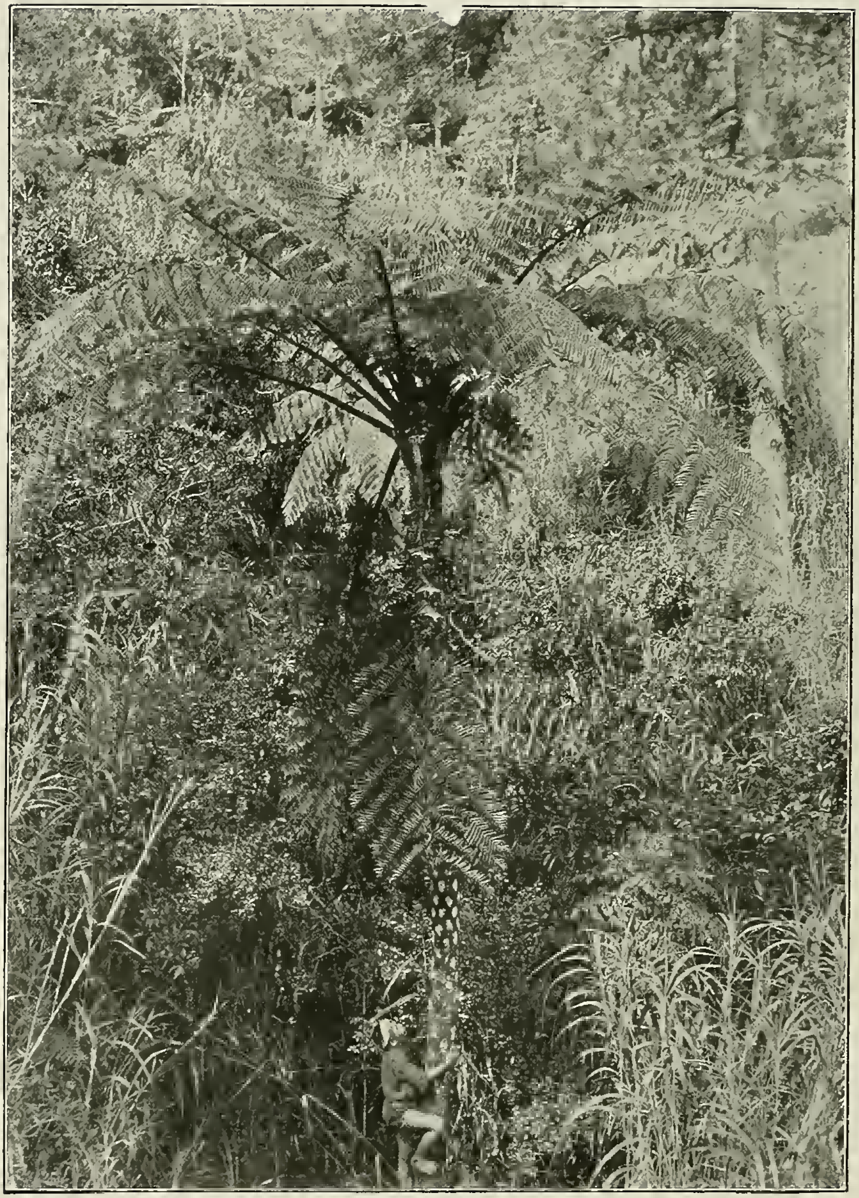
Numerous new industries, such as raising of vanilla in the lowlands and the cultivation of fruits and vegetables peculiar to the temperate zone in Benguet, ought, if properly conducted, to result profitably.

BENGUET—THE GARDEN OF THE PHILIPPINES

IN a cablegram to the Secretary of War dated April 15, Governor Taft announced his arrival at Benguet, which he described as follows:

"Great province. This is only 150 miles from Manila, with air as bracing as Adirondacks or Murray Bay. Only pines and grass lands. Temperature this hottest month in the Philippines, in my cottage porch at 3 in the afternoon, 68° F. Fires are necessary night and morning."

Benguet is a little province about the size of Rhode Island. It consists almost entirely of high mountains, some of them reaching to 7,000 feet, and resembles an American park in the variety and beauty of its scenery. The elevated tablelands of the province Governor Taft plans to make a health



IGORROTE CLIMBING A TREE FERN, BENGUET.

No. 13.—In Benguet Province, Luzon, gigantic tree ferns and the northern pine are seen growing side by side. It is a wonderful region, where tropical, subtropical, and temperate zone plants thrive equally well.

IN THE PINES. BENGUET.

No. 14.

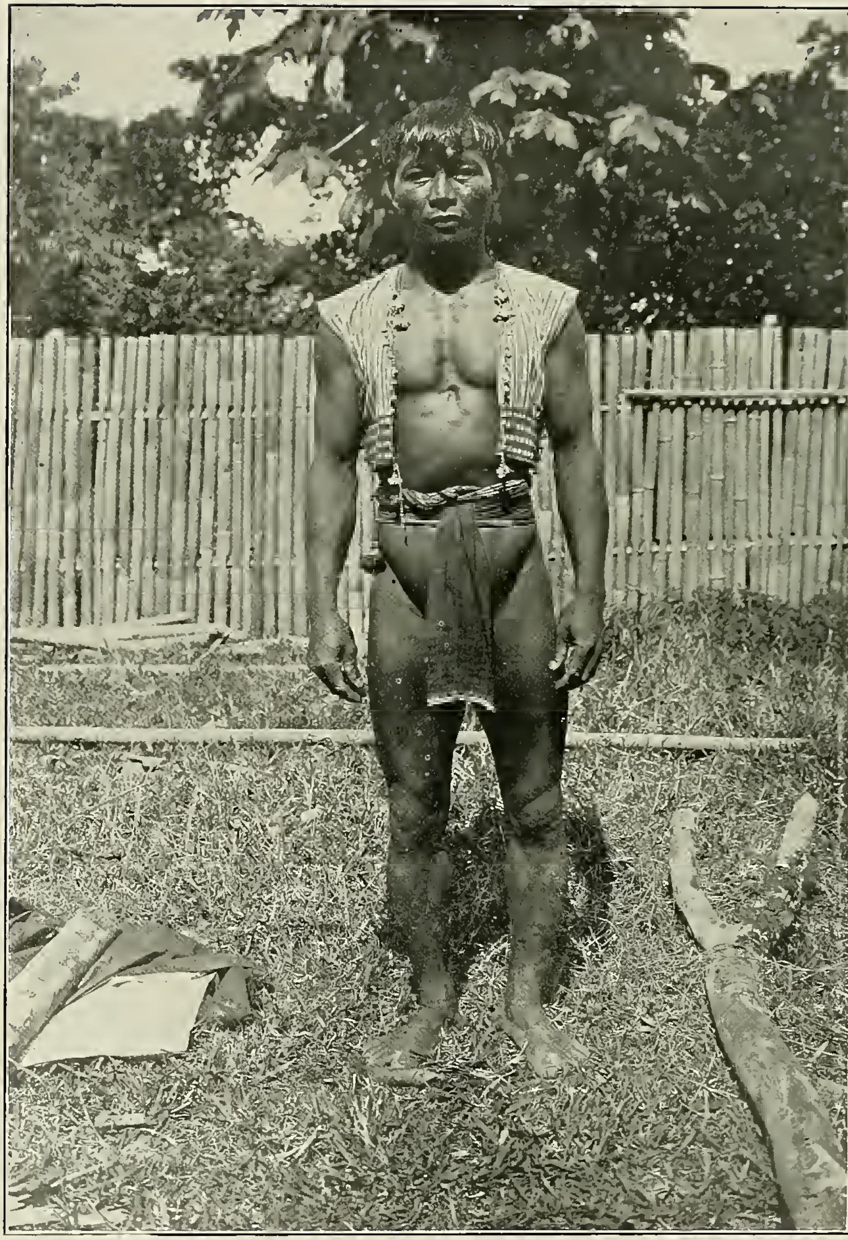
THE IGORROTE TOWN OF CABAYAN, BENGUET, LUZÓN

Houses surrounded by coffee bushes.

No. 15.—Some of the finest coffee in the world is grown in these valleys by the Igorrotes.

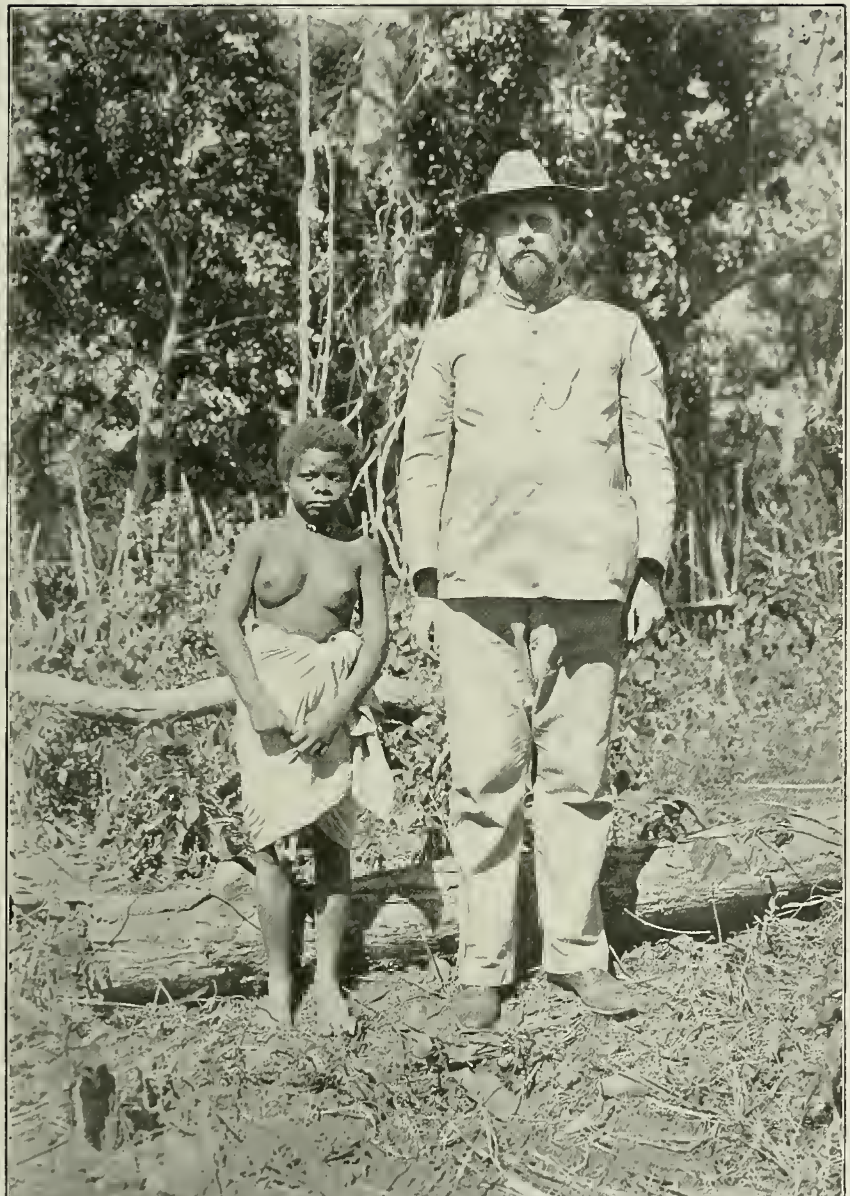
IGORROTE RICE TERRACES, CABAYAN, BENGUET, LUZÓN.

No 16.—The Igorrotes are the Highlanders of the Philippines. They are a fine race, spread over the northern half of Luzon, and have considerable mechanical ability.



A CHIEF OF THE GADDANES, ISABELA, LUZÓN.

No. 17.—One of the most important branches of the insular government is the Bureau of Non-Christian Tribes, whose duty it is to find out the actual conditions of the various non-Christian tribes in the archipelago. These tribes comprise about 2,000,000 people. At present no accurate information is to be had about them. They cover Northern Luzon, Mindoro, Palawan, and the great island of Mindanao. Some of them, like the Negritos, are comparatively harmless, while others, like the Gaddanes, are fierce and hard to control. It is said that head hunting is still practiced by the Gaddanes, and that a young man of this tribe cannot find a bride until he has at least one head to his credit.



ADULT NEGRITO WOMAN, SHOWING RELATIVE SIZE.

No. 18.—The Negritos are physical and mental weaklings, and are rapidly disappearing. They are found in the interior of all the larger islands, and are generally supposed to have been the first inhabitants of the islands, having come from New Guinea. They hide in the mountain forests, where they were driven by later invaders. There are about 30,000 of them left. They live on the fruits and tubers which they find in the forest, and like the pigmies of Africa kill their game with poisoned arrows.

resort for the Americans in the islands. At present it is reached only by horse trail, but a wagon road is being built by the insular government and a railway has been surveyed and will be constructed before many years.

Forests of pine and cedar cover the higher slopes of the mountains, while lower down in the valleys gigantic ferns are seen.

It may well be doubted if any region in the world offers such unexcelled advantages for experimental work with plants as are presented by the climate and soil of Benguet. The climate admits of the growing of a great variety of tropical, subtropical, and temperate zone plants. In the gardens of the governor one may see coffee bushes bearing heavily, fine tea plants, hot-house gardenias, caladiums, dracænas, frangipani, and mango trees, all characteristic of the tropics; alsophila tree ferns, scarlet hibiscus, passion fruit, begonias. hydrangeas, and many other plants of the subtropical regions, and side by side with these potatoes, tomatoes, peas, beans, celery, and other garden vegetables and monthly roses, all strictly temperate zone products, while the neighboring hillsides are covered with pine trees and produce raspberries and huckleberries in considerable abundance.

A red volcanic soil covers large areas in the province. This soil seems extraordinarily fertile. At the beginning of the rainy season last year, the most unfavorable time, cabbage, tomatoes, onions, leeks, carrots, turnips, parsnips, beans, peas, cucumbers, marrow, squashes, pumpkins, salsify, Irish potatoes, white oats, wheat, millet, and alfalfa were sown, and the results would have done justice to California.

On the elevated plateau are vast stretches of well-watered grazing land, where thousands of horned cattle can find rich pasturage.

About 15,000 people live in Benguet, nearly all of whom are Igorrotes. The Igorrotes of this province are intelligent, and pronounced vastly superior to the average Filipino. They are willing workers, cheerful, trustworthy, and skillful laborers. The illustrations Nos. 15 and 16 show that they possess considerable natural talent in construction. They are non-Christianized, having always resisted the attempts of the Spanish to convert them.*

* REFERENCES.—The following list of official works relating to the Philippines, published by the government, may be of service. The reports may be purchased from the Superintendent of Public Documents, Washington, D. C.:

Report of the Shurman Commission, 4 vols., $2.35.

First Report of the Taft Commission, November 30, 1900, 1 vol., $0.50.

Second Report of the Taft Commission, June 30, 1901, 2 vols., $0.95.

Third Report of the Taft Commission, November 1, 1902, 2 vols., $1.65.

Atlas of the Philippines, $3.15.

Pronouncing Gazetteer and Geographical Dictionary of the Philippines, $2.10.

The Coal Measures of the Philippines, $0.40.

The People of the Philippines, $0.05.

THE BRITISH SOUTH POLAR EXPEDITION

THE Antarctic expedition sent out by the Royal Geographical Society and Royal Society of England in 1901 has done very good work during its first year in the far south. Captain Scott, the leader, with a sledging party, succeeded in getting 100 miles nearer the South Pole than any predecessor, reaching 80° 17'; the expedition wintered 400 miles further south than any other expedition had ever done before, which makes their meteorological and other scientific observations specially valuable; in their vessel the *Discovery* they coasted along the ice-barrier one hundred and fifty miles beyond the point where James Clarke Ross stopped 60 years ago. This ice-barrier extends from the land out upon the water. From its front, which Captain Scott believes floats on the water, the great southern icebergs break, towering sometimes to nearly 1,000 feet, and compared to which the icebergs of the North Atlantic are but pigmies. After coasting for many days along the ice-front to longitude 152° 30′, latitude 76°, they returned and put in at a safe harbor—MacMurdo Bay. This they made their base of action. Here they passed the winter in sight of Erebus, the volcano which Ross had seen belching forth fire and smoke in 1841. It is quiet now. A sledging party ascended a glacier to the height of 9,000 feet, and found a level plain stretching to the west as far as the eye could reach.

In latitude 82° they discovered an extensive mountainous region, hitherto absolutely unknown, extending to 83° 20′ nearly due south. This discovery seems to indicate that land stretches to the Pole in a series of lofty mountains, and is an important geographical result.

CAPTAIN SCOTT'S REPORT

The *Morning*, the auxiliary wooden ship that left New Zealand December 6, 1902, to carry supplies to Captain Scott, found the expedition at their winter base on Victoria Land, left the provisions, and then returned to New Zealand. The following is Captain Scott's report of his work until the arrival of the *Morning*:

The *Discovery* entered the ice-pack on December 23, 1901, in latitude 67° south. Cape Adare was reached on January 9, but from there a heavy gale and ice delayed the expedition, which did not reach Wood Bay till January 18. A landing was effected on the 20th in an excellent harbor, situated in latitude 76° 30′ south. A record of the voyage was deposited at Cape Crozier on the 22d. The *Discovery* then proceeded along the barrier within a few cables' length, examining the edge and making repeated soundings. In longitude 165° the barrier altered its character and trended northwards. Sounding here showed that the *Discovery* was in shallow water. From the edge of the barrier high snow slopes rose to an extensive, heavily glaciated land, with occasionally bare precipitous peaks. The expedition followed the coast line as far as latitude 76°, longitude 152° 30′. The heavy pack formation of the young ice caused the expedition to seek winter quarters in Victoria Land. On February 3 the *Discovery* entered an inlet in the barrier in longitude 174°. A balloon was sent up and a sledge party examined the land as far as latitude 78° 50′, near Mount Erebus and Terror. At the southern extremity of an island excellent winter quarters were found. The expedition next observed the coast of Victoria Land, extending as far as a conspicuous cape, in latitude 78° 50′. It was found that mountains do not exist here, and the statement that they were to be found is clearly a matter for explanation. Huts for living and for making magnetic observations were erected, and the expedition prepared for wintering. The weather was boisterous, but a reconnaissance of sledge parties was sent out, during which the seaman Vince lost his life, the remainder of the party narrowly escaping a similar fate. The ship was frozen in March 24.

The expedition passed a comfortable winter in well-sheltered quarters. The lowest recorded temperature was 62° below zero. The sledging commenced with the coming of spring, on September 2, parties being sent out in all directions. Lieutenant Royds, Mr Skelton, and party successfully established a record in an expedition to Mount Terror, traveling over the barrier under severe sledging conditions, with a temperature of 58° below zero. Commander Scott, Dr Wilson, assistant surgeon, and Lieutenant Shackleton traveled ninety-four miles to the south, reaching land in latitude 80° 18′ south, longitude 163° west, and establishing a world's record for the farthest point south. The journey was accomplished in most trying conditions. The dogs all died, and the three men had to drag the sledges back to the ship. Lieutenant Shackleton almost died from exposure, but is now quite recovered. The party found that ranges of high mountains continued through Victoria Land. At the meridian of 160° foothills much resembling the Admiralty Range were discovered.

The ice barrier is presumably afloat. It continues horizontal and is slowly fed from the land ice. Mountains, ten or twelve thousand feet high, were seen in latitude 82° south, the coast line continuing at least as far as 83° 20′ nearly due south. A party ascending a glacier on the mainland found a new range of mountains. At a height of 9,000 feet a level plain was reached, unbroken to the west as far as the horizon.

The scientific work of the expedition includes a rich collection of marine fauna, of which a large proportion are new species. Sea and magnetic observations were taken, as well as seismographic records and pendulum observations.* A large collection of skins and skeletons of southern seals and sea birds has been made. A number of excellent photographs have been taken and careful meteorological observations were secured. Extensive quartz and grit accumulations were found horizontally bedded in volcanic rocks. Lava flows were found in the frequently recurring plutonic rock which forms the basement of the mountains.

*It will be interesting to note whether the disturbances of Mont Pelée and La Souffrière, and in Guatemala and Mexico during the past twelve months have been recorded by Captain Scott's instruments or by any of the South Polar expeditions.

Before the arrival of the *Morning* the *Discovery* had experienced some privation, owing to part of the supplies having gone bad. This accounted for the death of all the dogs. She has, however, revictualled from the *Morning*, and the explorers are now in a position to spend a comfortable winter.

RECORDS OF FARTHEST SOUTH

The following table, compiled by Mr Cyrus C. Adams, gives the records of the most important Antarctic explorers arranged in the order of the most southerly points attained ; it gives the names of the explorers, the year in which they reached their most southerly latitude, the latitude and longitude they attained, the method of reaching it, whether by sledge or ship, and the name of the vessel or vessels in their expeditions :

S. lat.	Long. from Gr.	
80° 17′	163° 00′ W.	Captain Scott, 1902, sledge, steamer *Discovery*.
78 50	165 00 W.	Borchgrevink, 1900, sledge, steamer *Southern Cross*.
78 10	161 27 W.	Captain James Ross, 1842, ship, sailing vessels *Erebus* and *Terror*.
74 15	34 17 W.	Captain Weddell, 1823, ship, sailing vessels *Jane* and *Beaufoy*.
71 36	87 39 W.	Lieutenant De Gerlache, 1899, ship, steamer *Belgica*.
71 30	15 00 W.	Captain James Ross, 1843, ship, sailing vessels *Erebus* and *Terror*.
71 10	106 54 W.	Captain Cook, 1774, ship, sailing vessels *Resolution* and *Adventure*.
69 53	92 19 W.	Captain Bellingshausen, 1821, ship, sailing vessels *Vostok* and *Mirny*.
69 40	12 00 E.	Captain Biscoe, 1831, ship, sailing vessels *Tula* and *Liveley*.
69 21	2 15 W.	Captain Bellingshausen, 1820, ship, sailing vessels *Vostok* and *Mirny*.
69 10	79 00 W.	Captain Evensen, 1894, ship, sailing vessel *Hertha*.
69 00	172 11 E.	Captain Balleny, 1839, ship, sailing vessels *Eliza Scott* and *Sabrina*.
68 10	60 00 W.	Captain Larsen, 1893, ship, sailing vessel *Jason*.
67 5	147 30 E.	Lieutenant Wilkes, 1840, ship, sailing vessel *Vincennes*.
67 51	39 40 W.	Captain Moore, 1845, ship, sailing vessel *Pagoda*.
67 31	142 54 W.	Captain Cook, 1773, ship, sailing vessels *Resolution* and *Adventure*.

GEOGRAPHIC NOTES

BUREAU OF FORESTRY

THE plan which Maryland adopted some time ago of getting the coöperation of the Bureau of Forestry in making a detailed study of her forests is a most excellent one, and is equally available to all the states and about equally advantageous to them. With the help of the trained foresters of the Bureau of Forestry the Maryland Geological Survey was able to make an inventory of the forest wealth of the state, finding out how much there is of it, the condition it is in, what benefit it is to the state, including its effects on stream flow and on agriculture; how much damage it has suffered, and how such damage may be lessened. The forests of Allegany, Cecil, Garrett, Calvert, and Harford counties have already been thoroughly studied by experts of the Bureau of Forestry, and reports for the first three have been published by the state.

The work suggests the very great advantages of a similar coöperation between other states and the Bureau of Forestry, although the examinations need not always be as detailed as in the case of Maryland. The matter is extremely simple and may be easily arranged, and the results are valuable out of all proportion to the cost of such work to the states. The Bureau furnishes and pays the salaries of the experts who make the examination, when the state has guaranteed their field expenses. The reports of the Bureau's experts become the property of the state, provided they are credited, when published, to the Bureau.

For a long time the Bureau of Forestry has been urging state investigations of forest lands, because the results of such investigations are as valuable to the Bureau as to the states themselves. Inquiries are constantly received from lumbermen and others regarding the forest resources of different states which the Bureau is unable to answer fully, because often no accurate studies of the regions have been made. Every bit of reliable information concerning the forests of the different states and territories is welcomed by the Bureau as contributing to the sum of knowledge of the forest resources of the whole country on which the Bureau must base its general forest policy.

States like New York, Massachusetts, New Hampshire, Connecticut, Pennsylvania, Minnesota, Michigan, and Wisconsin, which are working out for themselves some sort of forest policy, find it absolutely essential to take stock of their timber lands. Michigan has begun such an examination, through coöperation between the state forest commission, the university authorities, and the Bureau of Forestry. A study already made of 60,000 acres of forest preserve lands in northern Michigan by T. H. Sherrard, of the Bureau of Forestry, resulted in recommendations for fire-protection experiments and for tree planting, which have been submitted to the state legislature. California has appropriated $15,000 for an examination of the forests of the state. A report on the forests of Texas has been prepared under direction of the Bureau of Forestry, and will probably form when published the basis for forest legislation in the state. Several years ago the forests of the northern part of Wisconsin were examined by Filibert Roth, of the Bureau, and his report was published by the Bureau and by the state. Prof. J. G. Jack, of the Bureau, two years ago made an examination of the forests of Vermont, and the work was continued more recently by C. D. Howe. Recommendations for forest preserves before being acted upon by the legislature must be supported by reliable studies of the forest growth on the areas which it is proposed shall be reserved. New Hampshire, alarmed by the heavy cutting in the White Mountains, has appropriated $5,000 for an examination of that region by the Bureau of Forestry, and an examination of the forest lands on Long Island may form a part of the summer's work of the Bureau.

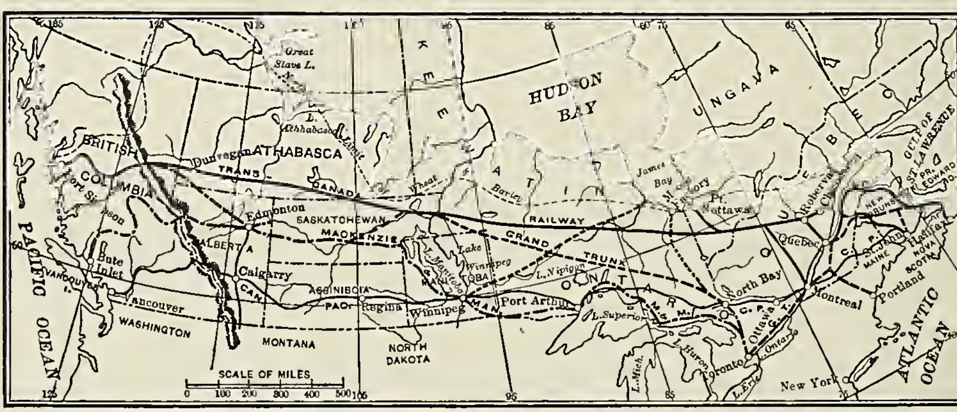
THE NEW TRANS-CANADA RAILWAY

THE projected new trans-continental railway, for which the Dominion Government recently granted a charter to the Trans-Canada Railway Company, is described by Mr E. T. D. Chambers in the *Review of Reviews* for April. Of the commercial importance of the new road Mr Chambers writes as follows:

"The proposed line of the Trans-Canada Railway is one of the most direct which can span the continent. Starting from deep-water termini at Chicoutimi—the head of navigation on the Saguenay River—at Quebec, and at Montreal, it is destined to traverse and develop the best part of the newly discovered wheat and timber lands of northern Quebec in the James Bay district, to tap the whole of the James Bay and Hudson Bay trade, to open up the valuable mineral country of northern Ontario, to cross the center of the rich wheat lands of the Peace River valley, and, finally, to reach one of the finest ports on the Pacific coast by a pass in the mountains only 2,000 feet high, as compared with 4,425 at Crow's Nest, and with 5,400 at Kicking Horse.

"The most cursory glance at the line laid down on the map for the new road reveals the directness of the route and and its far-northern location.

"From Quebec to Port Simpson *via* the Trans-Canada Railway will be only 2,830 miles, all of the route south of the northern limit of wheat, while the distance between the same points *via* the Grand Trunk Railway will be about 3,400 miles, and that from Quebec to Vancouver by the Canadian Pacific Railway is 3,078 miles. The expected saving in both distance and gradients by the proposed road over existing routes from Manitoba to the Canadian seaports on the St Lawrence is so great that the promoters have already undertaken to carry wheat from all points on its line in the Province of Manitoba to the ocean steamer at Chicoutimi, Montreal, or Quebec at rates which will save the farmers of Manitoba and the Northwest about seven cents per bushel on present cost of transportation to the



Courtesy of Review of Reviews

Map showing Route of new Trans-Canadian Railway seaboard. It is claimed that this saving alone will much more than pay the total interest upon the cost of the road's construction.

"It is admitted on every hand that the terminal seaports of the Trans-Canada leave nothing to be desired. The harbor of Port Simpson is said to be the finest on the Pacific coast north of San Francisco. It has the additional advantage of being much nearer to Yokohama than either Vancouver or San Francisco. Nottaway, on James Bay, which is to be reached by a branch of the main line, is the only deep-water harbor on the bay, and with some dredging might be used by vessels drawing thirty feet of water. The coast line of James and Hudson Bays, tributary to this railway, will be about four thousand miles. Chicoutimi, on the Saguenay, can be reached by vessels of any draught, and Quebec has magnificent docks, which have cost the government millions of dollars, with deep-water berth and elevator facilities for steamers of any draught. The new bridge now building over the St Lawrence, at Quebec, will enable the Trans-Canada road to make use of St John and Halifax for winter ports if ever those of Quebec and Chicoutimi should be blocked by ice."

EXPEDITION TO TURKESTAN

DR RAPHAEL PUMPELLY is on his way to Turkestan on a most important scientific mission. His journey is for the purpose of looking over the ground in Turkestan with reference to a combined physico-geographical and archæological exploration, if such further work should be found to be promising as to results and practicable as regards execution.

It has been his wish to see this done for forty years, and the results obtained by Russian surveys in recent years in connection with some parts of the problem have strengthened his belief that the region offers a field of the greatest interest in connection with the relation between the growth and changes—social, economic, and ethnological—of nations and measurable changes in their environment.

The journey is made under the auspices of the Carnegie Institution. Prof. W. M. Davis, of Harvard, will have charge of the physical geographical part of the problem and will meet him on the Caspian early in May. In the meantime Dr Pumpelly has gone to St Petersburg to obtain the permission of the Russian Government, on whose willingness and sympathy all depends.

GEOLOGICAL SURVEY

THE Survey has begun an experiment which will doubtless prove of great practical service to the mining interests of the country. Heretofore the explorations of the geologists of the Survey have not been available until one to two years after the explorations were made. To prepare and to publish the complete report of a season's work takes considerable time. By the new arrangement such results of the season's work as have direct economic importance are to be published at once in advance of the purely scientific investigations. This plan has been begun by the publication of a bulletin (No. 213) which summarizes the work of economic character done in 1902. The bulletin, says Dr C. Willard Hayes in the preface, "is designed to meet the wants of the busy man, and is so condensed that he will be able to obtain results and reach conclusions with a minimum expenditure of time and energy. It also affords a better idea of the work which the Survey as an organization is carrying on for the direct advancement of mining interests throughout the country than can readily be obtained from the more voluminous reports."

The bulletin contains 60 brief papers, of which the following may be mentioned: "Investigation of Metalliferous Ores," by S. F. Emmons; "Placer Gold Mining in Alaska in 1902," by Alfred H. Brooks; "Gold and Pyrite Deposits in the Dahlonega District, Georgia," by E. C. Eckel; "Mineral Deposits of the Bitterroot Range and the Clearwater Mountains, Montana," by W. Lindgren; "Gold Mining in Central Washington," by George Otis Smith; "Ore Deposits of Tonopah and Neighboring Districts, Nevada," by J. E. Spurr; "Ore Deposits of Butte, Montana," by W. H. Weed; "Lead, Zinc, and Fluorspar Deposits of Western Kentucky," by E. O. Ulrich and W. S. T. Smith; "Coal Fields of the United States," by C. Willard Hayes.

GEOLOGICAL HISTORY OF NEW YORK CITY

THE geological history of New York and its vicinity is discussed at great length, illustrated by numerous maps and pictures, in New York City Geologic Folio, No. 83, recently issued by the Geological Survey.

Tens of thousands of years ago the greater part of the State of New York was covered by an immense glacier, similar in character to those now found in Switzerland and Alaska, but immensely greater in area and thickness. This ice sheet had gathered up in its course large quantities of sand, gravel, and mud. Part of this burden was pushed before the ice mass, and as the front of the glacier came to rest in the latitude of the city, the material pushed ahead of it was deposited there. When the glacier disappeared, owing to the coming on of a warmer climate, the mass of material deposited along its front became the familiar rounded hills of Long Island—the so called backbone of the island.

After the disappearance of the ice sheet, the land in the vicinity of the city sank, so that the sea covered points now 100 feet above tide level. During this period of submergence, the great brick-clay beds along the Hudson River were deposited. The traveler on the Central or the West Shore road can now see these beds—near Croton Landing or Haverstraw, for example—far above the railroad tracks, but they were all formed under water.

The next event in the history was, on the contrary, a gradual rising of the land until it stood considerably higher than at present. This was followed by a sinking just as gradual, which is still in progress. Along the coast of Long Island and New Jersey tree stumps may be seen under water. It is known that these have been covered by the sea within very recent times, and that the encroachment of the sea on the land is still going on.

Many other subjects of interest are discussed in this folio, which is the most interesting contribution to New York local geology ever published. It may be purchased from the U. S. Geological Survey, Washington, D. C., for 50 cents.

The apparatus or box for developing photographic films without the aid of the dark-room, referred to in this Magazine in May, 1902, will prove of great service to explorers and travelers. The present season is the first opportunity that men in the field will have of using the machine, as it was placed on the market too late last year. With the little box, which is no larger and not so heavy as a camera, one will be able to develop one's films in the evening beside the camp fire, or if a specially fine landscape is seen which the traveler wishes to secure beyond all doubt, he may develop his snap-shot in broad daylight before moving on, provided water is at hand. The box, invented by Mr A. W. McCurdy, is known as the Kodak Developing Machine.

NATIONAL GEOGRAPHIC SOCIETY

ON May 20 the National Geographic Society moves into its new home, the Hubbard Memorial Building, which has been erected as a memorial to Hon. Gardiner Greene Hubbard, the first president of the Society, by Mrs Hubbard and her children and grandchildren. The Society has now a membership of 2,600 in the United States. Every state and territory is represented on the membership roll. After May 20 the address of the Society will be Hubbard Memorial Building, Sixteenth and M streets, Washington, D. C.

The Annual Excursion of the National Geographic Society will be on Saturday, May 9, to Annapolis, Maryland. Members and their friends will leave Washington on a special train at 9 a. m., reaching Annapolis at about 10.15. The morning will be spent in witnessing the naval drills and in inspecting the grounds. The Superintendent of the Naval Academy has very kindly detailed some members of the naval force to guide the party. Immediately after luncheon, which will be served in Carvel Hall at 12.30 p. m., Elihu F. Reiley, Esq., of Annapolis, will address the Society. He will review some of the more noted points of interest in the history of the famous old town. Three of the four signers, from Maryland, of the Declaration of Independence were residents of Annapolis. After the address the party will visit the historic scenes in the town and return to Washington late in the afternoon. The excursion committee of the Society consists of Colonel Henry F. Blount, Dr F. V. Coville, and Mr Otto J. J. Luebkert.

Dr Jean Charcot is building an ice-resisting ship at Saint Malo, France. She is to carry 17 men and to have stowage-room for two years' provisions. Dr Charcot plans to sail the middle of May for the island of Jan Mayen, and then to explore the region around Nova Zembla and Franz Josef Land. It is a summer trip only, as he hopes to be back by the first of October of this year. Capt. de Gerlache, who commanded the Belgica South Polar Expedition of 1897–'98, goes with him as the oceanographer of the party.

Mr Ellsworth Huntington, A. B., Beloit, 1897, has lately been awarded the Gill memorial by the Royal Geographical Society of London for his explorations of the Euphrates River while science teacher in Euphrates College, Harput, Turkey, 1897–1901. Since 1901, Mr Huntington has been a student in the Graduate School of Harvard University. He has just been appointed Research Assistant by the Carnegie Institution, and now goes with Professor Davis to join Professor Pumpelly for a summer of exploration in Turkestan.

GEOGRAPHIC LITERATURE

Antarctica. By Edwin Swift Balch, author of "Mountain Exploration," "Glacières or Freezing Caverns," etc. With three large maps. Pp. 230, 7 x 11 inches. Philadelphia: Allen, Lane & Scott. 1902.

The present volume presents a succinct history of south polar exploration. It is written in most entertaining style, giving a graphic account of the battles of the explorers of sixty years ago in their small sailing vessels. A volume that would unravel the tangled and imperfect records of south polar exploration has long been needed. Mr Balch's book is especially welcome because of the present interest in the far south, where four ably led and ably equipped expeditions are at work.

The author aims to particularly emphasize the work done by American sailors in the Antarctics. It is not generally remembered that it was an American, Lieut. Charles Wilkes, of the U. S. Navy, who first discovered the Antarctic continent, whose area is twice that of Europe. Lieutenant Wilkes, commanding the "United States Exploring Expedition" on a voyage around the world, under orders from the Secretary of the Navy, Hon. J. K. Paulding, "to penetrate within the Antarctic region," sailed from Sydney, Australia, December 26, 1839. His squadron consisted of four small sailing vessels; the sloop of war *Vincennes*, 780 tons, under his own command; the sloop of war *Peacock*, 650 tons; the gun brig *Porpoise*, 230 tons, and the pilot boat *Flying Fish*, 96 tons. None of these ships were suitable for ice work, for not one of the vessels had planking, extra fasteuing, or other preparations for these icy regions. The pilot boat put back soon after starting, and several weeks later the *Peacock* also was forced to return when it was found that "the ice had chafed the stem to within one inch and a half of the wood-ends of the plauking." The other two vessels kept on and sailed along the Antarctic coast for some 1,500 miles, when they returned to Sydney. Lieutenant Wilkes reported to the Secretary of the Navy by letter on March 11: "It affords me much gratification to report that we have discovered a large body of land within the Autarctic Circle, which I have named the Antarctic Continent, and refer you to the report of our cruise and accompanying charts, inclosed herewith, for full information relative thereto."

As Mr. Balch well says:

"The cruise of Wilkes will remain among the remarkable voyages of all time. No finer achievement has been accomplished in the annals of the Arctic or of the Antarctic. With unsuitable, improperly equipped ships, amid icebergs, gales, snow-storms, and fogs, Wilkes followed an unknown coast line for over fifteen hundred miles, a distance exceeding in length the Ural Mountain range. It is the long distance which Wilkes traversed which makes the results of his cruise so important, for he did not merely sight the coast in one or two places, but he hugged it for such a distance as to make sure that the land was continental in dimensions. The expedition noticed appearances of laud on January 13; it sighted land almost surely on January 16, from 157° 46′ east longitude, and again more positively on Jannary 19, from 154° 30′ east longitude, 66° 20′ south latitude. On January 30 the size of the land was sufficiently ascertained to receive the name 'Antarctic Continent,' and this discovery of Wilkes is the most important discovery yet made in the Antarctic."

Impartial geographers in due time recoguized the importance of Wilkes' discovery, and in recognition of his work affixed the name of Wilkes Land to the portion of the Antartic Continent along which he coasted.

In view of the great achievements of Lieutenant Wilkes, Mr Balch justly argues against the appropriateness of the suggestion of Sir Clements R. Markham, President of the Royal Geographical Society, that the Autarctic regions be divided into four quadrants, each covering ninety degrees of longitude and each named after an Englishman.

The New York State Museum has published a geologic map of New York State exhibiting the structure of the state so far as known. The map has been prepared under the direction of Frederick J. H. Merrill, State Geologist; the geographic compilation is by C. C. Vermeule, and the geologic drafting by A. M. Evans. The map may be purchased from the State Museum at Albany for $5, mounted on rollers, or for $3 in atlas form.

Office Hours: 8.30 A. M. to 5 P. M. Telephone, Main 471

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THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XIV JUNE, 1903 No. 6

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE TETRAHEDRAL PRINCIPLE IN KITE STRUCTURE*

By ALEXANDER GRAHAM BELL

PRESIDENT OF THE NATIONAL GEOGRAPHIC SOCIETY

IN 1899, at the April meeting, I made a communication to the Academy upon the subject of "Kites with Radial Wings;" and some of the illustrations shown to the Academy at that time were afterwards published in the *Monthly Weather Review*.†

Since then I have been continuously at work upon experiments relating to kites. Why, I do not know, excepting perhaps because of the intimate connection of the subject with the flying-machine problem.

We are all of us interested in aerial locomotion; and I am sure that no one who has observed with attention the flight of birds can doubt for one moment the possibility of aerial flight by bodies specifically heavier than the air. In the words of an old writer, "We cannot consider as impossible that which has already been accomplished."

I have had the feeling that a properly constructed flying-machine should be capable of being flown as a kite; and, conversely, that a properly constructed kite should be capable of use as a flying-machine when driven by its own propellers. I am not so sure, however, of the truth of the former proposition as I am of the latter.

Given a kite, so shaped as to be suitable for the body of a flying-machine, and so efficient that it will fly well in a good breeze (say 20 miles an hour) when loaded with a weight equivalent to that of a man and engine; then it seems to me that this same kite, provided with an actual engine and man in place of the load, and driven by its own propellers at the rate of 20 miles an hour, should be sustained in calm air as a flying-machine. So far as the pressure of the air is concerned, it is surely immaterial whether the air moves against the kite, or the kite against the air.

*A communication made to the National Academy of Sciences in Washington, D. C, April 23, 1903, revised for publication in the NATIONAL GEOGRAPHIC MAGAZINE.

†See *Monthly Weather Review*, April, 1899, vol. xxvii, pp. 154–155, and plate xi

Of course in other respects the two cases are not identical. A kite sustained by a 20-mile breeze possesses no momentum, or rather its momentum is equal to zero, because it is stationary in the air and has no motion proper of its own; but the momentum of a heavy body propelled at 20 miles an hour through still air is very considerable. Momentum certainly aids flight, and it may even be a source of support against gravity quite independently of the pressure of the air. It is perfectly possible, therefore, that an apparatus may prove to be efficient as a flying-machine which cannot be flown as a kite on account of the absence of *vis viva*.

However this may be, the applicability of kite experiments to the flying-machine problem has for a long time past been the guiding thought in my researches.

I have not cared to ascertain how high a kite may be flown or to make one fly at any very great altitude. The point I have had specially in mind is this: That the equilibrium of the structure in the air should be perfect; that the kite should fly steadily, and not move about from side to side or dive suddenly when struck by a squall, and that when released it should drop slowly and gently to the ground without material oscillation. I have also considered it important that the framework should possess great strength with little weight.

I believe that in the form of structure now attained the properties of strength, lightness, and steady flight have been united in a remarkable degree.

In my younger days the word "kite" suggested a structure of wood in the form of a cross covered with paper forming a diamond-shaped surface longer one way than the other, and provided with a long tail composed of a string with numerous pieces of paper tied at intervals upon it. Such a kite is simply a toy. In Europe and America, where kites of this type prevailed, kite-flying was pursued only as an amusement for children, and the improvement of the form of structure was hardly considered a suitable subject of thought for a scientific man.

In Asia kite-flying has been for centuries the amusement of adults, and the Chinese, Japanese, and Malays have developed tailless kites very much superior to any form of kite known to us until quite recently.

It is only within the last few years that improvements in kite structure have been seriously considered, and the recent developments in the art have been largely due to the efforts of one man—Mr Laurence Hargrave, of Australia.

Hargrave realized that the structure best adapted for what is called a "good kite" would also be suitable as the basis for the structure of a flying-machine. His researches, published by the Royal Society of New South Wales, have attracted the attention of the world, and form the starting point for modern researches upon the subject in Europe and America.

Anything relating to aerial locomotion has an interest to very many minds, and scientific kite-flying has everywhere been stimulated by Hargrave's experiments.

In America, however, the chief stimulus to scientific kite-flying has been the fact developed by the United States Weather Bureau, that important information could be obtained concerning weather conditions if kites could be constructed capable of lifting meteorological instruments to a great elevation in the free air. Mr Eddy and others in America have taken the Malay tailless kite as a basis for their experiments, but Professor Marvin, of the United States Weather Bureau; Mr Rotch, of the Blue Hill Observatory, and many others have adapted Hargrave's box kite for the purpose.

Congress has made appropriations to the Weather Bureau in aid of its kite experiments, and a number of meteorological stations throughout the United

States were established a few years ago equipped with the Marvin kite.

Continuous meteorological observations at a great elevation have been made at the Blue Hill Observatory in Massachusetts, and Mr Rotch has demonstrated the possibility of towing kites at sea by means of steam vessels so as to secure a continuous line of observations all the way across the Atlantic.

HARGRAVE'S BOX KITE

Hargrave introduced what is known as the "cellular construction of kites." He constructed kites composed of many cells, but found no substantial improvement in many cells over two alone ; and a kite composed of two rectangular cells

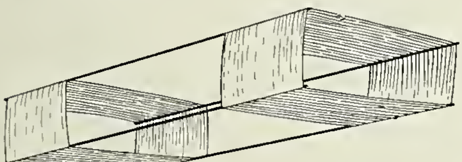


FIG. 1—HARGRAVE BOX KITE

separated by a considerable space is now universally known as "the Hargave box kite." This represents, in my opinion, the high-water mark of progress in the nineteenth century ; and this form of kite forms the starting point for my own researches (Fig. 1).

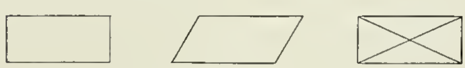
The front and rear cells are connected together by a framework, so that a considerable space is left between them. This space is an essential feature of the kite : upon it depends the fore and aft stability of the kite. The greater the space, the more stable is the equilibrium of the kite in a fore and aft direction, the more it tends to assume a horizontal position in the air, and the less it tends to dive or pitch like a vessel in a rough sea. Pitching motions or oscillations are almost entirely suppressed when the space between the cells is large.

Each cell is provided with vertical sides ; and these again seem to be essential elements of the kite contributing to lateral stability. The greater the extent of the vertical sides, the greater is the stability in the lateral direction, and the less tendency has the kite to roll, or move from side to side, or turn over in the air.

In the foregoing drawing I have shown only necessary details of construction, with just sufficient framework to hold the cells together.

It is obvious that a kite constructed as shown in Fig. 1 is a very flimsy affair. It requires additions to the framework of various sorts to give it sufficient strength to hold the aeroplane surfaces in their proper relative positions and prevent distortion, or bending or twisting of the kite frame under the action of the wind.

Unfortunately the additions required to give rigidity to the framework all detract from the efficiency of the kite : First, by rendering the kite heavier, so that the ratio of weight to surface is increased ; and, secondly, by increasing the head resistance of the kite. The interior bracing advisable in order to preserve the cells from distortion comes in the way of the wind, thus adding to the *drift* of the kite without contributing to the *lift*.



A B C

FIG. 2

A rectangular cell like *A* (Fig. 2) is structurally weak, as can readily be demonstrated by the little force required to distort it into the form shown at *B*. In order to remedy this weakness, internal bracing is advisable of the character shown at *C*.

This internal bracing, even if made of the finest wire, so as to be insignificant in weight, all comes in the way of the wind, increasing the head resistance without counterbalancing advantages.

TRIANGULAR CELLS IN KITE CONSTRUCTION

In looking back over the line of experiments in my own laboratory, I recognize that the adoption of a triangular cell was a step in advance, constituting indeed one of the milestones of progress, one of the points that stand out clearly against the hazy background of multitudinous details.

The following (Fig 3) is a drawing of a typical triangular-celled kite made upon the same general model as the Hargrave box kite shown in Fig. 1.

A triangle is by its very structure perfectly braced in its own plane, and in a triangular-celled kite like that shown in Fig. 3, internal bracing of any

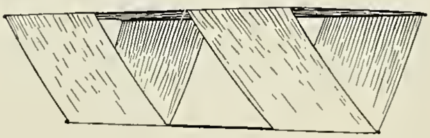


FIG. 3

character is unnecessary to prevent distortion of a kind analogous to that referred to above in the case of the Hargrave rectangular cell (Fig. 2).

The lifting power of such a triangular cell is probably less than that of a rectangular cell, but the enormous gain in structural strength, together with the reduction of head resistance and weight due to the omission of internal bracing, counterbalances any possible deficiency in this respect.

The horizontal surfaces of a kite are those that resist descent under the influence of gravity, and the vertical surfaces prevent it from turning over in the air. Oblique aeroplanes may therefore conveniently be resolved into horizontal and vertical equivalents, that is, into supporting surfaces and steadying surfaces.

The oblique aeroplane *A*, for example (Fig. 4), may be considered as equivalent in function to the two aeroplanes *B* and *C*. The material composing the aeroplane *A*, however, *weighs less* than the material required to form the two aeroplanes *B* and *C*, and the frame-

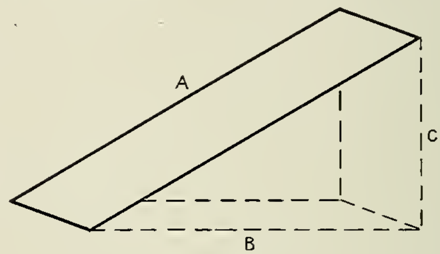


FIG. 4

work required to support the aeroplane *A* weighs less than the two frameworks required to support *B* and *C*.

In the triangular cell shown in Fig. 5, the oblique surfaces *ab*, *bc*, are equivalent in function to the three surfaces *ad*, *de*, *ec*, but weigh less. The oblique surfaces are therefore advantageous.

The only disadvantage in the whole arrangement is that the air has not as free access to the upper aeroplane *ac*, in the triangular form of cell as in the quadrangular form, so that the aeroplane

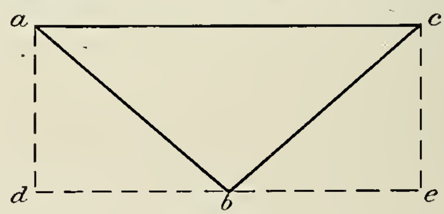
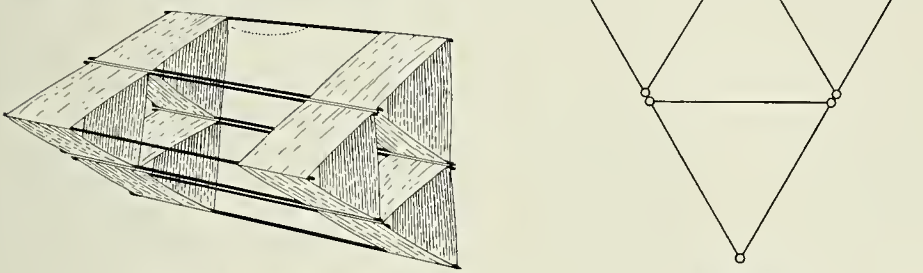


FIG. 5

ac is not as efficient in the former construction as in the latter.

While theoretically the triangular cell is inferior in lifting power to Hargrave's four-sided rectangular cell, practically there is no substantial difference. So far as I can judge from observation in the field, kites constructed on the same general model as the Hargrave Box Kite, but with triangular cells instead of quadrangular, seem to fly as well as the ordinary Hargrave form, and at as high an angle.

Such kites are therefore superior, for they fly substantially as well, while at the same time they are stronger in construction, lighter in weight, and offer less head resistance to the wind.



PERSPECTIVE VIEW END VIEW

FIG. 6—COMPOUND TRIANGULAR KITE

Triangular cells also are admirably adapted for combination into a compound structure, in which the aeroplane surfaces do not interfere with one another. For example, three triangular-celled kites, tied together at the corners, form a compound cellular kite (Fig. 6) which flies perfectly well.

The weight of the compound kite is the sum of the weights of the three kites of which it is composed, and the total aeroplane surface is the sum of the surfaces of the three kites. The ratio of weight to surface therefore is the same in the larger compound kite as in the smaller constituent kites, considered individually.

It is obvious that in compound kites of this character the doubling of the longitudinal sticks where the corners of adjoining kites come together is an unnecessary feature of the combination, for it is easy to construct the compound kite so that one longitudinal stick shall be substituted for the duplicated sticks.

For example: The compound kites *A* and *B* (Fig. 7) may be constructed, as shown at *C* and *D*, with advantage, for the weight of the compound kite is thus reduced without loss of structural strength. In this case the weight of the compound kite is *less* than the sum of the weights of the component kites, while the surface remains the same.

If kites could only be successfully compounded in this way indefinitely

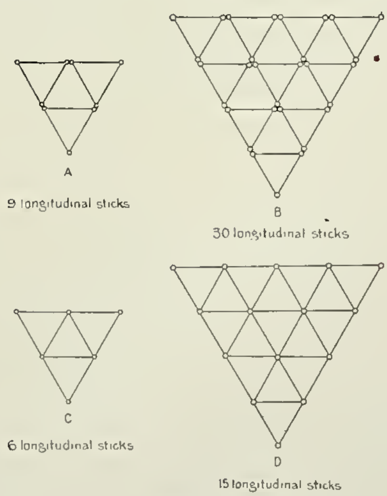
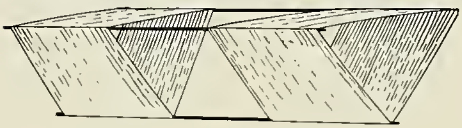
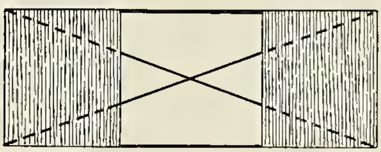


FIG. 7

we would have the curious result that the ratio of weight to surface would diminish with each increase in the size of the compound kite. Unfortunately, however, the conditions of stable flight demand a considerable space between the front and rear sets of cells (see Fig. 6); and if we increase the diameter



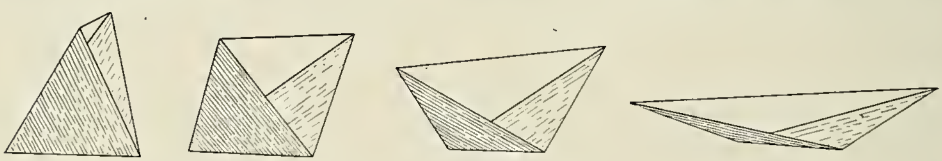
A



B

FIG. 8

of our compound structure without increasing the length of this space we injure the flying qualities of our kite. But every increase of this space in the fore and aft direction involves a corresponding increase in the length of the empty framework required to span it, thus adding dead load to the kite and increasing the ratio of weight to surface.



Acute-angled tetrahedron — Regular tetrahedron — Right-angled tetrahedron. — Obtuse-angled tetrahedron

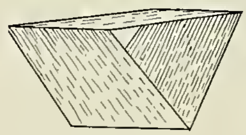
FIG. 10—WINGED TETRAHEDRAL CELLS

While kites with triangular cells are strong in a transverse direction (from side to side), they are structurally weak in the longitudinal direction (fore and aft), for in this direction the kite frames are rectangular.

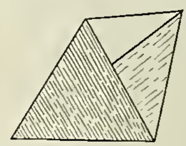
Each side of the kite *A*, for example (Fig. 8), requires diagonal bracing of the character shown at *B* to prevent distortion under the action of the wind. The necessary bracing, however, not being in the way of the wind, does not materially affect the head resistance of the kite, and is only disadvantageous by adding dead load, thus increasing the ratio of weight to surface.

THE TETRAHEDRAL CONSTRUCTION OF KITES

Passing over in silence multitudinous experiments in kite construction carried on in my Nova Scotia laboratory, I come



A



B

FIG. 9—A. A TRIANGULAR CELL
B. A WINGED TETRAHEDRAL CELL

to another conspicuous point of advance—another milestone of progress—the adoption of the triangular construction *in every direction* (longitudinally as well as transversely); and the clear realization of the fundamental importance of the skeleton of a tetrahedron, especially the regular tetrahedron, as an element of the structure or framework of a kite or flying-machine.

Consider the case of an ordinary triangular cell *A* (Fig. 9) whose cross-section is triangular laterally, but quadrangular longitudinally.

If now we make the longitudinal as well as transverse cross-sections triangular, we arrive at the form of cell shown at *B*, in which the framework forms the outline of a tetrahedron. In this case the aeroplanes are triangular, and the whole arrangement is strongly suggestive of a pair of birds' wings

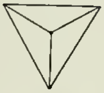


FIG. 11—ONE-CELLED TETRAHEDRAL FRAME

raised at an angle and connected together tip to tip by a cross-bar (see *B*, Fig. 9; also drawings of winged tetrahedral cells in Fig. 10).

A tetrahedron is a form of solid bounded by four triangular surfaces.

In the regular tetrahedron the boundaries consist of four equilateral triangles and six equal edges. In the skeleton form the edges alone are represented, and the skeleton of a regular tetrahedron is produced by joining together six equal

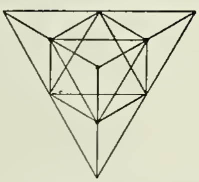


FIG. 12—FOUR-CELLED TETRAHEDRAL FRAME

rods end to end so as to form four equilateral triangles.

Most of us no doubt are familiar with the common puzzle—how to make four triangles with six matches. Give six matches to a friend and ask him to arrange them so as to form four complete equilateral triangles. The difficulty lies in the unconcious assumption of the experimenter that the four triangles should all be in the same plane. The moment he realizes that they need not be in the same plane the solution of the problem becomes easy. Place three matches on the table so as to form a triangle, and stand the other three up over this like the three legs of a tripod stand. The matches then form the skeleton of a regular tetrahedron. (See figure 11.)

A framework formed upon this model of six equal rods fastened together at the ends constitutes a tetrahedral cell possessing the qualities of strength and lightness in an extraordinary degree.

It is not simply braced in two directions in space like a triangle, but in three directions like a solid. If I may coin a word, it possesses "*three-dimensional*" strength; not "two-dimensional" strength like a triangle, or "one-dimensional" strength like a rod. It is the skeleton of a solid, not of a surface or a line.

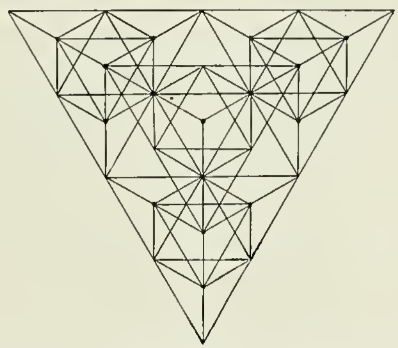


FIG. 13—SIXTEEN-CELLED TETRAHEDRAL FRAME

It is astonishing how solid such a framework appears even when composed of very light and fragile material; and compound structures formed by fastening these tetrahedral frames together at the corners so as to form the skeleton of a regular tetrahedron on a larger scale possess equal solidity.

Figure 12 shows a structure composed of four frames like figure 11, and figure 13 a structure of four frames like figure 12.

When a tetrahedral frame is provided with aero-surfaces of silk or other material suitably arranged, it becomes a tetrahedral kite, or kite having the form of a tetrahedron.

The kite shown in figure 14 is composed of four winged cells of the regular tetrahedron variety (see Fig. 10), connected together at the corners. Four kites like figure 14 are combined in figure 15, and four kites like figure 15 in figure 16 (at *D*).

Upon this mode of construction an empty space of octahedral form is left in the middle of the kite, which seems to have the same function as the space between the two cells of the Hargrave box kite. The tetrahedral kites that have the largest central spaces preserve their equilibrium best in the air.

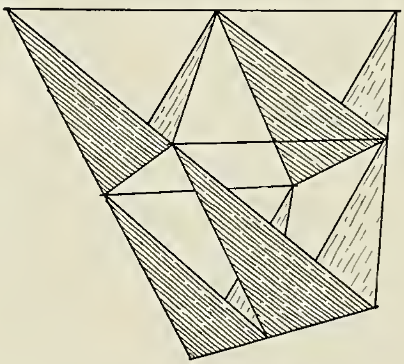


FIG. 14—FOUR-CELLED TETRAHEDRAL KITE

The most convenient place for the attachment of the flying cord is the extreme point of the bow. If the cord is attached to points successively further back on the keel, the flying cord makes a greater and greater angle with the horizon, and the kite flies more nearly overhead; but it is not advisable to carry the point of attachment as far back as the middle of the keel. A good place for high flights is a point half-way between the bow and the middle of the keel.

In the tetrahedral kites shown in the plate (Fig. 16) the compound structure has itself in each case the form of the regular tetrahedron, and there is no reason why this principle of combination should not be applied indefinitely so as to form still greater combinations.

The weight relatively to the wing-surface remains the same, however large the compound kite may be.

The four-celled kite *B*, for example, weighs four times as much as one cell and has four times as much wing-surface, the 16-celled kite *C* has sixteen times as much weight and sixteen times as much-wing surface, and the 64-celled kite *D* has sixty-four times as much weight and sixty-four times as much wing-surface. The ratio of weight to

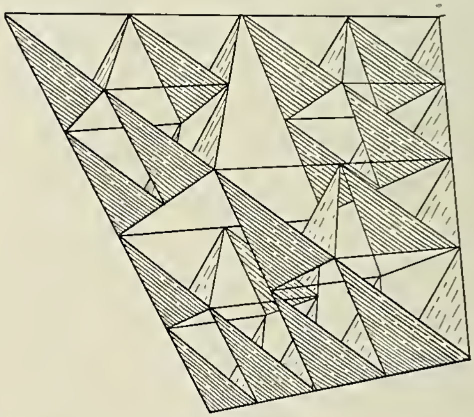


FIG. 15—SIXTEEN-CELLED TETRAHEDRAL KITE

surface, therefore, is the same for the larger kites as for the smaller.

This, at first sight, appears to be somewhat inconsistent with certain mathematical conclusions announced by Prof. Simon Newcomb in an article entitled "Is the Air-ship Coming," published in *McClure's Magazine* for September, 1901—conclusions which led him to believe that "the construction of an aerial vehicle which could carry even a single man from place to place at pleasure requires the discovery of some new metal or some new force."

The process of reasoning by which Professor Newcomb arrived at this re-

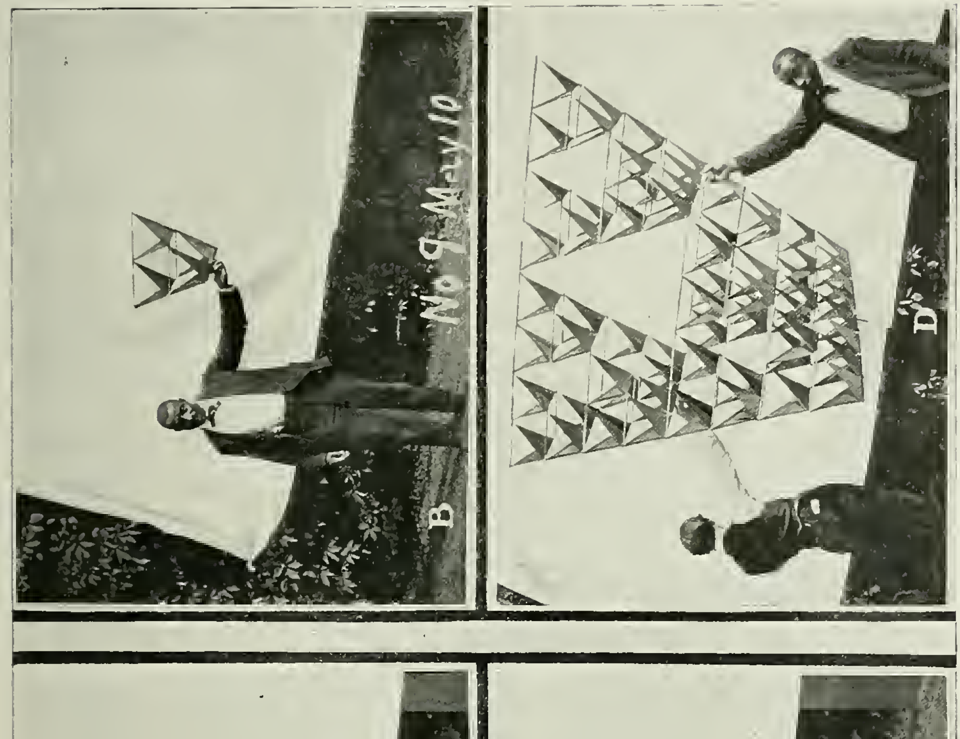


FIG. 16—TETRAHEDRAL KITES

A. A WINGED TETRAHEDRAL CELL
B. A FOUR-CELLED TETRAHEDRAL KITE
C. A SIXTEEN-CELLED TETRAHEDRAL KITE
D. A SIXTY-FOUR-CELLED TETRAHEDRAL KITE

markable result is undoubtedly correct. His conclusion, however, is open to question, because he has drawn a general conclusion from restricted premises. He says:

"Let us make two flying-machines exactly alike, only make one on double the scale of the other in all its dimensions. We all know that the volume, and therefore the weight, of two similar bodies are proportional to the cubes of their dimensions. The cube of two is eight: hence the large machine will have eight times the weight of the other. But surfaces are as the squares of the dimensions. The square of two is four. The heavier machine will therefore expose only four times the wing surface to the air, and so will have a distinct disadvantage in the ratio of efficiency to weight."

a giant kite that should lift a man—upon the model of the Hargrave box kite. When the kite was constructed with two cells, each about the size of a small room, it was found that it would take a hurricane to raise it into the air. The kite proved to be not only incompetent to carry a load equivalent to the weight of a man, but it could not even raise *itself* in an ordinary breeze in which smaller kites upon the same model flew perfectly well. I have no doubt that other investigators also have fallen into the error of supposing that large structures would necessarily be capable of flight, because exact models of them,

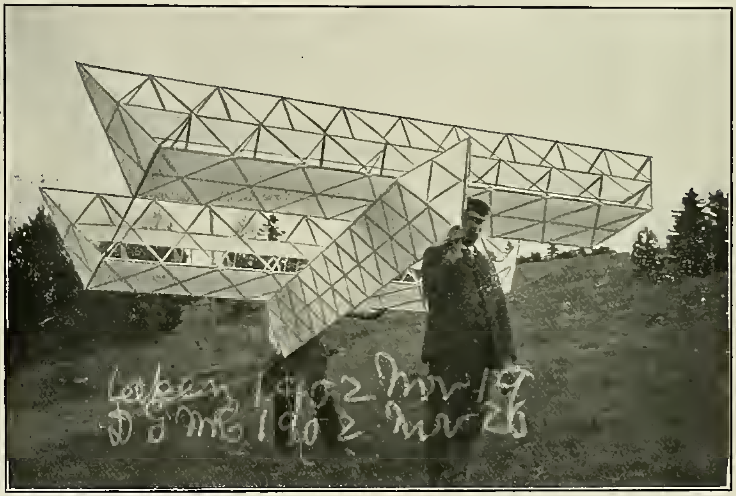


FIG. 17—THE AERODROME KITE

Professor Newcomb shows that where two flying-machines—or kites, for that matter—are exactly alike, only differing in the scale of their dimensions, the ratio of weight to supporting surface is greater in the larger than the smaller, increasing with each increase of dimensions. From which he concludes that if we make our structure large enough it will be too heavy to fly.

This is certainly true, so far as it goes, and it accounts for my failure to make made upon a smaller scale, have demonstrated their ability to sustain themselves in the air. Professor Newcomb has certainly conferred a benefit upon investigators by so clearly pointing out the fallacious nature of this assumption.

But Professor Newcomb's results are probably only true when restricted to his premises. For models *exactly alike, only differing in the scale of their dimensions*, his conclusions are undoubtedly sound; but where large kites are formed by the multiplication of smaller kites into a cellular structure the results are very different. My own experiments with compound kites composed of triangular cells connected corner to corner have amply demonstrated the fact that the dimensions of such a kite may be increased to a very considerable extent without materially increasing the ratio of weight to supporting surface; and upon the tetrahedral plan (Fig. 16) the weight relatively to the wing-surface remains the same however large the compound kite may be.

The indefinite expansion of the triangular construction is limited by the fact that dead weight in the form of empty framework is necessary in the central space between the sets of cells (see Fig. 6), so that the necessary increase of this space when the dimensions of the compound kite are materially increased—in order to preserve the stability of the kite in the air—adds still more dead weight to the larger structures. Upon the tetrahedral plan illustrated in Figs. 14, 15, 16, no necessity exists for empty frameworks in the central spaces, for the mode of construction gives solidity without it.

Tetrahedral kites combine in a marked degree the qualities of strength, lightness, and steady flight; but further experiments are required before deciding that this form is the best for a kite, or that winged cells without horizontal aeroplanes constitute the best arrangement of aero-surfaces.

The tetrahedral principle enables us to construct out of light materials solid frameworks of almost any desired form, and the resulting structures are admirably adapted for the support of aero-surfaces of any desired kind, size, or shape (aeroplanes or aerocurves, etc., large or small).

In further illustration of the tetrahedral principle as applied to kite construction, I show in figure 17 a photograph of a kite which is not itself tetrahedral in form, but the framework of which is built up of tetrahedral cells.

This kite, although very different in construction and appearance from the Aerodrome of Professor Langley, which

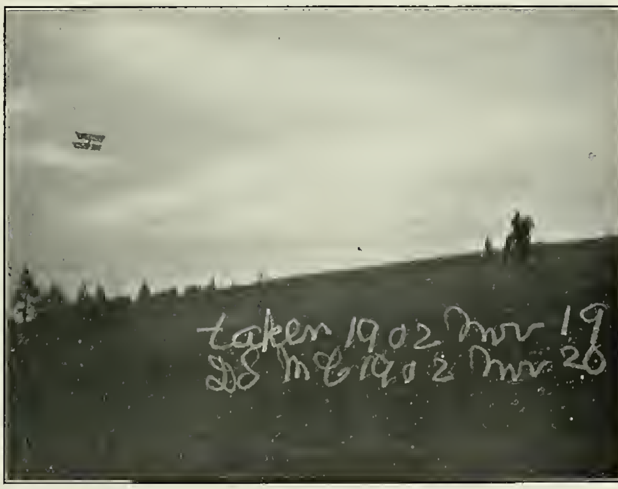


FIG. 18—THE AERODROME KITE JUST RISING INTO THE AIR WHEN PULLED BY A HORSE

I saw in successful flight over the Potomac a few years ago, has yet a suggestiveness of the Aerodrome about it, and it was indeed Professor Langley's apparatus that led me to the conception of this form.

The wing surfaces consist of horizontal aeroplanes, with oblique steadying surfaces at the extremities. The body of the machine has the form of a boat, and the superstructure forming the support for the aeroplanes extends across the boat on either side at two points near the bow and stern. The aeroplane surfaces form substantially two pairs of wings, arranged dragon-fly fashion.

FIG. 19—AERODROME KITE IN THE AIR

The whole framework for the boat and wings is formed of tetrahedral cells having the form of the regular tetrahedron, with the exception of the diagonal bracing at the bottom of the superstructure; and the kite turns out to be strong, light, and a steady flyer.

I have flown this kite in a calm by attaching the cord—in this case a Manila rope—to a galloping horse. Figure 18 shows a photograph of the kite just rising into the air, with the horse in the foreground, but the connecting rope does not show. Figure 19 is a photograph of the kite at its point of greatest elevation, but the horse does not appear in the picture. Upon releasing the rope the kite descended so gently that no damage was done to the apparatus by contact with the ground.

Figure 20 shows a modified form of the same kite, in which, in addition to the central boat, there were two side floats, thus adapting the whole structure to float upon water without upsetting.

An attempt which almost ended disastrously, was made to fly this kite in a good sailing breeze, but a squall struck it before it was let go. The kite went up, lifting the two men who held it off their feet. Of course they let go instantly, and the kite rose steadily in the air until the flying cord (a Manila rope

FIG 20—FLOATING KITE

$3/8$ inch diameter) made an angle with the horizon of about $45°$ when the rope snapped under the strain.

Tremendous oscillations of a pitching character ensued; but the kite was at such an elevation when the accident happened, that the oscillations had time to die down before the kite reached the ground, when it landed safely upon even keel in an adjoining field and was found to be quite uninjured by its rough experience.

Kites of this type have a much greater lifting power than one would at first sight suppose. The natural assumption is that the winged superstructure alone supports the kite in the air, and that the boat body and floats represent mere dead-load and head resistance. But this is far from being the case. Boat-shaped bodies having a V-shaped cross-section are themselves capable of flight and expose considerable surface to the wind. I have successfully flown a boat of this kind as a kite without any superstructure whatever, and although it did not fly well, it certainly supported itself in the air, thus demonstrating the fact that the boat surface is an element of support in compound structures like those shown in figures 17 and 20.

Of course the use of a tetrahedral cell is not limited to the construction of a framework for kites and flying-machines. It is applicable to any kind of structure whatever in which it is desirable to combine the qualities of strength and lightness. Just as we can build houses of all kinds out of bricks, so we can build structures of all sorts out of tetrahedral frames, and the structures can be so formed as to possess the same qualities of strength and lightness which are characteristic of the individual cells. I have already built a house, a framework for a giant wind-break, three or four boats, as well as several forms of kites, out of these elements.

It is not my object in this communication to describe the experiments that have been made in my Nova Scotia laboratory, but simply to bring to your attention the importance of the tetrahedral principle in kite construction.

APPENDIX

Through the courtesy of Dr Bell the NATIONAL GEOGRAPHIC MAGAZINE is able to present as an appendix to this article a series of some seventy illustrations of experimental forms of kites and structures used by Dr Bell. The illustrations were selected by the editor from several hundred pictures in Dr Bell's notebooks. The pictures were taken and developed by Mr David George McCurdy, the photographer of his laboratory, with the exception of Plate III, which was taken by Mr F. Tracy Hubbard. The notes explaining the illustrations were written by Dr Bell by request.

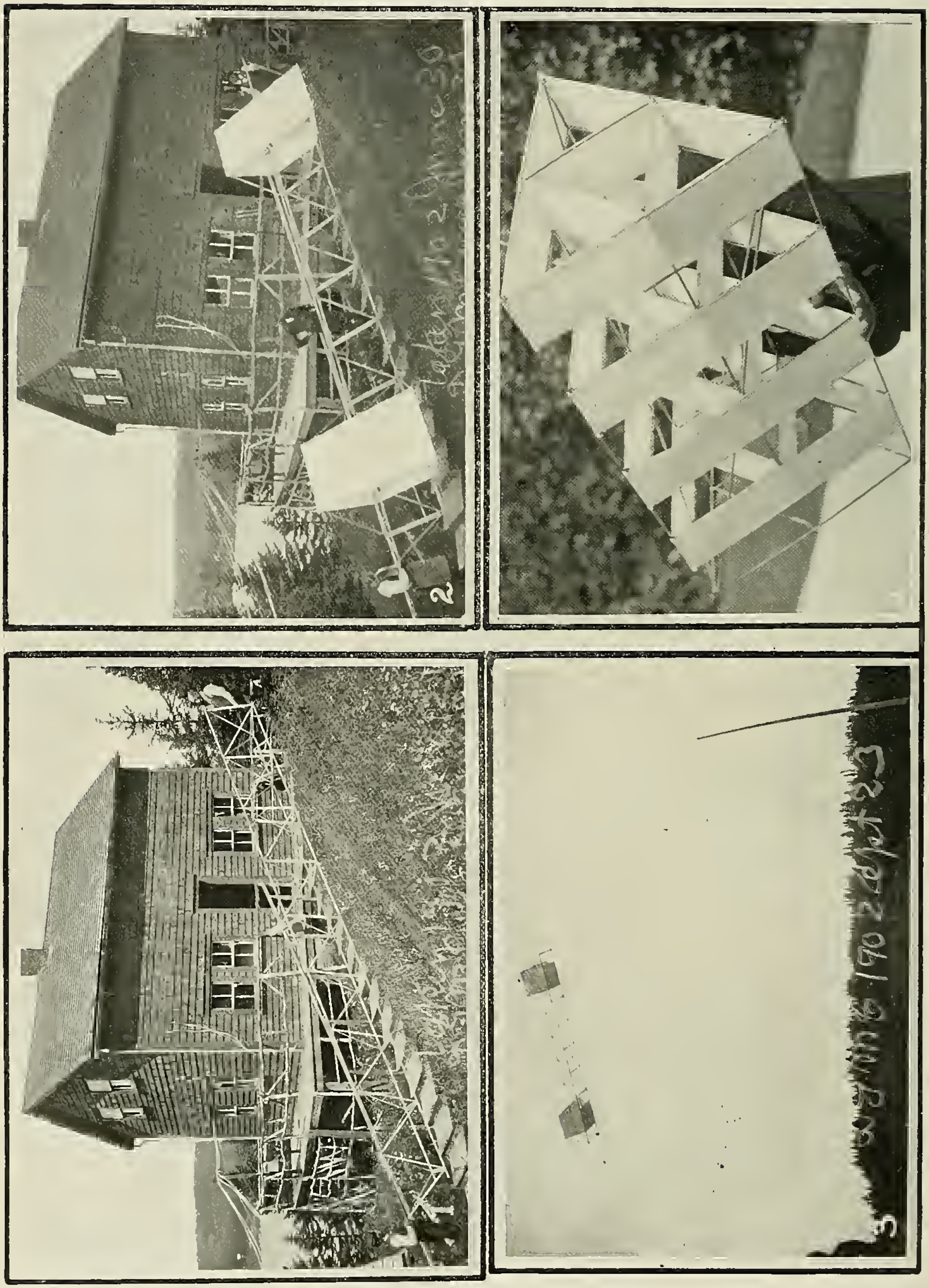


PLATE I

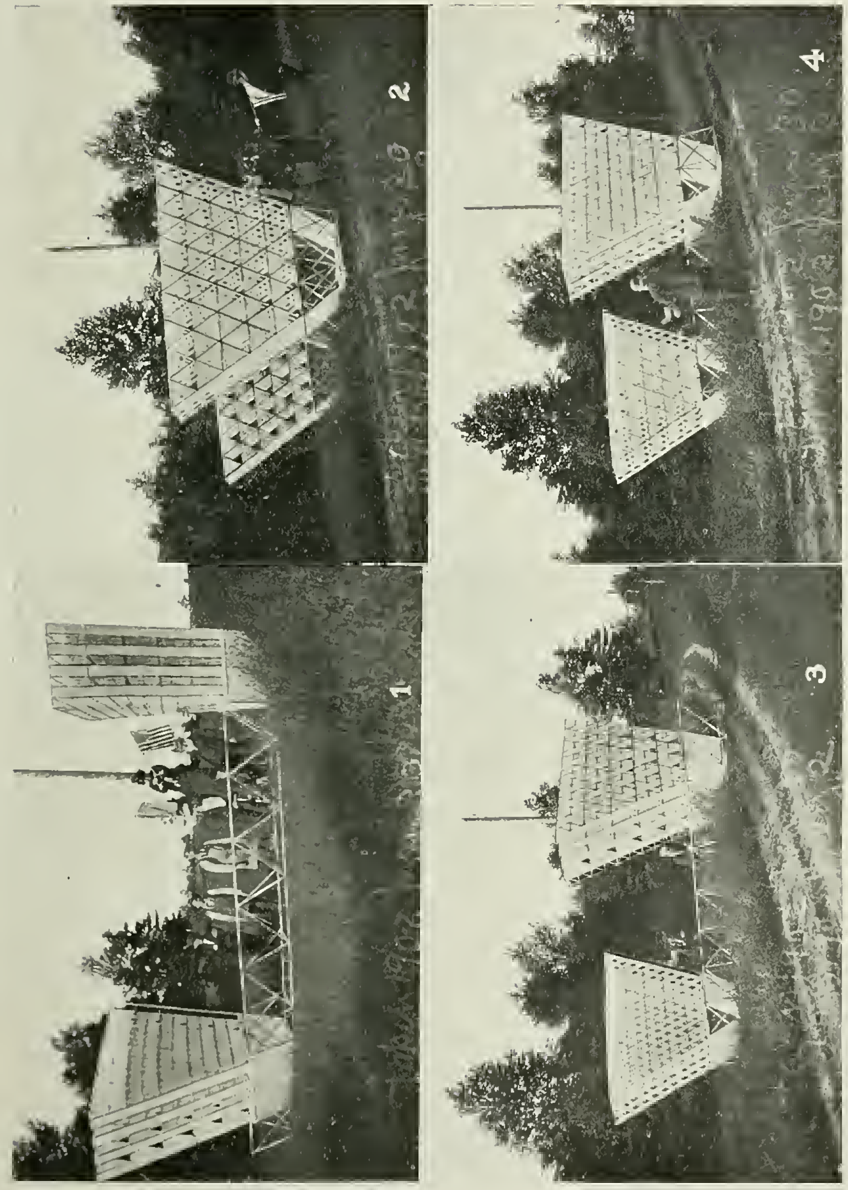


Plate II

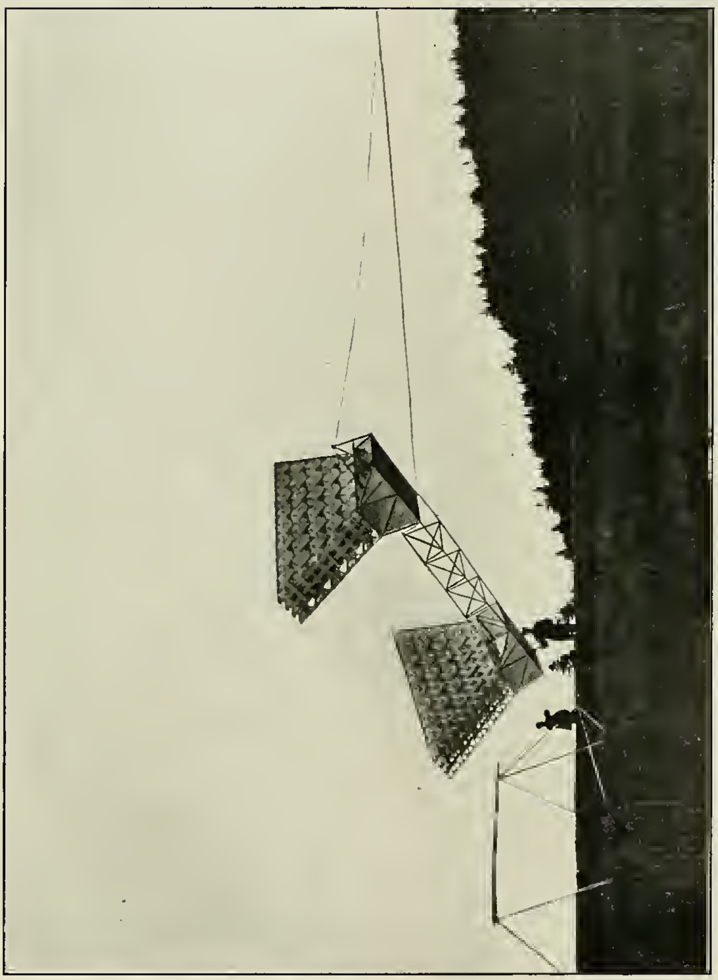


PLATE III

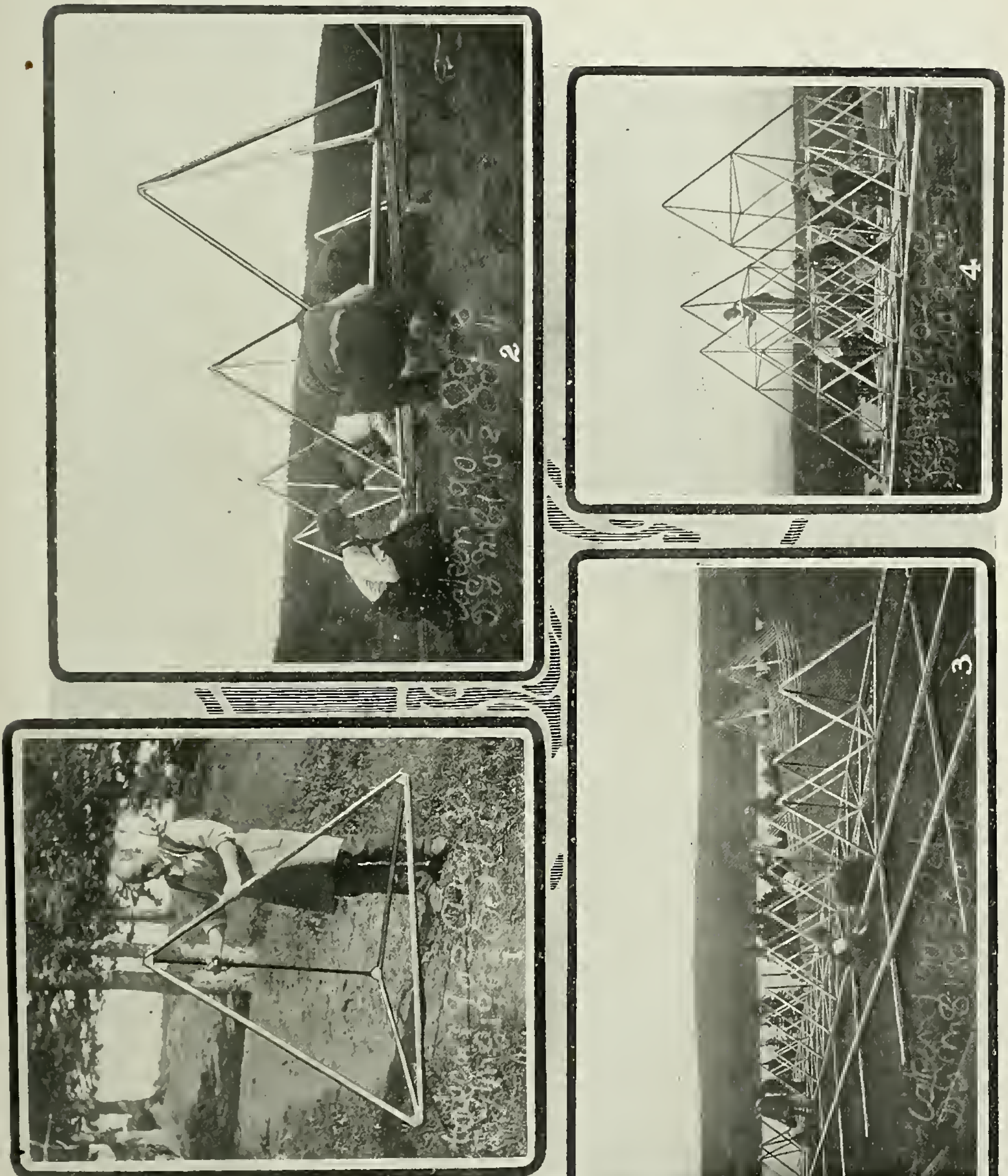


PLATE IV

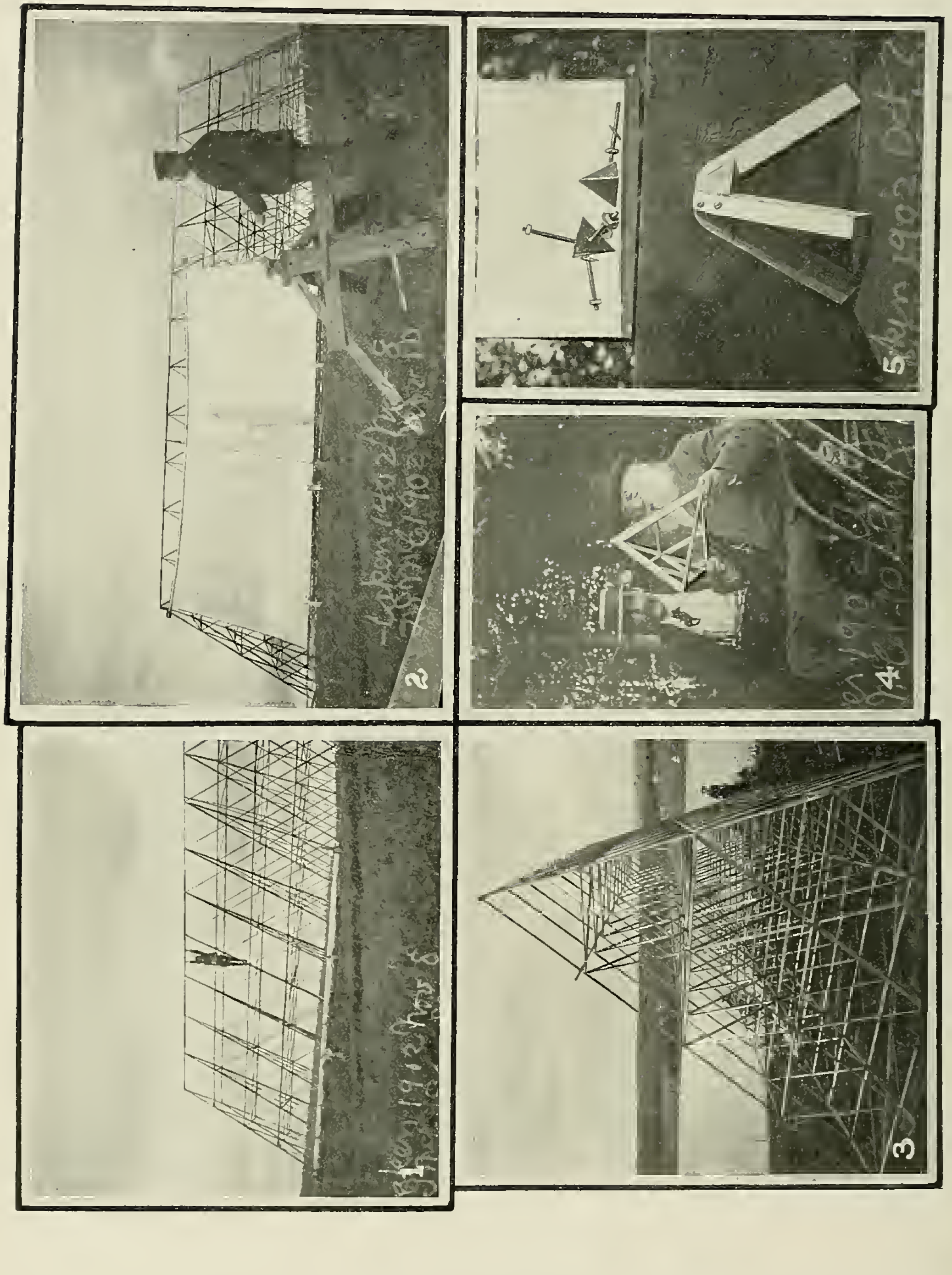


PLATE V

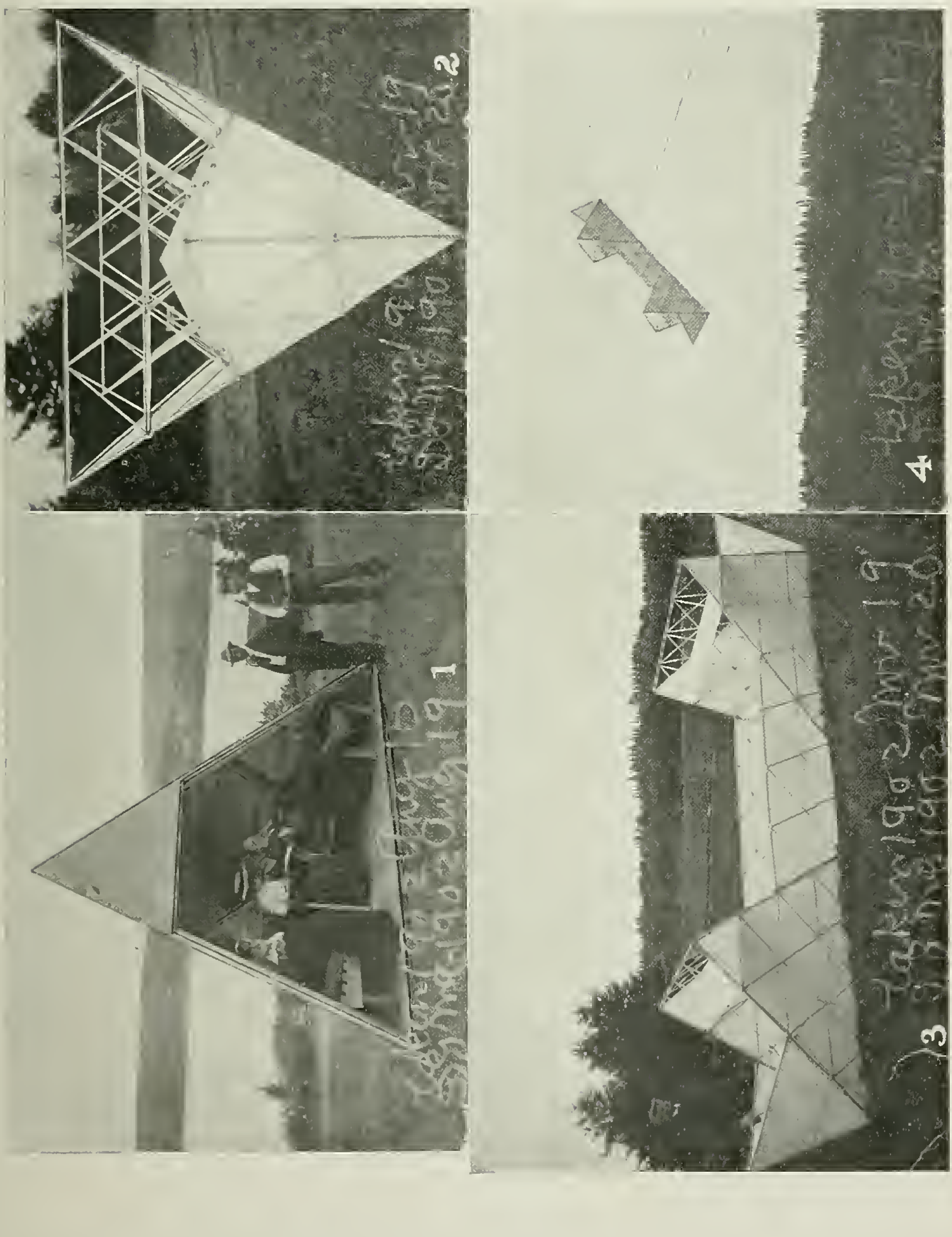


Plate VI

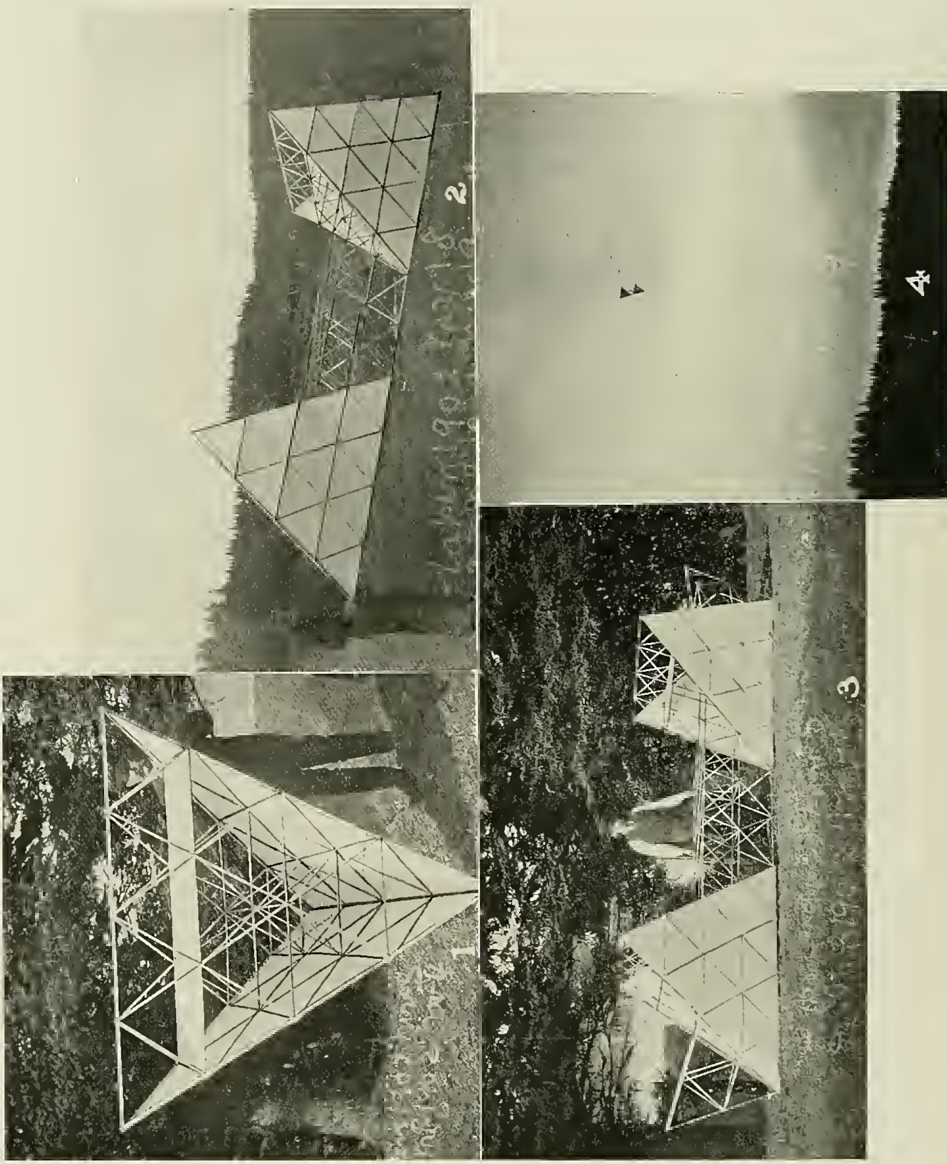


PLATE VII

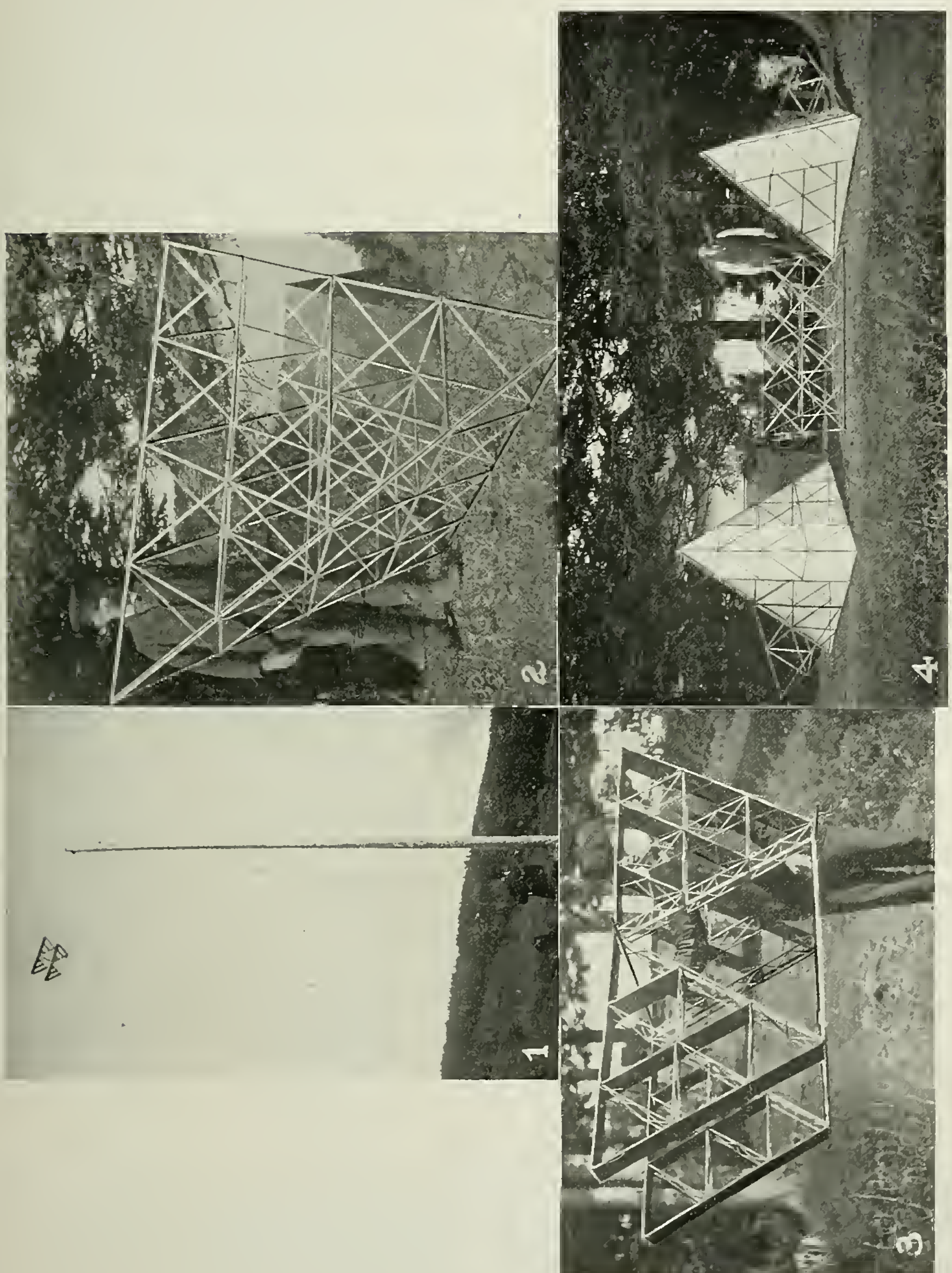


Plate VIII

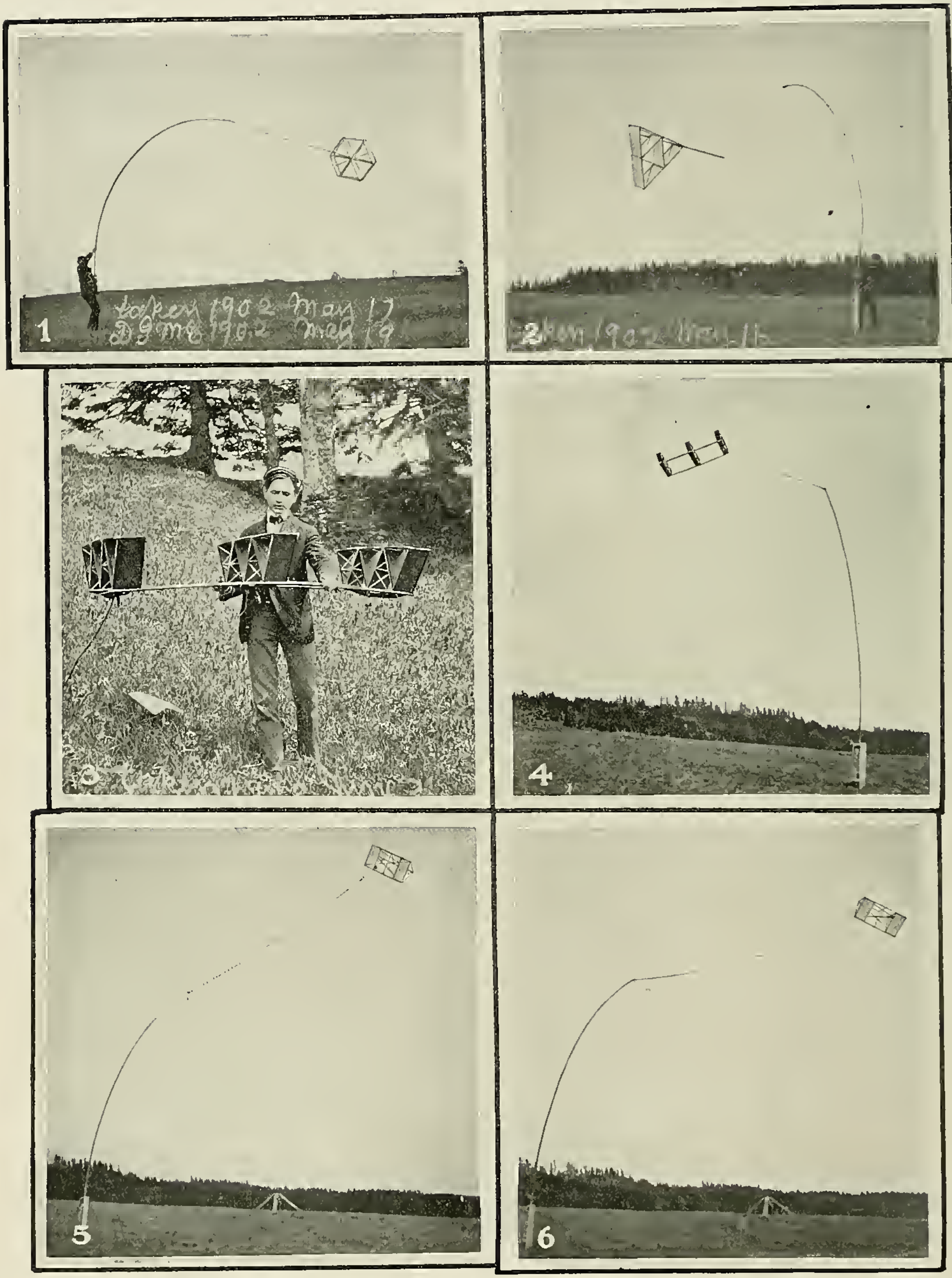


PLATE IX

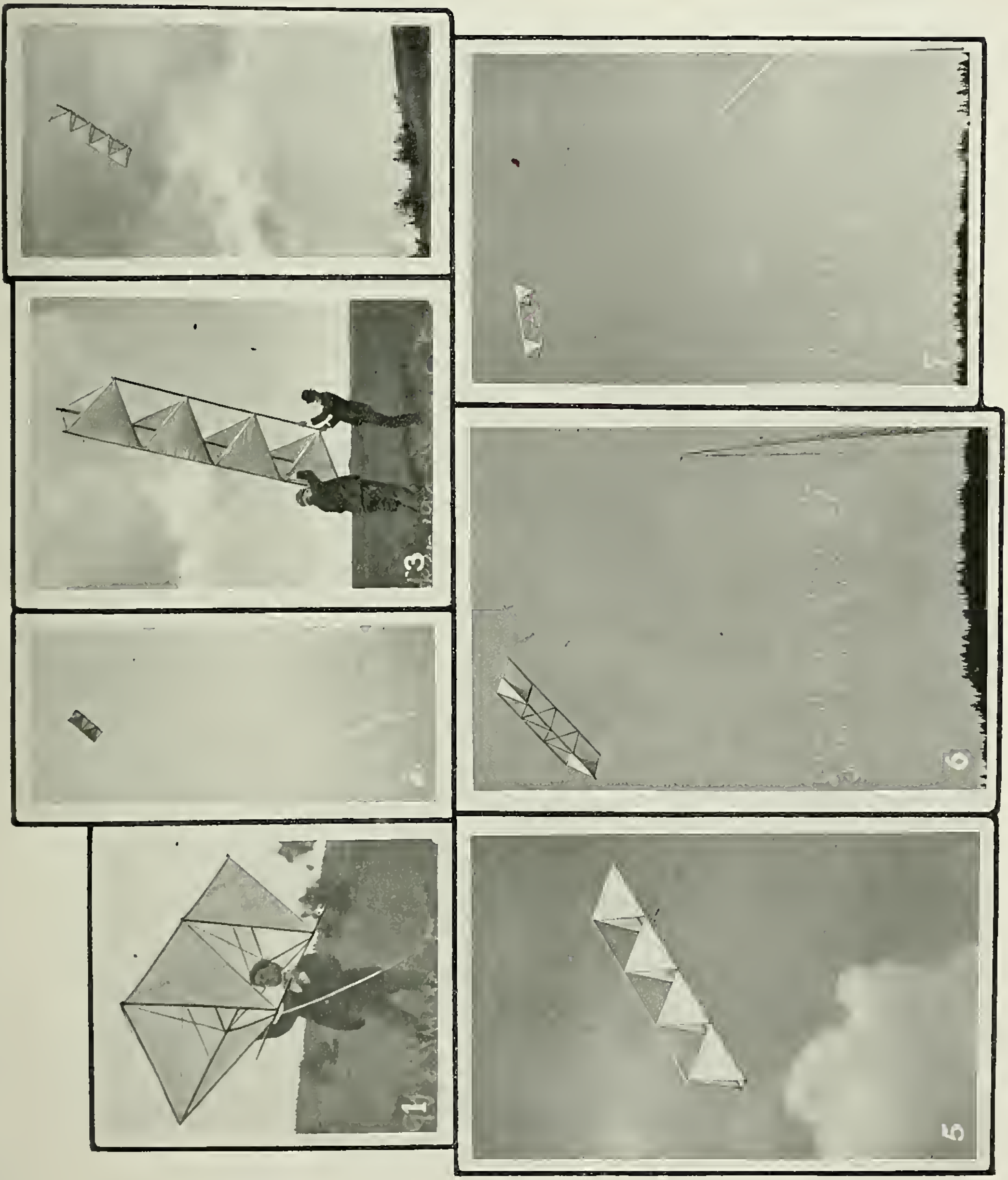


Plate X

PLATE XI

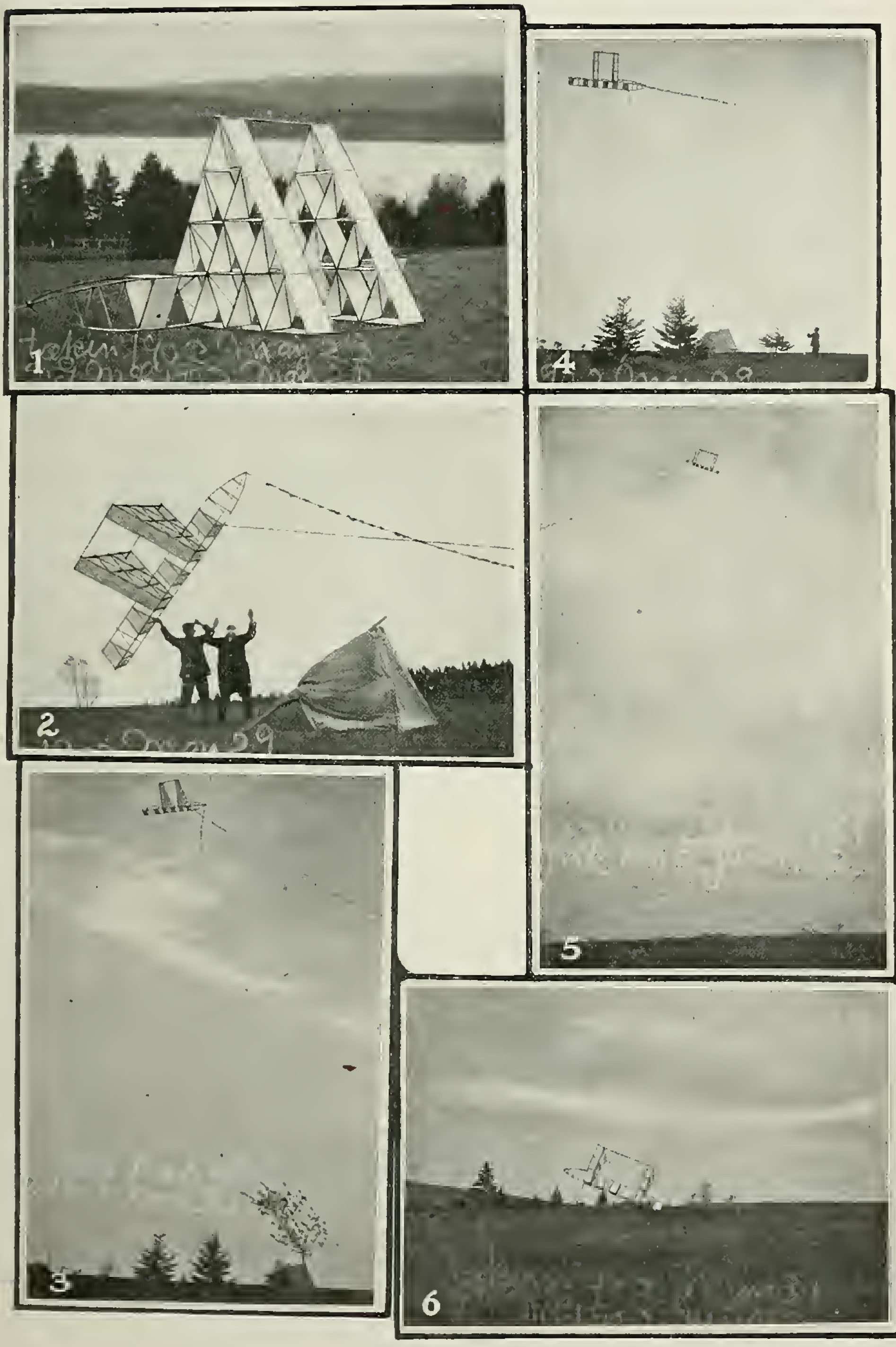


Plate XII

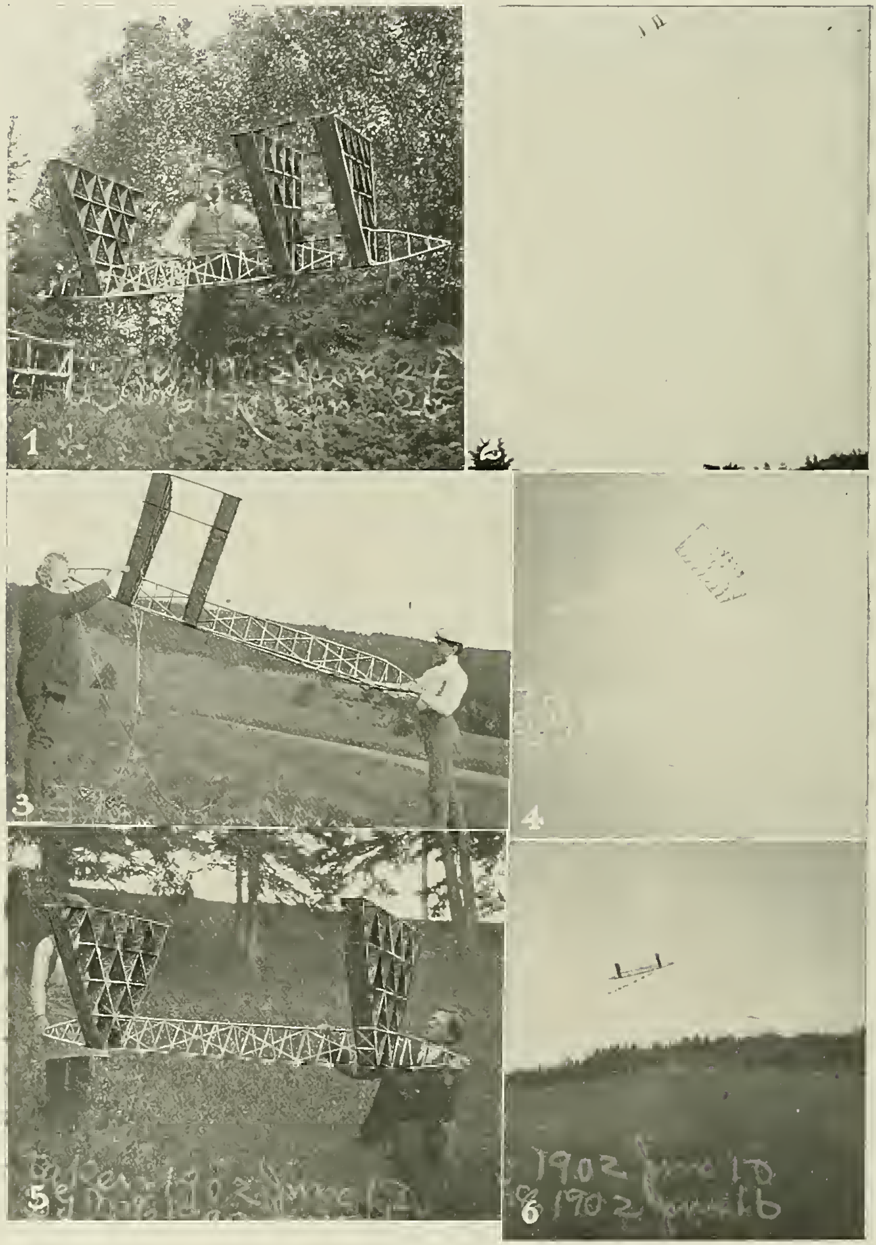


Plate XIII

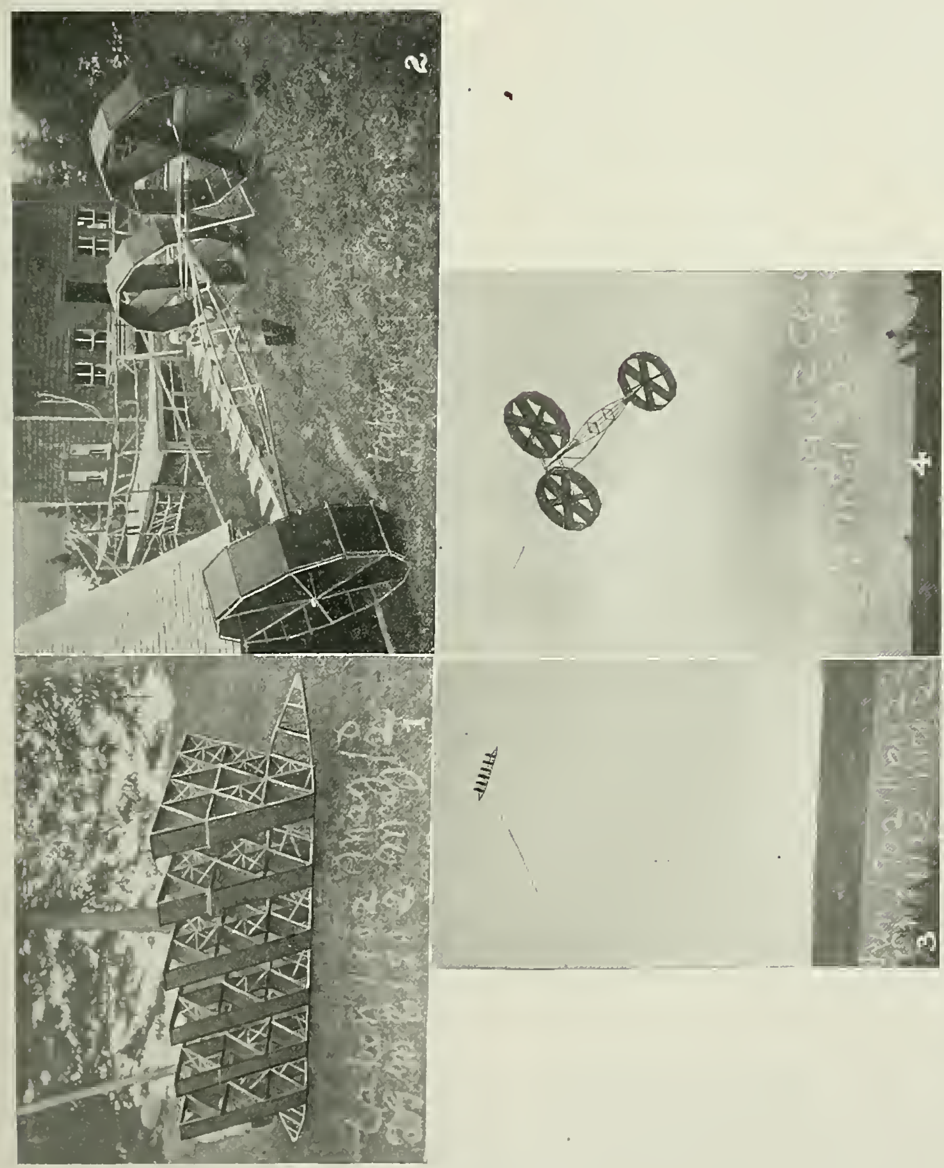


Plate XIV

PLATE XV

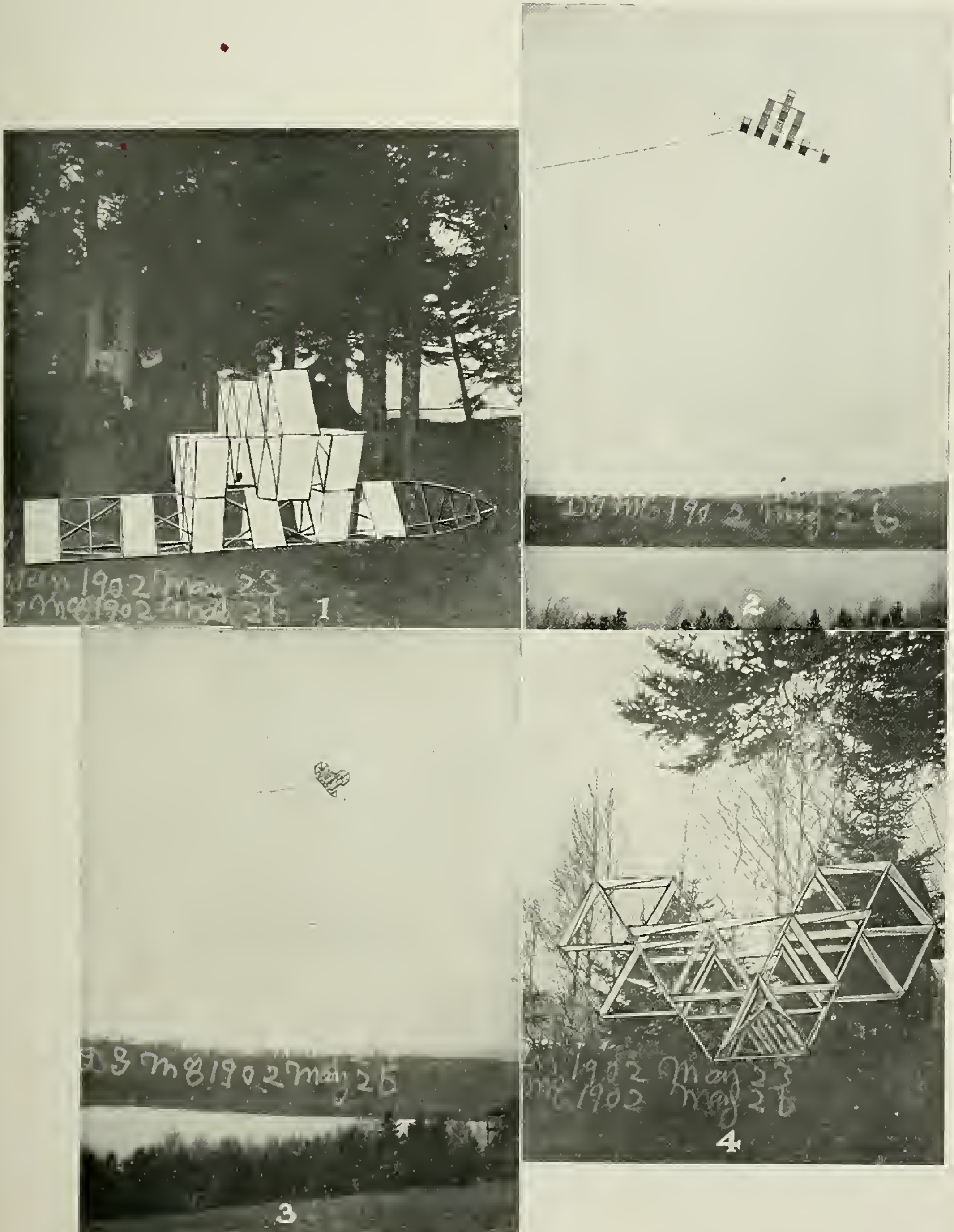


Plate XVI

NOTES ON THE PRECEDING ILLUSTRATIONS

By Alexander Graham Bell

Plate I.—1. Cellular framework for body of Multicellular Giant Kite. Although not built up of separate individual cells, the frame is composed *essentially* of nine tetrahedral cells connected together, corner to corner, at the tops, and held in position below by means of two parallel sledge runners braced diagonally with wire. Total length, nine meters (29½ feet). The diagonal wires do not show in the picture, and it may be possible that the photograph was taken before the rectangular part of the structure was braced.

2. Cellular framework shown in No. 1 provided with two covered cells to convert it from mere dead weight to be carried by the superstructure into a real flying structure by itself.

3. Cellular framework shown in No. 2 supported in the air as a kite without any superstructure whatever. It is flying by a rope attached to the front cell and has also a stern line to facilitate landing.

4. One of the individual kites forming the cellular unit or element of the superstructure of the Multicellular Giant Kite (formed of two triangular kites one inside the other). The superstructure was composed of seventy of the kites shown in No. 4 tied together at the corners, arranged in two sets of thirty-five kites each. The seventy kites were tested individually before being combined, and each was found to fly well by itself.

Plate II.—Different views of a Multicellular Giant Kite. The framework of the body is of stout material composed partly of tetrahedral cells, but the sledge runners at the bottom, being parallel, require diagonal bracing. This same body is shown in Nos. 1, 2, 3, Plate I. The superstructure is of light material and is composed of 70 triangular kites (like that shown in No. 4, Plate I) tied together at the corners and arranged in two sets—one at the bow, the other at the stern.

Plate III.—The Multicellular Giant Kite rising into the air. The body broke as the kite went up, so that no photograph of the kite could be taken at a higher elevation. The light superstructure seems to have escaped injury in the air, but a few of the constituent kites were broken by contact with the ground and the broken framework of the body. It is somewhat remarkable that the stout body sticks should have given way rather than the fragile sticks of the superstructure.

Plate IV.—Giant kites, too large to pass through the double doors of the storage building, had to be put together in the open field. This proving to be impracticable without some sort of shelter from the wind, a wind-break became a necessity, and I determined to build one out of tetrahedral cells. After the necessary number of tetrahedral cells had been prepared they were put together in a single day, the ridge-pole being added subsequently. When the kite-flying experiments ceased for the season the framework was taken to pieces and the tetrahedral cells employed in the construction of tetrahedral houses—covered with tent-cloth—for the shelter of sheep. The materials can be reassembled at any time desired, and the wind-break rebuilt in a few hours. The photographs illustrate different stages in the process of construction:

1. Tetrahedral cell employed in making the framework of the wind-break.

2, 3, and 4. The wind-break in process of construction.

Plate V.—1. Wind-break completed, showing canvas rolled down.

2. Wind-break showing canvas raised.

3. End view of wind-break.

4. Model of the framework for a tetrahedral house.

5. Tetrahedral nuts for fastening tetrahedral frames together.

Plate VI.—1. The observation-house where the kite experiments are observed and noted. The house itself is of the tetrahedral form.

2. Front view of winged boat, the framework of which is constructed of tetrahedral cells.

3. Another view of the winged boat.

4. The winged boat in the air.

Plate VII.—1. A tetrahedral frame of tetrahedral cells, winged on the outside, with an internal aeroplane.

2. A kite formed of two tetrahedral structures like that in No. 1 connected together by a framework composed of tetrahedral cells.

3. The kite of No. 2 fitted with compound tetrahedral frames at either end converting the framework into the form of a boat. This same kite with the framework covered constitutes the winged boat shown in Nos. 2, 3, and 4, Plate VI.

4. The kite of No. 2 in the air.

Plate VIII.—3. Non-capsizable kite. When from any cause the kite tips to one side the lifting power increases on the depressed side and diminishes on the elevated side, thus tending to right the kite.

1. Non-capsizable kite flying from flag-pole.

2. Tetrahedral frame used in the construction of the winged boat shown in Plate VI; also used in the structures shown in Plate VII.

4. Portions of the kite shown in Plate VII, No. 3, in sections ready to be tied together.

Plate IX.—Photographs illustrating mode of studying the behavior of bodies in the air, whether these bodies are capable of supporting themselves in the air or not. They are attached to the end of a bamboo pole by a cord sufficiently short to prevent them from dashing themselves to pieces upon the ground. A flag-pole is used for large kites, but a bamboo fishing rod is more convenient for testing the flying qualities of the smaller structures. In the cases shown in the plate, the cord is a manila rope, about ¼ inch in diameter. Such a rope is too heavy for light kites, but smaller cords make so little impression on the photographic film that it is often difficult when such cords are used to understand the conditions of an experiment from a photograph.

1. A single set of triangular cells constituting a hexagonal figure with six interior radial wings.

2. A single set of triangular cells constituting the figure of a triangle within a triangle.

3. A kite with three sets of triangular cells.

4. Kite shown in No. 3 flying from a bamboo pole.

5. Two-celled triangular kite with rope attached to rear edge of front cell.

6. Same kite shown in No. 5 flown by the bow.

Plate X.—These photographs illustrate experiments with kites formed partly of open tetrahedral cells, with the spaces between the cells covered.

1. Kite with two pentahedral cells close together, each cell having three of its five faces covered. The rectangular part of the kite is braced diagonally by means of tightly stretched wires.

2. Same kite shown in No. 1 at a considerable elevation in the air.

3. Similar kite with four pentahedral cells close together, each cell having

three of its five faces covered. The open spaces between the cells are tetrahedral in form.

4. Kite shown in No. 3 flying with its rectangular side up.

5. Kite shown in No. 3 flying with its rectangular side down.

6. Kite shown in No. 3 with the covering removed from the two middle pentahedral cells—rectangular side down.

7. Same kite shown in No. 6 flying with the rectangular side up. In this picture the short white line in the margin of the photograph indicates the direction of the flying cord.

Plate XI.—Experiments to determine the relation of center of gravity to center of surface in a flying structure by shifting the cellular superstructure to different parts of the body frame.

1. Superstructure over first body cell; center of gravity too far back.

2. Superstructure over second body cell.

3. Superstructure over third body cell.

4. Superstructure over fourth body cell; center of gravity too far forward; kite dived, superstructure smashed.

Plate XII.—Experiments with kites having two sets of cells in the superstructure:

1. Superstructure over second and fourth body cells.

2. Just rising in the air.

3. Flying by cord attached to front of first body cell.

4. Bringing the kite down while anchored by a bow-line.

5. Superstructure over first and fifth body cells. Flying line attached to front of first body cell. The apparent smallness of the kite shows that it is at a considerable elevation in the air.

6. Kite being landed from a distance. Allowed to fall on a slack line, but checked momentarily as it nears the ground to reduce the rate of fall. Again allowed to fall and the cord reeled in so as to give the kite headway at the moment of contact with the ground, thus causing the stern to strike only a glancing blow. A bow-line, however, is a great safeguard against injury.

Plate XIII.—The photographs illustrate the nature of experiments made to test the effect of varying the number and position of sets of triangular cells upon a body framework:

1. Two sets of cells near bow, and one stern set as a tail.

2. Kite shown in No. 1 at a great elevation in the air.

3. Same kite shown in No. 1 with the stern set of cells removed. The photograph shows very clearly the bow-line used to facilitate the handling of kites in the air. Flying by the bow-line reduces enormously the strain upon the structure when the kite first begins to rise in the air. This strain gradually eases off as the kite rises, and when it is at a considerable elevation the bow-line is made slack while the kite is held by the other, or "flying-cord," which in this case is attached to the rear edge of the first set of cells, when the kite rises still higher. The bow-line is again used in bringing the kite down, for the body then becomes practically horizontal as it nears the ground. This is advantageous, for it reduces the risk of injury to the kite upon landing. In good flying kites anchored by the bow the bow-line can be overrun by the hand, or by a grooved roller, until the kite is reached and grasped by the hand without allowing the kite to touch the ground at all.

5. Same kite shown in No. 3, but the sets of cells separated as far as possible upon the body.

6. Kite shown in No. 5 nearing the ground after an experiment. It is flying by the bow-line, and the photograph shows the other line blown back by the wind, or perhaps held in the hands of an assistant.

4. A kite with eight sets of cells.

The spaces between the sets are not sufficient to constitute the kite a good flyer. The sets of cells interfere with one another.

Plate XIV.—1. Multicellular kite having 6 sets of cells in the superstructure.

3. Multicellular kite in the air.

2. Giant kite having three 12-sided cells, each with 6 radial wings.

4. Giant kite flying from pole.

Plate XV.—1. Hexagonal kite with six radial wings, loaded in the middle with an adjustable weight.

3. Hexagonal kite flying from a flagstaff.

2. Twelve-sided kite with six radial wings, of giant construction.

4. Twelve-sided kite flying from a flagstaff.

Plate XVI.—Paddle-Wheel Kite. 1. Paddle-wheel kite on the ground.

2. Side view of same kite in the air.

3. Another photograph of paddle-wheel kite in the air.

4. End view of paddle-wheel kite. In most of the photographs the flying-line is invisible, but in above photographs and others the visibility has been improved by tying pieces of colored cloth at intervals upon it, as in the tail of an old-fashioned kite, thus enabling the direction of the cord for a short distance from the kite to be visible as a dotted line upon the photograph.

MR ZIEGLER AND THE NATIONAL GEOGRAPHIC SOCIETY

At the invitation of Mr William Ziegler, the National Geographic Society is to direct the scientific work of the north polar expedition which Mr Ziegler has equipped and which is known as the Ziegler Polar Expedition.

The National Geographic Society has chosen as its official representative on the expedition Mr William J. Peters of the U. S. Geological Survey. Mr Peters will be second in command, and will have entire charge of all the scientific observations and determinations of the party. Mr Peters is one of the splendid corps of explorers of the U. S. Geological Survey. He has made several notable journeys in Alaska, the most remarkable of which was in 1901, when, as leader of a Survey party, he made a sledge journey with dogs of 1,600 miles.*

The expedition sails from Trondhjem, Norway, about June 20, on the steam yacht *America*, which has been thoroughly overhauled and strengthened during the past year. They will advance as far north as the ship can take them, and will then land on Franz Josef Land, where the winter will be passed. As soon as light returns in 1904 the march for the Pole will begin. The *America* stays with the party. In June, 1904, an auxiliary vessel, under command of Wm. S. Champ, will go north to carry additional supplies and to escort the expedition home.

The commander of the expedition is Mr Anthony Fiala, of Brooklyn, N. Y. Mr Fiala was second in command of the first Ziegler expedition. He is about 33 years of age, strong and vigorous, and would seem to have all the requirements for a successful leader of an arctic expedition.

Mr Ziegler has shown himself an enthusiastic and generous supporter of arctic exploration. When his first

* See NATIONAL GEOGRAPHIC MAGAZINE, vol. 12, 1901, p. 399.

expedition returned unsuccessful in reaching the North Pole, though it had cost him several hundred thousand dollars, he at once announced that he would send out a second expedition. Everything that experience or thought could suggest has been provided. The party will take 30 Siberian ponies with them. The last expedition had a number of these ponies and found them much superior to dogs. They are both stronger and more enduring than dogs, and while they eat more they can carry more in proportion. The ponies can go anywhere that a dog can go and are more reliable, for when they come to a hummock they do not dart in different directions and upset the sledges. Hay to feed the ponies is being carried in solidly compressed bales. Besides the ponies, 200 dogs are also taken.

On the first Ziegler expedition eight nationalities were represented, and great confusion resulted because of the varieties of language. Every member of the present expedition is an American by birth or naturalization; most of the men have had experience in arctic work before, either in Alaska, Hudson Bay, or on whaling vessels. The sailing master, Captain Coffin, as captain of a whaler has for 25 years battled with the arctic ice. Mr Russell W. Porter, of the scientific staff, has had service in Greenland with Peary and also accompanied the first Ziegler expedition. Mr Francis Long was a member of the Greely expedition of 1881–'84.

Mr Ziegler's ambition to plant the American flag at the North Pole is patriotic and laudable. The National Geographic Society is glad to indorse his worthy object and to wish him and his gallant men success.

The instructions of the National Geographic Society to Mr Peters regarding the scientific work to be done are summarized in the following report to President Graham Bell by Mr G. K. Gilbert, Chairman of the Research Committee:

MAY 19, 1903.

DR ALEXANDER GRAHAM BELL,
President National Geographic Society.

DEAR SIR: The Committee on Research was instructed by the Executive Committee of the Society to consider the possibilities of scientific work by and under the direction of Mr Peters during the Ziegler Arctic Expedition, and to recommend the lines of investigation to be followed. I regret to say that the committee has not been able to hold a meeting, on account of the engagements of its members, and especially the absence of several members from the city. I have, however, conferred personally with Dr Merriam, General Greely, and Admiral Melville, of my colleagues on the committee, and also with Professor Moore, Chief of the Weather Bureau; with Mr Tittmann, Superintendent of the Coast Survey, and with other officers of the Coast Survey, and as a result of these conferences I feel warranted in making certain recommendations concerning the lines of research which may best be undertaken by Mr Peters.

The considerations influencing the selection of these lines are (1) that Mr Peters will have very little skilled assistance; (2) that during the long night to be spent in camp on Franz Josef Land there will be abundant time at his disposal, including his own and that of various assistants, and (3) that in the journey northward his attention will be quite fully occupied in the work of determining the route and position of the party, and with such executive work as may fall to his share. I think it well, therefore, that he limit his plan for research chiefly to such lines as can be best followed on the land, and that he restrict his attention in the main to such studies as his education and previous training best qualify him to conduct.

Gravity.—It is recommended that a determination of gravity be made by pendulum observations at the winter camp. With the assistance of Mr Hayford and other officers of the Coast Survey, Mr Peters is now making preparation for that work.

Tides.—It is recommended that systematic tidal observations be made at the base camp, a continuous record being maintained through a complete lunation and so much longer as may be necessary to eliminate any irregularities occasioned by storms. For this work Mr Peters is receiving instructions from Dr Harris, of the U. S. Coast Survey.

Magnetism.—It is recommended that systematic observations of the usual magnetic elements be made at the base camp. It is important that the declination be observed, if possible, at some point where a previous record has been made, and also that the magnetic station of the present expedition be definitely marked and recorded, so that at any future time it may be possible to reoccupy the station. The determination of declination will have immediate importance in connection with the main purpose of the expedition, because if the Pole is approached the compass will afford the most trustworthy means for orientation and for the determination of the proper route to be followed in returning. Conversely, the traverse of the journey on the ice, taken in connection with astronomical observations, will throw light on the position and curvature of the magnetic meridians in the polar region—a field of inquiry which has heretofore been occupied only in a theoretic way.

Aurora.—In connection with systematic magnetic work, it is desirable to make systematic observation of auroras, recording phenomena with some fulness. The question whether the aurora is ever accompanied by sound is one to which attention may well be given.

Meteorology.—It is the opinion of Professor Moore that in the present state of meteorologic investigation the regular observation at Franz Josef Land of pressure, temperature, and surface wind, while desirable, is less important than the determination of the height, drift, and velocity of clouds. Professor Moore has undertaken to prepare instructions for such a determination,

Sea-Depth.—In the judgment of Admiral Melville, it is very desirable that soundings be made during the northward journey, especially as the results of such soundings on the outward journey may aid in the determination of position during the return journey. They will, of course, make contribution to the general body of geographic information, and supplement the important determinations made by Nansen. Whether it will be practicable to carry on the sledges any apparatus adequate to reach considerable depth is a question which may advantageously be considered on shipboard.

Other Observations.—It is not recommended that any special preparation be made for observations in geology, zoölogy, or botany, although the geologist will welcome samples of prevailing rocks, and especially any fossils which may be found, and the zoölogist will be glad to have record of birds and mammals seen, so far as the members of the party may be able to identify them.

Yours very truly,

G. K. GILBERT,
Chairman Research Committee.

The names of the members of the expedition and their duties follow :

Commanding officer, Anthony Fiala, Brooklyn, N. Y.

Field Department

Chief of scientific staff and second in command, William J. Peters, Washington, D. C.

First assistant scientific staff, Russell W. Porter, Springfield, Mass.

Meteorologist, Francis Long, Brooklyn, N. Y.

Surgeon, Dr George Shorkley, Camden, Me.

Assistant surgeon, Chas. L. Seitz, Evansville, Ind.; assistant surgeon, J. Colin Vaughn, Forest Hill, N. J.

Veterinarian, H. H. Newcomb, Milford, Mass.

Quartermasters in charge of sledge equipment, Charles E. Rilliet, St. Louis, Mo.; Jefferson F. Moulton, Second Cavalry, U. S. Army.

Third assistant quartermaster, R. R. Tafal, Philadelphia, Pa.

Fourth assistant quartermaster, John W. Truden, N. Y. city, N. Y.

Assistants in quartermaster's department, John Vedow, Mass.; Pierre Le Royer.

Deck Department

Captain, Edward Coffin, Edgartown, Mass.

First officer, Edward Haven, Lynn, Mass.

Second officer, James W. Nichols.

First quartermaster, Allen W. Montrose, Lowell, Mass.

Second quartermaster, William R. Meyers, Boston, Mass.

Third quartermaster, Franklin Cowing, New Bedford, Mass.

Fourth quartermaster, Chas. Kunold, New York.

Seamen, Harry Burns, Dunkirk, N. Y.; D. S. Mackiernan, Dorchester, Mass.; Alfred Beddow, London, Eng.; Clarence W. Thwing, Boston, Mass.; Elijah L. Perry, New Bedford, Mass.; Emil Meyer, New York; John Duffy, Waltham, Mass.; William Ross, New York.

Assistant steward, Spencer W. Stewart, Brooklyn, N. Y.

Cook, George H. Smith, Somerville, Mass.

Boy, James Dean, New Bedford, Mass.

Engineer's Department.

Chief engineer, H. P. Hartt, Portsmouth, Va.

First assistant engineer, E. L. Varney, Camden, Maine.

Second assistant engineer, Anton Vedow, Boston, Mass.

Firemen, George D. Butland, Brooklyn, N. Y.; Charles E. Hudgins, Norfolk, Va.

GEOGRAPHIC NOTES

NATIONAL GEOGRAPHIC SOCIETY

At a meeting of the Board of Managers of the National Geographic Society on May 15, Dr Alexander Graham Bell tendered his resignation as President of the Society. Dr Bell stated that owing to the pressure of work he found it impossible to give to the Society the thought that the position of President demanded. The resignation of President Bell was accepted by the Board with profound regret, to take effect on the election of his successor. Dr Bell was appointed chairman of a committee of three to consider and nominate a successor. The other two members of the committee, appointed by the President, are Dr Willis L. Moore, Chief U. S. Weather Bureau, and Mr G. K. Gilbert, U. S. Geological Survey. As no election will be made until the fall, Dr Bell will continue as President of the Society for some months.

At the same meeting of the Board, Vice-President W J McGee was appointed chairman of the Committee on the International Geographical Congress which is to meet in America in 1904 under the auspices of the National Geographic Society. General Greely, the original chairman of this committee, was compelled to resign the chairmanship because of ill health and the pressure of official duties.

At an adjourned meeting of the Board held May 18 resolutions were unanimously passed indorsing the movement to bring the remains of James Smithson, the founder of the Smithsonian Institution, to America, and inter them in the grounds of the Institution.

The Geographical Society of the Pacific has taken similar action.

ALASKAN SURVEYS, 1903

THE operations of the United States Geological Survey in Alaska during the coming field season will be along the same general lines that have been followed during the last few years, except that the work contemplated involves rather more detailed mapping and investigation. The general policy of devoting special attention to regions of greatest activity in mining affairs will be continued.

It is planned to complete the surveys of the Seward Peninsula, which has been under investigation for several years. This peninsula embraces what are up to the present time the most important gold placers of the entire territory. Mr Arthur J. Collier, with an assistant, will make a special study of the geology and mineral resources of the southern and northwestern part of the peninsula. It is intended that his work should supplement that of previous years, and that he should pay special attention to the developments that have been made during the last season. It is hoped that by this means further light will be thrown on the occurrence of placer gold in the various forms of deposits in which it is found. To Mr D. C. Witherspoon will be entrusted the topographic survey of the northeastern part of the peninsula, including the gold fields adjacent to Deering. The geologic work of this area will be duly arranged for.

Two parties will be organized for surveys in the Yukon gold district. One party, led by Mr T. G. Gerdine, will make a topographic survey extending from the Fortymile region westward to the Tanana River and embracing as wide a belt as length of season and climatic conditions will permit, a special effort being made to reach and map the lower Tanana gold fields. The second party will be in immediate charge of Mr L. M. Prindle, and will have for its field of operations the Fortymile and Birch Creek regions and the newly discovered gold fields near the lower Tanana. This party will make a geological investigation and an examination of the mineral resources of the region. These two parties, it is expected, will obtain much information in regard to the new gold fields on the Tanana, which are reported to be very rich.

The investigation of the stratigraphy of the Yukon, begun by Mr Collier during the last season, will be continued by Dr Arthur Hollick. Dr Hollick will visit a number of points on the Upper and Lower Yukon with a view to determining the stratigraphic position of the coal-bearing horizons by special studies of local areas and extensive collections of fossils.

The Kayak Island and Controller Bay petroleum and coal fields will be the subject of a preliminary examination by Mr Frank C. Schrader. It is planned that Mr Schrader shall spend about two months in this region, with a view to ascertaining the extent of these important deposits and their probable economic value. Late in the season Mr. Schrader will make a more hasty examination of some of the petroleum and coal localities on Cook Inlet.

The investigations in southeastern Alaska will be made by Dr Arthur C. Spencer, who, with an assistant, will make a special study of the Juneau mining district and map the geology of the adjacent region. For this purpose a detailed topographic map was made

Prospecting for Gold in Alaska

during the last season. Dr Spencer will also make preliminary examinations of some of the other important mining districts of southeastern Alaska.

Mr Alfred H. Brooks, who has charge of the geologic work in Alaska, will go to Juneau in the early part of the season, and later will join Dr Hollick's party on the Upper Yukon for some stratigraphic studies. Later still, in company with Mr Prindle, he will visit the Tanana gold district. The month of September will be spent by him in the Nome and adjacent gold fields of the Seward Peninsula.

GOLD DISCOVERIES IN ALASKA

A STRIKE of rich placer diggings has been made in Alaska, in the Circle City mining division, on the tributaries of the Tanana River, a district in which for several years past American miners have made a thorough search for good placer-mining deposits without success. The present strike seems to be one of more than ordinary importance, and has caused a stampede of miners from Dawson City and other districts to the new fields. It is unsafe to predict too much, but the general opinion seems to be that a large and productive placer field in American territory has at last been struck. Circle City is practically deserted as a result of the rush. The Eagle-Circle route is reported to be the best means of reaching the Tanana from Dawson, as the trails by Fortymile and Goodpasture are unbroken, and no supplies are available. From Fortymile to the new diggings the distance is 160 miles.

The region of the recent discovery is not yet surveyed, though the United States Geological Survey has made several explorations in the vicinity. These explorations are a part of a general system of preliminary surveys which the Geological Survey has been carrying on in Alaska as rapidly as possible during the last five years. A report entitled "A Reconnaissance in the White and Tanana River Basin," by Alfred H. Brooks, contains the results of a reconnaissance made in 1898. It describes briefly the geography, geology, climate, and timber of the region, and, so far as the character of the investigation would permit, deals with the mineral resources. The party left the coast at Skagway in March, 1898, and made its way inland for about 100 miles with sleds; then, after waiting until the ice on the river broke up, it continued down the Lewes and Yukon rivers in canoes to the mouth of White River. That river had never before been ascended in boats because of its mad, rushing current. After six weeks of hard labor the party succeeded in dragging canoes and supplies up White River 150 miles, where a portage was found to Tanana waters. The downstream trip to the mouth of the Tanana, a journey of about 600 miles, occupied a month. The party finally reached the Yukon after a canoe journey of 1,600 miles.

A second report by Mr Brooks deals with the Upper Tanana Basin and is entitled "A Reconnaissance from Pyramid Harbor to Eagle City, Alaska." This also treats of the geography, geology, and mineral resources of the region traversed by the party. It is based on a journey made with pack horses from the coast at Pyramid Harbor, southeastern Alaska, to the Yukon, near the international boundary. The trip, which occupied about three months and was made on foot, aggregated about 600 miles. So arduous was the journey that only five of the fifteen horses that started with the party survived the trip. The chief difficulty with which the party had to contend was the many turbulent rivers that had to be crossed. Three boats were built by the party during the course of the summer.

A third journey was made by Mr

Brooks through the Tanana Basin during the summer of 1902. This extended through to the Yukon from Cook Inlet, by the Lower Tanana Valley. The report on this expedition is now in preparation.

DECISIONS OF THE U. S. BOARD ON GEOGRAPHIC NAMES

From January to May, Both Inclusive, 1903

Agamok; lake, Lake County, Minnesota (not Aganiak).

Alvada; post-office and railroad station, Seneca County, Ohio (not Alveda).

Balsam; mountain in the Catskills, Green County, New York (not Sheril nor Sherill).

Bantam; river, tributary to Shepaug River from the northeast, Litchfield County, Connecticut (not Shepaug nor East Branch Shepaug).

Barrack; mountain in Canaan, Litchfield County, Connecticut (not Garruck).

Basswood; lake, partly in Lake County, Minnesota, lying across the international boundary line (not Bassimenau, Bois, Blanc, nor Whitewood).

Beeslick; brook and pond in Salisbury, Litchfield County, Connecticut (not Beaslick, Peeslake, Bees Lick, Beestick, Beezelake, nor Nancook).

Belle Ayr; mountain and post-office, Ulster County, New York (not Belle Air, Belle Ayre, nor Belleayre).

Berne; post-office, town, and village, Albany County, New York (not Bern).

Caroga; creek, Fulton and Montgomery Counties; lake and town, Fulton County, New York (not Garoga).

Cary; lake in Whitney Preserve, Hamilton County, New York (not Carey nor Carry).

Castac; creek, railroad station, and valley, Los Angeles County, California (not Castaic nor Castiac).

Cheshnina; river, tributary to Copper River from the east, Alaska (not Cheshni).

Chumstick; creek, Chelan County, Washington (not Chumpstick).

Cypress; lake, partly in Lake County, Minnesota, lying across the international boundary line (not Otter Track).

Deceiper; creek, Clark County, Arkansas (not Decepier, Deceyper, nor Deciper).

Elliott; creek, tributary to the Kotsina from the east, Alaska (not Elliot).

Gabimichigami; lake, Lake County, Minnesota (not Gobbemichigamme, Gobbemichigomog, Michigamme, etc.).

Gakona; river, tributary to Copper River from the west, Alaska (not Gako).

Germano; post-office and village, German Township, Harrison County, Ohio (not German, Jefferson, nor New Jefferson).

Grays; island in marsh near Elliott, Dorchester County, Maryland (not Blackwalnut).

Jackson; hole, post-office, and valley, Uinta County, Wyoming (not Teton). So named, in 1828, by Captain Sublette, after his partner, David E. Jackson, of St Louis, Mo. In recent years erroneously alleged to have been named after a notorious convict and outlaw, "Teton Jackson."

Jellison; cape, Penobscot Bay, Waldo County, Maine (not Gellison).

Kawishiwi; river, Lake County, Minnesota (not Cashaway nor Kashaway).

Kekekabic; lake, Lake County, Minnesota (not Cacaquabic, Hawk, nor Sparrow Hawk).

Las Choyas; valley near San Diego, San Diego County, California (not Chollas, La Cholla, nor Las Chollas).

Levisa; river, the west fork of Big Sandy River, Kentucky and Virginia (not Lavisa nor Louisa).

Los Penasquitos; canyon and land grant, San Diego County, California (not Las Penasquitas, Paguay, Penasquitos, nor Pinasquitos).

Marshepaug; river, tributary to Shepaug River, draining from Tyler Pond, Litchfield County, Connecticut (not East Branch Shepaug, Marshapogge, nor Mashepaug).

McAdoo; creek, Posey County, Indiana (not Macadoo).

Mule; mountains, southeastern Arizona (not Mule Pass).

New Riegel; post-office and railroad station, Seneca County, Ohio (not New Reigel, New Riegle, etc.).

Ogishkemuncie; lake, Lake County, Minnesota (not Kingfisher, Ogishki Muncie, etc.).

Peking; city, capital of China (not Pekin). This is a reversal of the decision Pekin, rendered February 2, 1897.

Pinyon; flat, Riverside County, California (not Pinon nor Piñon).

Pipe; creek, Erie County, Ohio (not Oganse, Ogontz, nor Pike).

Pleito; creek, Kern County, California (not Plata, Plato, nor Pieto).

Put-in; bay in South Bass Island, Lake Erie, Ottawa County, Ohio (not Put in nor Putin).

Put-in-Bay; post-office, township, and village, Ottawa County, Ohio (not Put in Bay nor Put-in Bay).

Ribeyre; island in Wabash River, Posey County, Indiana (not Cut-off).

San Clemente; canyon, near La Jolla, San Diego County, California (not Clemente nor San Clemento).

San Dieguito; land grant and valley, San Diego County, California (not San Diegito nor San Digitas).

San Emigdio; creek, land grant, and mountain, Kern County, California (not San Emedio, San Emidio, nor San Emidion).

Shawangunk; mountains, Ulster County, New York (not Millbrook).

St Peters; creek and district, Somerset County, Maryland (not St Peter nor St Peter's).

Tia Juana; post-office and river, San Diego County, California (not Tijuana).

Tyler; pond in Goshen, Litchfield County, Connecticut (not Marshapauge, Tyler's, nor West Side).

Wachocastinook; brook, or creek in Salisbury, Litchfield County, Connecticut (not Mount Riga nor Washinee).

Wangum; lake in Canaan, Litchfield County, Connecticut (not Waugum, Wangem, nor Wungum).

Wells; island in St Lawrence River, Jefferson County, New York (not Wellesley).

Wenatchee; lake, post-office, precinct, railroad station, river, and town, Chelan County, Washington (not Wenache nor Wenatche). This is a reversal of the decision Wenache, rendered in 1892.

Weoka; creek, post-office, and precinct, Elmore County, Alabama (not Wewoka, Wewokee, Wiwoka, etc.).

Wolf; creek, Sandusky and Seneca Counties, Ohio (not Raccoon nor West Branch Wolf).

Wononpakook; pond in Salisbury, Litchfield County, Connecticut (not Long, Wanompakook, Wonon Pakok, nor Wononpokok).

Wononskopomuc; lake in Salisbury, Litchfield County, Connecticut (not Furnace, Wononscopomoc, Wononskopomus, etc).

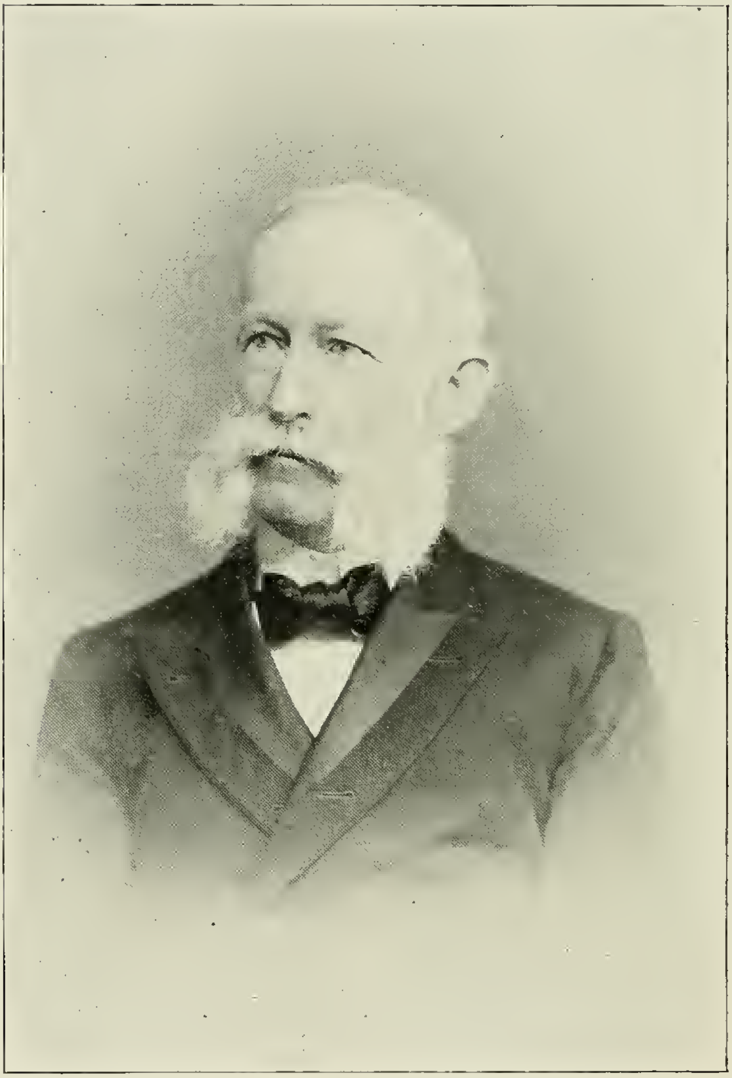
GEOGRAPHIC LITERATURE

American Diplomacy in the Orient. By John W. Foster, author of a *Century of American Diplomacy*. Pp. 498. 9 x 6 inches. Boston and New York: Houghton, Mifflin & Co. 1903.

This book covers a field which no other volume had even attempted to more than touch. There existed a mass of literature upon the subject, but it was utterly disconnected and the investigator was forced to seek for it laboriously at many different sources. To understand any one phase of American diplomatic achievement in the East required difficult and perplexing research. In consequence few Americans have attempted to grasp more than its mere outline. The reading public is now put in possession of an authoritative and comprehensive work—a work, too, which presents every advantage of a compendium, but a compendium enlarged and enriched by a chaste literary style. We have here an encyclopædic treatise wherein each part is conjoined with every other part, and wherein the whole composes a history majestic by the grandeur and worldwide influence of the deeds it recounts.

The opening chapter is preliminary, describing early European relations with the Far East. It emphasizes a fact, commonly unknown or forgotten, that Asiatic prohibition of foreign intercourse dates from hardly earlier than the beginning of the seventeenth century and was mainly due to "the violent and aggressive conduct" of the European discoverers and adventurers who visited those countries in the fifteenth and sixteenth centuries. The chapter concludes with the failure of the British expedition under Lord Amherst, then governor general of India, to establish diplomatic relations with China. That was in 1815.

The following twelve chapters, beginning with "America's First Intercourse" and ending with "The Spanish War: Its Results," summarize the first treaties with China and set forth the stages in that empire's increasing decrepitude, describe the opening, the transformation, and the enfranchisement of Japan, trace the development of the Hawaiian Islands and their annexation to the United States, picture the emergence of the anomalous kingdom



Hon. John W. Foster

of Korea, explain the imbroglio over the Samoan Islands, and touch upon the Spanish War only so far as it thrusts upon us a territorial and political heritage beyond the Pacific. The book concludes with a graphic presentation of the national factors now involved in the solution of the far eastern problem and with the expression of a confident assurance that the Union, which has met so well the emergencies of the past, will meet equally well the emergencies of the future.

In the compressed limits of 438 pages, to exhaust each specific topic discussed was an impossible task and such as no writer would attempt. The author says in his preface: "The treatment in a single volume of a subject embracing several countries and covering more than a century has required brevity of statement and the omission of many interesting facts." But a master's hand is shown in seizing upon and presenting essential facts and in throwing into distinctness not only those main facts but the minor facts therewith intimately connected. Hence there are left upon the reader's mind impressions photographic in their accuracy and clearness. Furthermore, the numerous footnotes are carefully chosen and of value to additional investigation. There is not one that is superfluous, not one that does not cast added light upon the text.

An appendix of 36 pages contains the Protocol of September 7, 1901, between China and the Treaty Powers, the Emigration Treaty of 1894 between China and the United States, the Treaty of 1894 between the United States and Japan, the Joint Resolution for annexing the Hawaiian Islands to the United States, the Samoan Treaty of 1899 between the United States, Germany, and Great Britain, the Protocol of August 12, 1898, and the Treaty of 1898 between the United States and Spain. To the joy of the student's heart, there is an admirable index of 22 pages.

Certain personal characteristics of the author invest his book with a peculiar charm. By international consent he is to be ranked among the ablest and most successful diplomats America has produced. In the special field of diplomacy concerning which he writes he has borne a distinguished and a prominent part. Yet in this volume he makes no reference to himself. It is doubtful if the pronoun I can be found from beginning to end. His name is sought in the index in vain. When forced by the exigencies of his narrative to refer to anything he has himself done he hides his personality under the indefinite designation of "a citizen of the United States." Such reticence concerning one's own exploits is rare among the men who have represented the United States in the East. But General Foster is as unassuming as he is great.

Another personal characteristic is revealed in his fairness and simplicity of statement. The spirit of apology or advocacy or partizanship is silent here. Calmly, dispassionately the facts are marshalled and the story told. A striking example among many which might be cited is afforded in Chapter VIII, upon "Chinese Immigration and Exclusion." This chapter deals with a burning question, over which Chinese immigrant and American laborer have been wrought to frenzy. On no political subject has there been more intemperance of feeling and expression. Yet all that could be said on either side is here put so comprehensively, so compactly, so forcibly, that either party might be content with this exposition of its case. Such capability of intimate appreciation and balanced statement is not wholly the result of wide experience and profound acquaintance with the motives which move men. It is a consequence far more of personal temperament and habit of mind.

When American enterprise first knocked at the doors of China, Japan, and Korea, those countries—with the exception of a few trading ports, difficult of access and hemmed in by almost prohibitive restrictions—were locked in seemingly impenetrable seclusion. This book is the tale of how American diplomacy, more than that of any other people, more perhaps than that of all other peoples, broke through the obstacles and brought those oriental States into international relations. Blunders were more than once committed. More than one American consul or envoy was incapable or unfortuuate. But the great majority of our representatives performed their parts well. They brought to their posts the diplomacy of practical men, diplomaed in the school of experience and sure to win over the obstructive astuteness of the East.

But it should always be remembered that along the path to final results the sailor, the merchant, the missionary, led the way. Moreover, from their ranks were recruited many who afterward in official station merited distinction. Such men were Major Shaw, Edmund Roberts, Townsend Harris, Peter Parker, H. N. Alleu, S. Wells Williams, and others deserving mention. Major Shaw was supercargo on *The Empress of China*, the first vessel to bear the starry flag across the Pacific. He became our first consul at Canton, "a man worthy the honor." Edmund Roberts, of New Hampshire, was a large ship-owner and merchant. Later accredited envoy to Siam, Muscat, and Annam, he became "the pioneer in the orieutal diplomacy of the United States." Townsend Harris, a supercargo and merchant from New York, was the first consul general in Japan, "negotiator of the first commercial treaty with Japan," no less a benefactor of that Empire than had been Commodore Perry. The medical missionary, Peter Parker, was twice chargé d'affaires, then commissioner, then efficient miuister to China. The medical missionary, H. N. Allen, has more than justified his appointment under two Presidents as minister to Korea. The name of S. Wells Williams, missionary of the American Board, author of "The Middle Kingdom," for twenty years secretary of legation and often chargé d'affaires at Pekin, is almost a household word.

It would be a congenial task to linger in the further discussion of "American Diplomacy in the Orient," even as it is delightful to linger over its perusal. However lengthy the review, much will be left unsaid.

The tale this book tells is weighty, yet, made up of peril, tact, persistence, daring, it has the fascination of romance. It is the record of a diplomacy wherein honest dealing, truth, and self-respect were dominant factors. It is the record of a diplomacy which the diplomacy of auy other country may be in vain challenged to surpass in ability, in influeuce, and in success. The unvarnished recital of its deeds casts honor upon the American name and inspires in the Americau reader a sentiment of gratitude and pride.

EDWIN A. GROSVENOR,
Amherst College, Massachusetts.

The Brazilian Government has provided for the mapping of its territory on a scientific basis. Last year the Congress appropriated the necessary funds for commencing the work, and a commission, of which Colonel Francisco de Abreu Lima is president, was to leave Rio early in May for the State of Rio Grande do Sul to make a reconnaissance of the first zone to be triangulated. The scheme, as far as at present outlined, includes the measurement of basis at Porto Alegre and Uruguayana, and the connection of these two cities by triangulation. This will give au arc of about six and one-quarter degrees of longitude in about latitude thirty degrees south. The Superintendent of the U. S. Coast and Geodetic Survey has been requested by the commission to supervise the preparation of the necessary tapes and accessories for the measurement of bases.

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Vol. XIV JULY, 1903 No. 7

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Vol. XIV, No. 7 WASHINGTON July, 1903

THE NATIONAL GEOGRAPHIC MAGAZINE

THE UNITED STATES; ITS SOILS AND THEIR PRODUCTS*

By H. W. Wiley, Ph. D., LL. D.

Chief Chemist, U. S. Department of Agriculture

DR DAY, in saying that I had come to take the place of the Secretary of Agriculture, reminds me of the remark of Oliver Wendell Holmes, on an occasion when by reason of the illness of Emerson he was sent to one of the lyceums to fill Emerson's appointment. The president of the lyceum stated that they had expected to listen to Mr Emerson, but by reason of illness they would not have that pleasure. However, Mr Holmes had kindly consented to fill his place. Whereupon Mr Holmes on rising remarked that he hardly hoped to fill the place of Mr Emerson, but would attempt to rattle around in it a little ; so to-day I cannot hope to fill the place of the Secretary of Agriculture, but will make as much noise in the large space unoccupied as possible.

ORIGIN OF THE SOIL

One of the oft-repeated theories concerning the origin of our earth is that at a remote period all the matter of which the earth consists at present was a part of the incandescent gas which filled the space now assigned to our solar system. As the cooling of this mass of gas progressed vortex rings were formed of gaseous matter. These on further cooling broke and rolled together, forming the sun, the planets, and the satellites of our present system. The next condition of the incandescent gas was incandescent liquid, which came in due season as the time rolled by. Finally, by the further process of cooling, a crust was formed upon the surface of these liquids which was the beginning of the solid surface of the earth. This crust would naturally be of the same composition as the liquid matter from which it was formed—practically homogeneous in character and consisting of the mineral matters which could only exist at that temperature.

In speaking of the soils of the United States, I would like to trace briefly their evolution from this primeval crust, which was the first ice formed on this

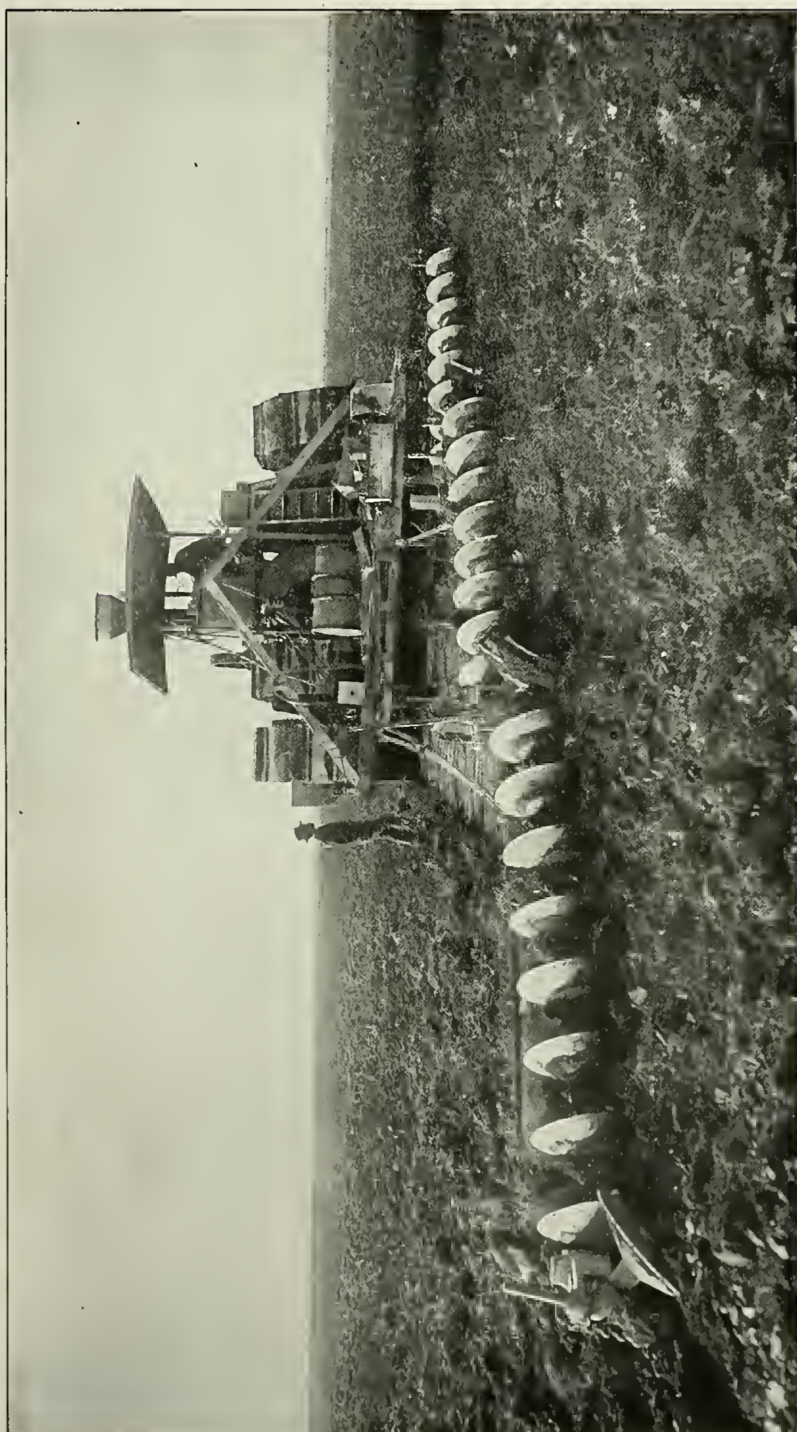
*Address before the National Geographic Society, February 18, 1903 globe. What have been some of the more active forces which have broken up this congealed mineral matter and brought it into the present condition in which we see the surface of our globe? First of all I will speak of the action of water, which is and has been one of the chief disintegrating agents acting upon the earth's surface. At the time the first crust was formed over the surface of the earth all the water which now exists must evidently have been above the earth's surface in the form of steam. As the cooling progressed this steam tended to condense in the form of clouds and finally water. Thus the original rain falling upon the hot surface of the earth was at once converted again into steam, but not until it had started a certain solvent action. Water has been termed the universal solvent, and it is not difficult to see how active it must have been at the time of which I speak. The sudden cooling of the surface at the spot where a drop of water struck would tend to crack it, the hot water would dissolve quickly any of the substances soluble therein, and this continual bombardment of boiling water must have had a tremendous effect in disintegrating the original crust formed over the earth's surface. As the earth continued to cool and diminish in size, the original surface wrinkled and formed hills and valleys. The continual descent of water would finally permit some of it to remain in the liquid state upon the earth's surface, and this coursing down the valleys continued the disintegration, both by solution and attrition. The original mineral matters were thus brought into a form of solution or suspension, and, seeking their natural chemical affinities, began to form from the first igneous rocks the first sedimentary rocks. These are the rocks which we now see in strata, covering the greater part of the earth's surface. All these stratified rocks must have been laid down under the water, and thus we are convinced that the surface of the earth during the long period of the formation of the soil must have been alternately above and below the surface of the water collected upon the globe.

INFLUENCE OF ORGANIC LIFE

When organic life came upon the earth's surface a new disintegrating force was introduced. Organic life, even in its smallest forms, such as bacteria, acts with vigor in decomposing rocks. The larger forms, which produce rootlets, help this disintegrating process along. These roots find their way into crevices of the rocks, and tend to split them open and to admit water below their surface. Certain bacteria also tend to oxidize the nitrogen of the air and form nitric acid, known under the common name of *aqua fortis*, which has a vigorous solvent action on many kinds of rock.

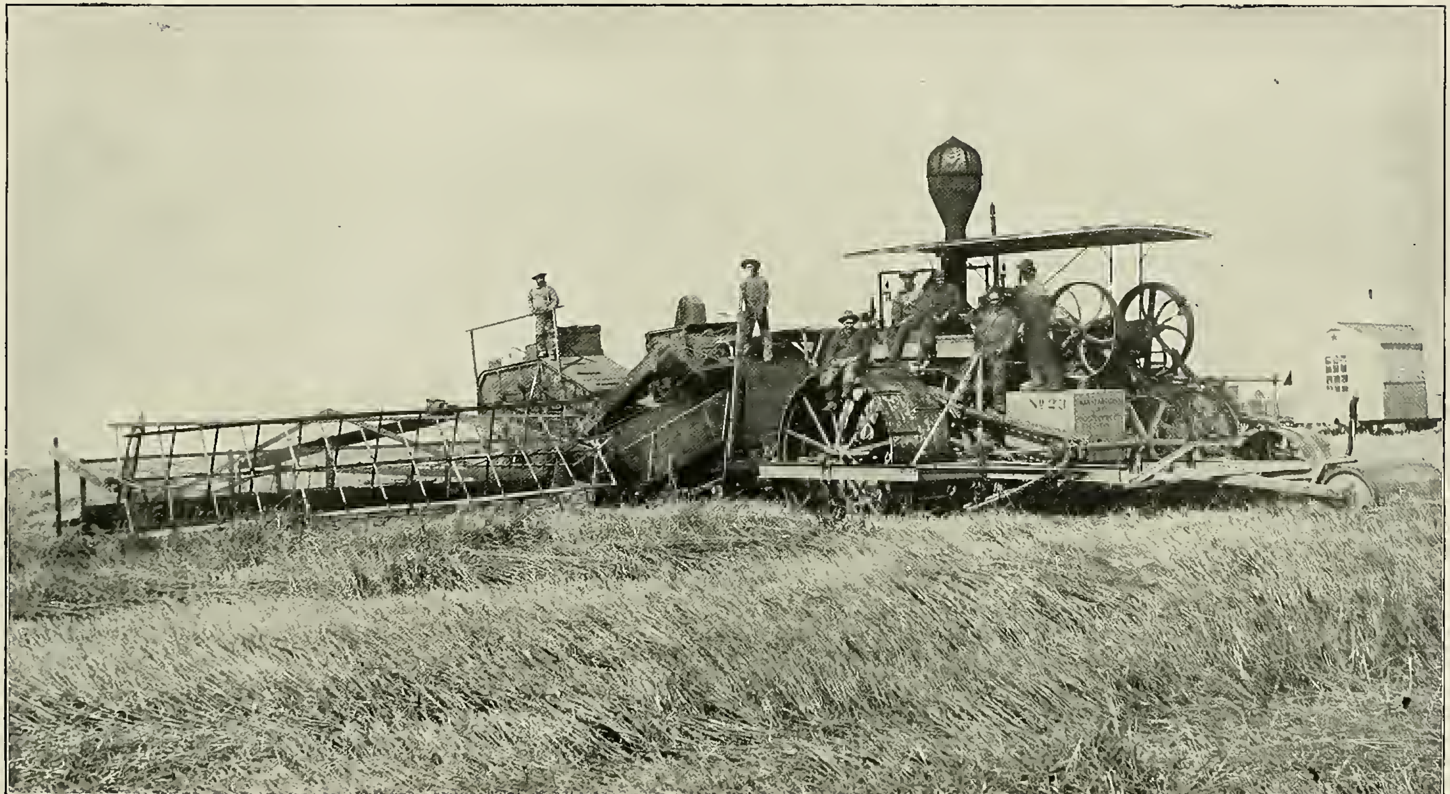
DIFFERENT KINDS OF SOIL

In the process of further cooling, ice was formed, and this also tended to have a disintegrating influence. Water in passing into ice increases in volume, and this tends to break and disintegrate many bodies. Rock saturated with water thus tends to break up when the water becomes ice. During the period of the ice age when large glaciers moved over the earth's surface, the crushing and grinding effects of the ice had much to do with disintegrating the rock. The vast areas of glacial drift which form the soil of many of our Western States are evidences of the gigantic scale on which these ice mills of the gods slowly ground the stones of the earth into soil. When the soil is formed by the decay of rocks without the transporting action of water or ice being active, the soils are said to be formed *in situ*. When the products of soil disintegration are carried by water and deposited along the banks of the streams or at their mouths, the soil is called alluvial. When



From Edwin S. Holmes, U. S. Department of Agriculture

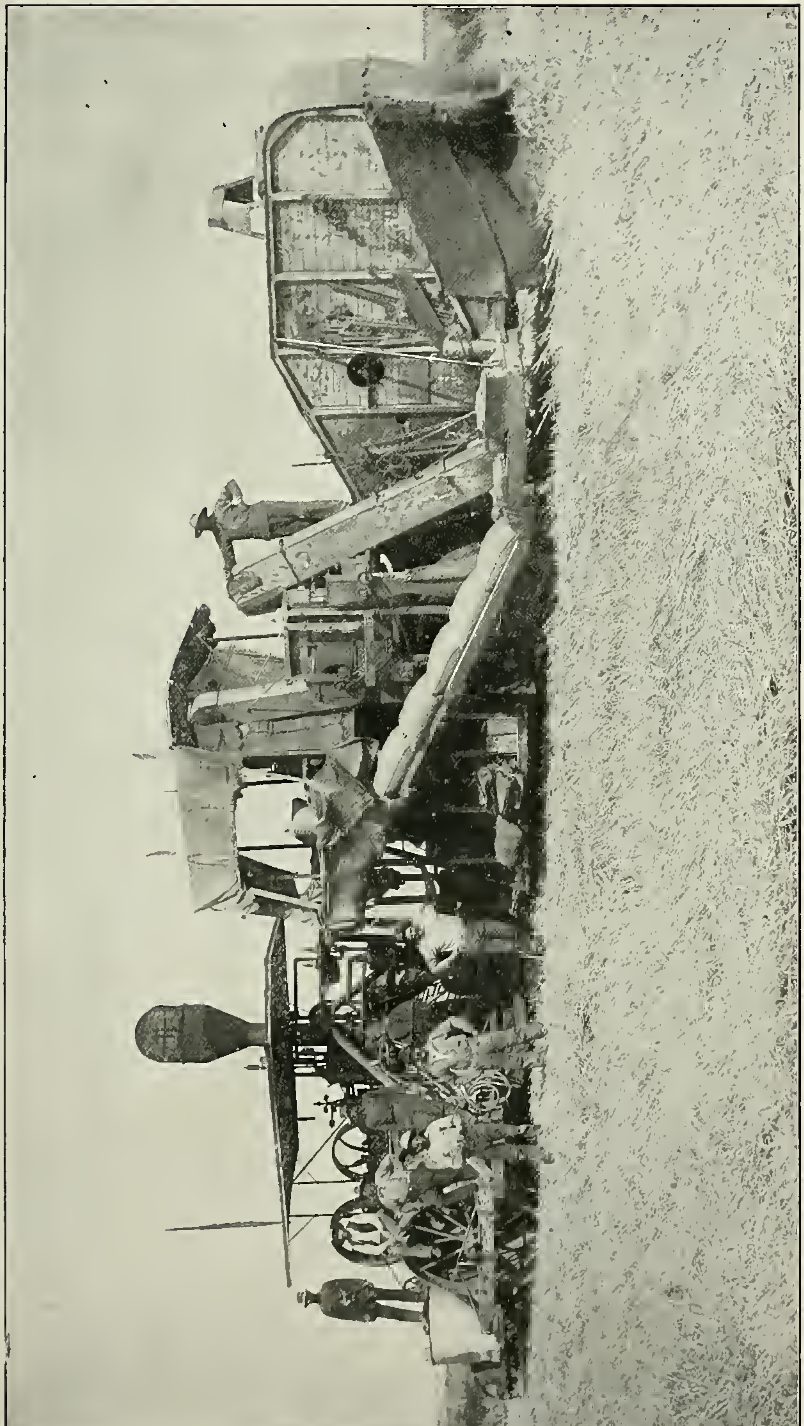
A Steam Plow in the Great Valley of California



From Edwin S. Holmes, U. S. Department of Agriculture

Front View of a Steam Harvester-Thrasher Used on the Pacific Coast

Ponderous machines like the one shown in this picture sweep through miles upon miles of ripened grain, cutting swaths from 16 to 42 feet in width, harvesting, cleaning, thrashing, and leaving behind a long trail of sacked grain, ready to be hauled to the warehouse, railroad, or mill. The machine can harvest from 60 to 125 acres a day, and requires only eight men to operate it. It can be used successfully only on a grain perfectly dry, as well as thoroughly ripe.



From Edwin S. Holmes, U. S. Department of Agriculture

Rear View of Steam Harvester-Thrasher

Showing the bags of harvested grain left behind as the machine advances products of rock disintegration are carried by moving ice and deposited therefrom, they are called glacial drift. When they are carried by wind, as is often the case, they are called æolian soils. The above are some of the varieties of soils as determined by their method of formation. Soils are also classified in regard to their chemical characters; as, for instance, when formed from the decay of carbonate of lime, they are called limestone soils. When arising from the disintegration of granite, they are called granitic soils. When formed chiefly from particles of silex, they are called sandy soils. When consisting mostly of silicate of alumina, they are called clay soils, and so on.

But for agricultural purposes the soil consists of more than decayed mineral matter. By the decay of organic matter there is introduced into the soil the element, humus, which is one of its principal characteristics from an agricultural point of view. The soil is filled with millions of organisms of a lower form, without whose activity the growing of crops would be impossible. The soil, therefore, not only contains the mineral matters which are necessary to sustain the life of plants, but also those organic elements without which these mineral matters would not be available for plant growth. The three principal mineral foods of plants are potash, phosphoric acid, and nitrogen. Lime, magnesia, iron, and many other mineral substances are also found in plants, but these are not absolutely essential to plant growth. If, however, either nitrogen, potash, or phosphoric acid be entirely removed from the environment, it is impossible to produce a matured plant. The great bulk of the material of which plants are composed is not drawn, however, from the soil, but is taken from the air and water. Great as have been the chemical achievements of man, no chemist has yet arisen whose skill can be compared to that of the plant itself. Any chemist who to-day, with all the appliances which science has placed at his disposal, could make by synthesis the various organic compounds of which plants are principally composed would rival the fame of Berzelius, Liebig, Hoffman, Berthelot, Gibbs, or Remsen. Thus the soil must be regarded as that part of plant life which furnishes the chemical support for the growing plant, supplies it with the mineral foods essential to its growth and maturity, and favors best those conditions which enable the plant cell to elaborate the organic matters of which the matured plant is chiefly composed.

THE UNITED STATES AN AGRICULTURAL COMMUNITY

Having thus briefly described how the soil originated, we pass to the consideration of the second part of the subject, namely, the crops which grow therein.

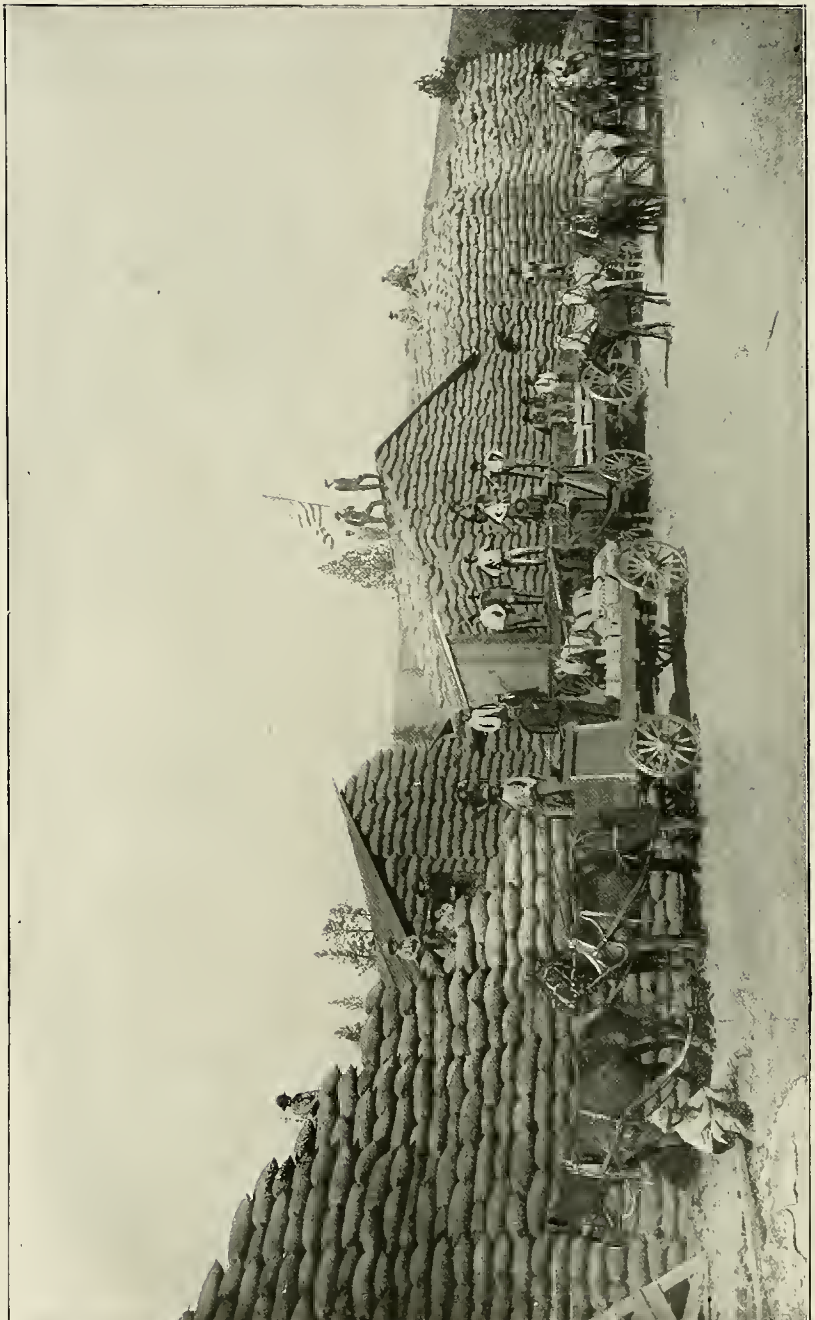
The United States is essentially an agricultural community. The basis of its wealth lies not so much in the products of its mines and manufactures as it does in those of its fields, gardens, orchards, and forests. The territory of the United States, including its new possessions, represents every variety of soil and every character of climate. It has agricultural lands in the tropics, in the subtropics, in the temperate zone, and in the sub-boreal regions of Alaska. In latitude its agricultural lands extend half way around the world. Agricultural crops are grown in the United States subject to all the vicissitudes of climate, to excessive rainfalls, to prolonged drouth, to intense heat, and to alternating frosts and sunshine.

Within the borders of the United States are grown every agricultural crop known to the world. It produces immense qnantities of the cereals; of fiber plants, including especially cotton and flax; of sugar-producing plants, including sugar cane, sugar beets, sorghum,

From Edwin S. Holmes, U. S. Department of Agriculture

Between the Walls of 100,000 Sacks of Wheat at Mission, Oregon

The warehouse is 56 feet wide and 310 feet long. There are 250,000 bushels of wheat in the sacks



From Edwin S. Holmes, U. S. Department of Agriculture

Sacked Wheat Awaiting Shipment

A Portion of the Grain Fleet in Portland Harbor, Oregon

and maple trees; all kinds of vegetables and fruits; medicinal plants of every variety; forest products of all kinds; spices and condiments of every description.

MAGNITUDE OF THE CEREAL CROPS OF THE UNITED STATES

As an introduction to the discussion of the subject embraced in this paper, a brief statement of the magnitude of some of the agricultural crops of the United States and the area under cultivation will be useful. In the year 1902 the following statistics show the area under cultivation, the yield per acre, the total production and the price per unit, and *in toto* the magnitude of our standard agricultural crops: The crop which is universal in the United States is maize or Indian corn. There is only one state in the Union in which a considerable area of Indian corn is not grown, viz., the State of Nevada, and it, as is well known, is a barren desert, except where irrigation can be practiced. The total area under cultivation in the United States in maize in 1902 was 94,043,613 acres. The total production was 2,523,648,312 bushels. The price per bushel was 40.3 cents. The total value of the crop was $1,017,017,349. The largest acreage devoted to maize in any one state was in Illinois, viz., 9,623,680 acres, yielding 372,436,416 bushels. The smallest reported area in any one state, with the exception of Nevada, as above mentioned, was 2,384 acres in Wyoming.

After maize the most important cereal

crop in the United States is wheat. The area in 1902 was 28,581,426 acres in winter wheat, and 17,620,998 acres in spring wheat, a total of 46,202,424 acres. The average yield per acre of winter wheat was 14.4 bushels. The total quantity of winter wheat produced was 411,788,666 bushels, and the average price was 64.8 cents per bushel. The total value of the winter wheat was $266,727,475. The average yield of spring wheat per acre was 14.7 bushels. The total production was 258,274,342 bushels. The average price per bushel was 60.2 cents. The total value of the spring wheat was $155,496,642. Placing the two sets of data together, we find the total yield was 670,063,008 bushels and the total value was $422,224,117.

The area sown to oats in the United States in 1902 was 28,653,144 acres. The average yield per acre was 34.5 bushels. The total yield was 987,842,712 bushels. The average price per bushel was 30.7 cents. The total value of the crop was $303,584,852.

The area sown to barley in the United States in 1902 was 4,661,063 acres. The total yield was 134,954,023 bushels and the total value was $61,898,634.

The total area sown to rye in the United States in 1902 was 1,978,548 acres. The yield was 33,630,592 bushels and the total value of the crop was $17,080,793.

The total area sown to buckwheat in the United States in 1902 was 804,889 acres. The total production was 14,529,770 bushels and the total value of the crop was $8,654,704.

The above comprise the principal cereal crops of the United States. They do not include, however, considerable areas sown to millet, sorghum, Egyptian corn, rice, and other cereals. Summarizing the above principal crops, we find the total area under cultivation was 176,343,681 acres; total production, 4,364,668,417 bushels; total value, $1,830,460,449.

COTTON CROP VALUED AT NEARLY FIVE HUNDRED MILLION DOLLARS

The area of cotton harvested in the United States in 1902 was 27,114,103 acres. In addition to this, 764,227 acres were planted to cotton, which were not harvested. The total production of cotton lint was 5,111,870,028 pounds.

The price per pound for cotton at Galveston February 6, 1903, was 9 cents, making the total value of the crop $460,068,303.

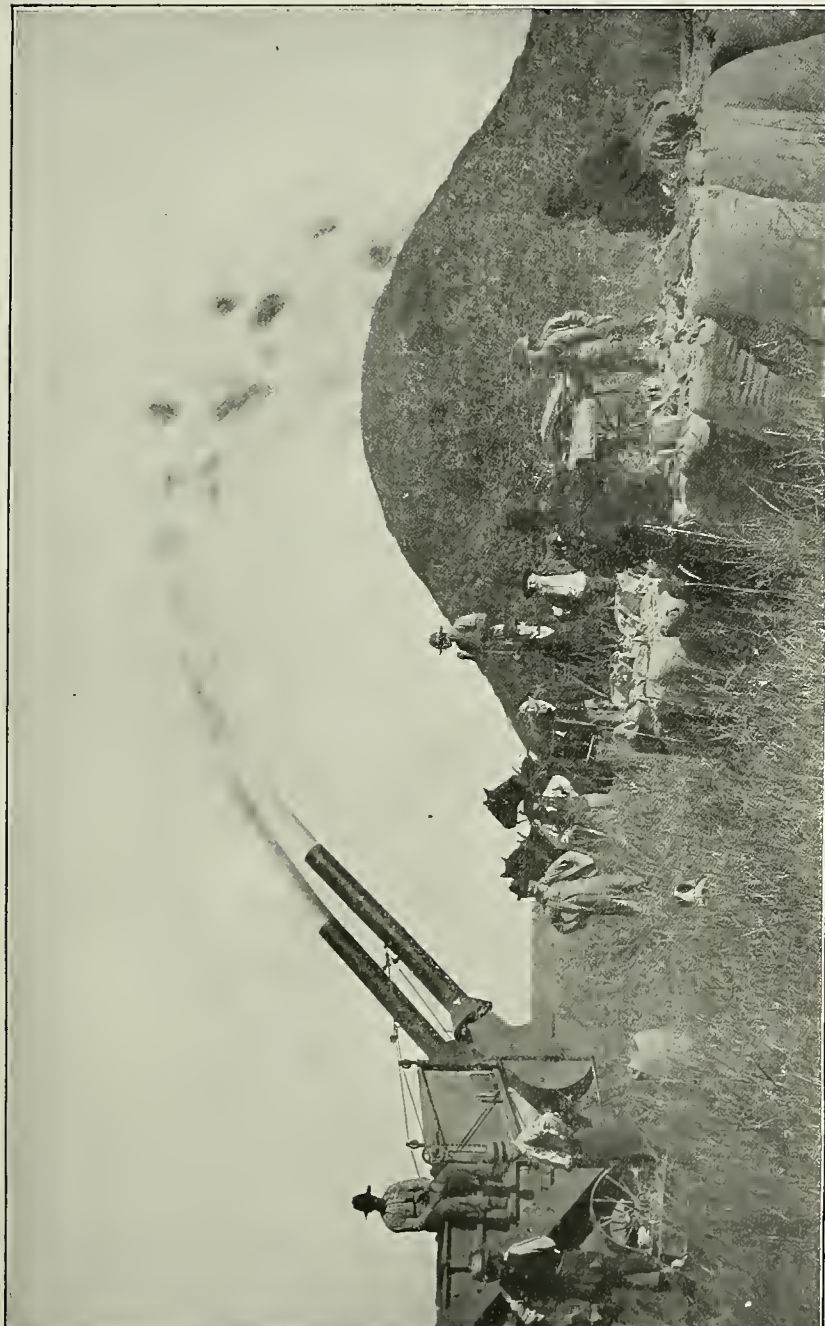
The area devoted to hay-making in the United States in 1902 was 39,825,227 acres and the yield 59,857,576 tons of 2,000 pounds each. The price per ton was $9.06. The total value of the crop was $542,360,364.

The total area planted to potatoes in the United States in 1902 was 2,965,587 acres. The yield was 284,632,687 bushels. The average price per bushel was 47.1 cents. The total value of the crop was $134,111,436.

The total area planted to tobacco in the United States in 1902, excluding Porto Rico and the Hawaiian Islands, was 1,300,734 acres. The total yield was 821,823,963 pounds. The total value was $80,472,506.

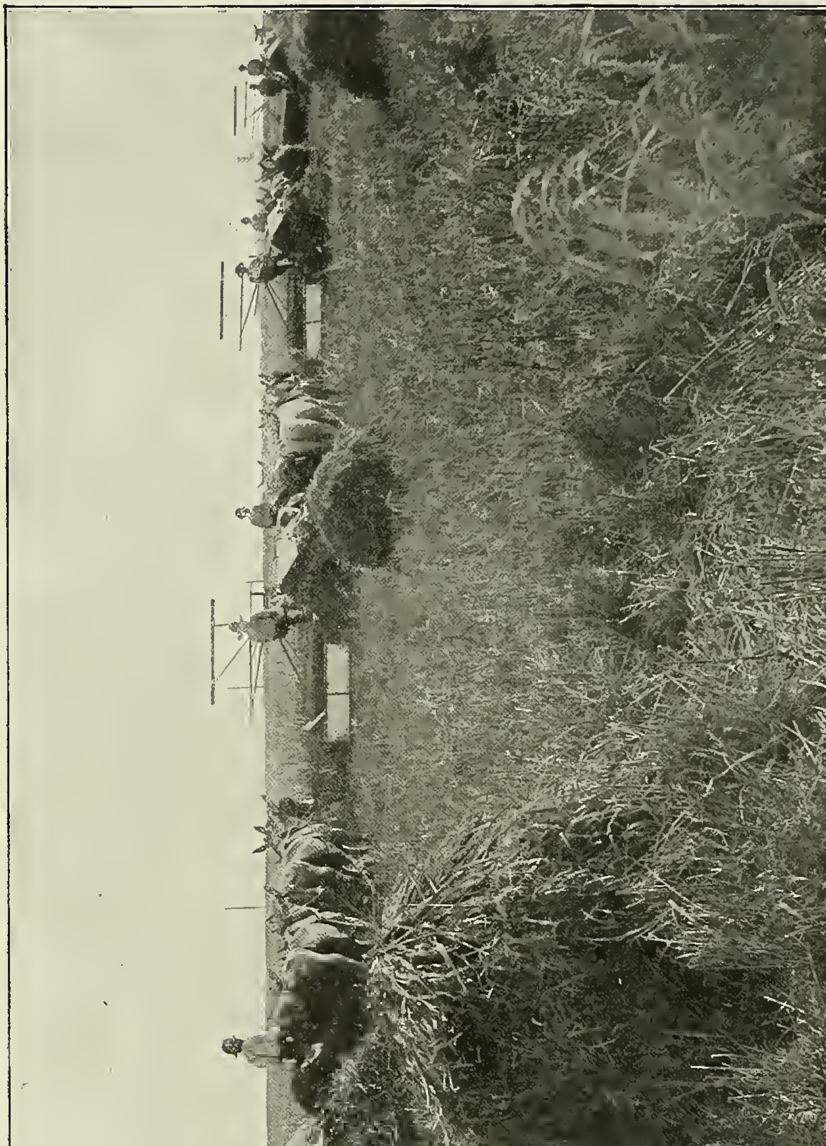
The total number of tons of sugar beets harvested in the United States in 1902 was 1,777,639 tons of 2,240 pounds. The total number of tons of sugar produced was 195,800 of 2,240 pounds. The acreage in beets is difficult to determine, but it may be assumed that the average crop was about eight tons per acre, which would make the total acreage 24,475 acres. The average price of the sugar was about four cents per pound, making the total value of the crop $17,543,680.

The total quantity of cane sugar made in the United States in 1902 was 767,000 tons of 2,240 pounds each. Of this amount Louisiana furnished 250,000 tons, Porto Rico 100,000 tons, the Hawaiian Islands 315,000 tons, and the



From S. A. Knapp, U. S. Department of Agriculture

Thrashing Rice With a Steam Thrasher in Southwestern Louisiana



From S. A. Knapp, U. S. Department of Agriculture

Harvesting Rice in Southwestern Louisiana

Rice is the only cereal crop of which the United States does not produce enough for its own consumption. Recent improvements in the cultivation and harvesting of rice are, however, increasing the annual crop, which now amounts to one-half of what we consume

Philippine Islands (exports) 102,000 tons.

Most of the cane sugar was raw, and did not bring so high a price as beet sugar, which was mostly refined. The average price of the cane sugar may be taken at three cents per pound. The total value of the crop was therefore $51,542,400.

The area planted to flax for the production of flaxseed in 1902 in the United States was 3,739,700 acres. The quantity of seed produced was 29,284,880 bushels, and the value of the crop was $30,814,661. In this valuation no account is made of the value of the flax fibers.

The area in hemp in the census year was reported as 16,042 acres, yielding 11,750,630 pounds of fiber valued at $546,338.

The area in vegetables, excluding potatoes, in the census year was 2,814,139 acres, producing a crop valued at $143,782,534.

The total area devoted to the production of peas in the census year was 968,371 acres, yielding 9,440,269 bushels valued at $7,909,074.

The total area devoted to the cultivation of peanuts was 516,658 acres, producing 11,964,959 bushels valued at $7,271,230.

The area devoted to the cultivation of castor beans was 25,738 acres, producing 143,388 bushels valued at $134,084.

The total area planted to hops in the census year was 55,613 acres, producing 49,209,704 pounds valued at $4,084,929.

The area devoted to the cultivation of broom corn in the census year was 178,584 acres, producing 90,947,370 pounds and valued at $3,588,414.

THE FRUIT CROPS

The total value of the fruit crops of all kinds in the United States in the census year was $131,423,517. Of this amount $83,751,840 was the value of the orchard fruit; $25,030,877 the value of the small fruits; $14,090,937 the value of the grapes, and $8,549,863 the value of the citrus and subtropical fruits.

The number of orchard trees of the different kinds in the United States in the census year was as follows:

Apple trees	201,794,764
Peach and nectarine trees	99,919,428
Pear trees	17,716,184
Plum and prune trees	30,780,892
Cherry trees	11,943,287
Apricot trees	5,010,139

The total area in fruit trees in the United States is 6,230,745 acres. The total area in small fruits is 304,029 acres, and the total value of the small fruits produced $25,030,877.

The number of olive trees in the United States in the census year was 1,540,155, and the number of pounds produced was 5,053,637.

The number of nut trees in the United States in the census year cultivated on farms was 1,649,072.

THE NUMBER OF FARMS

The total area under irrigation in the census year in the United States was 7,263,273 acres, and the value of the irrigated crops was $84,433,438.

The total area of the United States, including Alaska, Porto Rico, and the Hawaiian Islands, is 3,613,217 square miles, equivalent to 19,768,604,880 acres.

The number of farms in the United States in the census year was 5,739,657. The average number of acres in each farm was 146.6. The total acreage of the farms in the United States was 841,201,546. The value of the farm property in the United States in the census year was $20,514,001,838. The value of the farming implements and machinery was $761,261,550. The value of the live stock on the farms was $3,078,050,041.

The total value of the farms of the United States in the census year was

A Field of Pumpkins Grown for Seed

$16,674,690,247, of which the land, with improvements except buildings, was $13,114,492,056 and the farm buildings $3,560,198,191.

Of the 5,739,657 farms in the United States 2,024,964 were operated by renters, and 3,714,693 were operated by their owners.

NUMBER AND VALUE OF FARM ANIMALS

The number and value of farm animals in the United States on January 1, 1903, as estimated by the Statistician of the Department of Agriculture, were as follows :

Animals.	Number.	Valued at—
Horses..........	16,557,373	$1,030,705,959
Mules	2,728,088	197,753,327
Milch cows......	17,105,227	516,711,914
Other cattle....	44,659,206	824,054,902
Sheep....	63,964,876	168,315,750
Swine....	46,922.624	364,973,688

The total number of farm animals was 191,937,394, and the total value of the farm animals was $3,102,515,540.

The total value of the agricultural and horticultural crops of the United States for 1902, as estimated by the Statistician of the Department of Agriculture, is $3,500,000,000, not including live stock, the annual value of which is estimated at $1,000,000,000, making the total value of the agricultural products of the United States for 1902 $4,500,000,000.

The total value of the agricultural exports of the United States for the year ending June 30, 1901, was $943,811,020, amounting to 64.62 per cent of the total exports of all kinds from this country. Some of the principal items included in the above are as follows :

Value of cattle exported........	$37,566,980
" " sheep exported........	1,933,000
" " hogs exported	238,465
" " bacon and hams exported	60,341,804

Value of		pork exported	$13,059,551
"	"	lard exported	46,560,148
"	"	beef products exported	44,225,319
"	"	all other meat products exported	23,369,0 3
"	"	dairy products exported	9,403,722
"	"	cotton, raw	313,673,443
"	"	breadstuffs	275,594,618
"	"	tobacco, unmanufactured, exported	27,656,475

WILL OUR FOOD SUPPLY KEEP PACE WITH OUR ENORMOUSLY INCREASING POPULATION?

The foregoing data will show, in a general way, the vast agricultural resources of the United States. It is seen that we are not only able to feed our own people, but millions of people in other countries.

There is one question which constantly presents itself to the mind of the political economist, namely, Is the rate of increase in population to be diminished, or, if continued, will the food supply be exhausted in the near or remote future? In looking for answers to these questions, political economists must consult scientific agriculture. In the application of the principles of agriculture to science is found the only safe response. It is certain that under the fostering care of this country and with wise and well-directed engineering, many millions of acres of rich land can be procured for agricultural purposes through irrigation. Science teaches us in many other ways the methods of making the farm, to a certain extent, independent of the variations in rainfall. The true principles of conserving moisture for the purpose of crop production, and of utilizing to the best advantage the excess of precipitation, are now well known and are daily taught to our people. Scientific forestry is increasing the number of trees and bringing large areas into tree culture which before were only featureless plains. What the effect of tree planting will be upon the climate is not known with certainty, but the general impression is that

A Field of Silverskin Onions on Bloomsdale Farm, Philadelphia

Courtesy of The Homemaker

Cattle being Fattened for Export

the more abundant the growth of trees, the more readily is moisture preserved for agricultural purposes while the intensity and extent of floods is diminished.

The true principles of fertilization are annually increasing the average product of the older farm lands of the community. The principles of cattle feeding are introducing important economies into the utilization of farm products. We have no reason to think that the average wheat crop, for instance, in the United States would not increase in the amount grown per acre An increase of a single bushel per acre will give, in round numbers, an increase of sixty million bushels to the crop. The scientific farmer can readily double and treble his crop, and so, without increasing the acreage, supply double or treble the amount of wheat. The same principle is true of other crops. The future soil fertility will increase, not diminish. The average output of each acre will grow. While the capacity of the mouth to consume remains constant through all centuries, the capacity of the hands to furnish food is constantly increasing. We need not fear, therefore, a period of world starvation due to the exhaustion of the food-producing capacity of the soil. If universal hunger does come, it will not be from this cause. It may be—I would not deny it—that the final fate of man on earth is starvation or freezing, but the remote future at which such calamities can occur makes their event for practical purposes infinitely removed. We are now feeding, within the boundaries of the United States, eighty million people. When in a hundred years from now we are feeding two hundred million people, the quantity of food per head will be no less abundant than at present. In those days now so near at hand agriculture will be more a science and more an art. The fields will all be gardens, and the forests sources of income without destruction. The life of man will be full of amenities which are now denied the tiller of the soil, and the true aristocracy of the earth will be composed of those in direct touch with earth herself.

BIG THINGS OF THE WEST *

By Charles F. Holder

WHETHER rightly or not, the West has earned a reputation for big things—big fishes, big fruit, big trees; and so many really big things come from this section of the country that possibly some of the inhabitants fall naturally into the habit of telling big stories and painting as they rise. There are, however, certain peculiar conditions that hold on the Pacific slope that justify the story-teller. The West has the largest trees in the great Sequoias which rear their lofty heads two or three hundred feet in air. It possesses the giant redwoods, which possibly rank next in size and usefulness, great forests extending all along the fog-laden country of northern California. In Alaska we find the highest mountains in America, and the largest and most numerous glaciers, beginning with Muir and Malaspina, the latter the most remarkable glacier in the world. The stroller through the markets of San Francisco will find the western representative of the New York weak-fish—a huge creature ranging from eighty to one hundred pounds—and will be told

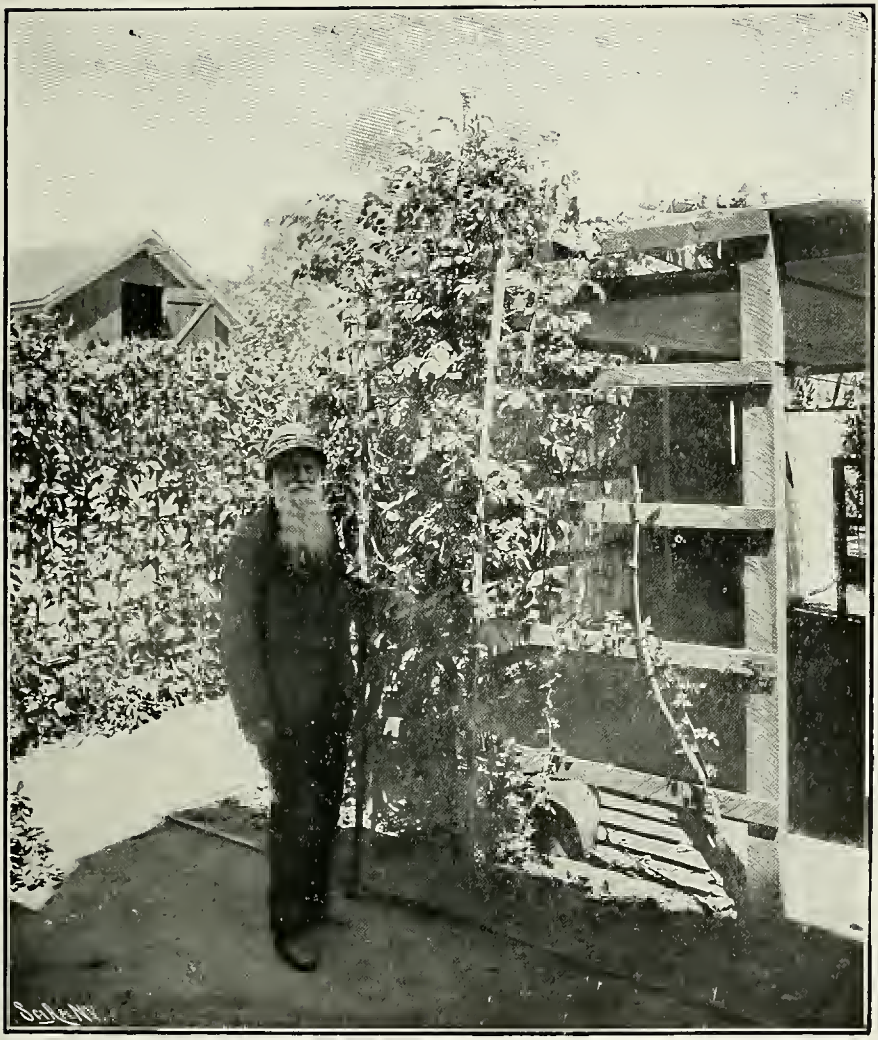
* Reprinted from the Scientific American Supplement by courtesy of Munn & Co.

Courtesy of the Scientific American Supplement

A Colossal Californian Pumpkin

that a similar fish is caught in the Gulf of California weighing two hundred pounds. In the Italian quarter of this city will be seen the octopus, or devil-fish, hung up for sale, a terrible array of arms or tentacles; not the little creature a foot or two across common in the East, but a veritable monster with a radial spread of perhaps twelve or fourteen feet. Along the upper coast these animals have been found with a radial spread of twenty-five feet—well named the spider of the sea. Along the coast will be seen a bass which often tips the scales at five hundred pounds; and at Monterey has been taken a mackerel weighing nine hundred pounds—suggestive that even fishes grow large in western waters. In Alaskan waters is found a monster clam, the "geoduck," one of which would afford a meal for several persons; not so large however as the great tridacna and its species, which weighs, with its two valves, five hundred pounds, the animal alone weighing thirty. This shell, though common in California, is from the equatorial regions of the Pacific, where, buried in the soft rock, its viselike jaws partly open, it is a menace to the natives who wade along the reefs searching for shells.

In southern California the vegetation is often remarkable for its size. At Santa Barbara is a grapevine which covers several hundred square feet, the vine itself resembling a tree, said to be the largest vine in the world, though this is open to doubt, for some of the old vines of Spain are of enormous size. Whether it is due to the newness of the soil and the fact that it is not yet exhausted by successive farming is not known, but nearly everything here grows very large and rapidly. The tree known as the Australian black wattle will attain a height of fifty or more feet in five years, palms the same height in less than twenty years, and eucalyptus one hundred feet in less time; so that it is a common saying in southern California that barren ground can be taken and made to look like a place fifty years old in five years. The extraordinary growth of flowering plants and shrubs in southern California is noticed. The eastern heliotrope grows in the form of a vine reaching twenty feet upward, covering the fronts of houses, in some way resisting the frost if at all protected by overhanging roof. In the city of



Courtesy of the Scientific American Supplement

A Giant Californian Potato Vine

Pasadena many remarkable examples of large growth are seen, one being a potato, which was trained to grow upon a trellis and assumed the form of a lusty vine over twelve feet high, producing an extraordinary number of potatoes.

Some of the photographs of fields of pumpkins taken in the fall in Southern California might well be considered open to suspicion, so enormous are the productions. One pumpkin exhibited by James F. Stewart & Co. in Los Angeles was so huge that a calf was held in the interior while a photographer took its picture. Doubtless the California rancher who raised this giant would tell the Eastern farmer that it was "not a good year for pumpkins, either." Another colossal pumpkin raised by J. J. Teague in 1901 weighed 230 pounds, and when dug out after the jack o' lantern fashion afforded a playhouse for the rancher's little daughter, if we may judge by the picture. In the old days California pears were famous all over the civilized world for their size, but today this reputation applies to all fruits. Strawberries grown here are sometimes so large that three or four would fill a plate. Sweet potatoes are often mammoth—four feet in length—while the oranges, the immense navels which sometimes hang upon the trees for a year, probably excel in size any similar fruit anywhere. In a Pasadena garden in the summer of 1902 could be seen string beans with pods three feet in length, presenting an extraordinary spectacle, and as though the vine was hung with green snakes. But this extraordinary growth cannot be attributed to the soil of Southern California, as the seeds are said by Mr Charles Richardson to have come originally from China, the growth not being abnormal, though doubtless when the wonderful plants are distributed over the state some patriotic Californian will claim that the bean is due to the remarkable soil and climate of California.

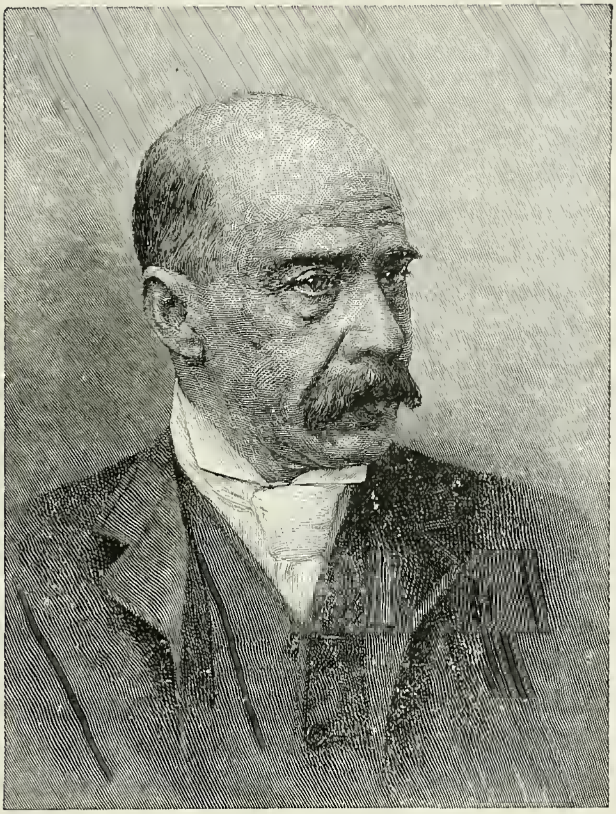
PAUL DU CHAILLU

PAUL BELLONI DU CHAILLU, who died at St Petersburg April 30, was born in New Orleans July 31, 1835. His birthplace was thus the same city to which Stanley nearly twenty years later drifted as a cabinboy, to be befriended and adopted by the merchant Stanley. Little is known of Du Chaillu's ancestors, except that they were of one of the old French Huguenot families that had settled in Louisiana. His father, a man of considerable means, was engaged in the West African trade and owned a "factory" or trading depot on the Gaboon coast, a few miles north of the Equator. Paul as a boy accompanied his father to Africa and lived for three or four years on the coast. He was a bright, enterprising youngster, who spent most of his time talking with the natives, hearing their stories and learning their dialects and ways of thinking and living. He liked better to listen to the stories of the native traders than to learn the business of his father. It was this personal knowledge of the native which enabled him afterward to travel for thousands of miles in the interior without being obliged to kill a single native.

About 1853 his father took him back to the United States, but the wild tales the boy had heard had fascinated him and excited him to find out how much was true of what the seacoast natives said of the cannibals, pygmies, wildmen or gorillas, and other marvels of the Great Forest. No white man had previously penetrated more than a few miles into the interior along this part of the coast.

In the fall of 1856 he sailed from New York in a three-masted schooner and was landed at Gaboon in December. The following three and one-half years he passed exploring a section of Africa stretching from Gaboon 320 miles inland and 250 miles north and south. On his return to New York in 1859 he wrote the story of his discoveries, which was published by Harper & Brothers in 1861 under the title of "Explorations and Adventures in Equatorial Africa; with Accounts of the Manners and Customs of the People, and of the Chase of the Gorilla, Crocodile, Leopard, Elephant, Hippopotamus, and other Animals. By Paul B. Du Chaillu, with Map and Illustrations. Harper & Bros., 1861." In his preface he states:

"I traveled—always on foot, and unaccompanied by other white men—about 8,000 miles. I shot, stuffed, and brought home over 2,000 birds, of which more than 60 are new species, and I killed upwards of 1,000 quadrupeds, of which 200 were stuffed and brought home, with more than 80 hitherto unknown to science. I suffered fifty attacks of the African fever, taking, to cure myself, more than fourteen ounces of quinine. Of famine, long-continued exposures to the heavy tropical rains, and attacks of ferocious ants and venomous flies, it is not worth while to speak.



Courtesy of Charles Scribner's Sons

Paul Du Chaillu

Born July 31, 1835; Died April 30, 1903

"My two most severe and trying tasks were the transportation of my numerous specimens to the seashore and the keeping of a daily journal, both of which involved more painful care than I like even to think of."

In the book he told of gorilla, of which he had brought back the first specimens and which he had been the first white man to see and hunt; of the fierce cannibal tribes, the Fans, who filed their teeth to keep them sharp; of the ravages of the Baskouay ants, which marched in dense columns miles in length, and who were marshalled by officers and generals; of hunting elephants with pitfalls; of a new variety of snake, less than four feet long and six and eight inches thick, which lies in the open places in the woods and whose bite is instantaneous death, and of many other equally wonderful sights.

The book was greeted with shouts of laughter and derision from one end of the American continent to the other. Mr and Mrs and Miss Gorilla was the common jest, and the name Du Chaillu became a byword for a fanciful storyteller. Du Chaillu was only 26 when his first book was published. He was unable to answer satisfactorily the storm of questions hurled at him; consequently nobody believed him, except Harper and Brothers in the United States and the Royal Geographical Society in England, both of whom valiantly and vigorously defended his truthfulness.

In 1863–'65 Du Chaillu made a second journey of exploration to Africa, the narrative of which appeared in 1867 as "A Journey through Ashango Land." This time he discovered the pygmies of the Dark Forest, but his descriptions of the little people were likewise received with incredulity. With this journey his explorations in Africa ended.

Gradually each of Du Chaillu's discoveries was confirmed by later explorers—by Schweinfürth, Stanley, Sir Harry Johnston, and others. Many years ago they were all verified; but the name Du Chaillu none the less still remains to most Americans that of a romance. In a certain sense Du Chaillu is himself responsible for this feeling, for all his descriptions are so vivid and are so thrillingly told that the reader feels he is reading a work of pure invention, rather than a narrative of actual experience.

His famous description of the first gorilla shot by a white man is worth quoting:

"Suddenly, as we were yet creeping along, in a silence which made a heavy breath seem loud and distinct, the woods were at once filled with the tremendous barking roar of the gorilla.

"Then the underbrush swayed rapidly just ahead, and presently before us stood an immense male gorilla. He had gone through the jungle on his all-fours; but when he saw our party he erected himself and looked us boldly in the face. He stood about a dozen yards from us, and was a sight I think I shall never forget. Nearly six feet high (he proved four inches shorter), with immense body, huge chest, and great muscular arms, with fiercely-glaring, large, deep gray eyes, and a hellish expression of face, which seemed to me like some nightmare vision: thus stood before us this king of the African forest.

"He was not afraid of us. He stood there, and beat his breast with his huge fists till it resounded like an immense bass-drum, which is their mode of offering defiance; meantime giving vent to roar after roar.

"The roar of the gorilla is the most singular and awful noise heard in these African woods. It begins with a sharp bark, like an angry dog; then glides into a deep bass roll, which literally and closely resembles the roll of distant thunder along the sky, for which I have sometimes been tempted to take it where I did not see the animal. So deep is it that it seems to proceed less from the mouth and throat than from the deep chest and vast paunch.

"His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now truly he reminded me of nothing but some hellish dream creature—a being of that hideous order, half-man, half beast—which we find pictured by old artists in some representations of the infernal regions. He advanced a few steps, then stopped to utter that hideous roar again; advanced again, and finally stopped when at a distance of about six yards from us. And here, just as he began another of his roars, beating his breast in rage, we fired and killed him."

In later years Du Chaillu traveled extensively in Sweden, Norway, Lapland, Finland, and other countries. He was the originator of the phrases "Land of the Midnight Sun" and "Land of the Long Night." In 1889 he published "The Viking Age," his most ambitious work, the result of many years of special research. He published his first book for young people in 1868, called

"Stories of the Gorilla Country." This was followed by many other similar books.

Mr Du Chaillu had many friends among the members of the National Geographic Society. His last public address in the United States was before the National Geographic Society, April 12, 1901, on the occasion of a farewell reception tendered him by the Society on the eve of his departure for Russia. His first lecture on his return was to have been before the National Geographic Society.

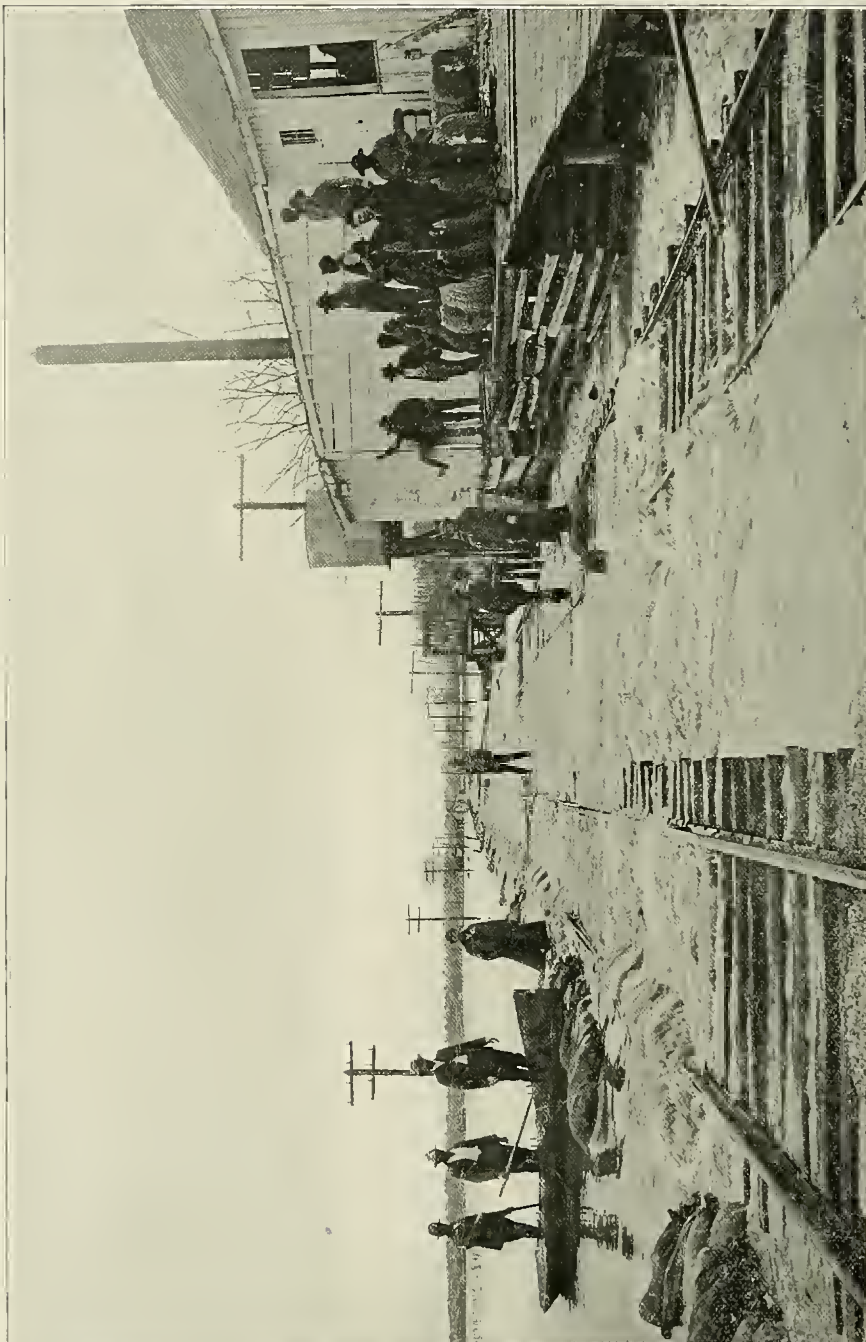
THE WEATHER BUREAU AND THE RECENT FLOODS

By H. C. Frankenfield,

Forecast Official, Weather Bureau

The unprecedented floods that have occurred in the Mississippi and lower Missouri Rivers during March, April, and June of the current year have served to bring into considerable prominence a feature of the Weather Bureau work not at all familiar to the general public, with the exception of those who dwell within the districts directly affected. Reference is had to the River and Flood Service which, by the uniform accuracy and general high character of its work during the recent floods, has afforded a striking realization of the true function of the Weather Bureau, namely, that of providing as effectively as possible by means of its warnings for the personal safety as well as the material comfort and welfare of the people in times of impending disaster by wind and water. Ordinarily the work of the River and Flood Service is limited to the forecasting day by day of the coming stages of water in the navigable rivers of the country for the benefit of the commerce thereon, with an occasional local warning of an approaching flood due to excessive precipitation over a more or less circumscribed area. These forecasts and warnings are expected by the commercial and agricultural interests of the communities affected, and are accepted by each individual as a portion of the legitimate assets of his calling. The country at large is very slightly and indirectly affected by the work, and as a natural consequence hears but little of it. It is only when the rains become general and frequent and excessive over the great watersheds, and when the rapidly swelling tides in the rivers give notice of the coming ruin and disaster that the interest of the whole country is awakened. About two-fifths of our entire population dwell within the watersheds of the three great interior rivers, and a much larger proportion of its great producing area is comprised within their limits. The interests of all are centered in these districts, and upon their welfare depends that of all. It is at these times that the River and Flood Service of the Weather Bureau stands forth in its true light, and by the timeliness and accuracy of its warnings affords ample opportunity for the protection of human life and such property as can be saved.

The flood of March and April, 1903, in the lower Mississippi River was the greatest in its history, the stages of water alone considered, although its actual volume was very probably less than in 1897, the increased heights hav-



Flood Scene, Marion, Ark., March, 1903

ing been due to the extension and increased dimensions of the levee system. The confinement of the waters within a narrow channel, of course, operates to elevate the flood plane, with the natural result that a given stage of water would be recorded with a much less volume than was formerly necessary to produce the same result. An inspection of the figures immediately following will confirm this statement, Cairo being used as a reference point for the reason that all lower river forecasts are predicated upon the Cairo stages :

	1897.	1903.	Excess or deficiency. 1903.
	Feet.	*Feet.*	*Feet.*
Cairo	51 6	50.6	—1.0
Memphis	37.1	40.1	+3.0
New Orleans	19.5	20.4	+0.9

The difference was most marked at Memphis, owiug to the completion of the St Francis levee, in Arkansas, since 1897, and had not this levee broken in several places the excess would have been still greater.

The Ohio and lower Mississippi Rivers, owing to a number of heavy and general rains that are the invariable accompaniments of storms of the Southwesteru type, had been rising steadily duriug February, but not to such an extent as to warrant flood warnings until the last two days of the month, when another storm of the same type moved northeastward through the Ohio Valley. It was not necessary to wait longer. Another general rain was certain to cause overflows of the already bank-full rivers, and warnings of danger were at once telegraphed from the river centers to all points between Pittsburg and Cincinnati, the character of the advices varying with the locality. For instance, at Pittsburg, where the fast-flowing mountain tributaries make every moment valuable, warnings were given to take all necessary precautions at once, the usual time for a flood to run out being but 18 hours, while at Cincinnati several days were allowed. On the same date a general warning was issued from Memphis that owing to the recent heavy and general rains the floods would continue for two weeks longer, with stages one or two feet higher. On March 1 the people of the New Orleans district were notified to make preparations for high waters. These warnings were repeated from day to day, gradually becoming more specific as the great volumes of the tributary waters came into the main stream. There were more heavy rains on the 7th and 8th, and on March 9 warnings were issued for stages below Cairo higher than were ever before recorded, should the levees remain intact. It was also stated that the rise would continue for ten days longer at Memphis and for four week at New Orleans, when a crest stage of 21 feet was expected at the latter place, 1.5 feet higher than in 1897. At the same time a stage of 50 feet was forecasted for Cairo. These warnings were repeated daily with such slight variations as were indicated. With the experiences of 1897 so fresh within the recollection of all, there was no occasion to impress upon them the necessity of immediate action. Thousands of men were put to work at once strengthening the levees and removing portable stock to places of safety. Armed forces patrolled the levees to guard them against breaking or cutting, and every possible precaution that experience, foresight, or prudence could dictate was taken. The warnings of the 12th raised the limits still higher except at New Orleans, 50.5 feet being forecasted for Cairo and 39 feet for Memphis, the latter to occur in seven days. About March 15 there was a sudden rise at Memphis due to receutly constructed levees and railroad embankments, and a

Camps of Negro Refugees, Flood of March, 1903 forecast was therefore made for a 40-foot stage within a few days. The crest stage of 40.1 feet was reached on the morning of March 20, 7.1 feet above the danger line and three feet above the high-water mark of 1897. At New Orleans the rise continued for nearly three weeks longer, and the crest stage of 20 4 feet was reached on April 6, 1.5 feet above the high-water mark of 1897. There were occasional surgings of the water to 20.7 feet, and had not the levees broken in the St Francis system and later at Hymelia, La., the forecast of a 21-foot stage made over four weeks before would have been fully verified. As it was, the error was on the right side, it being an important axiom of river forecasting to always slightly overestimate, if possible, the probable height of a flood crest.

The stages forecasted and those actually reached from Cairo to New Orleans were as follows. The forecast at Cairo was made four days in advance, and that at New Orleans 28 days in advance of the crest:

Stations.	Forecast stage.	Actual stage.
	Feet.	*Feet.*
Cairo	50.5 to 51	50.6
Memphis	40 0	40.1
Helena	51.0	51.0
Arkansas City	53.0	53.0
Greenville	49.0	49.1
Vicksburg	52 0	51.8
New Orleans	21 0	20.4 to 20.7

On the Ouachita River, 37 and 45 feet were forecasted and 36.2 and 44.5 feet reached at Alexandria and Monroe, La., respectively.

The floods of the last few days of May and the early days of June in the lower Missouri and the upper Mississippi were the greatest of any of which we have authentic record, except that of 1844. The stories of the ruin and desolation in the valley of the Kaw and at Kansas City are familiar to all. During the latter half of May persistent low barometric pressure over the eastern slope of the Rocky Mountains caused daily rainfalls of almost torrential character over Kansas, the excess above the normal amount for the season averaging about seven inches. The same conditions prevailed to a lesser extent to the eastward into northwestern Missouri and Iowa, and all streams soon became raging torrents. At Kansas City the maximum stage was 35 feet, 2 feet below the high-water mark of 1844. The records for points within the State of Kansas have not yet been verified, but there are sufficient data at hand to warrant the statement that they were higher than ever before recorded.

The first warnings of this flood were issued at Kansas City on May 26, and thereafter daily until the waters subsided. It was in connection with this flood that there occurred the single unfortunate feature of the flood work of the year. Owing to the want of sufficient funds for the purpose, no flood service has been maintained on the Kansas River, although the Missouri River is well supplied. For this reason it was not possible to forecast exact stages after May 29. On May 30 telegraph and telephone service were very uncertain, and on the 31st Kansas City was completely cut off from the west. On June 1 came the flood crest of 35 feet. The forecasts were from the necessities of the case very general in character, and stated only that a "serious flood" was imminent, and would continue as long as the rains were falling. East of Kansas City conditions were more favorable, and the forecasts were well verified, both as to time and stage. Warnings were first issued at Des Moines on the 25th of May, at Keokuk on the 28th, and at St Louis on the 30th. At this latter place warnings were issued on June 5 to prepare for a stage of 38 feet in about four days. On the fifth day that stage was exactly reached, and the waters began to slowly recede. This stage of 38 feet was 8 feet above the danger line, and within 2.6 feet of the great high-water mark of June 27, 1844.

This flood, while, of course, much more destructive than that of 1844, did not by any means equal it in volume. In 1844 the lowlands were not occupied, there were no busy centers of industry at Armourdale, Argentine, and East St Louis, and consequently the damage done was relatively slight. The rainfall in 1844, however, was decidedly greater than in May, 1903, and there were no levees along the river to hold the waters. Yet with all bottom lands overflowed, a stage of 37 feet was reached at Kansas City on June 20 and of 41.4 feet at St Louis on June 27. At the same time the Illinois River was from 10 to 15 miles wide from La Salle to its mouth, and from Hardin down united with the Mississippi to form one continuous river. The consequence of an equal amount of rain during the present year and equally well distributed cannot be estimated with any degree of exactness. Nevertheless it is reasonably certain that several feet would have been added to the stage at St Louis, and that the entire city of East St Louis would have been totally submerged to a depth of at least 8 or 10 feet.

The annual rise of the Columbia River is always a subject of interest to the people of the north Pacific coast. This rise depends almost entirely upon the melting of the winter snows in the mountains, and there are at times wide divergences of opinion as to the probable extent of the rise and its effects upon the Willamette River at Portland, Oregon. In March of the present year the official in charge of the Weather Bureau office at Portland issued a bulletin on the subject, in which he stated that from the amount of snow then in the mountains a stage of 24 feet, or 9 feet above the danger line, would be reached at Portland about the middle of June. On June 13 the stage was 22.8 feet, with the Columbia still rising slowly.

Against such cataclysms as those at Pacolet and Heppner, flood warnings cannot avail. They are caused by torrential downpours upon extremely precipitous watersheds. Millions of tons of water are suddenly poured into a deep reservoir with but a single narrow avenue of escape. The results are then apparent, but they are beyond the province of human wisdom either to foresee or prevent.

A SUGGESTED FIELD FOR EXPLORATION

THE cabled reports tell of the continued activity of Mont Pelée in Martinique, of Colima in Mexico, and of Santa Maria in Guatemala. For a period now of eighteen months there have been unceasing volcanic disturbances in a belt extending east and west, from the west coast of Mexico to Martinique, and north and south, from central Mexico to Venezuela. Since January 1, 1902, this belt at some point or other along its length has been constantly in a state of violent disturbance. The first disturbance occurred in January, 1902, when an earthquake destroyed Chilpancingo in Mexico, and caused the loss of thousands of lives. On April 18 Quesaltenango and other towns in Guatemala were likewise ruined and fearful destruction of life resulted. On May 8 occurred the eruptions of Mont Pelée and La Souffrière, numbering 35,000 victims. In November the Santa Maria volcano in Guatemala erupted, and thousands of lives were destroyed. Early in 1903 Colima in Mexico erupted, and many more lives were lost. Since the eruption of Mont Pelée, on May 8, blasts even more terrific than the first fatal one have burst repeatedly from its mouth.*

We know that all these phenomena are related to each other in a general way, but what that relation is we are unable to explain. The Royal Society of England in 1902 sent two geologists to Martinique and St Vincent to study conditions there ; the French Academy of Sciences did likewise ; the National Geographic Society sent two eminent American geologists, Prof. I. C. Russell, head of the department of geology, University of Michigan, and Robert T. Hill, of the U. S. Geological Survey, and one foreign-born geographer, C. E. Borchgrevink ; Harvard University and the National Geographic Society jointly sent Dr T. A. Jaggar, of the Department of Geology of Harvard University ; the American Museum of Natural History sent one geologist, Dr E. O. Hovey, who is still in the field, and Prof. Angelo Heilprin, of the Academy of Natural Sciences, Philadelphia, has made three separate trips to the same region. But each of these expeditions has observed and studied only one point in the region of volcanic disturbance, and that point on the extreme eastern end of the belt. No one has gone to Colima or Santa Maria, on the western end, the ashes from whose craters are different from the ashes from Mont Pelée and Souffrière. The conclusions of all these expeditions deal with one locality, with one point of weakness only. What is needed is a careful examination of all the principal points of disturbance on the belt, Santa Maria in Guatemala, Colima in Mexico, etc., so that the phenomena at the various points on the belt may be carefully compared.

The trouble with all past investigations of volcanoes has been that the study has not been sufficiently complete and general. Krakatoa, Vesuvius, and Mauna Loa have each been examined and carefully watched by expert geologists and special commissions, but these investigations have been handicapped by being limited to a small area of activity. An opportunity like the present for studying active volcanic conditions, not at one point only, but at several connecting points extending over a wide region, has never before been presented.

A more comprehensive study of volcanic action will throw light on the forces writhing beneath the earth's crust. What is beneath the upper strata we do not know. By a systematic study of such a region as the volcanic belt of Central America great and invaluable information may be gained as to the origin and history of the earth.

But a far greater discovery may result from such investigation ; it may be possible to foretell when volcanic disturbances are to occur, and thus to prevent such a series of catastrophes as have horrified mankind during the last eighteen months.

To carry out a careful and thorough study of this long volcanic belt would require probably less than $5,000, a mere trifle compared to the vast sums at present being expended to further exploration in the north and south polar regions. A wiser expenditure for scientific exploration could not be made, in view of our absolute ignorance today of the causes of volcanic action and the tremendous revelations that are possible from a comprehensive study of the extended region of present volcanic activity.

* Consult "Mont Pelée and the Tragedy of Martinique," by Angelo Heilprin, pages 257–270. Philadelphia : J. B. Lippincott & Co. 1903.

INTERNATIONAL GEOGRAPHIC CONGRESS

AT a conference of representatives from the several Geographic Societies in the United States, held Saturday, June 20, 1903, in the American Geographical Society Building, 15 West Eighty-first street, New York city, to arrange for the meeting of the Eighth International Geographic Congress, to be held in this country in 1904, the organization of the Committee of Arrangements was perfected by the election of Prof. W J McGee, of the National Geographic Society, Washington, D. C., chairman, and Dr J. H. McCormick, secretary. It was formally voted to hold the Congress in Washington in September, 1904, adjourning to St Louis, Missouri, to meet in connection with the International Congress of Arts and Science. In addition to the formal sessions of the Congress in Washington, it is planned to hold informal sessions or social meetings in other cities. After the final session in St Louis, a trip is planned to the City of Mexico, the Grand Canyon, Yosemite Valley, Yellowstone Park, and other points of interest to the members of the Congress. The following subcommittees were appointed: Program, Mr C. C. Adams, of the American Geographical Society; Exhibits, Mr Henry G. Bryant, of the Geographical Society of Philadelphia; Invitations, Prof. A. L. Rotch, of the Appalachian Mountain Club; Transportation, Dr G. B. Shattuck, of the Geographic Society of Baltimore; Finance, Messrs C. J. Bell, David T. Day, and Jno. Joy Edson. The appointment of other committees was deferred till the next meeting of the Committee of Arrangements. A formal prospectus will be issued in a few days.

GEOGRAPHIC NOTES

GEOLOGICAL EXPLORATION IN EASTERN ASIA

CHINA, the land which so deeply interests us politically and commercially, has also its scientific interest. Geographically it is a region of great diversity of aspects—along the Hoangho and Yangtze having great flood plains, more extensive than those of the Mississippi; along portions of its coast presenting bold promontories like the coast of the Pacific; throughout the central region exhibiting mountain ranges which the rivers traverse in deep canyons, and in its northwestern portion consisting of extensive plateaus and deserts, which extend to the heights of the Tibetan ranges. Geologically the rocks of China comprise representatives of every known geological period, and the record of the earth's history appears to be as full and as interestingly exhibited in the Middle Kingdom as in the United States. It is natural that geographers and geologists should take a lively interest in exploration of any unknown country, but with reference to China their appetite has been whetted by the suggestions of explorers who have had opportunity to travel hastily, but rarely have been able to do more than glance at the problems which presented themselves.

The Carnegie Institution of Washington, recognizing that China is a rich field of investigation, has made a grant for exploration in eastern Asia, and plans have been developed, based upon the results of extensive researches carried out by Baron von Richthofen thirty years ago. The plans are comprehensive in purpose, including the study of the successions of rocks—that is, stratigraphy, the problems of structure involved in the mountains, and the history of mountain growth as expressed in the existing valleys and heights, and the paleontology of the various strata which may be encountered.

The party will consist of Mr Bailey Willis, geologist in charge, and Mr Eliot Blackwelder, paleontologist.

Mr Willis is a member of the National Geographic Society, and has been accredited its representative in China, with authority to make investigations on its behalf should opportunity occur.

These gentlemen will leave this country in July, and, proceeding by way of Europe, will confer with Baron Von Richthofen and other eminent European scientists. During the early part of September they will travel from St Petersburg to Peking by the Siberian Railway, and as soon as possible after their arrival in Peking will enter upon geological field work. The detail of operations during their sojourn in China depends upon conditions which can not now be exactly foreseen. It is expected that they will return to the United States in the summer of 1904.

THE NORWEGIAN EXPEDITION TO THE MAGNETIC NORTH POLE BY ROALD AMUNDSEN

THE following information regarding this interesting and important expedition is derived from Mr Amundsen's article in the March issue of *Terrestrial Magnetism*:

The leader, Amundsen, has taken part in the magnetic observations of the *Belgica* South Polar Expedition, and so has already had some experience in magnetic work in polar regions. His ship, the *Gjöa*, which has been especially built for Arctic exploration, is 70 feet long, 20 feet broad, and has a tonnage of about 48. She is provided with a small petroleum motor, and makes about four knots an hour. She will carry 30,000 liters of petroleum stored in iron vessels to serve for heating, cooking, and to furnish the motive power. The vessel will be provisioned for four or six years and carry a crew, with officers, of 8 men.

Mr Amundsen's instruments, which will serve for making both absolute and relative magnetic observations, were constructed and tested under the direction of Professor Neumayer while director of the "Deutsche Seewarte." His outfit also includes two sets of self-registering instruments.

He proposes to start north during the early summer of this year, stopping at Godhavn, Greenland, for dogs.

His first base station will probably be in the vicinity of North Somerset, in Leopold Harbor, from which he hopes to send news of his work in 1904 by means of whale hunters. There he proposes to make absolute magnetic observations, and also operate his self-registering instruments for a time. From this base station he likewise proposes to make sledge trips, on which magnetic observations will be made. In the summer of 1905 he may locate his base station on King William Island, and again set up his self-registering instruments. The following summer (1906) he will attempt to locate his base station at Herschel Island, and open communications with Fort McPherson, of the Hudson Bay Company. His return trip will be made by way of Bering Strait, and he proposes to stop at Sitka and make his final observations there at the U. S. Coast and Geodetic Survey magnetic observatory for the determination of instrumental constants.

Mr Amundsen thus contemplates making a complete and systematic magnetic survey of the region about the

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Tetrahedral Kite in the Air

magnetic pole, from which not only an accurate location of the magnetic pole may result, but other most important results will follow. The determination of the north magnetic pole by Captain James Clark Ross, in June, 1831, rested on a single determination. Owing to local disturbances, which may be expected in that region, there is no telling how close his determination was to the actual magnetic pole. His position was on Boothia Felix, in north latitude 70° 05′ 17″ and west longitude 96° 45′ 48″.

It is generally believed that the magnetic pole is subject to a fluctuation in its position, and it is hoped that Amundsen's work will throw some light upon the rate and direction of motion.

THE TETRAHEDRAL KITE

THE accompanying illustration shows one of Dr Alexander Graham Bell's tetrahedral kites in the air. It was received after the June number of the NATIONAL GEOGRAPHIC MAGAZINE went to press. The kite is the sixty-four-celled tetrahedral kite shown as D in figure 16, page 227 of the June number. The illustration shows the kite flying at the proper angle. The photograph was taken at Colonial Beach, Virginia, May 26, 1903, by Mr A. W. McCurdy.

PORTO RICO AND THE UNITED STATES

PORTO RICO is now furnishing a market of a million dollars a month to the producers and merchants of the United States, and supplying nearly a million dollars' worth each month of tropical products required by the United States.

These figures of commerce between Porto Rico and the United States are in marked contrast with those of earlier years. In the fiscal year 1898, which immediately preceded the transfer of Porto Rico to the United States, the exports from the United States to that island were $1,505,946. In the next year they were $2,685,848; in 1900, $4,640,449; in 1901, $6,965,408; in 1902, $10,882,653, and in the year 1903 will be about $12,000,000. Thus the total shipments from the United States to Porto Rico for 1903 will be eight times as great as those of 1898, and six times as great as those of 1897. On the other hand, shipments from Porto Rico to the United States have grown from $2,414,356, in 1898, to $8,378,766, in 1902, and probably nearly or quite $12,000,000 in 1903, or about five times as much in 1903 as in 1898.

The United States is sending to the island cotton fabrics, iron and steel wares, and great quantities of rice, provisions, and breadstuffs; Porto Rico ships in return sugar, tobacco, coffee, and fruits.

The increased value during the last five years of Porto Rico from a commercial point of view is admirably shown by a statement recently issued by the Bureau of the Department of Commerce and Labor.

SUMMER SCHOOL OF GEOLOGY AND GEOGRAPHY AT CORNELL UNIVERSITY

THE summer school which is to be conducted by Cornell University July 6 to August 15, 1903, for students of geology and geography offers an attractive and exceedingly varied series of courses. The location of the school is itself a lesson in all that is beautiful and instructive. The campus of Cornell University is situated on a hillside, overlooking a large lake in one direction, and broad, beautifully sloping valleys in the other, and bounded by narrow gorges with many falls, cascades, and rapids. The campus is the center of a great variety of beautiful, interesting, and instructive geographic features. The excursions of most of the field courses are for the study of these features By these excursions the student is taught method and fact upon a broad range of geologic and physiographic phenomena.

The university library is fully supplied with books and magazines on geologic and geographic subjects, and these are accessible to the students in the school. The laboratories are equipped with many models, maps, photographs, and specimens illustrating phases of geology, physiography, and geography. There is, furthermore, a collection of fully 5,000 lantern slides for use in the lecture courses.

The lecture courses have been planned with great care and men selected to give them who are recognized authorities in the subjects which they are to teach. The courses and lecturers are as follows:

Physical Geography of the Lands; Prof. R. S. Tarr (Professor of Dynamic Geology and Physical Geography, Cornell University).

Laboratory Course in Physical Geography; Assistant Principal Carney (Assistant Principal, Ithaca High School) and Mr Mills (Assistant in Physical Geography, Cornell University).

Field Course in Physical Geography; Professor Tarr, Mr Whitbeck, and Mr Mills.

Dynamical Geology; Prof. A. P. Brigham (Professor of Geology and Natural History, Colgate University, Hamilton, N. Y.).

Laboratory Course in Geology; Mr Matson (Assistant in Geology, Cornell University).

Field Course in Geology; Professor Brigham, Assistant Principal Carney, Mr Matson, and Mr Mills.

Geography of the United States; Professor Brigham.

Geography of Europe; Professor Tarr.

Home Geography; Prof. C. A. McMurry (Director of Practice Department, Northern Illinois Normal School, DeKalb, Ill.).

Type Studies in Geography for Grammar Grades; Professor McMurry.

Commercial Geography; Principal Emerson (Principal Cobbet School, Lynn, Mass.).

Laboratory and Field Work in Commercial Geography; Principal Emerson.

Class-room Problems in Geography; Mr R. H. Whitbeck (Supervisor in New Jersey State Normal School, Trenton, N. J.).

Physical Geography for Grades; Mr Whitbeck.

Round-table Conference, for consideration of topics of geographic interest; all the teachers and such students as desire to attend.

Advanced Field and Laboratory Course in Dynamic Geology and Physical Geography; Professors Tarr and Brigham, with assistants.

The regular summer session also includes courses in Education, History, Economics, Botany, Zoölogy, and other subjects which have a bearing on geographic work.

The Summer School has also planned a series of entertaining and instructive excursions in the vicinity of Ithaca; among them excursions to Lake Ontario, to Niagara Falls, Wilkes Barre and Hazleton, and Watkins Glen.

THE SWEDISH SOUTH POLAR EXPEDITION

HON. AUGUSTUS E. INGRAM, Deputy Consul General of the United States at Paris, under date of May 29, sends to the NATIONAL GEOGRAPHIC MAGAZINE the following note of an expedition to be sent out by France in July to rescue the Swedish South Polar Expedition:

When Dr Otto Nordenskjold set out from Sweden, over a year ago, with a party of thirty-six persons on an expedition for the South Pole, his last words were: "If you are without news of me by April 30, 1903, come to my rescue, for we shall all be in great danger."

That time has come, and no news has been received of Dr Nordenskjold. In Sweden a relief expedition is being organized, but it cannot start until the end of August. Since this may be too late, and as it is thought that Dr Nordenskjold's expedition is now in the vicinity of Cape Seymour, which is French soil, the national pride of France has been stirred to be the first to rescue these brave but unfortunate men.

A vessel has already been constructed in France on the lines of the immortal *Fram* and has been named *Le Français*. Dr Jean Charcot,* well known in French scientific circles, is to command the expedition, and he will be accompanied by other scientists and experienced naval officials. The sum of 150,000 francs is, however, necessary to complete the equipment, and a leading Parisian journal, *Le Matin*, has opened its columns for a subscription list. All classes of people are responding liberally, and it is probable that the French Government, in addition to aid extended by its naval and scientific officials, will also make a contribution of money.

The expedition is expected to leave Havre on the 15th of July, and will without loss of time attempt the work of rescue. When this has been accomplished, *Le Français* will, like the *Fram*, proceed south until it is inclosed in the moving field of ice. At the opportune time a dash across the ice for the South Pole will be made.

This expedition is of especial interest, as it is now nearly three-quarters of a century since France sent an expedition to the South Pole, at which time Dumont d'Urville made considerable discoveries.

Since the expected visit to Lisbon of His Majesty Don Alfonso XIII, King of Spain, will not take place next month, the exposition of Portuguese cartography, organized by the Geographical Society of Lisbon, under the high protection of His Majesty King Don Carlos I, which was to coincide with that visit, has been postponed until next autumn.

German South Polar Expedition.—The *Gauss*, the steamer of the German South Polar Expedition, has been reported off the east coast of South Africa. Few details of the work of the party have as

*Dr Charcot had originally intended (as stated in this Magazine on page 217, May, 1903) to use his vessel for Arctic rather than South Polar exploration.

yet been received, but it would appear that, owing to the ice, they failed to get farther south than 66° 2', and that the expedition was thus practically a failure. No expense had been spared to make the expedition a success. (It cost $400,000.) The plans had been formed after years of deliberation with the most competent men in Europe. The leader, Captain Drygalski, had proven his ability by previous work in Greenland. Bad luck alone can explain the failure of the expedition and the bitter disappointment of the German nation.

Mr W. J. Peters, the representative of the National Geographic Society on the Ziegler North Polar Expedition, was presented on his departure with the Society's flag. The flag of the National Geographic Society is of three colors—blue, brown, and green—representing respectively the air, the land, and the water.

The Swedish Government has made a grant of $20,000 to Dr Sven Hedin to enable him to publish the results of his recent explorations in Central Asia. The work will consist of a series of volumes to be completed within three years. There will be an English edition.

Prof. William H. Brewer, of Yale University, has resigned the presidency of the Arctic Club. He has been president of the Arctic Club since it was founded, eight years ago, and to his leadership is due much of the success of the organization.

Mr Robert T. Hill, of the U. S. Geological Survey, who visited Martinique as one of the representatives of the National Geographic Society, and whose preliminary reports upon the St Pierre disaster have been published in the NATIONAL GEOGRAPHIC MAGAZINE, the *Century*, and *Collier's Weekly*, is engaged upon a careful study of the scientific aspects of the eruptions, which will be presented in the NATIONAL GEOGRAPHIC MAGAZINE during 1903. He is also completing a monograph on the Windward islands for Prof. Alexander Agassiz, to be published by the Museum of Comparative Zoölogy of Harvard University. This work will be the result of several years of careful study of the islands and will thoroughly discuss the details of their geological structure and their bearing upon the alleged Windward bridge and the myths of Atlantis. Mr Hill is also engaged on a comprehensive geographical work upon the Republic of Mexico. From this country, where he has been gathering notes for the past fifteen years, he has just returned, after a most interesting mule-back trip across the southern end of the Sierra Madre between Mexico City and Acapulco.

Francis H. Herrick is the author of a recent report issued by the U. S. Fish Commission entitled "The Reproductive Period in the Lobster." Dr Herrick concludes from his experiments that the spawning periods of the female are two years apart.

The Royal Geographical Society is planning to send south the coming fall an auxiliary vessel to bring back the British South Polar Expedition. According to report, the *Discovery* has been frozen in, and is separated from open water by six miles of ice, which is too great a distance to open with a channel.

The British members of the Alaskan Boundary Commission are Lord Alverstone, Chief Justice of England; Sir Louis Jette, Lieutenant Governor of Quebec, and Justice Armour, of the Supreme Court of Canada.

An attempt to ascend Mount McKinley is being made this summer by Dr Frederick A. Cook and Mr Robert Dunn.

GEOGRAPHIC LITERATURE

A Teacher's Manual of Geography. By Charles McMurry, Ph. D.; pp. 108. New York: The Macmillan Co. 1902. $0.40

This book is designed to accompany Tarr and McMurry's admirable series of geographies. To the teacher of geography this little volume will be of much practical and suggestive assistance.

The Alaska Frontier. By Thomas Willing Balch. With 28 maps. Pp. 198, 7 x 11 inches. Philadelphia: Allen, Lane & Scott. 1903. $2.00.

Mr Balch presents in this volume the results of studies he has been making for several years on the subject of the Alaska Canadian boundary. He has not only consulted the maps of the State Department, but also made a special investigation in the archives at St Petersburg, Berlin, Paris, London, Edinburgh, and other cities. His researches have enabled him to publish a notable work, containing new facts of considerable importance.

The basis of Mr Balch's argument is a series of 28 maps, the earliest being Vancouver's chart of 1799. These maps are copies of maps published by the Russian, English, and Canadian governments. They all show the boundary exactly as claimed by the United States and agreed to by Great Britain and Canada alike for three-fourths of a century.

One of the most notable of these is British Admiralty Chart No. 787, which was first issued in 1877. Eighteen revised editions of this chart have since been issued, the latest being in 1901, three years after the Canadian claim was put forward; but each edition shows the boundary exactly as given in the United States maps.

Mr. Balch is always careful to give references to authorities referred to, a fact that is specially desirable in works of this nature. The volume is dedicated "to the memory of William H. Seward and Charles Sumner, to whom the United States owes Alaska."

Unknown Mexico. By Carl Lumholtz, M. A. Two volumes, 8vo, pp. i–xxxvi, 1–530, i–xvi, 1–496, with 15 colored plates, two large maps, and many other illustrations. New York: Charles Scribner's Sons. 1902.

As indicated by a full sub-title, this is a record of five years' exploration among the tribes of the western Sierra Madre; in the Tierra Caliente of Tepic and Jalisco, and among the Tarascos of Michoacan. It supplements a number of more technical publications, including Dr Lumholtz's splendid memoir "Symbolism of the Huichol Indians," issued by the American Museum of Natural History in 1900. The expeditions were conducted and the results prepared for publication under the auspices of various institutions and individuals, among whom the author especially credits the American Geographical Society, the American Museum of Natural History, Mr and Mrs Morris K. Jesup, Mr Andrew Carnegie, and Mrs Elizabeth Hobson. Starting with a large train in southern Arizona, Dr Lumholtz entered Sonora, and then crossed the Sierra Madre into Chihuahua; gradually the party was divided and disbanded as he worked southward along the eastern slopes of the Sierra until he was practically alone in the Tarahumare, Tubari, and Tepehuane countries, and quite without Caucasian companions in the Huichol, Cora, Tipecano, and Tarasco districts. Traveling usually by easy stages and making long stays in many of the native settlements, he enjoyed excellent opportunities for study of the habits and customs of surviving tribes, as well as for archeologic research. Considerable collections were made of both prehistoric and modern material; most of these were sent to the American Museum of Natural History. In the northern sierra numerous habitations, both ancient and modern, were found in natural or slightly-worked niches in the stupendous cliffs and barrancas; these are described as cave-dwellings, an unfortunate designation (since it tends to perpetuate the groundless notion that primordial human homes were in caves) growing out of the fact that our ordinary speech does not distinguish subterranean caverns from the open clefts or niches sometimes called rock-houses—a term too awkward for common use. In the Tarasco country imposing yacatas, or structures of stone or earth sometimes containing ornate sculptures or fictile ware, were discovered and some of them were explored, these ruins forming a connecting link between the simpler antiquities of southwestern United States and the elaborate monuments of southern Mexico, Yucatan, and Peru. Still more productive were the researches in the intermediate region, since here certain of the tribesmen were found to retain in exceptional degree their aboriginal arts and industries, their native speech, their primitive faiths, and many of the social regulations of their ancestors; and Dr Lumholtz succeeded in gaining the confidence of the Tarahumare, Tepehuan, and Huichol tribesmen so completely as to permit him to record their primitive characteristics with unexampled fullness. The ceremonial use of tobacco; the symbolism of the primitive music and dance and of the attendant costumes; the esoteric purpose of feasting; the devotional use of intoxicants; primitive marital regulations and mortuary observances; the emblematic decoration of fabrics and wares—these are but examples of the subjects apparently kept in the mind of the author throughout, and certainly elucidated with remarkable clearness in his chapters. And, so far as practicable, the points are illustrated and the observations established by photographs made on the ground or by objects collected and preserved in a great museum. In a word, the two volumes form a storehouse of facts invaluable to the working anthropologist. Throughout the record breathes a sympathy with primitive men and a depth of appreciation of their sentiments and ideas seldom seen in scientific treatises, so that it presents one of the clearest pictures of primitive life thus far drawn. The work is abundantly illustrated, largely by photomechanical reproductions, partly by engravings and lithographs bearing inherent evidence of fidelity; and the beauty of the book-making is no less striking than the excellence of the contents.

W J M.

Complete Geography. By Ralph S. Tarr and Frank M. McMurry. With many maps and illustrations. Pp. XI+478+X, 6½x8½ inches. New York. The Macmillan Co. 1902.

The plan of this text book is excellent and has been admirably carried out. Only three chapters precede the intensive treatment of the United States. The first is a physiographic history of the continent, showing how its principal mountain ranges and valleys came into existence; how its coal beds were formed; what were the effects of the great ice age; and what have been the more recent changes in the coast line, with their results. The second chapter describes the plants, animals and peoples of North America, and the third explains latitude and longitude. Then follow seven chapters on the United States, each dealing with one group of states. The rest of North America is then described. By this arrangement the more difficult subjects of General Geography, seasons, winds and rain, ocean movements and distribution of temperature, forming Part II of the volume, are deferred until the pupil is better prepared to understand them. Part III deals with South America, Part IV with Europe, and Part V with Asia, Africa, Australia, and Island Groups. The maps and illustrations, of which there are 500, are well chosen and are very clearly and beautifully reproduced.

Through the Heart of Patagonia. By H. Hesketh Prichard, F. R. G. S., F. Z. S., etc. Large 8vo, pp. i–xvi, 1–346, with 40 plates and 3 maps. New York: D. Appleton & Co. 1902.

In 1897 Dr F. P. Moreno stumbled on a piece of skin containing bony tubercles, which had been found with human remains in a Patagonian cave; the character of the integument and the associations suggested that it was from a Mylodon (or Giant Ground Sloth) of Tertiary facies perhaps still surviving, and Dr F. Ameghino used it as the type of a new genus and species, *Neomylodon listai*. A portion of the skin was taken by Dr Otto Nordenskjöld; another piece passed into the hands of Prof. E. Ray Lancaster, Director of the British Museum of Natural History, and Dr A. Smith Woodward, who made a critical study, as did also Dr S. Roth, who identified it with a Pampean genus related to Mylodon and renamed it *Grypotherium listai*. The find, in associations indicating that the animal was stabled in the cave and fed by early man, together with attendant rumors that it had been seen alive, naturally attracted much attention. Among those interested was Mr C. Arthur Pearson, of London, who financed an expedition in charge of Mr Prichard to search for further traces of the animal. This expedition failed of its primary purpose, since neither remains nor living specimens of Grypotherium were found; yet it was successful in practically demonstrating that the creature no longer lives in its former range, and also in extending exploration of the southern Andean region. Among the results of permanent value may be noted surveys about the eastern portion of Lake Buenos Aires; explorations and surveys about Lake Argentino, including the discovery of Lake Pearson; the finding of a new puma (*Felis concolor pearsoni*); various notes on the habitat and habits of Patagonian animals; a study of "The first attitude of wild animals toward man;" and useful ethnologic observations, chiefly on the Tehuelche tribe. The sumptuous report details these results, and also forms an interesting record of travel and adventure, satisfactorily illustrated by reproductions of the author's photographs, as well as by more fanciful sketches in color and tint; while a full Appendix contains reprints of the principal papers on Grypotherium, together with a note by the author on the native legends, a description of the new puma by Oldfield Thomas, and a list of plants, with their localities. A suggestive chapter on the future of Patagonia touches on the resources of this portion of the great country, Argentina, sometimes of late fitly styled the United States of South America. The book is handsome, despite the somewhat inferior typography and lab*ou*red orthography of the English press.

W J M.

Three Notable Works on Alaska, the results of extended explorations in the territory in 1901, have been published by the Survey: "Preliminary Report on the Ketchikan Mining District," by Alfred H. Brooks, Ketchikan; "Reconnaissance from Fort Hamlin to Kotzebue Sound," by way of Dall, Kanuti, Allen, and Kowak rivers, by Walter C. Mendenhall; "Reconnaissance of Northwestern Portion of Seward Peninsula," by Arthur J. Collier.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE UNITED STATES: HER INDUSTRIES*

By O. P. AUSTIN,

CHIEF OF BUREAU OF STATISTICS, DEPARTMENT OF COMMERCE AND LABOR

THE progress of the United States in its material industries has been the surprise of the whole world, the pride of her affectionate citizens. From a handful of five million people at the beginning of the last century she has grown to eighty millions, and from the smallest of beginnings she has reached the head of the list in agriculture, in mining, in manufacturing, in currency, and in wealth.

The purpose of this series of lectures is to present to you a picture of the growth of our common country, a picture of a century of unparalleled development—a development before which the world stands in amazement. No such record is known to history; no such development has occurred within so short a period; no such height has been attained in invention, in science, and in their application to the affairs of daily life, the life of the masses. While all nations have shared, in a greater or less degree, in the progress and prosperity of the century, the United States has enjoyed an especially large share of both, and made a record of which her citizens may well be proud.

To the first lecture of this series was assigned the story of the great natural resources and advantages of the country, and to the second the history of the development of our great agricultural resources. Both of these have been presented.†

To me has been assigned the subject of the industrial wealth of the nation, the development of the conditions which have made this the greatest manufacturing as well as the greatest producing nation.

And no subject could be more welcome, more inspiring to the student of the development of our country and its material resources. To trace the growth of our manufacturing interests from a total of 200 million dollars in 1810 to 13,000 millions in 1900, and the advance of the United States from the bottom of

*An address before the National Geographic Society, February 25, 1903.

† "The United States—Lands and Waters," Cyrus C. Adams, NATIONAL GEOGRAPHIC MAGAZINE, May, 1903; "The United States—The Soil and Its Products," NATIONAL GEOGRAPHIC MAGAZINE, July, 1903.

the list of great manufacturing nations to the very head of that list, is a task which fully compensates the student, in a renewed admiration for the history of our people and a renewed faith in their future.

The first attempt at a census of manufactures in the United States was in 1810, when the total value was found to be, in round terms, $200,000,000. The census figures of manufactures in 1820 and 1830 were incomplete, but those of 1840 were about a half billion dollars; those of 1850, about one billion; 1860, nearly two billions; 1870, over four billions; 1880, about 5½ billions; 1890, more than 9 billions, and 1900, 13 billions. The actual increase from decade to decade, still speaking in round terms, was: from 1850 to 1860, nearly one billion dollars; 1860 to 1870, over two billions; 1870 to 1880, one billion; 1880 to 1890, four billions, and 1890 to 1900, 3½ billions. In round terms, it may be said that the growth in the first half of the century was one billion, and in the second half 12 billions of dollars.

The slow growth in the first half of the century is due in part to the fact that a large share of the manufacturing was still performed in the household. While the factory system of manufacture began to take the place of that of the household in England in the closing years of the 18th century, especially as related to textiles, it did not obtain a foothold in the United States until during the period of the embargo and the War of 1812, and it was not until about 1840 that it became general; and as late as the middle of the century a considerable share of the manufacturing was still carried on in the family or in the small shop by the aid of the family and apprentices, as distinguished from the factory with paid employés and the application of power. Hence it is not surprising that the census of 1850 showed manufactures amounting to but one billion dollars' value, while the chief cause for astonishment is the wonderful growth which has occurred since that time—a growth from one billion dollars in 1850 to 13 billions in 1900.

I shall therefore confine my analysis of the growth of manufactures and its causes chiefly to the last half of the century, and in this I rely largely upon some charts and diagrams, by the use of which the eye may aid the mind in readily comparing the relative figures which mark the stages of growth. Necessarily the figures of manufactures as a whole can only be stated at decennial periods, for it is only by the national census that this great task of measuring the operations of the national workshop is undertaken, and I am proud to say that the United States takes this measurement much more effectively and more in detail than any other nation of the world.

Before beginning this analysis, I will say in general terms that the census figures show that the number of manufacturing establishments has grown from 123,025 in 1850 to 512,339, or four times as many in 1900; the sums paid in salaries and wages, from $236,755,464 to $2,732,821,528, or 12 times as much as in 1850, and the value of the manufactures from $1,019,106,616 to $13,039,279,566, or 13 times as much as in 1850.

It is proper to add that the figures of the total value of manufactures are merely an aggregation of the values reported by all manufacturers, and as the products reported by one manufacturer often become the materials for use by others, the figures of the grand total are to that extent duplications. For example, the leather reported as a manufacture by the tanner becomes the material used by the manufacturer of boots and shoes, and is a second time reported by him in stating the value of the manufactures turned out. The yarn produced by one manufacturer becomes the manufacturing material for the maker of cloth, and the cloth becomes the material used by the manufacturer of clothing,· the value of the yarn being thus reported three times, and that of the cloth twice, in the final statement of the grand total of manufactures produced. But as this custom has been followed in each census it does not materially affect the value of the figures for comparative purposes in showing the growth of the manufacturing industry. On the other hand, the fact that values of manufactures have greatly fallen since the earlier dates considered indicates that the actual increase in quantity produced is even greater than that indicated by the figures, which necessarily deal with values only.

With this basis of necessary statistical data I shall try to present the remaining facts and analyses in a manner in which the growth may be measured with the eye as well as the ear, and conclusions thus more readily reached as to the growth and cause of this growth, in which we all feel such a just pride.

No. 1.—VALUE OF MANUFACTURES OF THE UNITED STATES, 1810 TO 1900

The length of the lines here presented indicates the relative value of the manufactures of the United States in 1810 and in each census year, beginning with 1840. It will be observed that the first great increase was in the decade 1860–1870; the second, from 1880 to 1890. It is well known that the civil war conditions, the exceptional home demand, and the difficulties of importation greatly stimulated manufacturing during the period 1860–1870, and the fact that the production of 1870 was stated in an inflated currency also probably accounts in some degree for the high figure of that year, and also for the fact that the apparent increase in the next decade was small. The second great increase, from 1880 to 1890, was due to the opening of the interior by railways, by which the natural products were easily assembled for manufacture, the great reduction in cost of transportation, the enormous investments of capital in manufacturing, and the application of labor-saving machinery to much which was formerly performed by hand. In the decade from 1890 to 1900 came the enormous expansion in our exports of manufactures, from 151 millions in 1890 to 433 millions in 1900, and the organization of great industrial combinations by which cost of manufacturing and

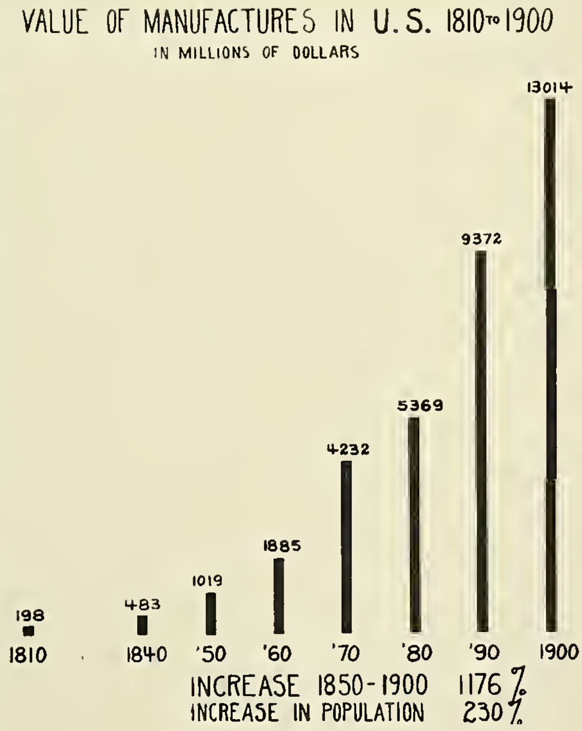
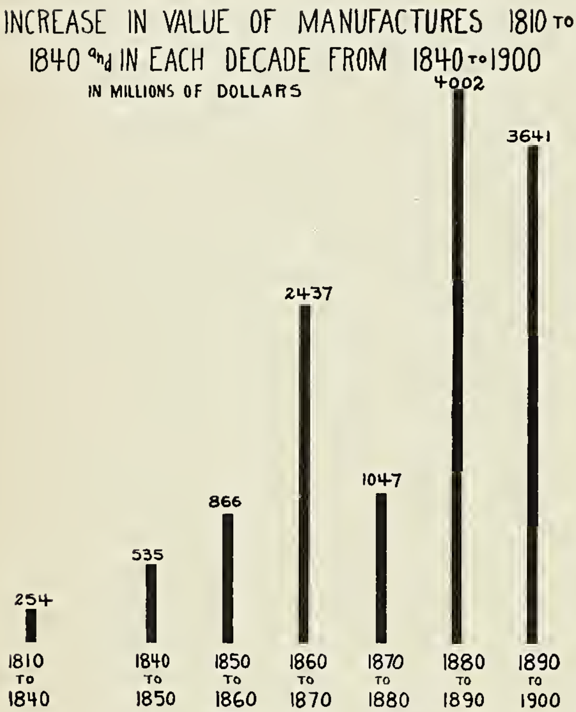


DIAGRAM NO. 1



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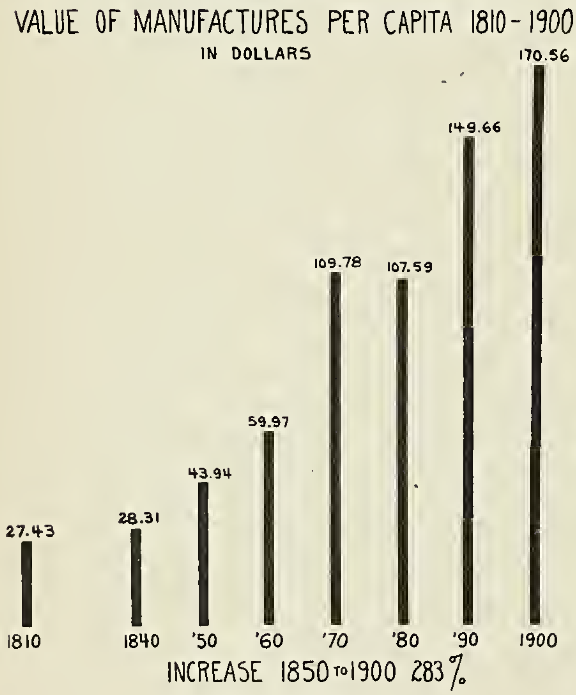


DIAGRAM NO. 3

handling was further reduced and production greatly stimulated.

No 2.—INCREASE IN VALUE OF MANUFACTURES, 1810 TO 1840, AND IN EACH DECADE FROM 1840 TO 1900

This shows the actual increase in the value of manufactures reported in each census year, as compared with its predecessor, and confirms what has just been said relative to the growth in the decades 1860–1870 and 1880–1890 and 1890–1900.

No. 3.—VALUE OF MANUFACTURES PER CAPITA, 1810 TO 1900

The very great increase in population suggests, of itself, a great increase in manufacturing, and it is therefore proper to show the value per capita of the manufactures of the United States iu each census year. It will be seen that the value of manufactures reported in 1810 and 1840 averaged about $28 per capita, and are now about $170 per capita, or three times as much for each individual at present as in 1860, four times as much as in 1850, and six times as much as in 1840. This indicates that the per capita value of manufactures consumed by the masses has increased at about this rate, as 97 per cent of the manufactures are consumed at home, while the fact that prices have greatly fallen meanwhile indicates that the quantity consumed is probably five times as much per capita as in 1860 and ten times as much as in 1840.

No. 4.—NUMBER OF PERSONS IN EACH 1,000 ENGAGED IN MANUFACTURING AND AGRICULTURE, 1870 TO 1900

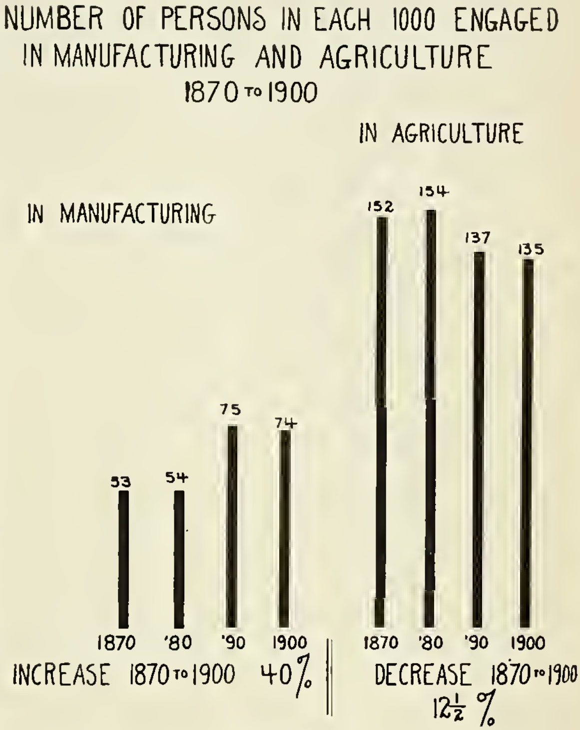
This shows the number of persons in each 1,000 eugaged in manufacturing and agriculture, respectively. It will be seen that the number engaged in manufacturing has increased from 53 per thousand to 74 per thousand, an increase of 40 per cent since 1870, while the number engaged in agriculture has decreased from 152 to 135 per thousand, a decrease of 12½ per cent, in the same time, showing the trend of labor from agriculture to manufacturing.

NO. 5.—TOTAL NUMBER OF PERSONS ENGAGED IN MANUFACTURES AND AGRICULTURE, RESPECTIVELY, 1870 TO 1900

While there is no desire to measure the growth of manufacturing by that of any other industry or make invidious comparisons, it seems not improper to call attention to the relative growth of the manufacturing industry as compared with agriculture, which was formerly considered the chief occupation of the people of the United States, and which still furnishes two-thirds of our enormous exportations. This diagram shows the actual increase and percentage of increase in the total number of persons engaged in manufactures and agriculture respectively, and their relative growth in the past 30 years. It will be seen that those engaged in manufacture have increased from 2 millions to over 5½ millions, and those in agriculture from about 6 millions to 10½ millions, and that while twice as many persons are still engaged in agriculture as in manufacture, the relative growth has been much more rapid in the manufacturing industry. The number engaged in manufactures have nearly trebled, while the number engaged in agriculture has not quite doubled.

NO. 6.—VALUE OF PRODUCTS OF MANUFACTURING AND AGRICULTURE, RESPECTIVELY, 1870 TO 1900

The relative growth on the part of manufactures has also been more rapid than that of agriculture, since manufactures occupy a comparatively new field, while agriculture had pretty well developed the most productive sections prior to 1880, since which the manufactures have made their greatest gains.



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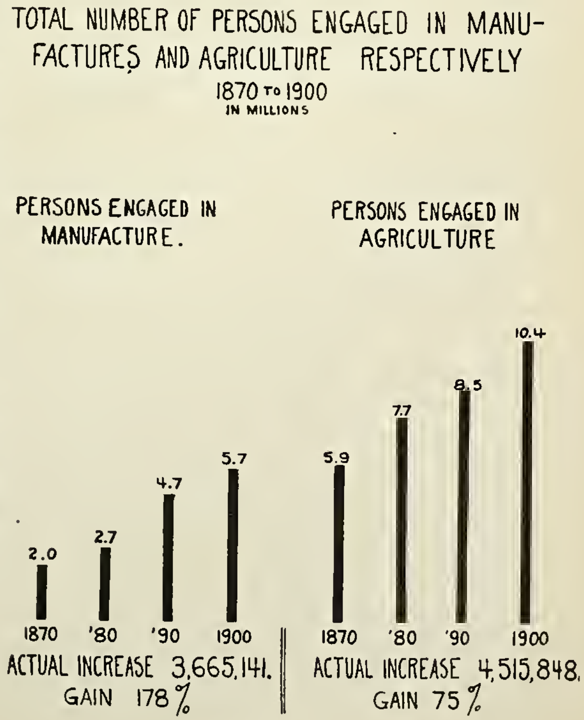

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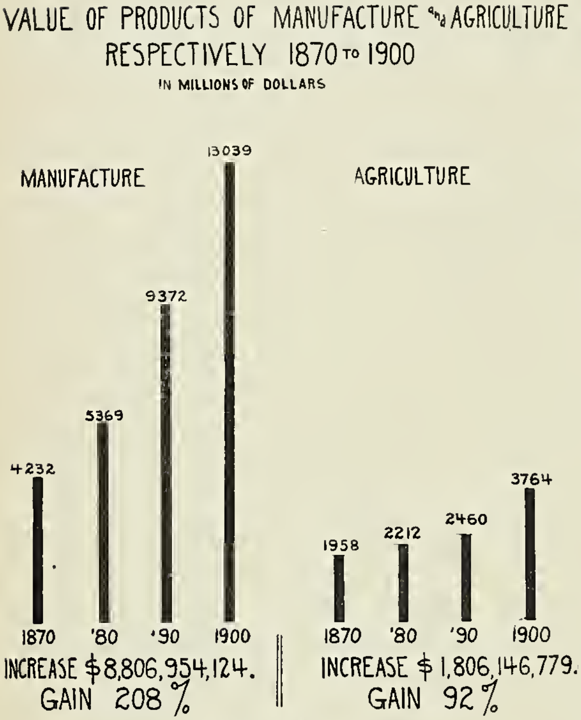

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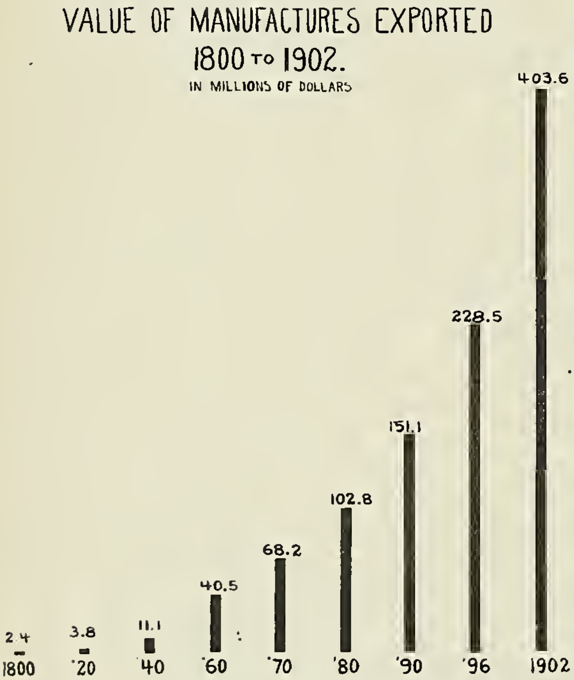


DIAGRAM NO. 7

The increase in the value of manufactured products from 1870 to 1900 was 208 per cent, while that of agricultural products was 92 per cent. I present these figures of total values of manufactures and agricultural products respectively merely for the purpose of showing the relative growth rather than relative value of product. A mere comparison of the aggregate value of manufactures with aggregate value of agricultural products would manifestly do injustice to agriculture, since, as already explained, the statement of the gross value of manufactures contains many duplications, while there are but few duplications in the statement of total products of agriculture. But a comparison to show the relative growth of the two industries, or the percentage of growth in each, seems not improper, since the duplications of value in the statement of total manufactures have existed in all census reports, and a fairly accurate estimate of the percentage of growth may therefore be had for use in comparing with the percentage of growth in agricultural products.

One especially interesting fact which the recent census developed is that our manufacturing industry draws 80 per cent of its raw material from farms of the country and actually utilizes one-half of the agricultural products of the country. The great cotton and woolen manufacturing industries obtain their raw material from the agriculturist, the material used by the manufacturer of leather originates on the farm or ranch, as do also those used in the manufacture of wines and liquors, the tobacco manufacturing industry, the milling and canning industries, and various other lines of manufacture. The census estimates that 80 per cent of the raw material used in manufacturing is the product of agriculture, and that 51 per cent of the value of the products of agriculture was purchased and used by the manufacturers of the country as raw material in their manufacturing. This suggests the importance of the manufacturing industry to the farmer, to say nothing of the market furnished him by nearly 6 million people finding employment in the factories and workshops of the country.

No. 7.—VALUE OF MANUFACTURES EXPORTED, 1800 TO 1902

I want now to speak briefly of the effect of this increase in manufactures upon our foreign trade. Much has been said in recent years about the increase of our exports of manufactures, and quite justly, for the growth, especially in the past decade, has been very great. The growth of the entire century, taken as a whole, has been remarkable, but especially so in the past decade, as will be seen from this diagram, which shows that the exportation of manufactures in 1800 was about two and one-half million dollars; in 1840, 11 millions; in 1860, 40 millions; in 1880, 102 millions, and in 1890, 151 millions, but that in the short period from 1890 to 1902, only 12 years, the increase was nearly double that of the 90 years from 1800 to 1890, making the total exports of manufactures in 1902 403 million dollars.

No. 8.—PER CENT WHICH MANUFACTURES FORMED OF IMPORTS AND EXPORTS, 1820 TO 1902

It is not so much, however, in the power to supply foreign markets in which our manufacturers have made their great record as in their complete control of the home market among 80 million prosperous people. They have so fully supplied that market that they have steadily reduced the share which manufactures form of the imports, while they were also increasing the share which manufactures formed of the exports. This diagram shows the percentage which manufactures have formed of the imports and exports since 1820. The share which they formed of the imports has steadily decreased, from 44.9 per cent in 1820 to 16.6 per cent in 1902, and the share which they form of the exports has steadily increased from 7½ per cent in 1820 to 30.8 per cent in 1902.

No. 9.—DISTRIBUTION OF MANUFACTURES EXPORTED

Before leaving this subject, you will perhaps be interested to know what becomes of the manufactures which are

DIAGRAM NO. 8

exported from the United States. This diagram shows the distribution of manufactures by grand divisions. You will see that fully one-half of the manufactures exported goes to Europe, the greatest manufacturing center of the world. Of the 410 million dollars' worth of manufactures exported in 1901, 215 millions value went to Europe, 96 millions to North America other than the United States, 33 millions to Asia, 29 millions to Oceania, 27 millions to South America, and 10 millions to Africa.

No. 10.—VALUE OF MANUFACTURERS' RAW MATERIAL IMPORTED AND PER CENT WHICH IT FORMED OF TOTAL IMPORTS, 1820 TO 1902

Still another effect of this growth of our manufactures has been an increasing demand for the class of manufacturing the most remarkable growth has been in the years since 1890, the total having increased from 178 millions in 1890 to 327 millions in 1902, the gain in the 12 years since 1890 being nearly equal to that of the 70 years from 1820 to 1890. From the second group of lines it will be seen that manufacturers' raw materials, which formed less than 6 per cent of the imports in 1820, now form 36 per cent of the greatly increased total.

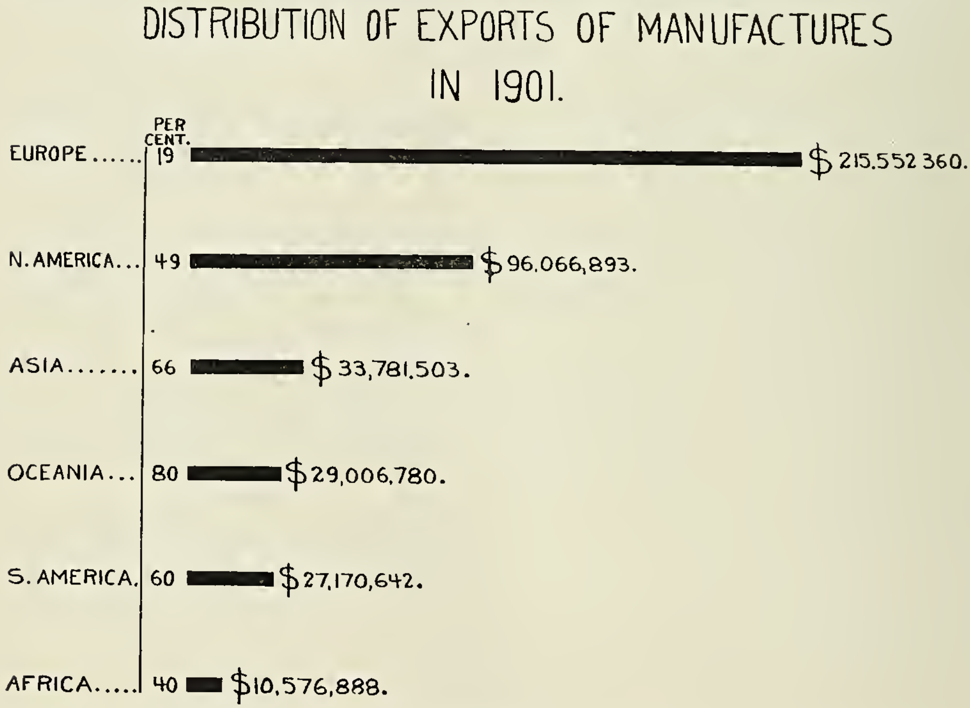


DIAGRAM NO. 9

material which we do not produce at home, such as fibers, rubber, silk, tin, chemicals and many other articles. This diagram shows the increase of manufacturers' raw materials imported since 1820. It will be seen that their total importation grew from 3 million dollars in 1820 to 61 millions in 1860, then suddenly increased to 160 millions in 1880 and 178 millions in 1890; but that

No. 11.—RELATIVE VALUE OF MANUFACTURERS' MATERIAL AND ALL OTHER IMPORTATIONS, 1890 TO 1902

This shows the value of manufacturers' material imported in 1890, 1900, and 1902, and compares its value with that of all other imports. It will be seen that while manufacturers' material increased, the other imports decreased. Manufacturers' material increased from

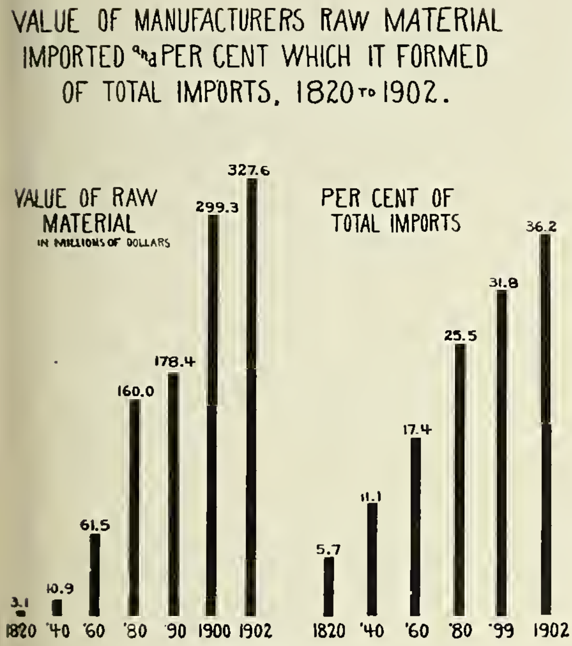


DIAGRAM NO. 10

265 millions to 420 millions, while the other importations decreased from 524 millions to 480 millions.

NO. 12.—GROWTH OF DOMESTIC EXPORTS, AND SHARE WHICH MANUFACTURES FORMED OF THE SAME, 1870–1901

In this illustration the broken portion of the lines indicates the share which manufatures formed of the grand total. The diagram covers only the period from 1870 to 1901. A more extended statement, however, would show that exports of domestic manufactures formed in 1800 but 7.8 per cent of the total exports, and amounted to but 2½ million dollars, and that the growth in the first half of the century was extremely slow, having reached only 17½ millions in 1850 and forming but 13 per cent of the total exports. In 1875 the exports of manufactures amounted to 92½ million dollars and formed 16.5 per cent of the total exports, and in 1900 were 433 millions and formed 31.6 per cent of the total exports. In 1902 they were 403 millions in value and formed 29.7 per cent of the total, the reduction in 1902 as compared with 1900 being chiefly due to the excessive home demand for certain lines of manufacture, notably iron and steel.

NO. 13.—GROWTH OF EXPORTS OF MANUFACTURES, AND SHARE WHICH IRON AND STEEL FORMED OF THE SAME, 1870-1901

In this illustration the broken lines show the share which iron and steel

DIAGRAM NO. 11

formed of the total manufactures exported in each year from 1870 to 1901. The growth in the exportation of iron and steel manufactures has been phenomenally rapid, the total value of iron and steel exported being less than two million dollars in 1850, 9 millions in 1875, and 122 millions in 1900. For the fiscal year 1902 the total was 98½ millions, the reduction compared with 1900 being due, as already indicated, to the unusual home demand for iron and steel manufactures for use in domestic industries, this demand being so great that the importations of iron and steel in 1903 exceed by far those of any year in the last decade.

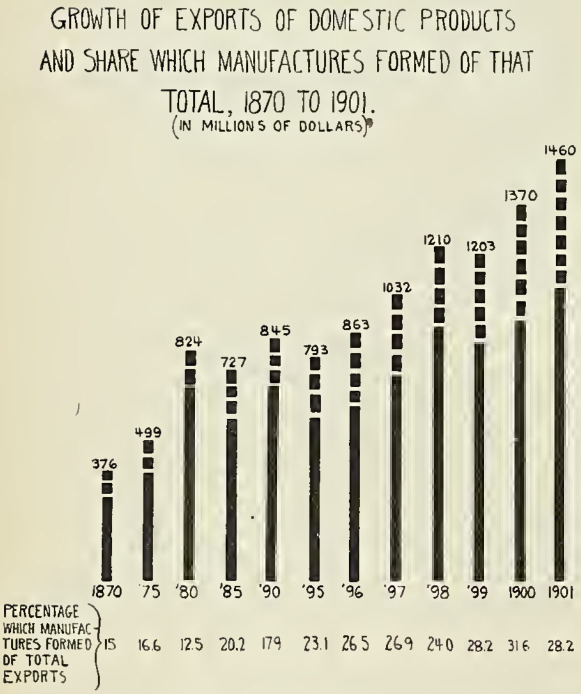


DIAGRAM NO. 12

No. 14.—EXPORTS OF MANUFACTURES OF IRON AND STEEL FROM 1870 TO 1901

This illustration shows the growth in exports of iron and steel manufactures during the period from 1870 to 1901, and illustrates the statements already made regarding the very rapid growth in this class of our manufactures. The United States has in recent years become the world's largest producer of iron ore and pig iron, her total production of pig iron in 1902 exceeding that of the United Kingdom, Germany, and Belgium.

No. 15.—PROGRESS IN THE PRINCIPAL MANUFACTURING INDUSTRIES FROM 1870 TO 1901

This diagram is intended to illustrate the growth in the production of the great articles which enter into manufactures, such as pig iron, cotton, and coal. The growth of coal production was from 32 million tons in 1870 to 261 millions in 1901; of pig iron, from 1,665,000 tons in 1870 to 15,879,000 tons in 1901, and over 18 millions in 1902. The growth of cotton manufactured at home was from 857,000 bales to 3,547,000 bales. The importation of the principal raw materials for use in manufacturing increased from 20 million dollars in 1870 to 176 millions in 1901—all illustrating the rapid growth in the manufacturing industries of the United States. The capital employed in manufacturing is shown by the census of 1870 at 2,118 million dollars, and that of 1900 at 9,874 millions, and the value of manufactures turned out in 1870, 4,232 millions, and in 1900, 13,040 millions.

Having now shown the growth in manufactures compared with conditions in our own country at the beginning of the century, I want to say a few words about the growth of manufactures in the United States compared with the growth in other countries, especially those great manufacturing countries of Europe—France, Germany, and the United Kingdom. These three countries produce practically two-thirds of the manufactures of all Europe, and therefore it seems unnecessary to take into consideration in this study the other and smaller

DIAGRAM NO. 13

countries. Curiously, even these old and well developed countries do not take as complete a census of manufactures as does the United States, and a comparison of growth year by year or even decade by decade is difficult. That distinguished statistician, the late Mr Mulhall, however, made shortly before his death some careful calculations on the value of the manufactures of the principal countries of the world, especially those of Europe, at various dates, and these are generally accepted as the best available information on this subject. I shall now show you by the same process which I have applied in the study of our own figures his statement of the value of manufactures in France, Germany, and the United Kingdom from 1840 to the close of the century, comparing their growth with that of the United States.

NO. 16.—VALUE OF MANUFACTURES IN FRANCE, GERMANY, THE UNITED KINGDOM, AND THE UNITED STATES, 1840, 1860, 1888, AND 1894

In the four groups of lines shown you in this diagram is presented Mr Mulhall's statement of the relative value of manufactures produced in the four

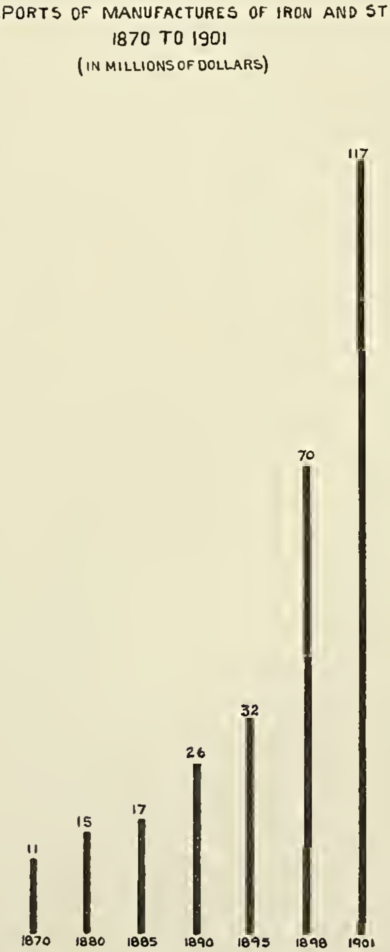


DIAGRAM NO. 14

countries, France, Germany, the United Kingdom, and the United States, at the four dates which I have named, 1840, 1860, 1888, and 1894, the term "Germany" applying in the earlier periods to those States now included in the German Empire. The first group of lines indicates the value of the manufactures of each of the four countries in 1840 as shown by Mr Mulhall's figures, arranged in the order of magnitude, the United States the smallest, 467 million dollars, the European countries following in the order, Germany, France, United Kingdom. It will be seen that in 1840 the value of manufactures in the United States was less than one-third of those of Germany or France, and less than one-fourth of those of the United Kingdom. In the other groups of lines I have retained the same scale of measurement per million used in the first group, and the same relative position for each of the countries. In 1860 you will note that the United States had almost overtaken Germany and France, and that its manufactures were about two-thirds in value those of the United Kingdom. In 1888 the United States had outstripped all of her competitors in the race, the value of her manufactures, as will be readily seen, being more than those of France and Germany combined and nearly twice as great as those of the United Kingdom. In 1894, as will be seen by a glance at the final group of lines, the United States made still greater gains over her competitors, the value of her manufactures in that year being nearly as

PROGRESS IN THE PRINCIPAL MANUFACTURING INDUSTRIES 1870 - 1901.

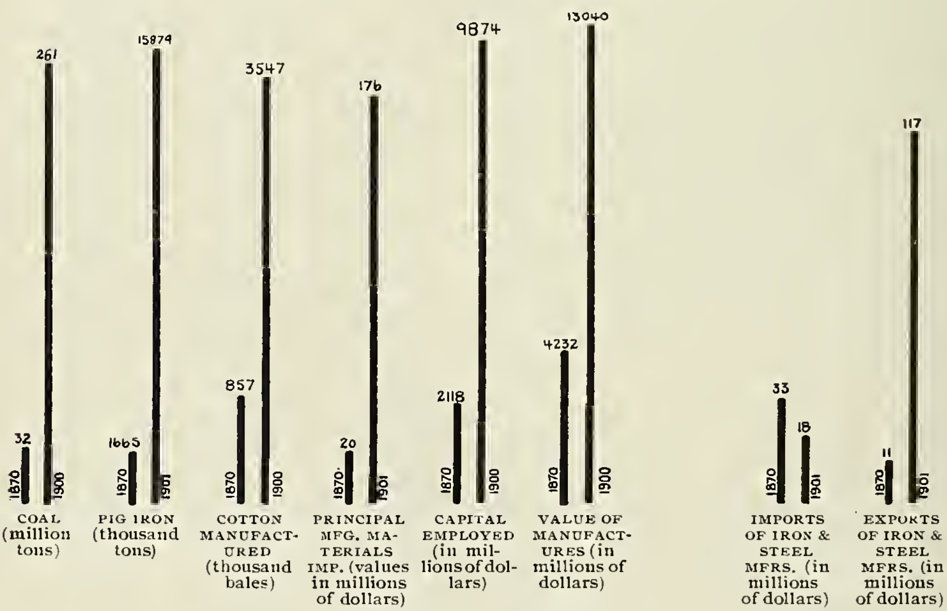


DIAGRAM NO. 15

great as those of France, Germany, and the United Kingdom combined.

NO. 17.—GROWTH OF MANUFACTURES IN FRANCE, GERMANY, THE UNITED KINGDOM, AND THE UNITED STATES, 1840 to 1894

Before leaving this subject it may be interesting to note the actual rate of growth in manufactures in each of the four countries which have just been discussed, and I present in this diagram lines and figures which will show to the eye the actual growth in each country at the dates already named. The first group of lines relates to France, the second to Germany, the third to the United Kingdom, and the fourth to the United States. In France it will be seen that the growth has been steady, but not rapid, the increase being from $1,606,000,000 in 1840 to $2,900,000,000 in 1894, an increase of 80 per cent. In the case of Germany the growth was more rapid — from $1,484,000,000 to $3,359,000,000, an increase of 126 per cent. In the United Kingdom the growth was at about the same rate as that of Germany—from $1,883,000,000 to $4,263,000,000, also a gain of 126 per cent. In the United States the growth, it will be seen, was far more rapid than that of other countries—from $467,000,000 in 1840 to $9,498,000,000 in 1894, a growth of nearly 2,000 per cent. In other words, the manufactures of France in 1894 were scarcely double those of 1840; those of Germany, nearly two and a half times as great as in 1840; those of the United

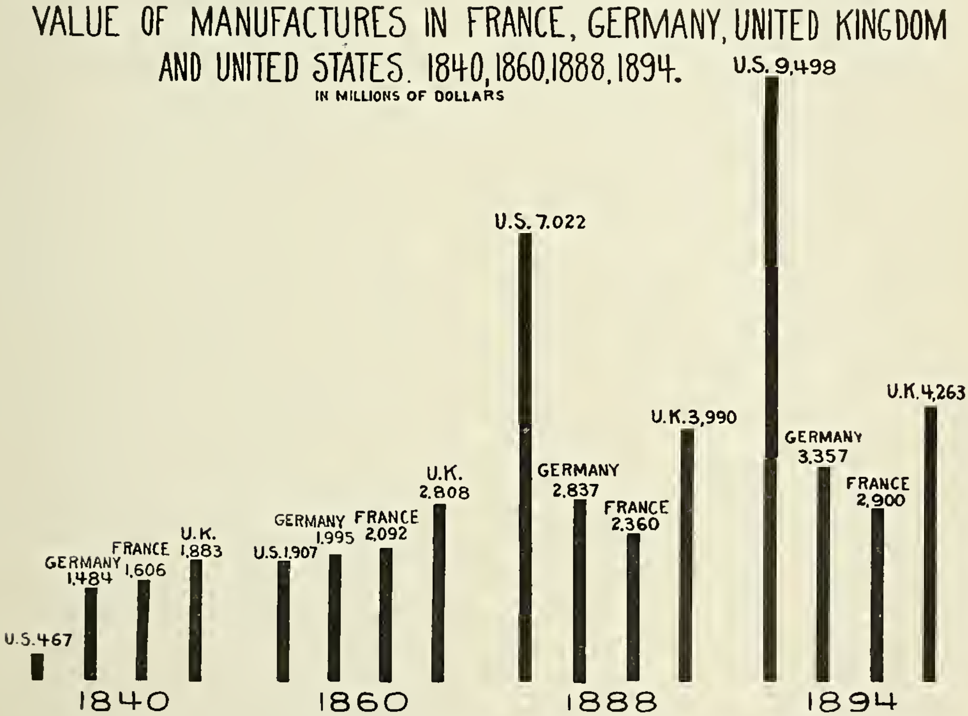


DIAGRAM NO. 16

Kingdom, nearly two and a half times as great as in 1840, and those of the United States practically twenty times as great as in 1840.

The causes of our rapid growth in manufactures, as compared with these European countries, are not difficult to find. The 5 great articles which enter most largely into the manufacturing industries today are iron, wood, copper, cotton, and coal, the latter being the important and necessary factor in transforming the others into manufactures. In each of these great requirements of manufacturing the United States has larger known supplies than any other country of the world, and better transportation facilities for assembling them for manufacturing. A few years ago the United Kingdom was the largest producer of pig iron; today we have not only far surpassed that country in the production of iron, but in 1902 our production of pig iron actually exceeded the combined production of the three greatest pig-iron-producing countries of Europe—the United Kingdom, Germany, and Belgium—and our production of steel exceeds that of other countries in a like proportion. Our production of pig iron has grown from less than one million tons in 1865 to over 17 millions in 1902, and of steel from 20 thousand tons in 1867 to over 13 million tons in 1901. Of copper the United States now produces one-half that of the entire world, our production of copper having grown from less than 1,000 tons in

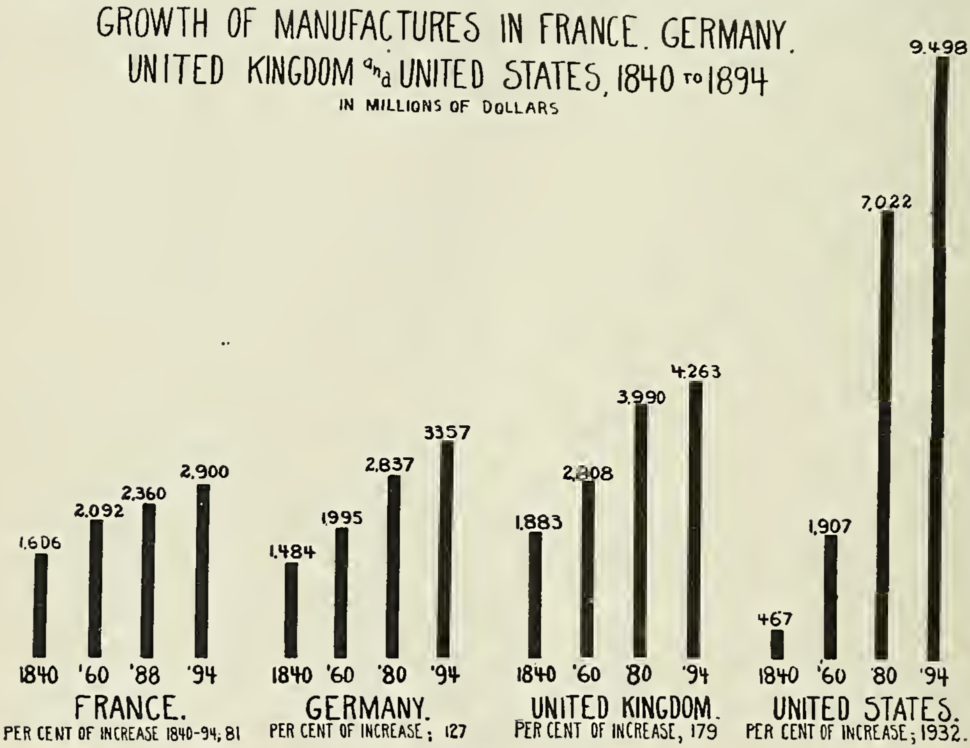


DIAGRAM NO. 17

1850 to 270 thousand tons in 1900. Of cotton, another important factor in manufacturing, our production has grown from three million bales in 1870 to an average of more than ten million bales per annum during the last five years, and the United States now produces three-fourths of the cotton of the world and turns one-third of that product into manufactures. Of timber the United States is the world's largest producer. Of coal, for use in assembling and transforming these articles into manufactures, the United States now produces more than any other country, her production having grown from 32 million long tons in 1870 to 261 millions in 1901. In transportation facilities, by which these products are assembled for manufacturing, railways have grown from 20,000 miles in 1856 to 200,000 miles in 1902, and are now two-fifths those of the entire world. Vessels passing through the Sault Ste. Marie canal have increased from 106 thousand tons register in 1855 to 25 million tons register in 1902, or nearly 20 times that passing through the Suez canal; and freight rates have fallen to about one-fifth those of 1860 and less than half those of 1880.

These comparisons of the growth in the production of the great staples required for manufacturing may be more readily and interestingly presented by some simple diagrams showing the relative growth in production in the United States and those countries which may be considered in any degree our competitors.

No. 18.—GROWTH OF COAL PRODUCTION IN THE UNITED STATES, UNITED KINGDOM, AND GERMANY, 1875 TO 1901

One of the important causes of the growth of our manufacturing is our plentiful coal supply and the ease with which it is produced. The United States now actually produces one-third of the entire coal supply of the world. The United States, the United Kingdom, and Germany produce three-fourths of the coal of the world, and I show in this diagram the growth of coal production in each of these three countries from 1875 to 1901. It will be seen that the United States and Germany started abreast in 1875, with a production of about 50 million tons each, but far below the United Kingdom, which

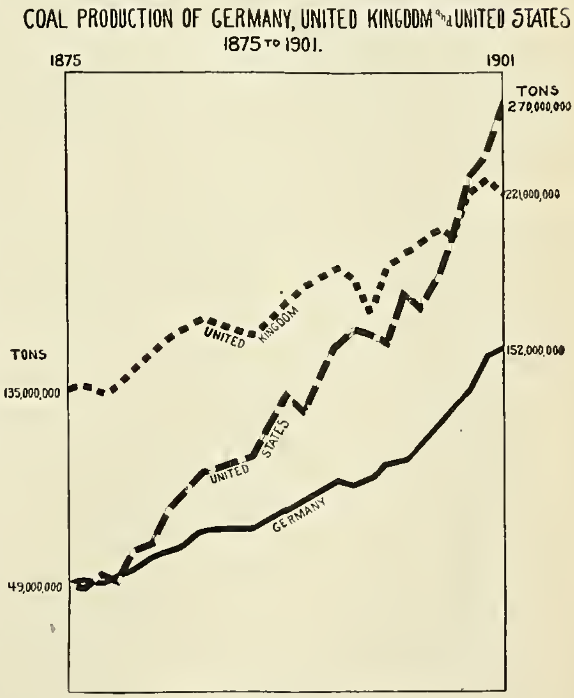


DIAGRAM NO. 18

produced about 135 million tons. The United States advanced much more rapidly than Germany, and in 1898 passed the United Kingdom, and is now sufficiently in the lead to assure that she will continue the greatest coal-producing country of the world. This assertion is fully justified by the fact that the area of our coal fields is 10 times as great as those of all Europe, and they are only equaled in area by those of China, which must remain undeveloped until transportation facilities make their supplies available.

No. 19.—COAL PRODUCTION OF THE WORLD, 1870–1901

This diagram shows the growth in coal production of the world from 1870 to 1901. The first pair of lines shows the production of Germany in 1870 and 1901 respectively, the second pair the

No. 20.—PIG-IRON PRODUCTION OF THE UNITED STATES COMPARED WITH THAT OF THE UNITED KINGDOM AND GERMANY

An equally important factor in manufacturing is the supply of iron and steel. I have already told you that the United States produces one-third of the coal of the world, and I may now add that she produces 30 per cent, or nearly one-third, of the iron ore of the world. Of iron and steel, as of coal, the three great producing nations of the world are the

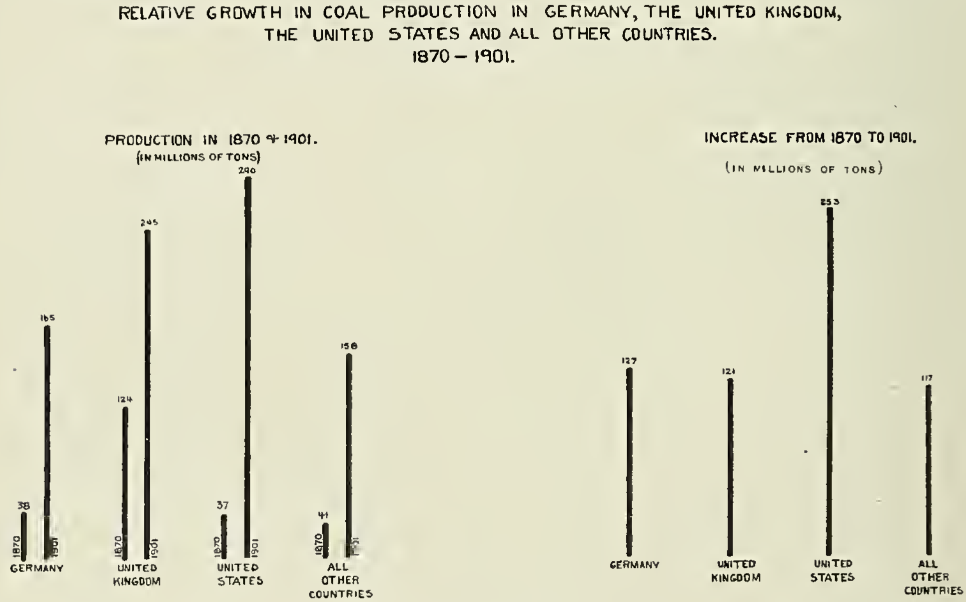


DIAGRAM NO. 19

United Kingdom, the third pair the United States, and the fourth pair the remainder of the world. In the second group of lines is shown the increase in production from 1870 to 1901 in Germany, the United Kingdom, the United States, and the remainder of the world. It will be seen that the gain of the United States in that time was equal to that of Germany and the United Kingdom combined.

United States, the United Kingdom, and Germany. This diagram shows the growth of pig-iron production in the United States, United Kingdom, and Germany since 1877. It will be seen that the United States and Germany started abreast in 1877, far below the United Kingdom, and that in 1901 the United Kingdom and Germany were about equal, but with the United States so far above them that her output was actually equal to the combined production of the United Kingdom and Germany, and in 1902 was equal to both those countries, with Belgium thrown in for good measure.

No. 21.—STEEL PRODUCTION OF THE UNITED STATES, UNITED KINGDOM, AND GERMANY, 1877 TO 1901

In steel production the progress of the United States has been even more striking, compared with that of her chief competitors, than in iron or coal. The United States, United Kingdom, and Germany, it will be seen from this diagram, started nearly abreast in 1877, but the United States so far surpassed them that her production of steel is now not only greater than that of both combined, but is actually 44 per cent of that of the entire world.

No. 22.—COPPER PRODUCTION OF THE UNITED STATES COMPARED WITH THAT OF OTHER COUNTRIES

Copper, which was always an important metal, has become especially so in the recent years in which the use of electricity has so marvelously increased; and, as the demand for copper increased, the supply of the United States has so increased that she has not only outstripped all her rivals, but now produces one-half the copper of the world. The four principal copper-producing countries are: United States, Spain, Chile, and Japan. It will be seen from this diagram that while all these countries were nearly abreast in production in 1883, at the beginning of the world's great demand for copper, the United States immediately began her upward movement in production, while the other countries have made little change in their output. As a result we now produce as much copper as all the other countries of the world combined.

No. 23.—COTTON PRODUCTION OF THE WORLD, AND SHARE OF THE UNITED STATES IN THAT PRODUCTION

Another extremely important factor in manufacturing is cotton. Of this the

PIG IRON PRODUCTION OF GERMANY, UNITED KINGDOM & UNITED STATES
1877 TO 1901.

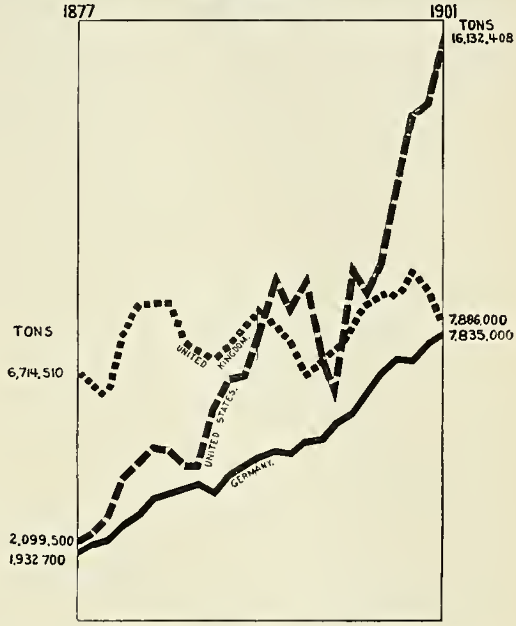
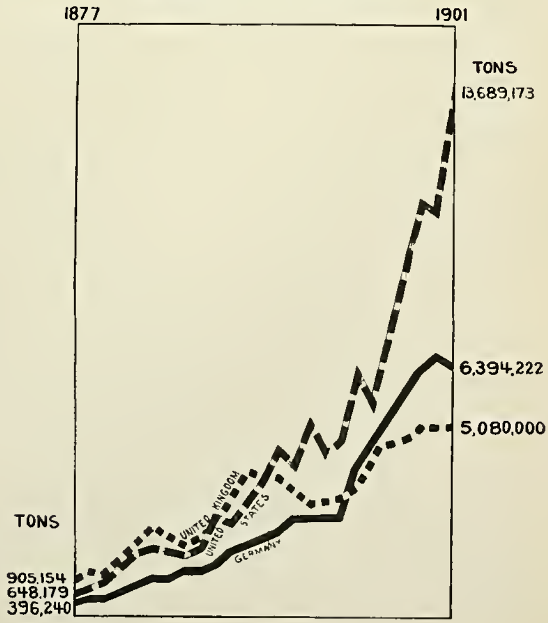


DIAGRAM NO. 20

STEEL PRODUCTION OF GERMANY, UNITED KINGDOM AND THE UNITED STATES 1877 TO 1901.



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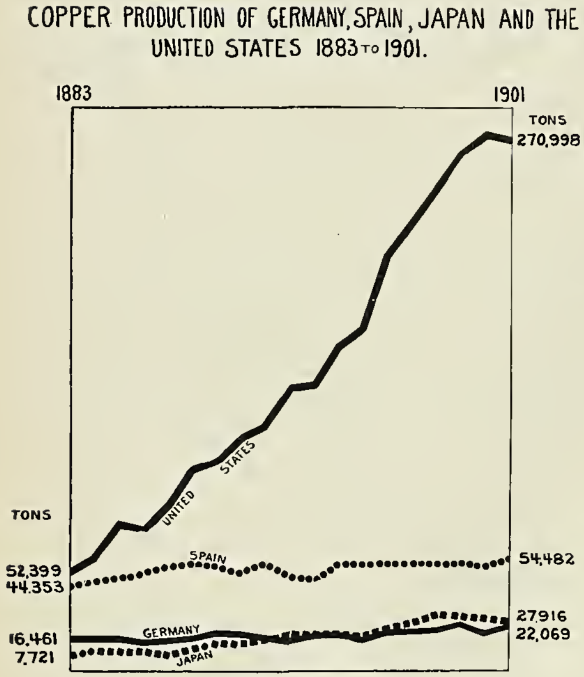

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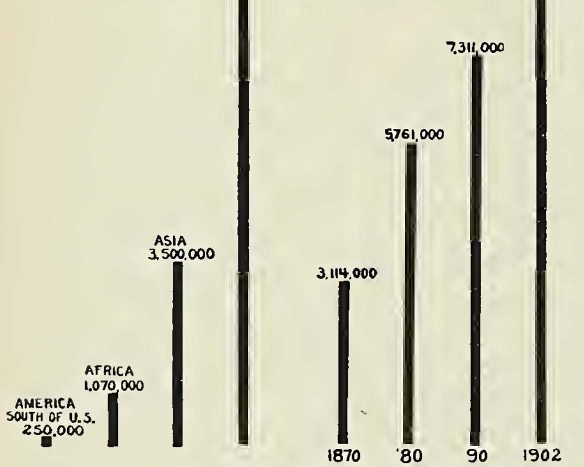


DIAGRAM NO. 23

United States produces practically three-fourths of the world's entire supply, and has doubled her production since 1880, and shown an ability to double the present product if the world demands it. This diagram shows the world's production of cotton in 1902. The first line is for all of America south of the United States ; the second, Africa ; the third, Asia ; and the fourth, the United States. The second group of lines shows the production of the United States in 1870, 1880, 1890, and 1902, indicating the growth of production in response to the world's demands.

No. 24.—RAILWAYS OF THE UNITED STATES AND EUROPE, 1850–1902

While the production of raw materials is an important factor in manufacturing, the power of quickly and cheaply assembling those materials for actual manufacturing and of distributing them after manufacture is another important factor, and in this the United States surpasses all other nations. In this diagram I compare the railways of the United States not merely with those of a single country, but with those of all Europe. In 1850 our railways were two-thirds as great in length as those of Europe ; in 1870, five-sixths as great ; in 1880, nine-tenths, and in 1902 they actually exceeded those of all Europe by 12 per cent. The second group of lines shows the relative railway mileage of the United States in 1850, 1870, 1880, and 1902, and indicates the rapidity of growth.

I have now shown you, first, the increase in production of manufactures ; second, the increase in production of raw material, and, third, the increase of transportation facilities. These three facts suggest that probably the manufacturing industries have extended far into the interior of the country, and especially to those sections where the raw material or the coal is produced, and an examination of the records of the census shows that this is true. We are accustomed to think of the New England and Middle States as the chief seat of the manufacturing industries, and it is rather surprising to know that the center of the manufacturing industries has steadily moved westward until it is now located in the State of Ohio.

It is equally surprising to know that Ohio ranks first of all the States of the Union in the manufacture of carriages and wagons and of clay products, and second in agricultural implements and in iron and steel manufactures. Illinois holds first rank in the manufacture of agricultural implements, cars, bicycles, and distilled liquors, and second in men's clothing, furniture, musical instruments, soap, and candles. Wisconsin ranks first in lumber and timber production, Minnesota first in flour manufacturing, Missouri first in the manufacture of tobacco, Texas first in the manufacture of cotton-seed oil cake, Colorado first in lead, and California first in explosives, wines, and preserved fruits. The various manufacturing interests have extended far into the interior of the country, and in some cases across the entire continent.

While the plentiful supply of raw materials and unexcelled facilities for assembling them are perhaps the most striking among the causes of our manufacturing success, we must add another factor, the strenuousness of labor. This is one which we, as Americans, scarcely appreciate, because it is a condition to which we have always been accustomed; but that it has been an important factor in our success over other nations is evidenced by the attention which it receives from representative men of other countries who have studied our success and sought to learn its causes. Mr J. S. Jeans, secretary of the British Iron Trade Association, who recently accompanied a commission of iron and steel manufacturers sent to the United States to study conditions here, in his report says: "One of the notable characteristics of the principal cities and industrial centers of the United States is the comparative absence of a leisured class. The typical American appears to live only to work, and to work at something that will be a life-long career of usefulness to himself and the community. Every man, however rich, must have a calling in the United States." Mr Lud-

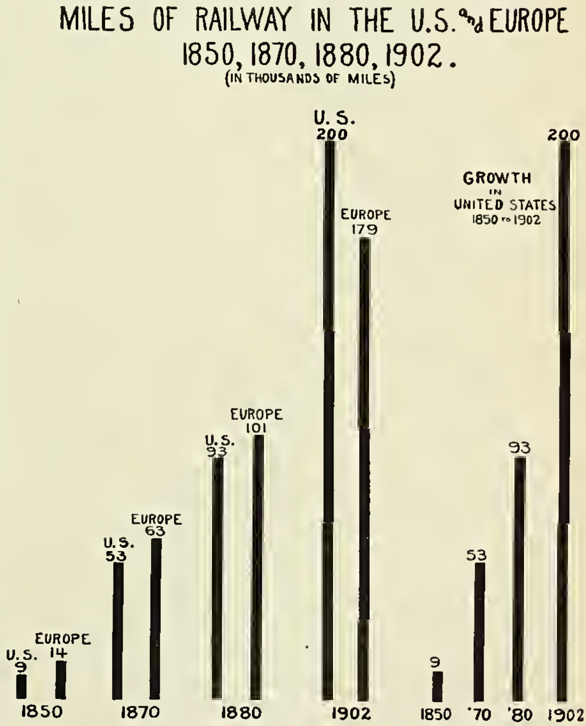


DIAGRAM NO. 24

wig Max Goldberger, of Berlin, Royal Privy Councillor of Commerce and member of the Imperial German Consultative Board for Commercial Measures, who visited the United States in 1902, spending some eight months studying our commercial conditions, says: "A sort of fanaticism for work seems to have taken hold of men in the United States. Labor is so intense in the centers of industry that, barring sleep, it scarcely permits of any other recreation, and for that reason places of pleasure, if we except large towns, are very rare. The fanatical desire for work, of which I have just spoken, begins in early youth, and almost as young as the industries of the country are the leaders of large enterprises, many of them mere boys. On the other hand, there are few men who stop work and retire to live on their incomes, even when they have earned millions."

One other cause of our growth in production—and it is the last one which I shall suggest—is the greatness, the physical greatness, of our country. We do not realize, I think, how big we have grown. We proudly compare the growth of our manufacturing or exports with that of the United Kingdom, for example; but we do not, apparently, stop to consider that the area of England is less than that of the State of Kansas, and that of the entire United Kingdom less than that of Kansas and Nebraska combined. When we compare our own conditions with those of France, we forget that its area is less than that of our two Territories of Arizona and New Mexico combined. We look with complacency upon the figures which compare our growth in manufactures, commerce, and population with that of Germany, but overlook the fact that all of the German Empire is smaller than our single State of Texas. The area of the Thirteen Colonies, as defined by the Peace Treaty of 1783, was equal to that of the present United Kingdom, France, Germany, Norway, and Sweden, whose combined population today is 143 millions. The area added by the Louisiana Purchase is greater than the present area of Spain, Portugal, Italy, Austria, Hungary, and all of the Balkan States, with a combined population of 145 millions. The area added by the Florida Purchase is more than that of the present Denmark, Netherlands, Belgium, and Switzerland, whose population today is 18 millions. The combined area of the Texan, Mexican, Oregon, and Alaskan additions is nearly equal to that of all European Russia, whose present population is 106 millions. Thus, our present area, including Alaska, may be said to practically equal that of all Europe, whose population is in round terms 400 millions of people.

THE INTRODUCTION OF THE MANGO

THE great popularity of the mango among the natives of the Tropics, who in most places prefer the fruit to the orange or banana, recently led the U. S. Department of Agriculture to study the mango with a view of ascertaining whether it might not be made as popular among the people of the United States as the orange and banana. Great quantities of mangoes are grown in Porto Rico, and it occurred to the Department that if the fruit was such as would find favor among the American people, a profitable industry might be started on the island in exporting mangoes to the United States. Mr G. N. Collins, a specialist of the Department, was dispatched to Porto Rico to investigate the question. He found the mango one of the most common fruits in the island, and during the season when it is ripe, May to August, eaten in larger quantities than any others, with the possible exception of the banana, which is used more as a vegetable and cooked in one form or other. Unfortunately, most of the mangoes at present grown in Porto Rico are, however, too fibrous and coarse to ever become popular in

From G. N. Collins, U. S. Department of Agriculture

Grove of Mango Trees, between Cabo Rojo and Joyua, P. R.

the United States. The best varieties, which are rich and delicate, are scarce at present; but Mr Collins believes that in a very short time, with more care in the cultivation of the tree and with the introduction of new varieties of mango, great quantities of the finest fruit can be grown and shipped to this country. He believes that the fruit would soon become immensely popular and equal, if not surpass in popularity, both the orange and banana.

Mr Collins' report to the Department of Agriculture* has recently been published, and from it the following notes are taken :

Though European residents in the Tropics almost universally acquire a fondness for the mango, and in England the demand for it is steadily increasing, it having been found possible to make importatious from Iudia, notwithstanding the great distance, the mango is as yet little known in the United States, having been represented in our markets only by fruit of inferior varieties. These give no suggestion of the qualities of the better sorts, and tend rather to discourage than to increase the demand. If an effort similar to that which brought the banana into favor in the United States † could place an adequate supply of good mangoes before the public, there is no apparent reason why this new tropical fruit should not repeat the history of its now popular predecessor.

A taste for mangoes has in most people to be cultivated; but once acquired, it is like a taste for olives, and becomes almost a craving. The milder flavored varieties, in which no taste of turpentine is to be detected, are usually enjoyed even by the novice, but after one becomes familiar with the fruit a slight taste of turpentine ceases to be disagreeable. The fiber, however, that exists in the poorer varieties is an unmitigated evil, and renders the eating of a mango a serious operation. Persons forming their opinion of the fruit from these poor varieties usually indorse the proverbial statement that the mango is "a mass of tow saturated with turpentine;" but those acquainted with the fruit at its best are almost unanimously enthusiastic in their praise. Elphinstone, the historian of India, says:

"The mango is the best fruit of India, at once rich and delicate, and all other fruits are comparatively insipid beside its intensity of taste. There is something in it that is nothing less than voluptuous."

Good mangoes are produced in America, but as yet in such small quantity that few persons have had an opportunity to taste any but inferior fruit. Sample lots of the more common and poorer varieties are frequently shipped to northern markets, and have doubtless done much to hinder the growth of the trade. A first impression is very lasting, and first impressions of the mango based on such fruit are likely to be anything but favorable. As an example, mangoes are frequently to be found in the Washington market, but we have never seen one that could be called good, even in comparison with the Porto Rican fruit.

This impression will doubtless be difficult to dispel; but if really good mangoes could be placed in the markets their increase in popular favor would be certain and the growing of mangoes might become a profitable pursuit.

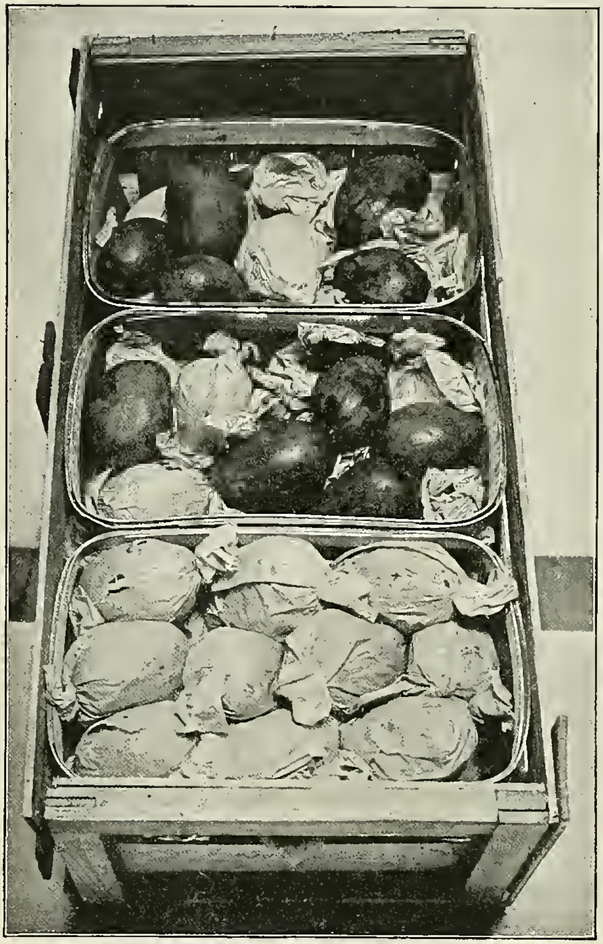
In spite of the fact that in all mango-producing countries the natives consider the fruit wholesome and perfectly safe, prejudice against it exists among some military officials and others, who con-

* "The Mango in Porto Rico." By G. N. Collins, Department of Agriculture, Bureau of Plant Industry, Bulletin No. 28.

† The banana was first introduced on a large scale into the United States by a steamship line which brought great quantities of bananas from the West Indies. It was not confidence in the latent popularity of the fruit that induced the steamship line to bring the bananas over, but a last effort to get freight for its vessels.

From G. N. Collins, U. S. Department of Agriculture

Branch of Mango Tree with Fruit, Tapachula, Mexico



From G. N. Collins, U. S. Department of Agriculture

Mango Fruit, showing Method of Packing

demn the fruit as positively dangerous. During the Spanish war this prejudice was so strong that the soldiers in Porto Rico were prohibited from eating the mango, and many beautiful trees were cut down. This prejudice probably arose from eating the fruit when unripe, in which state, like most other fruits, it is unwholesome.

In some parts of India the natives at one season of the year live almost exclusively on mangoes, apparently without harm. An extract from the Pharmacographia Indica, in Watt's Dictionary, describes the fruit as "invigorating and refreshing, fattening, and slightly laxative and diuretic."

The mango tree (*Mangifera indica*) varies in height, according to the variety, from little more than a bush to a tree 50 to 70 feet high, with a trunk 6 to 10 feet high and 2 feet or more in diameter. The leaves are lanceolate, about 1 foot in length, tapering gradually to a narrow point, with a smooth, shining surface. The young leaves are first pink, then red before turning green. The top is rounded and very dense. The bark is gray and smooth. The flowers are small, reddish-white, or yellowish, borne in large upright racemes. The fruit varies greatly, according to the variety. In some kinds it is not more than 2 or 3 inches in greatest diameter, while others are three or four times that size, some weighing as much as 4 pounds. In form they vary from nearly spherical to long and narrow like a cucumber, straight or crooked. The most common varieties are usually from 2 to 4 inches in length, more or less kidney-shaped, with the "nak" or stigmatic point more or less produced. In color they may be green, yellow, or red. In composition the difference is no less pronounced. In some the seed is large and the thin flesh between it and the skin consists almost entirely of fiber attached to the seed, while in others the seed is small, and in some so nearly aborted that it is easily cut with a knife. In the best varieties the fiber is almost entirely wanting and the entire fruit consists of a mass of juicy, usually orange-colored pulp.

The Anacardiaceæ, to which the mango belongs, include also the turpentine tree (*Pistacia terebinthus*), the original source of turpentine, and it seems not at all unlikely that the characteristic odor of the mango is in reality due to the presence of turpentine or some closely allied substance. Exudations of a transparent resinous substance similar to that of the turpentine tree are frequently to be noticed in the mango.

The mango (*Mangifera indica*) is said by De Candolle to be native in South Asia or the Malay Archipelago, and recent authors report it as wild in the forests of Ceylon and the regions at the base of the Himalayas, especially toward the east, at an altitude of from 1,000 to 2,000 feet. Its culture is very ancient, as shown by references in Sanskrit mythology and ancient Hindu folklore.

For so old and so useful a plant, its distribution was comparatively limited until historic times. To the west it had not passed the Red Sea, being unknown in Egypt, while to the east it had apparently not reached the islands of the Pacific. The species is not well adapted for distribution by natural agencies, and man has probably been chiefly responsible for its dissemination.

In the New World it seems to have been first introduced into Brazil, although it is not known at what date.

The mango is now a common fruit throughout the Tropics of the world. It has been developed to the highest state of perfection in its home in India, where the number of well-marked varieties is enormous. Mr Maries, of Durbhungah, has collected over 500 varieties, 100 of which he characterizes as good. Thirty-four of these varieties he describes in Watt's Dictionary of Economic Products of India. Ceylon is also famous for its mangoes. Both the east and the west coasts of Africa have several good varieties. In Australia the culture is fast increasing, and it bids fair to become one of the most popular fruits. One very fine variety is said to exist in the island of St Helena. The mango is the most highly prized fruit of Guam, where there is a fine seedling variety. Its cultivation in that island is, however, not a success, owing probably to the thin soil, which affords such a shallow footing that the hurricanes uproot the trees in all exposed localities. In the Hawaiian Islands Mr William C. Stubbs* reports: "The mango is receiving perhaps more attention just now than any other fruit. As many as twelve or fifteen varieties have already been introduced. It is a delicious fruit, and decidedly ornamental in any ground." In the New World, Trinidad and Jamaica have the largest collections, although the drier regions of Central America and Mexico may be found to offer better seedling varieties.

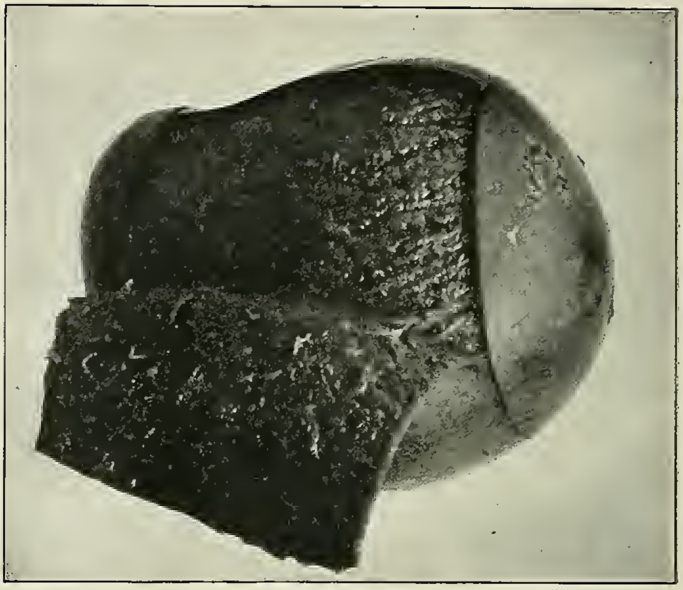
In spite of the many discouraging frosts that have visited Florida, planters of that state are actively engaged in propagating good varieties by budding, grafting, and inarching, and, if visited with no further misfortune, will in a few years produce considerable quantities of high-grade fruit.

The mango will grow in a variety of conditions, and it seems to have little preference as to soil, the most important requirement being a deep soil that is well drained. As to climate, it is much more exacting, and the fact that the tree may thrive well in a given locality and yet fail to produce fruit should be kept always in mind. The mango will be prolific only in regions subjected to a

* Bull No. 95, Office of Experiment Stations, U. S. Department of Agriculture, Report on the Agricultural Resources and Capabilities of Hawaii, p. 40.

From G. N. Collins

Mango Fork (full size)



From G. N. Collins. U. S. Department of Agriculture

Mango Fruit, showing Method of Peeling (natural size)

considerable dry season. On the moist north side of Porto Rico the trees grow luxuriantly, but they are not nearly so prolific, nor is the fruit of such good quality, as on the dry south side, and in the very dry region about Yauco and at Cabo Rojo the fruit seemed at its best, while its abundance was attested by the fact that fine fruit was selling as low as 12 for a cent. In Guatemala and Mexico the mango was found at its best only in regions where severe dry seasons prevailed.

Under favorable conditions the mango is very prolific. The tree of which a branch is shown on page 323 was estimated to have in the neighborhood of 5,000 fruits at the time the photograph was taken, and trees quite as prolific were seen near Cabo Rojo, Porto Rico; while trees in southern Florida before the freeze of 1886 were estimated to bear as high as 10,000 mangoes. From this it will be seen that with 25 to 100 trees per acre enormous quantities of mangoes can be produced on very small tracts of land, provided the right climatic conditions exist.

The method of peeling a stringy mango is shown on this page. A cut is made around either end of the fruit and these are then connected along one side, the central strip being peeled off in one piece. The skin remaining on the ends of the fruit affords a means of holding it without the fingers coming in contact with the juicy flesh. If in addition a sharp-pointed fork is at hand, this can be firmly fixed in the seed and the skin at the ends removed, thus saving the sweetest part of the fruit. The illustration on page 326 shows a special mango fork secured in Mexico by Dr J. N. Rose. The long slender tine in the center easily penetrates the seed, and the shorter outer tines need only to touch the seed to prevent it from turning.

The best varieties of mango have hardly any fiber and the pulp is sliced with a knife, or sometimes is so soft that it is eaten with a spoon.

Porto Rico seems very well adapted to the production of mangoes and, as the plant is strictly tropical and very susceptible to cold, would seem to have a decided advantage over Florida, where good varieties are already successfully grown, but where, except in the extreme southern part, the danger of injury from cold is very great. A really high-grade mango is unknown in Porto Rico, and the first steps toward making their exportation profitable is the introduction from the other islands, or from Florida, Mexico, or the East Indies, of grafted stock of the best varieties.

The season of ripe mangoes in Porto Rico is from May to August. By selecting proper varieties this might be prolonged, since in some parts of India it extends over a period of six months. This would be a great advantage in shipping the fruit to temperate regions, as at present the season coincides with the season of temperate fruits, which places the mango at a decided disadvantage.

RAINFALL AND THE LEVEL OF LAKE ERIE

MANY people think that the rainfall, although differently distributed through the year, averages about the same one year as another, or if there is a deficiency one year, it will be made up the next. With this erroneous notion in mind, those concerned with navigation on the Great Lakes have naturally looked for some other explanation of changing water levels, for from 1888–1901 they witnessed a period of low water so long it seemed unreasonable to expect it ever to attain its former level. However, a comparison of the level of Lake Erie, as shown by the gage at Cleveland, with the record of rainfall along the Great Lakes shows a complete correspondence.

The high water in Lake Erie in 1902 and the heavy rainfall of that year are fresh in the minds of those who live near it.

The Weather Bureau established a number of stations on the Great Lakes in 1870. The first marked deviation from normal level in Lake Erie after this was in 1872, when the water was lower than for many years before or after. The rainfall that year was below the normal at every station on the Great Lakes. (I have taken no account of stations on Lake Ontario.) In 1876 the water was higher than for many years before and higher than any year since. The rainfall was above normal at all stations except Marquette, where it was nearly an inch below. At Milwaukee the excess was 18.28 inches; at Grand Haven, 11.52; at Detroit, 8.07.

In 1878 the lake was considerably higher than the preceding or following year. The rainfall was a little below normal at Duluth and Grand Haven, but above at all other stations, being 60.24 inches at Buffalo, where the normal is only 38.04, and 53.51 at Cleveland, where the normal is 36.29.

In 1882 the lake was higher on an average than in any other year since 1876. The rainfall was below normal at Buffalo, Detroit, and Milwaukee, but above normal at the ten other stations, the excess at most of them being greater than the deficiency at any of these three.

In 1890 the water was higher than in the years immediately preceding or following. The rainfall was not far from normal on the upper lakes, but above normal at all Lake Erie stations.

In 1895 the water was the lowest for half a century, and the rainfall on the Great Lakes probably the least, certainly the least recorded at the Weather Bureau stations since their establishment.

These include all the years that differ in any marked degree from those that precede and follow.

If we consider parts of years we find also a close agreement between rainfall and lake level. Examination of the monthly record of lake level at Cleveland led me to think the rainfall at the different stations must have been below normal for the first half of 1888 and the last three months of 1887. On consulting the record I found it so. To exactly account for the stage of the water during brief periods, of course several things must be considered—surplus or deficiency in the different lakes at the beginning of the period, time required for water to flow from the upper lakes, evaporation, melting of snow on the watershed, whether ground is frozen, whether rain falls gradually or so fast that a larger portion passes quickly into the streams.

Most of the time since 1887 Lake Erie has been lower than for many years before. The rainfall has also been less, as the table shows. If any one could tell us when this dry cycle will give place to a wet one, the information would be highly appreciated. Perhaps the wet one has already begun. At any rate, those concerned need not fear any appreciable lowering of Lake Erie below its level in the past decade from any other cause than drouth. I believe that people now at Cleveland, Toledo, Detroit, Milwaukee, and Chicago will live to see the water higher than their fathers ever saw it. The same cannot be said of places on Lake Huron or the northern part of Lakes Superior and Michigan, for the slow tilting of the earth's crust is such as gradually to lower the water in those regions.

MEAN ANNUAL RAINFALL ON THE GREAT LAKES

Station.	Year established.	Mean in inches to December 31, 1887	Mean since 1887.	Mean deficit since 1887.
Duluth	1870	32.8	27.0	5.8
Marquette	1871	32.3	32.4	—0.1
Chicago	1870	36.7	30.5	6.2
Milwaukee	1870	33.2	28.5	4.7
Grand Haven	1871	38.9	30.4	8.5
Alpena	1872	37.9	29.7	8.2
Port Huron	1874	33.5	29.3	4.2
Detroit	1870	33.6	30.7	2.9
Toledo	1870	32.7	28.0	4.7
Sandusky	1877	37.5	31.5	6.0
Cleveland	1870	37.4	33.1	4.3
Erie	1873	43.2	35.2	8.0
Buffalo	1870	38.1	36.8	1.3

E. L. MOSELEY.

GEOGRAPHIC NOTES

THE RAILROADS AND FORESTRY

THE Bureau of Forestry has continued this year on a far larger scale the experiments in timber seasoning and preservation for the railroads which it began last year under Dr Hermann von Schrenk. This work will be done for the New York Central, the Erie, the Baltimore and Ohio, and the Pennsylvania railroads in the East, and for the Illinois Central, the Santa Fé, the

St Louis and San Francisco, the Missouri, Kansas and Texas, the Northern Pacific, and the Burlington in the South and West.

The scarcity of valuable timbers is felt by no class of consumers more keenly than by the railroads, which use every year 110,000,000 ties merely to renew those worn out and decayed. The price of timbers has risen in some instances to a figure which makes their use prohibitive ; in other cases the supply is so nearly exhausted that the roads have been compelled to look about for new timbers.

The Bureau of Forestry has been called on to assist in solving the difficulty, and has come forward with the very practical and simple suggestion that the railroads, instead of continuing to use expensive, high-grade timbers for such a low-grade purpose as that of railroad ties, shall use the cheaper woods. For example, to the complaint of the New York Central that it finds it more and more difficult to secure longleaf pine ties from Georgia at the price it can afford to pay, the Bureau suggests that the road use the beech, maple, and birch of the Adirondacks. The complaint that the timbers rot very quickly when laid in the ground is answered by the suggestion that they should be seasoned and preserved, just as beech is seasoned and preserved in France. The Great Eastern Railroad of France has succeeded in making beech ties last 35 years by impregnating them with tar oils. The unseasoned longleaf pine ties used by the New York Central last only five years ; and the beech, if laid green, without seasoning or preserving, would in many cases last no more than three years. The substance of the proposal which the Bureau has made to the railroads, and which the railroads have thought so well of as to adopt, is that experiments be made to determine whether cheaper timbers may be treated with preservatives at a cost so low and be made to last such a long time that it will pay to substitute them for the more expensive timbers now employed.

The railroads have thought so well of these ideas that they will not only carry on under the Bureau's direction the necessary experiments in seasoning and preserving, but have engaged the Bureau's help in learning where cheap timbers for ties may be obtained. In other words, the railroads have decided that if they can be convinced that it will pay to season and preserve cheap timbers for ties, they will acquire large areas of timber lands on which they will grow their own trees, cut their own ties, and thus be assured of a steady supply. This means that some of the great railroads of the country are in a fair way to practice forestry on a very large scale, and to employ a great many foresters.

Work of a similar nature to the railroad experiments is being carried on for the American Telephone and Telegraph Company, which used last year 150,000 telephone poles and 3,000,000 feet of timber in cross-arms. Seasoning experiments are being conducted on chestnut telephone poles near Harrisburg, Pa., and on cedar poles near Wilmington, N. C.

Important and valuable as this work is to the railroad and telegraph companies, it is of far greater importance and value to the country at large. The use of cheaper timbers for railroad ties is in several ways an economic saving; it relieves the high-grade timbers of a part of the heavy demand that is being made upon them, opens a market for timbers for which there is now little sale, and affords splendid opportunities for conservative management of timber lands. The work is being prosecuted according to the regular coöperative system of the Bureau, by which the field and traveling expenses of the Bureau's agents are paid by those for whom the work is done.

New York, October 17, 1902.

Commander Robert E. Peary, U.S.N.
Washington, D.C.,

Dear Sir:-

The Peary Arctic Club acknowledges your preliminary report of the 17th ult. and letter of the 4th inst., and extends to you its cordial welcome upon your return to country and home. It honors you for patience, courage and fortitude, undaunted by formidable obstacles; thanks you for the wise and effective use of the means placed at your disposal, and congratulates you upon your achievements memorable in the annals of science and discovery.

Assuring you of our appreciation and regard, we subscribe ourselves -

PRESS OF JUDD & DETWEILER, WASHINGTON, D. C.

THE NATIONAL GEOGRAPHIC MAGAZINE

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CONTENTS

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE UNITED STATES—HER MINERAL RESOURCES*

By C. Kirchhoff, Editor The Iron Age

WHEN I was a boy I was taught that in this great country, as in fact in any land, an assured future lay with him who identified himself as closely as possible with the development of its natural resources; that the producer of the primary articles of necessity, the tiller of the soil, and the miner must under all circumstances find an outlet for their energies and a reward for their special skill and knowledge. To one born in the sight of the Golden Gate, soon after the wonderful gold discoveries in California, the future held out vast possibilities to every searcher for treasure; yet the wildest dreams of the gold-seekers of that day have been outdone by the subsequent discoveries of our mineral wealth, although now the yellow metal is occupying a minor place when compared with the useful minerals.

It may be stated as a general proposition that to a civilized community the possession of mineral wealth is important almost in the inverse order of the unit value of the individual mineral. Cheapest and yet most important of all is coal and fuel, next iron, the baser metals, the precious metals, and finally the precious stones. Without the first named no great industrial expansion is possible, while the last named, however welcome, do not through their absence hamper growth.

It is not possible to speak with precision as to the extent of the mineral resources of any country, because new discoveries are made from time to time even in Europe, where exploration has extended over many centuries. It is certainly not possible in our own land, where much territory is still covered with dense forests and swamps and whole mountain ranges have been untrod. Under the circumstances, comparisons are unsafe, but with such qualifications it is stating a fact that the United States has been blessed with almost unrivaled resources.

The geographical distribution of our mineral resources could be fairly well shown in maps and charts, so far as exploration and development have revealed them. We might in that way show our assets, territorially distributed, but we would create a very erro-

*An address before the National Geographic Society, March 4, 1903.

neous opinion of their real value. With the most important minerals the economic value of a deposit is dependent upon many other considerations besides those of mere size and extent. Conspicuous among these are accessibility to markets, the means of transportation, natural or artificial, the existence of a supply of labor and the character of that labor, climate, the character of the community, its laws, etc. These in their shifting influence find expression in the actual product, and that is a better measure of relative importance than mere location and extent.

The latter, designated on maps by coloring, is a poor guide, since relatively unimportant deposits may cover a very extended territory. Coal measures may underlie many thousands of square miles, yet the seams which they enclose may not be numerous nor thick nor possess a coal of satisfactory quality. A field small in area, at some distant place, may be the scene of enormous operations, while the greater basin may hardly be able to supply local requirements. The anthracite coal regions, as to area, constitute only an exceedingly small portion of the known coal fields of the United States, yet their importance overshadows any other industrial district.

Useful minerals are found in deposits which may in general be classified, for the purpose of estimating them as assets, into two groups. First are those which are beds constituting one of a series of strata. They are usually persistent and fairly regular over large areas like the coal seams, and therefore permit of some estimate of their contents. Second are those whose origin is due to local circumstances, and these include the fissure veins. They are usually irregular, and it is in most cases entirely impossible to arrive at any conclusion of their extent and value without most elaborate underground exploration or actual mining operations. It is therefore quite impossible to submit more than very vague data relative to the magnitude of the mineral wealth of any country. In a very rough way we may do so, of course, so far as coal is concerned. How rough that is will be readily understood when the statement is made that out of an estimated coal area of about 4,650,000 square miles in the world, China is credited with 4,000,000 square miles. Our own country is put down at about 280,000 square miles, and this compares with 11,900 square miles for Great Britain, 1,770 square miles for Germany, 2,086 square miles for France, and 510 square miles for Belgium. Considering the enormous tonnage which the European countries named are furnishing from their relative restricted territory, our possible reserves look huge. Of course areas are not a true measure of value or importance. Thus our Pennsylvania anthracite fields embrace a territory of only 468 square miles, and yet outdo in value probably any coal area of like extent anywhere in the world.

We must therefore leave to the imagination the pleasure of dealing with the magnitude of our mineral wealth. All we do know is that it is very great, not alone in its magnitude but also in its variety.

There is hardly a state or territory in the Union which does not possess and is not utilizing mineral property, particularly when we include clays and stone and mineral springs. Maine has her granite and stone; Vermont her marbles, granite, and copper; Connecticut her iron ore; Massachusetts her granite, pyrites, and iron ore; New York, salt, stone, petroleum, natural gas, clays, cement, gypsum, graphite, and iron ore; New Jersey, clays, marls, zinc, and iron ore; Pennsylvania, petroleum, coal, iron ore, natural gas, cement, rock, and clays; Maryland, iron ore; Virginia, coal, iron ore, zinc ore, pyrites, and copper ore; North Carolina, gold, stone, corundum, mica, copper, and iron; South Carolina and Florida, their phosphates; Tennessee, coal, copper, iron ore, and phosphate rock; Alabama, coal and iron ore; Louisiana, sulphur and salt; Kentucky has coal, iron, zinc, and lead; West Virginia, petroleum, natural gas, coal, and salt; Texas, petroleum, coal, iron ore, quicksilver, and silver; Arkansas, zinc, manganese, bauxite, whetstone, and coal; Missouri, lead, zinc, iron ore, and clays; Ohio has coal, petroleum, natural gas, clays, grindstones, salt, and iron ore; Michigan, copper, iron ore, coal, cement, grindstones, clay, limestone, and salt; Illinois, coal; Indiana, natural gas, coal, petroleum, whetstones, and clays; Wisconsin, iron ore, lead, and zinc; Iowa, clays and lead; Kansas, lead, zinc, coal, natural gas, salt, and gypsum; Indian Territory, coal; South Dakota, gold, copper, and lead; Wyoming, petroleum, coal, copper, salt, and iron ore; Colorado, gold, silver, lead, copper, petroleum, coal, and iron; Utah, gold, silver, lead, coal, iron, and sulphur; Montana, copper, silver, gold, and sapphires; Idaho, lead, gold, and silver; Oregon, gold, copper, and silver; Washington, coal, iron ore, lead, and silver; Arizona is famous for copper, silver, and gold; New Mexico for coal, iron ore, copper, and silver; Nevada for silver, gold, and copper, and California for gold, copper, quicksilver, petroleum, borax, asphaltum, magnesite, and stone.

As the pioneers penetrated into our country they caught some glimpses of these treasures. The Jesuit fathers, in the reports of their journeys in 1659 and 1660, mention the copper of Lake Superior, and Le Sueur, in his explorations of the Mississippi at the commencement of the eighteenth century, noticed the lead deposits of that region. Copper was mined in Connecticut and in New Jersey, and iron manufacture began in New England and in Virginia at about that time, but it was not until the end of the eighteenth century that iron, lead, and copper mining were carried on on a fairly comprehensive scale. Coal was mined in the vicinity of Richmond from 1770 to 1780. In 1820 the first cargo of anthracite reached Philadelphia, while in 1833 and 1834 Virginia, North Carolina, South Carolina, and Georgia were in the zenith of a gold-mining boom which resulted in an annual product of about $600,000. The year 1844 saw the opening of the Lake Superior copper region, and then in 1848 came the famous California gold excitement, followed by gold mining in Oregon in 1852, in Arizona in 1858, in Colorado in 1859, in Idaho and Montana in 1860. Iron mining on Lake Superior began in 1856. In 1859 came the discovery of the Comstock lode, which created an enormous activity in silver mining and led to the opening of the Unionville, Kelso Run, Belmont, White Pine, Eureka, Esmeralda, and Pioche districts in Nevada, the Owyhee in Idaho, the Cottonwood and Bingham in Utah, and the silver districts of Colorado. The year 1860 brought the discovery of petroleum in Pennsylvania, to be followed many years later by the utilization of natural gas.

The development of the copper mines of Arizona began seriously in 1880 and 1881 with the opening of the Bisbee, Globe, and Clifton districts, to which later on the United Verde was added. Butte rushed into prominence at about the same time. Later in the seventies Leadville began to pour forth its mass of argentiferous lead.

It may be stated in a general way that enterprise did not seriously turn to the mining industry in this country until the second half of the last century, and that its greatest achievement has been crowded into the last 30 years. I do not propose to weary you with an endless array of figures. Suffice it to say that the value of the mineral product of the United States had risen to about $370,000,000 in 1880, reached $620,000,000 in 1890, and, according to the statistics collected by Dr David T. Day, of the United States Geological Survey, exceeded $1,000,000,000 in 1901. This includes $350,000,000 for coal, $242,000,000 for pig iron, $87,000,000 for copper, $78,000,000 for gold, $66,000,000 for petroleum, $55,000,000 for stone, $33,000,000, commercial value, for silver, $27,000,000 for natural gas, and $23,000,000 for lead.

We stand first as producers of coal, our output in 1901 having been 263,000,000 long tons, Great Britain following with 220,000,000 tons, and Germany with 153,000,000 tons, our percentage of the world's total being about 31 per cent. In petroleum we have been racing with Russia, occasionally first and sometimes second. In 1901 we furnished a little over 69,000,000 barrels to the world's total of 165,000,000 barrels, our percentage being 41.9 per cent as compared with Russia's 41.5 per cent.

In the manufacture of pig iron we have now reached the point that our production is greater than that of our largest rivals, Great Britain and Germany, put together, with Belgium thrown in. We manufactured in 1902 fully 40 per cent of the world's total.

The gold production of the world was about $265,000,000 in 1901, to which we contributed $80,000,000 and Australasia $77,000,000. Of course, when the Rand resumes its full production and again starts on its natural increase, we shall probably have to yield first place to it.

The world's production of silver has a commercial value of about $103,000,000. Here again we occupy the first rank, with Mexico as a close second.

The supremacy in the copper mining industry is undoubtedly ours for many years to come. In 1901 we produced over 52 per cent of the total of the world's yield of 512,000 tons. In that year, with a product of 269,000 tons, we came close to the entire world's output in 1890, when it was 273,000 tons.

We stand second in zinc, following Germany. Our output of that metal in 1901 was 125,000 tons out of a total of the world of 501,000 tons, or over 25 per cent.

These figures, enormous as they are, do not really reflect adequately the great importance of our mining, since it lies at the foundation of the manufacturing industries of this country and is the basis of its industrial greatness, backed as it is with an equally lavish supply of raw materials from the forest and the farm. Mining and rail transportation have reciprocally aided one another, and in turn have contributed powerfully to the wellbeing of the farmer and the lumberman.

As in other realms of material progress, the United States has outstripped all other civilized countries in the development of its mining and metallurgical industries.

Brief though the period be during which we have been actively mining, we have witnessed the exhaustion of famous great deposits and the decline of entire camps and districts. This is apt to occur most rapidly in the case of placers, conspicuous among which are the auriferous sands and gravels in which the precious metal has been concentrated by the washing action of streams. California's enormous gold production of the early days fell off rapidly after the first decade of working. The exhaustion of the silver-gold bonanzas of the Comstock lode, the rapid collapse of the mining of silver-lead ores of the Eureka district in Nevada, the practical cessation of working of once exceedingly productive quicksilver mines of California, are a few instances which could be multiplied. Yet thus far we have again and again witnessed the rapid rush into prominence of new districts. Thus Cripple Creek in Colorado recorded its first shipment of gold in 1891, the amount being estimated at $2,000. Two years later it was $2,000,000, in 1897 it had crossed the $10,000,000 mark, and in 1900 had risen to $18,000,000. Butte, in Montana, was a silver camp of some importance 20 years ago, when copper was discovered and the district suddenly loomed up with exports by the ship cargo of 30 per cent ores to the astounded smelters of Swansea, Wales. When Leadville's great reserves of oxidized silver-lead ores began to show signs of exhaustion, the Cœur d'Alene County, in Idaho, rose to more than fill the gap.

Again and again we have faced the possibility that our petroleum supply would ultimately fail us; yet as the derricks fell into ruins in one field they rose like magic in others, the most startling recent instance being the opening of the California and Texas fields.

Some uneasiness has been felt as to the future of the Lake iron ore supply. The Marquette district was in full development when the Menominee was opened out. Then came in rapid succession the Gogebic and the Vermilion ranges, and finally, as the climax of all, the Mesaba range. Again and again the prediction was made that the old Marquette range would show evidences of exhaustion, and yet year after year new mines have taken the place of old ones. New reserves are being opened up in all the districts until this generation may well dismiss any fears of future supplies, even taking into consideration that the demands are rapidly increasing year after year.

As for our resources of coal, the most important of our minerals, we are not likely to have a Coal Exhaustion Commission, like that of our British friends, for centuries to come.

Our record of feverish activity is one of which we have every reason to be proud, but it must be acknowledged that it has been accompanied by serious abuses. In the rush to get rich we have deliberately followed the principle that it pays to waste. Within certain limits that may be economically justifiable. In a new country, without adequate transportation facilities, high labor, and difficult surroundings, it is possible only to select the best and the richest, but unfortunately in mining that process of selection in most cases practically renders unavailable for the future that which has been rejected. Much of it is forever lost to the world, and what can be saved at a later date can be recovered only at a greatly increased cost. In the early days of our mining we have been unskillful, and even today we are robbing nature's storehouses of treasure, often destroying more than we utilize. At one time, not so many years since, barely one-third of the anthracite coal in our beds finally reached the consumer. The other two-thirds were lost in mining and in preparation for market.

It is characteristic of a great many of the mineral deposits that the mass of the ore, particularly with growing depth, is low in grade, the useful mineral being disseminated in relatively large quantities of barren rock. Very often the rich ore occurs only in streaks and pockets, which constitute a minor percentage in the total amount of valuable material. In hunting for them the poorer material is rejected, although it may be close to the border line of profitable extraction. With improved economic conditions there is greater opportunity, and with greater skill and a broader comprehension there is a growing tendency among managers to rely more and more upon a moderate return on the large bodies of poor ore, accepting the occasional bonanza as a welcome addition to revenue. The reckless hunt for rich streaks is giving way to systematic utilization of a maximum of the deposits. It may not be as merry and exciting a life, but it is certainly a longer one and happier one. There has been a great improvement in this direction in this country. It should be stated, however, that we can never hope to utilize the entire contents of a deposit. Still, there can be no doubt that we have paid dearly in wasted resources for the achievements of opening them up so rapidly.

We have no particular grounds for mere pride of possession in our magnificent resources. Our glory, from a national point of view, should be completeness of utilization, and that has at times suggested the nationalization of our mineral industry with the object of checking the abuses referred to. It may be doubted whether our practical good sense will ever allow that question to come to the front. The nation as such has only control now of those mineral resources which lie dormant in the national domain. In order to encourage their development, ownership is surrendered under easy conditions to the discoverer. That policy has unquestionably fostered enterprise in the past, but it is an open question whether the time is not approaching when the nation at large must assume the attitude of some state governments and of all private owners of mineral lands. These demand a royalty which may become an important source of revenue, and they generally provide, what is more important to the nation, that the mine shall be operated in a workmanlike manner. The present generation has responsibilities to future generations. In their behalf it has the right and the duty to demand that the nation's gifts be not wantonly destroyed ; that every means which engineering skill suggests be exhausted ; that every reasonable precaution be taken to preserve from destruction useful mineral which, while not profitably available now, may become highly precious to future generations.

Nor should title to mineral property on the public domain be given without some provision for its surrender as the penalty for long continued idleness. It should revert to the nation when after reasonable opportunity the discoverer is either unable or unwilling to utilize nature's bounty.

The United States has been exceedingly generous in throwing open its mineral resources. It has been a wise policy which the results on the whole have thoroughly justified. But conditions have changed greatly. The opening up of our mineral resources has ceased to be the hazardous undertaking it once was. Their utilization has become an undertaking in which engineering skill can more readily guarantee results. The splendid work of our U. S. Geological Survey has brushed away many uncertainties. The development of our great railway systems has lessened costs, and cheaper and more confident capital has become a willing handmaiden to enterprise. The time is therefore approaching, if it is not now at hand, when the nation is justified in imposing conditions not hitherto warranted. Conspicuous among these should be a rigid enforcement of the obligation to put a stop to wanton waste.

In the last few years a good deal of alarm has been felt that very dangerous monopolies may be created through the control of our mineral resources by powerful consolidations of capital. At the first blush, in studying the magnitude of those resources, we may feel inclined to dismiss the danger as remote. It assumes a somewhat different aspect, however, when we begin to differentiate. The conditions affecting the industrial utilization of mineral property vary greatly, and a closer study reveals the fact that a relatively small number of the deposits, through favoring circumstances, give their possessors special advantages. The deposits may be exceptionally rich or extensive, particularly pure, or may be so located with reference to the markets that they are capable of yielding an adequate supply at a cost far below others. These advantages may represent enormous sums, and can therefore be capitalized correspondingly. Unless those who control them extort uudue returns, measured by earning capacity, the owners of the other less favorably located deposits cannot compete and live. Of course, the risk is always run by those who secure control of the best of the mines that new deposits as valuable may be discovered elsewhere, just as those who utilize monopolies based upon patents take the chance that inventive genius, stimulated by opportunity, made exceptionally artificial, find means to dispute exclusive possession. There may be iron ore deposits as rich and as great as any on the Lake Superior ranges in the Rocky Mountain region, yet for a generation to come they might as well be non-existent, so far as the controlling position of the United States Steel Corporation is concerned. An enormous power for good or for evil may be wielded by groups of capitalists who control the commercially available mineral resources, though they constitute only a small fraction of the total assets of mineral wealth of the country. The fact that in most cases the earning capacity of these consolidations has been rated exceedingly high furnishes a premium on the development of hitherto neglected deposits, and thus constitutes the greatest source of danger to the stability of many of these giant undertakings. What is perhaps to be most deplored is that these organizations, on their present basis, impose upon the industries dependent upon them a burden of fixed charges which must handicap this country in its struggle for an increasing share in the world's markets.

While the record of the achievements in mining, *quantitively*, has been extraordinary in this country during the past fifty years, we may look back with even greater satisfaction upon what has been accomplished *qualitively*, if we may so term it. It cannot be stated in an array of figures, but constitutes even a greater glory to the captains of industry and the engineers and inventors who deserve the credit for it. It is expressed in the more complete utilization of the natural resources, as in the increase in the total extraction of the contents of a coal bed. It is in evidence in the capacity to utilize bodies of ores lower and lower in grade. It is proven by ability to produce from rebellious or impure ores metals nearly chemically pure and commercially available for a wider and wider range of consumption. It is measured by an expansion of markets which may be due to the fact that technical progress has proceeded more rapidly in our country than in others.

While it is true that in these early days our miners and smelters rose to the occasion when they were called upon to meet special conditions, the general fact is apparent from a study of our development that generally we first copied and then adapted the methods approved by experience in Europe. There were some very notable exceptions. We were forced to and did create hydraulic mining to collect the gold from alluvial deposits. We developed the preparation of anthracite for the market. We had nothing to guide us in the handling of the native copper rock of Lake Superior. The Washoe process was worked out to treat the silver ores of the Comstock lode. There were no precedents for methods in the petroleum industries, and we had to learn by ourselves how to collect, distribute, and utilize natural gas. We taught the world how to use the steam shovel in mining. We have pushed the development of the rock drill in mining and quarrying, and in more recent years have been in advance of all countries in the employment of modern coal-cutting machinery. Still it is a fact that Cornish, Welsh, aud English miners long controlled the working out of our mining methods, and that German and English metallurgists guided our first steps in utilizing our more complex silver, lead, and copper ores.

One of the most brilliant reports on the state of the art ever written, that of the late Abram S. Hewitt on the Paris Exposition of 1867, is a confessiou of superiority of European methods in iron manufacture, which is almost staggering to one who reads it in the light of the present day. I cannot help feeling that the recognition of our iudebtedness to European practice in the earlier days should be insisted upon, since it is becoming altogether too common to assume that we are the chosen people so far as the mechanic arts are concerned. That feeling is so often encountered that the fear of the danger of overconfidence is naturally aroused.

A strikiug fact is the growing interdependence of the various branches of the mechanic arts as contrasted with the conditions prevailing 25 years ago. The one relies upon the other, uot alone for its products, but is aided, too, by suggestions and support. The metallurgist's progress is accelerated by the mechanical engineer, and the latter looks to the former for increasingly strong aud reliable materials. The electrician has greatly widened the capacity for improving methods on the part of the copper producer, and in turn is under a debt to the copper miner, and the achievements of the rail-maker are returned in kind by the railroad builder, who has taught both much of value in transporting materials. Thus all are shoulder to shoulder in the march of progress, mutually helpful and united—all powerful.

To a constantly increasing degree pure science, primarily in search of the truth for its own sake, sheds its searchlight along the path, and has become a closer and more valued ally year by year. The majority of active workers looked askance at this meddler, preferring to allow their own fancy full sway whenever they stopped to seek for causes or explanations. Practical men may sometimes become impatient when the laborious and apparently hypercritical methods of the scientist do not more promptly clear an obscure point or furnish him with a suggestion for successful new lines of work, but the day has long passed when research was treated with grudging respect, if not with open hostility. No oue is now readier to acknowledge his indebtedness to the chemist or the physicist than the manager or the practicing engineer. The fear is disappearing of impracticable science on the one hand aud of unscientific practice on the other.

The mining industry has suffered and, unfortunately, will suffer, particularly iu its relation to labor, from one appareutly trifling circumstance, and that is the impression which a visit to underground operatious makes upon the average layman. To be dropped suddenly into the dark depths with only a flickering candle to guide the uncertain steps, appalled by the dead silence or alarmed by strange noises, the rumble of the distant car, the reverberation of a shot far away, the rushing of uuseen streams of water—the visitor is impressed with a sense of insecurity and danger. The bright sunlight has never seemed sweeter to him than upon his return to the surface, and if he happens to have access to the columns of the press he describes iu lurid language the awful experience which incidentally convinces him that he is braver than he gave himself credit for in his innermost heart. Mining in the popular mind becomes one of the most hazardous of callings when, as a matter of fact, there are many others above ground which involve greater risks. With some exceptions, of course, the conditions which surround the work of the miner are rather favorable. He is not exposed to the rigors of the elements, and particularly during the last few decades the hygienic conditions have been brought to a high standard.

It is a fact that progress during the last 50 years has been pushed along lines even more important in their way than the increase in tonnage, the cheapening of product, or the raising of the standard of quality. The captains of industry in mining have, like others, displayed increasing care of their armies of men.

It has become an axiom with every enlightened manager that every means which shall render more satisfactory the surroundings of the worker is bound to tell upon the results of their labor. A comparison of our modern mines and plants with those of former decades, of which some even now survive, proves what attention is paid to making the conditions under which manual labor is performed as tolerable as the circumstances will permit. There has been a tremendous improvement in this direction, and it does not lessen the achievement when we frankly acknowledge that it is largely due to the recognition of the fact that progress in this direction pays handsomely.

Let me go a step further, and that is to make the claim that the crowning glory of the efforts to improve our mining and metallurgical industries has been that they have contributed their full share to the development of this materialistic age. They have helped to bring within the reach of an ever-growing circle of people not alone the necessities, but also many of the comforts and some of the luxuries of life. Let me confess that it seems to me the greatest and most commendable of achievements to raise ever so little the mass of humanity in civilization, and that is what progress in the mechanic arts during the past century has accomplished in a striking manner. Start the masses on a higher plane—level them up. The great genius may not tower so far above them as once he did; but that is again in harmony with our democratic institutions. Let there be an increasing equality of opportunity, even though it makes the struggle fiercer and fiercer, if only public conscience will demand with sterner emphasis that the methods for achievement be lawful and fair.

EXPEDITION INTO TEXAS OF FERNANDO DEL BOSQUE

Standard-Bearer of the King, Don Carlos II In the Year 1675

Translated from an Old Unpublished Spanish Manuscript

By Betty B. Brewster

On the 19th day of November, 1674, Don Antonio Balcarcel Rivadaneira Sotomayor, alcalde maior of the town of Nuestra Señora de Guadalupe de la Nueva Estremadura (now Monclova), having decided that the good of his majesty's service required a military organization to show the force and arms his majesty could bring to resist the Indians, who might not wish to live peaceably under the royal protection and who by their example would seduce into rebellion barbarous tribes from whom injury to the royal service might be apprehended, resolved, under the authority of his royal commission and in the name of the king, to have the royal standard raised. After assisting at the holy sacrifice of the mass he gave the order and said: I consign this royal standard to the keeping of Fernando del Bosque, a Spaniard of the greatest experience and trustworthiness; in whom are united all the qualifications and parts required, and in the manner that I should and ought and find occasion to as conquistador of the new conquest and settlement; and in the name of the king I elect him to be such royal standard-bearer for this new conquest and settlement, and in it shall be accorded to him all the preëminences and privileges allowed other royal standard-bearers of like new conquests, having and holding him for such royal standard-bearer. And he shall use and exercise such office as he can and ought in all things and causes connected therewith.

To this the said nominee assented and received said royal standard and offered to serve his majesty voluntarily and of his own will, without regard to any salary or pay therefor, and he made oath in the following form: I swear and make homage according to law, one, two, three times; because, being out of Spain I ought to do it the more: to hold and to guard this royal standard in peace and in war; working solely in the service of the king until the time shall come when I must die upon it, and when in obedience to the royal command whoever may be present shall carry it to the one that shall next be charged with its keeping. And I will fulfill all that a faithful vassal and loyal hidalgo should.

Father Juan Larios had been lately appointed by the Franciscan order comisario misionero for the region beyond the Rio del Norte, and had been directed to carry his work of evangelization to the savage tribes inhabiting it. He and that other intrepid priest, Father Manuel de la Cruz, had already entered Texas several times. Father Freyes, the historian, says that Father Manuel de la Cruz penetrated into the country as far as the Medina River. He had remained over the Rio del Norte with a tribe called the Boboles, but being informed that the Yrbipias had planned to capture him by command of a god that they had, this god being a man who had ordered them to bring the daring missionary before him to answer for his temerity in coming into the country, the Boboles defended the priest, by command of Don Estaban, chief of the Gueiquesales. This chief with six Indians of his tribe came to see General Balcarcel, and, being asked his purpose in coming, said that he and his tribe desired to become Christians and to receive religious instruction, and he had come in the name of the following tribes, all of whom were his friends and allies: the Gueiquesales, Manos Prietas, Bocores, Siaexer, Pinnancas, Escabaca-Cascastes, Cocobiptas, Cocomaque, Oodame, Contotores, Colorados, Babiamares, Taimamares. These tribes had received religious instruction from the missionaries, and on one occasion they had protected them from the Yrbipias, who wished to capture Father Manuel de la Cruz when he was on the other side of the Rio del Norte.

On the 13th of January, 1675, another Indian, who was a Christian and called Francisco, belonging to the tribe called Bagnanames, accompanied by the chief of his tribe, who was called in the idiom of his people Yosame Carboau, and eighteen warriors and three women, came to see General Balcarcel. All of them were brought by the Christian Indian, Francisco, from the mountains called Dacate in the Indian language, and which are about thirty leagues on the other side of the Rio del Norte.

They said that they were tired of wandering through the mountains and dying like animals. On the 26th of January, 1675, there came to General Balcarcel Pablo, an Indian chief of the nation called Manos Prietas, and with him eight Indians of the Gueiquesales, the Bapacorapimancos, and Espopolames. These, being examined, said that they were Christians and had been baptized by Father Juan Larios, and they had come to make their submission to the king. On the 29th of April, 1675, this same Indian Pablo came and brought with him 232 persons, great and small, as follows: 120 warriors, 65 women, and 47 boys and girls. They had come to ask to be placed in settlements, and said that they had left a large number of their people congregated together toward the Rio del Norte; that they were very numerous; they could not tell how many. These were followed by other chiefs living beyond the Rio del Norte, all of whom asked to be placed in settlements and to have missionaries sent to them.

General Balcarcel, having established his settlement of Nuestra Senora de Guadalupe de Estremadura, in December, 1674, commenced building a church, which was soon completed. Royal orders had been issued to push the conquests as far as possible, and to gather the Indians together into settlements, where they might receive religious instruction, cultivate the soil, and live peaceably under the royal protection. General Balcarcel, in compliance with this order, determined to send an expedition, under military command, along with Father Juan Larios, who had been appointed and directed to proceed at once to the conversion of the barbarous Indians living beyond the Rio del Norte. The military commander of this expedition was Fernando del Bosque, the royal standard-bearer, and Father Juan Larios, accompanied by Father Dionisio San Buenaventura, both of the Franciscan order, was to have charge of all matters pertaining to the missionary purpose of the expedition. With these there were ten other Spaniards—an interpreter of the Spanish and Indian languages, Don Lazaro Augustin, himself an Indian, and Juan de la Cruz, of the Boboles, his ensign, and 20 others of his tribe who were most faithful to the Spaniards, and 100 warriors of the Gueiquesale tribe accompanied the expedition.

They were ordered by General Balcarcel to proceed to the Nadadores, and beyond as far as the Sierra Dacate, and to instruct the Indians to plough their lands and to cultivate them, and live industriously, and they should go to such places as the good service of their majesties required, and they should instruct the Indians in the Holy Catholic religion, and should take royal possession of all parts of the country visited, and take note of the longitude of the rivers, and of the trees, forests, and mountains, and should count the people, great and small—men, women, and children.

JOURNAL OF FERNANDO DEL BOSQUE, ROYAL STANDARD-BEARER, IN COMMAND OF THE EXPEDITION

April 30, 1675.—Left the town of Nuestra Senora de Guadalupe of this province in obedience to the order of the alcalde maior, Don Antonio Balcarcel Riva de Neira Sotomayor; traveled along the river below the town toward the north, and having reached a place called Pajarito, on the river, about six leagues from the town, we found it unpossessed and without any signs of having been recently inhabited. We took possession of it in the name of the king our master, Don Carlos II, whom God defend, and in sign of possession we erected a high wooden cross, and at this place we saw many fish in the river and caught some. We gave it the name of San Felipe de Jesus.

May 2, 1675.—On the first of May

left the place called San Felipe de Jesus, always traveling toward the north, along the same river for about four leagues, where it joined another stream, which we traveled along, still toward the north, leaving on our right hand in the direction of the sunrise a range of high hills with sharp peaks, and passing beyond them we reached the ford of a river called the Nadadores, which place we found unpossessed and uninhabited. We took royal possession of it in the name of the king. Today religious instruction was given to the Indians, who were fishing in the stream, which was full and swift. There were poplars and forests of mesquite along its banks. This place is about ten leagues from Sau Felipe. We erected a high wooden cross on the bank of this river and named the place San Francisco del Paso. We saw taken from this stream turtles and many large fish.

May 4, 1675.—Having left the place called San Francisco del Paso on the Nadadores, and having crossed the river and traveled toward the north, having all the time a high and long sierra on our left (this long chain rau from south to north), after traveling about four leagues we came to a creek at a long ridge; there was ruuning water in it, and our Indians called it in their language Toporica. We took royal possession of it in the name of the king, and in sign thereof erected a high wooden cross. We gave this place the name of Santa Cruz.

On the same day, month, and year, having left the place called Santa Cruz and having traveled about four leagues toward the north, still having the said chain of mountains on the same side of us, we reached a creek below a ridge and in front of a peak. There was running water in it and a growth of tule. We took possession of this place in the name of the king and gave it the name of Santa Catalina Martyr. We erected a high wooden cross and performed the other acts necessary to the assertion of our rights of possession. Religious instruction was given to the Indians.

May 5, 1675.—Left said place called Santa Catalina Martyr and traveled about six leagues toward the north, having the sierra already mentioned always in the same position. We reached a broad river with groves of very large poplars, cedars, and mesquite, with extensive and beautiful plains of green grass; a delightful place. The Indians said it was called the River Savinas, or, in their language, Muero. We gave it the name of San Antonio. It was uninhabited. We took possession of it in the name of the king, our master, and in sign thereof erected a high wooden cross. There were fish of all kinds in this river and in abundance. Religious instruction was given to the Indians by the missionary fathers.

May 7, 1675.—We left the Rio San Antonio and traveled toward the north. About 12 leagues from said Rio San Antonio de Savinas we came to a watering place, to which we gave the name of San Ilefonso. We found it uninhabited, with only the ruins of two grass huts. We took possession of it in the name of the king, our master, and in sign thereof erected a high wooden cross. We gave this place the name of Sau Juan Evangelista. The missionary fathers gave religious instruction to the Indians.

May 9, 1675.—Having left the place called San Juan Evaugelista and traveled toward the north about 6 leagues, across a plain with clumps of mesquite trees, we came to another watering place, in which there was tule growing. It was between high ridges, with groves of oak trees. We found it uninhabited and took royal possession of it in the name of his majesty and for said conquest, aud we gave it the name of San Raymundo de Pena Fuerte, and in sign of possession erected a high wooden cross. Religious instruction was given to the

Indians by Father Dionisio San Buenaventura.

May 10, 1675.—Having left the place called San Raymundo and traveled toward the north about 3 leagues, we reached a river that ran from west to east, which our Indians said was called Agua Azul (Blue Water). There were a great many fish in this river of all kinds, and it was a very beautiful place, with many poplars, willow, mesquite, and guisache trees and plains of green grass. It was uninhabited and we took possession of it in the name of the king, our master, and in sign thereof erected a high wooden cross. We called this river Rio de San Josefa. The missionary fathers gave religious instruction to the Indians.

May 11, 1675.—Having left the place called Rio de San Josefa and traveled about 3 leagues toward the north, through a very grassy plain, with many mesquite trees, we reached a very broad, full, and swift river, its width being about 400 varas. This our Indians said was called the Rio del Norte. We found it uninhabited and deserted but for a few ranches of those Indians who construct their huts of grass; as we had traveled above the ford, our Indians determined to cross where the river was divided into three streams. It was necessary to construct rafts of wood to cross over the middle one. In crossing the first the water reached above our stirrups and almost to the covers of our saddle trees. It was 200 varas wide and a vara and a half in depth all the way through, and there were willow trees on its banks and on an island in the middle. It was very pleasing, and there were many large fish and turtles caught, to which we bear witness, having held them in our hands. We took possession in the name of the king, of said river and territory. This stream appeared to run from west to east. We gave it the name of San Buenaventura, and in sign of possession erected a high wooden cross. Father Dionisio San Bueuaventura gave religious instruction to the Indians.

May 13, 1675.—Having left the place called Rio San Buenaventura del Norte and traveled toward the north about 4 leagues, we reached a creek between some ranges of hills, where we found 54 Indian warriors of the Yoricas and Jeapes tribes, with loads of buffalo meat. We examined them through Don Augustin, the interpreter, in their language and the Spanish. Having asked them many questions, they said they had come to kill buffalo to get meat for the sustenance of their families and ranches, and having no food in their country, necessity had compelled them to come so far in search of it; that there was a great number of them, they could not say exactly how many; that they desired to become Christians and to be placed in settlements and receive religious instruction from the missionaries; that the fear they had of other tribes, who were their enemies, had prevented their going to seek them; that two of their number had been killed, those who had done this being the Ocames, Pataquakes, and Yrbipimas; and that in proof of their submission to the king, our lord, they would go with us as far as the Indian tribes of the Sierra Dacate and Yacasole, and they would send to their ranches for their people to come out to wherever our chaplain could give them religious instruction. We named this place San Gregorio Nasianseno.

May 14, 1675.—We started, having with us the Indians of the Yoricas and Jeapes, already mentioned, and traveled from the place called San Gregorio Nasianseno for about three leagues toward the north. We reached a watering place in a plain without other trees than mesquite. We found it uninhabited and unpossessed. We took possession of it in the name of the king, and in sign of possession thereof erected a high wooden cross and named the place

San Bisente Ferrer. The missionary fathers gave religious instruction to the Indians.

On the same day and in said province and place called San Bisente Ferrer, the Indians and Spaniards killed two buffalo for our people to eat; the form of these animals is very ugly; they resemble bulls and cows; the skin is covered with wool; their shoulders are high, which makes them look humpbacked; they have a short neck and their heads are covered with long woolly hair, which hangs over their eyes and interferes with their seeing well. Their horns are short and thick, but like those of a bull; their rump and buttocks are shaped like those of a hog; their forefeet and knees, and from there up until the junction with the shoulders, are covered with long woolly hair, like the beard of a goat. Their tail is naked to near the end, where it has a heavy tuft of hair. The females had four teats. They were about the size of neat cattle; they looked at people in a sidelong way like wild boars.

In this same place, San Bisente Ferrer, on this same day and month and year, before me, Fernando del Bosque, lieutenant of the alcalde maior, appeared an Indian chief of the Bibit nation, who said he was a Christian and had been baptized in Saltillo, and another Indian, who said he was chief of the Jume nation. They were examined through the interpreter, Don Lazaro Augustin, in their language and the Spanish language. Being asked several questions, they said they had desired for a long time to become Christians, and some of their people had gone to the town of Saltillo and succeeded, but the greater number of them were unable to go, for it was far and they could not bring their people, for which reason many of them had died from smallpox without receiving the waters of baptism, and they wished and asked to be gathered together in a settlement and to receive instruction in the Christian doctrine. This they had not been able to do themselves; nor had they been able to join the remainder of the tribe for fear of the barbarous Indians, who would kill them and the people they had with them, being one hundred and five persons, great and small—fifty-five warriors and the remainder women and children.

In said place, San Bisente Ferrer, on said day, month, and year, before me, said lieutenant, appeared six Indian warriors who said they belonged to the Pinanacas, Xaeser, Teneinamar, who are of the party of Don Estaban, Gueiquesale. They were examined by Don Lazaro Augustin, interpreter, in their idiom and the Spanish language. Being asked why they had come to see me, they replied that they had come in the name of their chiefs and to make homage to his majesty the king, and that they wished to live under the Christian doctrine and to remain in a settlement.

May 15, 1675.—Having left the place called San Bisente Ferrer with our company, the missionary fathers, Spaniards and Indians, we traveled toward the north, and reached a river about four leagues from the place called San Bisente Ferrer, which our Indians said was called in their language Ona, which means salty. We took possession of it in the name of the king, and in token thereof erected a high wooden cross. We named this place San Isidro Labrador. We found many live oak and mesquite trees and herds of buffalo, fine pasturage, and many fish in the river. It was uninhabited.

In said place and said province, said day and year, in said place called San Isidro Labrador, before me, said lieutenant, appeared the chiefs, Xoman, Tereodan, Teaname, Tumamar, with their people, whom we examined through sworn interpreters acquainted with the Mexican and Castilian languages, these being Don Lazaro Augustin, governor of the pueblo of San Miguel de Luna, of the town of Guadalupe, of this province, and Pascual, an Indian. These chiefs were each asked questions apart from each other to see if what they said agreed, and they all said that they were heathen, without knowledge of the true God or what He was; nor did they know anything of the true way of salvation and were without light in regard to it; that they wished to become Christians and to be baptized with their children and their wives and to live as such in the settlement or settlements in which they might be placed, and though they were too old to enjoy it themselves, their children could, and they would raise them as Christians and they would continue in the same way, and from this time they gave their allegiance to the king, our master, Don Carlos II, and they would be friends to the Spaniards. At this they all shouted, "*Viva, Viva, Viva*, the King, our master!" and from what I observed, with much sincerity and zeal. In the name of the king I received them under the royal protection, and assured them on the part of the king that all would be accomplished, and I demanded that on their part they should live quietly and peaceably and assemble for catechism at the place most convenient to them. Because of the distance from their habitations and of the dissensions that existed between the barbarous tribes in the territory, the one against the other, and which lead to their killing each other, and not having the means of feeding so many people myself, I told them to remain for the present in the most convenient place. They said through the interpreter that they would do so. Their people came up and went and kissed the sleeves of the habits of the missionaries, Fathers Juan Larios and Dionisio de San Buenaventura, and asked permission to give them an offering of what they had, in thanksgiving to God for having opened to them the way of truth. They then placed on the ground, some a piece of lard, some a piece of tallow, and others the skins of animals, such as they use for clothing, beds, and covering.

In said place and river of San Isidro, in said province, on the 16th day of May, 1675, we erected a portable altar with fittings for the purpose of celebrating mass, and at the sound of a little bell all the people came to be present at it and to hear mass chanted by Father Juan Larios. All the people attended, and when it was over they begged Father Larios to baptize them. He made them understand by the interpreter that he could not do this until they had learned the prayers, and he consoled them by baptizing fifty-five children at the breast, the Spaniards being sponsors for them. Religious iustruction was given them, and acount, was made of those with the four chiefs and they numbered four hundred and twenty-five warriors and seveu hundred and forty-seven women and children of all ages, making a total of one thousaud one hundred and seventy-two.

At said place of San Isidro, on said day, month, and year, I, the lieuteuaut of the alcalde maior, installed in possession of his ministry, as comiserio misionero, Father Juan Larios, in accordance with the royal provision.

On said day, month, and year, and at said place, before me, said lieutenant of the alcalde maior, appeared an Indian of the Guiequesale nation, and brought into my presence a Spanish boy, who appeared to be about twelve years old. He had a line on his face, marking him from his forehead to his nose, and two lines on his cheeks, one on each, aud rows of them on his left arm and one on the right. Having examined said Indian through the interpreter, D. Lazaro Augustin, aud the Indian, Pascual, also an interpreter, he said, being asked where he had gotten the Spanish boy, that his, the said Indian's, mother had raised the boy; that many years before the Cabesas had brought him with others from Yndee, near Parral, and had given him to his mother, and that he loved him as his own brother, and he had brought him to the Spaniards as a proof of friendship and in order that he might be sent to his own parents. The boy was not examined at this time as to how many more Spaniards the Indians had because he could not speak the Spanish language. Only said Indian was asked if there were more Spanish children among the Indians. He said that said Cabesas Indians, when they had brought this one, had another boy and a girl, and they killed the boy with their arrows, having placed said boy standing up, and he saw that he clasped a cross in his hands, and that he recited prayers and was praying until he died; and that the Spanish girl they kept with them to serve them, and that in a raid the said Cabesas made to rob and kill, one of their own number was killed, and they took the girl and shot her with arrows until she was dead, and they left her lying in that place, and that two years afterward he passed that place and found her just as she had been left; her body had not become corrupted nor had the animals eaten it; and, seeing that, he had taken her up and carried her to a cave, where she now was, and that she had very long hair, and he knew no more than this, which was the truth.

May 18, 1675.—In said province I, said alcalde maior, having left said place called San Isidro and traveled about 8 leagues, more or less, toward the north, and having reached a place and a small stream which was said to be called Dacate, found it abandoned and uninhabited. We took possession of it in the name of the king, and we gave it the name of San Bernardino, and in sign thereof we erected a high wooden cross; and this day came before me the chief of the Geniocane tribe of Indians, who said that he was awaiting the missionaries, with his people in another place further on, so that they might receive religious instruction, and the reason they had not come was because of the number of their enemies, who would not allow them to pass and seek succor, and, above all, they killed one another; and upon this the missionaries determined to grant their petition and give them religious instruction and spiritual assistance.

May 20, 1675.—Having left the place called San Bernardino in compauy of said fathers, comisario misionero and capellan gobernador, aud Indians, and having traveled about 8 leagues toward the north and in said district, said Indians that had come out to receive us reached their village or assistencia. It was on a stream, between two ridges, where there were many arbors of grapes growing like wild grapes, and the green grapes were very large, like those of Castile, and there were a great many of them, like a vineyard. We took possession of it in the name of the king, and in sign thereof erected a high wooden cross. Religious instruction was given to the Indians by Father Dionisio San Buenaventura.

May 21, 1675.—In said province and said place, already mentioned, which we gave the name of San Jorje, I, said lieuteuant of the alcalde maior, bear witness that said fathers comisioneros ordered an altar to be erected, and on it the father Dionisio de San Buenaventura offered the holy sacrifice of the mass, and said Geniocanes Indians assisted at it, with those of the other tribes, and after mass they received religious instruction from Father Juan Larios; and having counted them there were sixty-five warriors and one hundred and thirteen women and childreu, making a total of one hundred and seventy-eight persons of said Geniocane tribe, all of whom desired to become Christians, and asked the father Comisionero to let them become Christians, and he consoled them by telling them when they had learned how to pray he would baptize them. On this day the said comisario misionero took possession of the exercise of his office.

May 23, 1675.—In said place of San Jorje, I, said lieutenant of the alcalde maior, having recognized how great was the number of Indians desiring to become Christians and to be placed under religious instruction, and in villages and settlements, as each day there came to me chiefs from the various tribes, and as they are all far from the town of Guadalupe and enemies to each other, yet all wish to be instructed in the Christian doctrine at the same time,, and as they gather together according to their barbarous feuds, and fight and kill each other. (The country is apparently divided into three parts or tracts. The country which reaches from Guadalupe to the north, on the left hand, is under the control of Don Estaban, chief of the Guiequesale, and that in the center is peopled by the followers of Juan de la Cruz, captain of the Bobole nation, and that on the right hand, occupied by the Catujanos, Tilijæs, Apes, Pachaques, with their followers among the Indians) and all wish to receive religious instruction from the missionaries and Spaniards, and they are in the midst of enemies, and we were unable to carry out their wishes, I determined to return to the town of Guadalupe and make a report to the alcalde maior.

May 25, 1675.—In said province I, the lieutenant of the alcalde maior, having left the place called San Jorge in said company of the comisario misionero and the chaplain and traveled about 14 leagues toward the north, reached a small creek with many groves of trees. We found it deserted and uninhabited. It was between high-peaked ridges. We took possession of it in the name of the king and erected a high wooden cross in sign of possession. We gave it the name of San Pablo Ermitano. Religious instruction was given to the Indians by Father Dionisio San Buenaventura, and he asked the Indians of the four chiefs, already mentioned in the report, at San Isidro and followers of Don Estaban if they would remain quiet in their territory and not fight and kill each other, and would congregate themselves together under their principal chief, and these chiefs said that they would remain quiet, waiting until a missionary should be sent to them to instruct them, and in the meantime they would assemble in pueblos.

May 29, 1675.—In said province I, said lieutenant of the alcalde maior, having left the place called San Pablo Ermitano on our return to the town of Guadalupe in company of said missionary fathers, the Spaniards and Indians reached another point of the Rio San Buenaventura del Norte, where we found a part of the Indians of the Boboles tribe with their women and children, who were there killing buffalo for their subsistence. It was some time since they had left their pueblo. They were asked if they would join with their chief and others of their tribe and receive religious instruction from the missionaries, and they agreed to this.

June 1, 1675.—In said province I, said lieutenant of said alcalde maior, having left said Rio de San Buenaventura and traveled about 20 leagues toward the west, reached a river which was said to be called the Nueces, where we found the chiefs of the Bocora and Pinanaca at some springs of water with many walnuts and groves of different kinds of trees. We took possession of it in the name of the king, and in sign thereof erected a high wooden cross. Religious instruction was given to the Indians by Father Juan Larios, and an altar was erected under a cover of branches and Father Dionisio San Buenaventura said mass, and at the sound of a bell the people congregated to recite the prayers. A count was made of the followers of the Bocora chief there, and they numbered 150 persons—62 warriors and 88 women and children—and in this place I gave him* possession in all that related to his ecclesiastical administration.

June 10, 1675.—In said province I, the lieutenant of the alcalde maior, having left the river and place of Senor San Diego, in said company of the comisario misionero and the chaplain, Spaniards and Indians, and traveled about twenty-two leagues, passing through the valley of the Rio San Antonio de Sabinas, we entered through an opening of one of the large sierras, called Obayas, and reached a creek, which we found deserted, uncultivated, and uninhabited. We took possession of it in the name of the king, for this conquest, and gave it the name of San Anbrosio, and in sign of possession we erected a high wooden cross, where the comisario misionero said mass, at which the Contore chief, Don Bernabe, with his people was present, and after mass religious instruction was given to the Indians by the comisario misionero. We counted this nation and they numbered 78 warriors and 130 Indian women and children.

June 12, 1675.—In said province I, the said lieutenant of the alcalde maior,

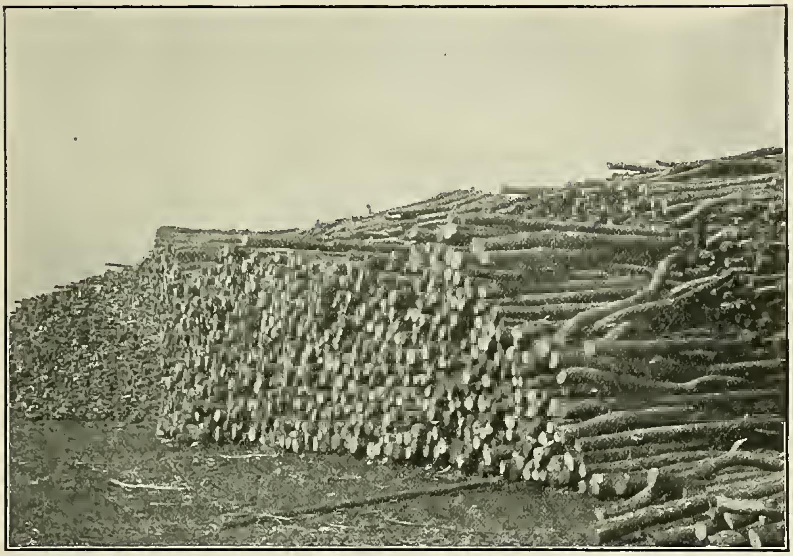
*The comisario misionero.

having left the place called San Anbrosio, and traveled about 14 leagues as it appeared, and toward the city of Guadalupe, and opposite it, at the foot of a high sierra, and toward the west of it, in company of said missionary fathers and Spaniards, we reached a water hole, deserted and uninhabited. We took possession of it in the name of the king, and in sign of possession erected a high wooden cross and named the place San Bartolemé. At this place came into my presence Don Salbador, chief of the Bobosarigami, with some of his people, who said he had sent for the remainder of his people, who had scattered for want of food. They were given religious instruction by the comisario misionero, Father Juan Larios, and afterward they were counted, and they numbered 44 warriors and 75 women and children with the Tetecores; and they were directed to unite with the others, under Don Bernabe and Don Estaban. To all of which we bear faith and sign with said fathers and our assisting witnesses, who were Anbrosio de Berlanga and Diego Luis Sanchez, Fernando del Bosque, Fr. Juan Larios, Fr. Dionisio de San Buenaventura, Diego Luis Sanchez, Anbrosio Berlanga.

On June 12 the expedition returned to the town of Nuestra Senora de Guadalupe, and the royal standard-bearer, Fernando del Bosque, reported to the alcalde maior and conquistador, Don Antonio Balcarcel Rivadaneira Sotomayor.

THE HARDY CATALPA

ONE of the most important and interesting efforts of the Bureau of Forestry is to encourage landowners to start plantations of commercially valuable trees. A large plantation of useful trees, such as the Hardy Catalpa, a few years after planting, will yield each year in posts and stakes about as large and regular a return on the original investment as an orange or fruit plantation. There are a number of Hardy Catalpa plantations in Kansas, Iowa, and Nebraska which for several years have been paying their owners very good profits. The tree grows rapidly, and is exceedingly durable. The



From Wm. L. Hall, U. S. Department of Agriculture

Posts from the Planting of 1890, Yaggy Plantation

Bureau of Forestry has made a special study of the Hardy Catalpa, and recently published an interesting little book describing the tree, by Mr William L. Hall. The following paragraphs are an abstract of the report:*

Forest planting on the prairies west of the Mississippi River began with the earliest settlers. To plant trees for protection from sun and wind seemed one of the first and most important things to be done, and with the building of a house and the breaking up of a garden patch it formed a part of the settler's first summer's work. Each year thereafter, as time and means permitted, the plantation was increased. Scarcely a decade passed before extensive groves for the general purposes of shelter and ornament appeared on almost every farm. The success of these proved that the want of the natural forest could in part be supplied by planted timber.

The growing of forest trees for other farm needs, such as fuel, posts, and poles, was also practiced by many settlers, for the prices of these materials were extremely high in the districts far from the natural forest. The idea of growing posts and poles to sell, however, did not meet with approval for a number of years. It was too long an investment to be attractive in a country just settled. About twenty-five years ago a few men, impressed with the prevailing high prices of such materials and believing it possible to produce them in plantations within fifteen or twenty years, began to plant timber as an investment. Their example encouraged others to plant for the same purpose, and as a result of the work there are now in the Middle West quite a large number of commercial plantations, in some of which the marketing of products has already begun.

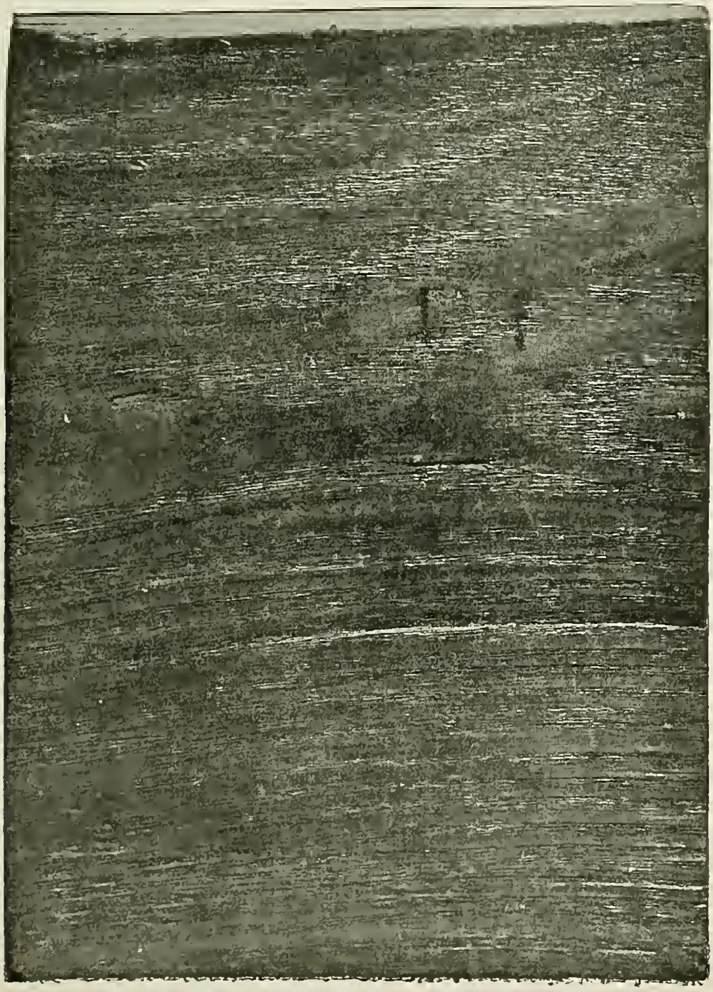
*The Hardy Catalpa By William L. Hall, Superintendent of Tree Planting. With 30 full-page plates. Bureau of Forestry, U. S. Department of Agriculture, Bulletin No. 37.

From Wm. L. Hall, U. S. Department of Agriculture

Trees which were not Cut Back when Young. Planting of 1891

Many side branches and crooked form the result

Of the trees used for commercial planting none have been planted more extensively in the region of southern Iowa and Nebraska and eastern Kansas than the Hardy Catalpa. In its native habitat along the lower Wabash and Ohio Rivers this tree nearly a century ago gained a reputation for rapid growth and durability. A few years' trial on the plains sufficed to prove its good qualities for that region. It was easily propagated, grew rapidly on prairie soil, had good form, was drought resistant, had few insect or fungous enemies, and above all was a lasting timber, adapted to many uses. Such good qualities soon



From Wm. L. Hall, U. S. Department of Agriculture

Wood of the Hardy Catalpa After Lying Ninety Years in Water

Block from a tree which grew near New Madrid, Mo., and was felled by the earthquake of 1812. It was taken out of the water a short time ago and worked into fence posts

From Wm. L. Hall, U. S. Department of Agriculture

A 20-Year-Old Plantation of Hardy Catalpa, Southern Iowa brought it into general recognition. In the regions named it took the lead as a commercial tree, especially for such purposes as fence posts, telegraph and telephone poles, and railroad ties.

Its value for most of these purposes has been quite fully demonstrated. As a post timber it has given excellent satisfaction. It ranks with Black Locust and Osage Orange in durability, while it surpasses them in rate of growth, form, penetrability, and freedom from checking. Altogether, as a post timber suitable for growing in a large section of the Middle West it has no equal. For telegraph and telephone poles its only deficiency seems to be a tendency toward crookedness, but possibly this can be overcome by special treatment. As a railroad-tie timber the Hardy Catalpa has not had sufficient trial to demonstrate what its rank should be. Experiments have left no doubt as to its resistance to decay. The only question lies in its resistanee to wear. So far as tried, it does not stand the wear and tear of a railroad track so well as White Oak, especially under heavy traffic. In the Middle West, however, the traffic on many railroads is comparatively light, while the decay of timber is particularly rapid. Under these peculiar conditions Catalpa will probably outlast Oak as a tie timber. The main commercial plantations of Catalpa are in Iowa, Kansas, and Nebraska. Kansas especially has a number of large and highly successful plantations.

EXPLORATIONS IN TIBET

AN interesting account is given in a late number of the *N. Y. Tribune* of some recent explorations in the heart of Tibet by a Russian subject, G. Z. Zoubikov, who succeeded in residing quietly at Lhassa for some months. Zoubikov's success deserves especial credit in view of the recent unsuccessful attempts to enter Lhassa by Sven Hedin and Colonel Kozloff.

M. Zoubikov is a Bouriat and a graduate of the Oriental Faculty of the University of St Petersburg. As a born Buddhist and familiar from childhood with Tibetan, he found no difficulty in passing for a llama. He brought back a great number of photographs and other illustrations of the life of the country, and his book, which will soon be published, will contain much information hitherto unobtainable.

M. Zoubikov made an extended report of his journey at a meeting of the Geographical Society a few days ago. He was immediately awarded the Przhevalsky prize, which is conferred in honor of the first Russian Tibet explorer.

The frontiers of Tibet, which were closed to European travelers after the French explorers Huc and Gabet were expelled from Lhassa, in 1846, have not been absolutely shut against a certain portion of Russian subjects, namely, the Buddhistic Bouriats of the Baikal region. The Bouriats are talented people, and the same value attaches to M. Zoubikov's observations as would be the case were he a European. His stay lasted over a year.

In the summer of 1900 M. Zoubikov entered Tibet from the north as a member of a caravan of seventy pilgrims, including many llamas. He approached central Tibet by the Boumza Mountain, where Przhevalsky was turned back in 1870. The road led through a treeless country with snow-topped mountains extending east and west in parallel chains. The people in this region were few and nomadic. An agricultural community was found within only sixty or seventy miles of Lhassa.

CLIMATE AND POPULATION

The climate was found to be harsh and dry. Snow falls occasionally from December to March; rain from May to August. April, September, October, and November are dry. The medium annual temperature was found to be 42, 67, and 50 degrees Fahrenheit for morning, noon, and night respectively. The data for December was 17, 34, and 27 degrees, and for July 60, 77, and 65 degrees.

The population, which has at times been estimated at 33,000,000, is probably about one-tenth of this number. It is decreasing through disease, particularly smallpox, and on account of the large number of celibate priests.

The sons of Chinese soldiers and merchants temporarily resident in Tibet are counted Chinese, the daughters Tibetans. Other foreigu residents are Indians from Cashmere and Mongolians and Tibetans from Nepul, the latter being skilled artisans, architects, sculptors, and jewelers. The Cashmere Mahometans are traders. They usually convert their Tibetan wives.

Almost all the land in central Tibet belongs to the Dalai Llama. Only high officials in Lhassa have hereditary homes. The Tibetan houses are of brick and stone, and have chimneys only in the kitchen. The other rooms have holes to let the smoke escape, and are cheerlessly cold. Dried dung is the principal fuel.

The common folks wear white, the wealthy red, officials yellow, and soldiers blue clothing of homespun. Jewels are worn in great abundance by the women. Barley meal, soup, the raw flesh of the yak and of sheep, butter, sour milk, and vegetables are main items of the diet. Wheat spirits sell for a cent a bottle. Men smoke tobacco and the priests take snuff.

PEOPLE RELIGIOUS AND IMMORAL

The people of central Tibet are passionately attached to their religious observances, which are purely formal. Prayers are regarded as of magic potency and figure in all ordinary and extraordinary affairs of life. Medicine is in small popular favor. Morals are primitive, and marriage ties are loose. Both polygamy and polyandry are common.

Agriculture and cattle-raising are the principal employments. Wheat, barley, peas and beans, cattle, sheep, yaks, horses, asses, and mules are the main products. Yaks and asses are used as pack animals. Labor is cheap, men being paid two or three cents a day, while women usually serve for their food and clothing. Even a llama receives only ten cents for a whole day's prayers. Sheepskins, cattle, yak tails, statues, books, and yellow llama caps are exported. The yak tails serve as horse tails in the outfit of Turkish pachas. English and Indian cottons and woolens and copper and enamel utensils are introduced from India and tea, silks, cottons, horses, and asses from China.

EXHAUSTING METHOD OF WORSHIP

Lhassa was built in the seventh century. It has a picturesque location on the southern slope of a mountain, with luxurious gardens on the west and south. The Uitchu River passes to the south of the city. Dikes and canals have been constructed as protections against overflows. A fine, broad street around the city serves for religious processions and penitential exercises. Penitents go the length of this street, falling to the ground every five or six feet, so that in a day they prostrate themselves about 3,000 times. The city is small, having at most only 10,000 regular inhabitants. It is, however, an important trade center. The native traders are all women.

The Temple of Buddha, in the center of the city, is about 140 feet square. It is three stories high and has three gilded Chinese roofs. It shelters a gigantic bronze statue of Buddha, which has a hammered gold and jeweled headdress. A sacrificial fire, fed with melted butter, burns before the statue. Other statues and relics are kept in other chambers of the same temple, among which is the statue of the Goddess of Women, to which are offered spirits and wheat. The wheat is at once eaten by mice. In the same temple are also rooms for the Dalai Llama and his council.

The residence of the Dalai Llama is about a mile away from Lhassa, on Mt Bodala. It was built in the seventh century. Near by is the old castle Hodson-Bodala, which is 1,400 feet long and nine stories high. Here are the treasury, the mint, the schools of theology and medicine, quarters for 1,200 officials and 500 monks, and a prison. As many as 1,000 priests take part in religious processions to this mountain.

M. Zoubikov also minutely describes various monasteries and temples, including three near Lhassa, where 15,000 monks are mainly engaged in learned pursuits. At one of these—Brabun—nearly 6,000 boys, young men, and even gray-bearded patriarchs are studying theology, the total number of resident monks being 8,000.

SELECTION OF THE LLAMA

Tibetan Buddhism, brought from India in the seventh century, struggled against the native Shamanism until the ninth century, when a compromise was agreed upon. According to the current teaching, there are many spirits which are continually reincarnated in men. The Dalai Llama is the living Buddha. Another defender of the faith is the spirit Choidshen, whose power is manifested through pious ascetics who spend their lives in contemplation.

Since the fifteenth century all power, civil and spiritual, has been nominally in the hands of the Dalai Llama, but China maintains a Manchu resident and an army. In order to avoid strife in selecting a Dalai Llama, the electoral council places three strips of paper with the names of three boys in an urn, and the Manchu resident removes one with a small staff. The new Dalai Llama's education is intrusted to a college of learned men. Until his twenty-second year the government is in the hands of a regent appointed by the Emperor of China. The present Dalai Llama is twenty-seven years old. He is the fifth since 1806, one of the regents having continued in authority for an unusually long time, owing to three children selected to be Llamas having died before attaining majority.

The Dalai Llamas' Council, in whose hands is the actual power, embraces four so-called "Galons," appointed by the Emperor of China. The administration is in the hands of a closed aristocracy, and bribery and corruption are nearly universal. Among the common penalties are drowning, torture, flogging, banishment, and fines. The Tibetan army of four thousand men is poorly disciplined, and is armed with bows and old fashioned guns. Robbery flourishes.

GARDENING IN NORTHERN ALASKA

By MIDDLETON SMITH

PROBABLY the first experimental gardening in Alaska, north of the Arctic circle, was done by the International Polar Expedition to Point Barrow, Alaska, 1881–1883, which was organized for the purpose of coöperating in the work of circumpolar observation proposed by the International Polar Conference. The main object of the expedition was the prosecution of observations in terrestrial magnetism and meteorology. Experimental gardening was an elective investigation.

The arctic night at Point Barrow, which is of 70 days' duration, ends at noon on January 23, when the upper edge of the sun's disk appears above the southern horizon. The next day the entire disk is visible. Each succeeding day the sun rises a little earlier and a little more to the east of south, and sets a little later and a little more to the west of south, and finally, when the day and night are of equal length, it rises directly in the east and sets in the west. The day continues still to lengthen and the night to shorten until the middle of May, when the midnight sun appears above the northern horizon and the long arctic day begins; the sun then remains above the horizon both day and night for 70 days, or until July 24, when it dips its lower disk at midnight below the northern horizon, and night and day again begin. But at no time are the sun's rays at Point Barrow vertical. The maximum altitude is 42° 3′, which occurs at noon on June 22.

The snow does not begin to melt until after the sun remains continuously above the horizon, and does not disappear before July, but the land close to the coast is practically free from snow by the fifth of June. The snowfall is very light, the depth on the land along the coast at no time exceeding 15 or 18 inches. The total annual precipitation—rainfall or melted snow—is only eight inches.

A level treeless area (tundra) occupies the entire Point Barrow region. The subsoil, principally sand and gravel, perpetually frozen, is covered on the tundra generally by a light, clayey soil, and at spots near the coast by a dark, loam-like soil, which thaws to a depth of from 3 to 9 inches. Upon the latter soil, within 200 yards of the ocean water line, the gardening described in this article was done. The soil has been enriched somewhat by refuse from Eskimo iglus, or permanent dwellings, which many years previous existed there. The garden was dug to the depth of about 4 inches and raked. No other preparation of the soil was made, and no further attention was given to the garden from the time of seeding to harvest day.

On June 13 the seed of lettuce, radish, and mustard were sown. By this date caterpillars, worms, flies, and beetles appeared; ranunculus flowers were in bloom. June 21, one day before the sun reached its highest altitude and eight days after the date of seeding, the lettuce and radish germinated, but the mustard failed of germination. By this date additional species of flowers, including the daisy and the willow, were in bloom, and the pools of fresh water, which had formed on the tundra from rain and melted snow, were fairly alive with insect life, upon which the red phalarope was feasting.

The following table shows the temperature, precipitation, and weather from date of seeding to germination:

Month.	Temperature.			Precipitation.	State of weather.
	Max.	Min.	Mean.		
	° F.	° F.	° F.	*Inches.*	
June 13	36.1	31.8	34.25	0.00	Foggy.
14	37.0	32.0	34.52	0 21	Cloudy.
15	35.0	31.9	33.75	0.12	Foggy.
16	35.2	29.1	32.41	0.00	Foggy.
17	36.9	29.0	34.20	0.00	Foggy.
18	45.2	30.9	38.55	0.00	Clear.
19	41.5	35.1	38.94	0.01	Cloudy.
20	38 9	33.0	35.57	0 05	Cloudy.
21	35.3	31.0	33.52	0.02	Cloudy.

The minimum temperature was below freezing seven days out of the nine required for germination. The maximum was above 40° on only two days.

The mean daily temperature, from hourly readings, ranged from 32°.41 to 38°.94, the general average mean for the entire time being 35°.08. The total precipitation was 0.41 inches. The state of the weather was cloudy or foggy, excepting one day, when it was clear. Flurries of snow were not infrequent.

On July 10, twenty-seven days after seeding and nineteen days after germination, harvesting began. The lettuce leaves were from 1 to 2 inches in width and from 3 to 4 inches in length. The radishes, spherical in form, were from ½ to 1 inch in diameter. The condition of these vegetables at the time of harvest was perfect. The quality could not be excelled by any grown anywhere in lower latitudes, Antarctica, by inference, excepted.

Table Showing Temperature, Precipitation, and Weather from Date of Germination to Harvest.

Month.	Temperature.			Precipitation.	State of weather.
	Max.	Min.	Mean.		
	° F.	° F.	° F.	*Inches.*	
June 22	34.3	26.8	30.92	0.01	Cloudy.
23	33.2	29.0	31.85	....	Fair.
24	37.3	30.1	31.54	....	Clear.
25	53.5	34.0	43.00	0.00	Fair.
26	38.8	32.0	33.92	....	Cloudy.
27	33.7	29.6	32.27	0.03	Cloudy.
28	34.9	29.3	32.29	....	Cloudy.
29	37.5	29.8	34.20	0.00	Cloudy.
30	40.6	32.0	35.14	0.00	Foggy.
July 1	43.4	32.2	39.10	0.02	Cloudy.
2	48.7	34.0	42.18	0.00	Fair.
3	39.8	31.6	35.37	0.03	Cloudy.
4	41.2	32.2	37.72	0.00	Cloudy.
5	47.4	33.2	41.50	0.00	Fair.
6	46.7	39.8	43.97	0.00	Fair.
7	60.6	42.2	53.35	0.00	Clear.
8	49.0	36.2	44.28	0.00	Clear.
9	43.4	29.8	35.98	0.04	Foggy.
10	55.2	37.3	46.51	0.00	Clear.

During the nineteen days required for the crops to mature the minimum temperature was 32° or below for nine days. The maximum temperature was 50° or above for three days only. The mean daily temperature, from hourly observations, ranged from 32°.92 to 53°.35, the general average mean for the entire time being 38°.16. The total precipitation was 0.13 inches. There were 4 clear, 5 fair, and 10 cloudy or foggy days.

A study of the conditions under which the plants germinated and matured is not only curiously interesting, but suggests that there was some stimulating force—perhaps the large amount of atmospherical electricity—which caused them to arrive at maturity in a much shorter period than those grown in temperate zones. Whatever the agency, inasmuch as the summer season is so very brief, it is absolutely necessary that plant life in the north should arrive at maturity very quickly in order to perpetuate the species.

The vast tundras of northern Alaska are nature's gardens—the most extensive, the least cultivated, the most productive of any on the American continent. Every summer continuous beds of flowers on these level treeless areas extend north from the Arctic Circle to the shores of the ocean. True, the flowering plants are lowly in stature, but they are not pitiful or frost pinched as might be supposed. True, they keep close to the frozen ground, as if in love with mother earth, but they display masses of color—yellow, purple, and blue—so bright as to make them visible at great distances ; and in the fall of the year their ripe foliage and the golden sunshine cause the tundras to fairly glow in rich colors—red, purple, and yellow—still further intensified by the varied colors of the ripening berries growing almost everywhere, all blending harmoniously with the neutral tints of the ground lichens and mosses, on which they seem to be painted.

EXCAVATIONS AT ABYDOS

THE following letter from Prof. Flinders Petrie to the *London Times* outlines his work at Abydos during the present year :

To the Editor of the *Times :*

SIR : The continuation of the work of the Egypt Exploration Fund at Abydos this year has given a wider view of the early civilization, of which the general lines had been fixed by the previous work on the Royal Tombs and the town. The clearance of the old temple site over several acres has brought to light, in a depth of about 20 feet, no less than ten successive temples ranging in age from about 5,000 to 500 B. C. For the first time we can see on one spot the changes from age to age through the whole of Egyptian history. To separate these buildings was an affair of anatomy rather than spade work ; the walls of mud brick were so commingled with the soil that incessant section-cutting with a sharp knife was the only way to discriminate the brickwork. Often only a single course of bricks or a thin bed of foundation sand was all that told of the great buildings which had existed here for centuries. Over 5,000 measurements were taken for the plans and levels. The main result as regards the religion is that Osiris was not the original god of Abydos ; the jackal god, Upuaut, and then the god of the West, Khentamenti, were honored here down to the XIIth dynasty. The most striking change is seen about the IVth dynasty, when the temple was abolished, and only a great hearth of burnt offering is found, full of votive clay substitutes for sacrifices. This exactly agrees with the account of Herodotus that Cheops had closed the temples and forbidden sacrifices. This materializing of history is made the more real by finding an ivory statuette of Cheops of the finest work, which shows for the first time the face and character of the great builder and organizer who made Egyptian government and civilization what it was for thousands of years after. This carving is now in the Cairo Museum.

The discoveries of the civilization of the Ist dynasty, the beginning of the kingdom, expand what we already had from my work in the Royal Tombs. Of Menes, the founder, we have part of a large globular vase of green glaze with his name inlaid in purple ; thus polychrome glazing is taken back thousands of years before it was previously known to exist. The free use of great tiles of glaze for wall coverings shows how usual the art was then. In the highest art of delicate ivory carving there are several pieces of this age ; especially the figure of an aged king, for its subtlety and character, stands in the first rank of such work, comparable to the finest carvings of Greece or Italy. We must now reckon the earliest monarchy as the equal of any later age in such technical and fine art.

Pottery of forms and material quite unknown in Egypt also belongs to this remote age ; and it proves to be identical with that in Crete of the late neolithic age. This fresh connection illustrates the trade and the chronology of that period. A head of a camel modeled in pottery takes back its relation to Egypt some 4,000 years ; hitherto no trace of it had appeared before Greek times. An ivory carving of a bear extends also the fauna of early Egypt.

The great fort long known as the Shunet ez Zebib is now connected with the remains of another fort, which was discovered between that and the Coptic Deir, which is in a third fort. These buildings prove now to have been the fortified residences of the kings of the IId dynasty, whose sealings we have found in the dwelling-rooms.

Of a later age may be noted some

large decrees of the Vth and VIth dynasties, the oldest example of iron yet known, which is of the VIth dynasty, and in the XVIIIth dynasty a great memorial tablet of the grandmother of that line, and the remains of a cliff temple of the type of Deir el Bahri. These are but the salient points of a winter's work of much historical interest. The collection will be exhibited as usual at University College, Gower street, from July 1 to 25.

Unhappily, the growing lawlessness of Egypt, which Lord Cromer noticed in each of his recent reports, has affected our work, and "a large number of offenses, not very serious in themselves, but which cumulatively become serious, have been committed, and but too often have been committed with impunity" (Report, 1902, p. 40). A statue was stolen from my house, and though the footprint of the thief exactly agreed with the very peculiar foot of one of the men who were notoriously accused in the village, and all the links were named by witnesses, yet no conviction could be obtained; £35 are said to have changed hands as bribes over this. Next, my workmen from Quft were subject to a general conspired assault in the market and each robbed of his money at once; but no redress whatever could be obtained. The police officer added to the injury by taking away one man who had been beaten to see the doctor, who did nothing but detain him till he paid 10*s*. bribe to be let go. Last year the relations of a man who died of fever were mulcted of £6 by another doctor, and on my complaining the official inquiry resulted in giving an account which was absurdly false, to my personal knowledge.

It is impossible that the present machinery can work to elicit the truth. Witnesses are examined by petty officers, who dictate the final statement of evidence at their own will, and the witnesses are summoned through their sheikh, who is the first man to be "squared" by the offenders, and "who, they think, will assuredly, sooner or later, endeavor to wreak his vengeance on them" (Report, p. 36). Such a system—dating long before the British occupation—is the most perfect for facilitating bribery and the suppression of truth. This is not the place to discuss the remedies. Happily, Lord Cromer considers that "the points which most require attention are the police, the department of justice, and sanitation." I do not touch on more personal threats to our party and being fired at, as I only wish here to refer to the failure of justice. But matters have gone so far that we must look for safety to our own resources rather than to the law, which has in each case proved to us useless.

I remain your obedient servant,

W. M. Flinders Petrie.

University College, June 22, 1903.

GEOGRAPHIC NOTES

FOREIGN COMMERCE OF THE UNITED STATES IN 1903

THE foreign commerce of the United States in the fiscal year just ended is larger than in any preceding year in its history. The total of imports and exports, as shown by the Department of Commerce and Labor through its Bureau of Statistics, is, for the year 1903, $2,445,610,417, against $2,310,-937,156 in the year 1900, which was considered the banner year prior to 1903. Imports are larger than in any preceding year and exports are larger than in any preceding year save in the exceptional year 1901. The imports for the first time crossed the billion-dollar line, the total being $1,025,619,127, and the exports for the second time crossed the 1,400 million line, being $1,419,991,290, or practically 1,420 millions. The single year in which the value of exports exceeded those of 1903 is the fiscal year 1901, when the total was $1,487,764,991. The imports exceeded those of 1893 by about 159 million dollars and the exports exceeded those of 1903 by about 572 million dollars. The imports, therefore, have increased 18.4 per cent during the decade and exports have increased 67.5 per cent during the same period.

The growth in importation, which is the most striking characteristic of the year's commerce, is very largely in materials for use in manufacturing. Only eleven months' figures are yet available in such detailed form as to show the increase by great groups, but the figures of the eleven months ending with May show that articles in a crude condition for use in manufacturing increased 62 million dollars, or about 20 per cent, as compared with the corresponding months of last year; articles partially manufactured for use in manufacturing increased 4 million dollars, or about 5 per cent; articles manufactured and ready for consumption increased 18 million dollars, or about 13 per cent, and articles of voluntary use, luxuries, &c., increased 14 million dollars, or about 12 per cent, while articles of food and live animals increased 15 million dollars, or about 8 per cent.

WHITE POPULATION OF THE CHIEF BRITISH COLONIES

MR W. P. REEVES, in a recent issue of the London *Times*, gives a careful estimate of the population of the principal British colonies, which is just now a matter of special interest. The figures given with regard to it by writers and speakers differ widely. This is not surprising, as most of the statements are based upon official returns published from two to twelve years ago. In the case of Africa south of Zambesi, it is impossible to hope for exactness, and Mr Reeves has therefore given a figure slightly below what seems to him probably correct. The total—11,075,000—will doubtless appear low to many British colonists, but not only aborigines, but Asiatics resident in the colonies, have been deducted.

White Population in July, 1903

Canada	5,525,000
Australia	3,860,000
South Africa	875,000
New Zealand	815,000
Total	11,075,000

For some little time past the average increase of whites in the British colonies has been at the rate of about 20,000 per month.

The Building of Dalny.—Russia, in the name of the Chinese Eastern Railway Company, is making tremendous progress in building the great commercial city of Dalny, which has superseded Port Arthur. The Russian engineers, with 20,000 Chinese laborers to carry out their plans, have already made 50 miles of streets, of which 12 miles are macadamized; one good-sized dry dock has been built and another dry dock large enough for the largest steamers is nearly completed. Repair shops and foundries, tramways and electric power plants have been constructed. An enormous pier is nearly finished, which is to be 1,925 feet long and 350 feet wide, and has a depth of water of from 18 to 28 feet and which will contain seven railway tracks and nine large warehouses. The present population of the city is over 42,000. The Bureau of Statistics of the Department of Commerce and Labor has published a comprehensive report on "The Building of Dalny," by the U. S. commercial agent at Dalny, M. M. Langhorne (Advance Sheets of Consular Reports, July 28, 1903, No. 1708).

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE GEOGRAPHICAL DISTRIBUTION OF INSANITY IN THE UNITED STATES*

By Dr William A. White,

Superintendent Government Hospital For The Insane, Washington, D. C.

When I was invited by the National Geographic Society to address the Society on the geographical distribution of insanity in the United States, my ideas on the subject were extremely chaotic. I had vague notions of the possibility of formulating laws that would express the relationship between insanity and latitude and longitude, temperature, precipitation, &c., and I felt that a diligent study of statistics would be rewarded by the emergence of such laws. Similar ideas, I think, would quite naturally occur to any scientific man not especially acquainted with the statistical study of sociological phenomena. Confronted at the outset by the fact that the proportion of insanity varies greatly in different regions of the United States, what more natural than to ascribe such variations directly to the difference in man's physical environment in these localities?

From time immemorial variations in climate and in weather conditions have been supposed to produce profound effects upon man's conduct, and such expressions as the "depressing effects of heat" and the "stimulating effects of cold" are common in our every-day conversation, and I believe that all of us have a more or less clearly defined idea that the physical and mental characteristics of the different races of men are to some extent an expression of the effects of the climatic and geographic conditions under which they live. This general conception was particularly fathered by that great English historian, Henry Thomas Buckle, who, in the opening chapters of his "History of Civilization in England" traces in detail the effects of the four great physical factors—climate, food, soil, and the general aspect of nature—upon the characters of individuals and upon the growth of races and the progress of civilization.

There has consequently been fostered

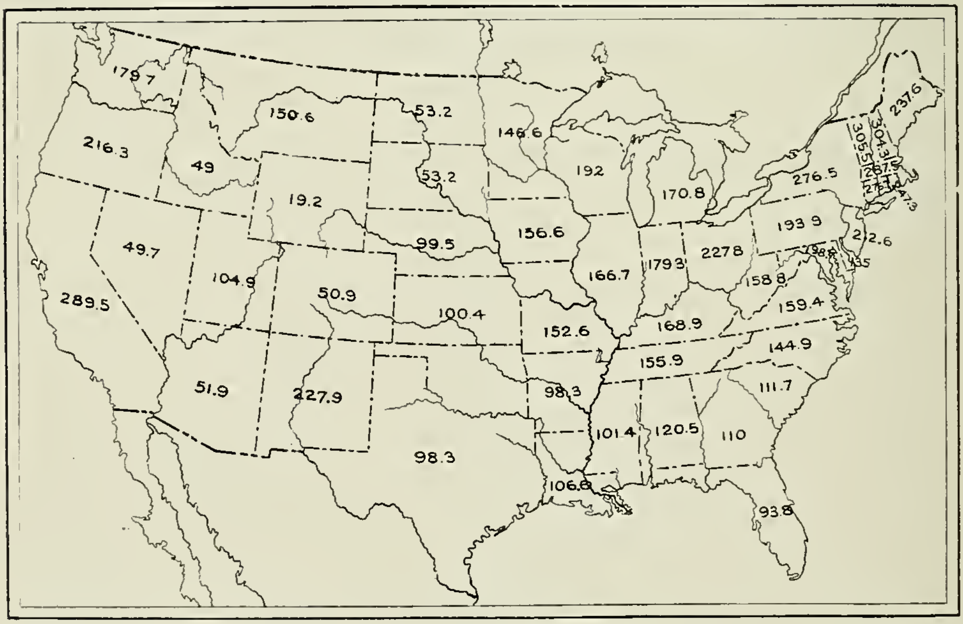
* Read before the National Geographic Society, Washington, D. C., February 6, 1903.

a general tendency on the part of statisticians and those engaged in the study of abnormal mental conditions, to follow along these lines with a view to establishing relations of cause and effect.

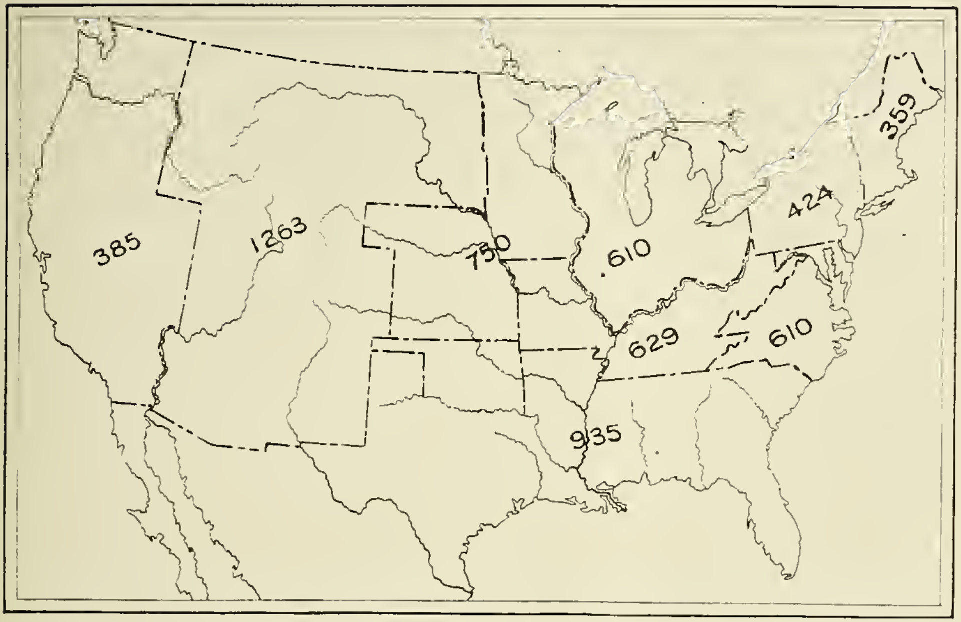
If I am not able to present to you such laws as I originally dreamt of, clothed in all the beauty of mathematical formulæ and demonstrating beyond doubt the precise effects of each climatic and geographic factor upon the prevalence of mental disease, I at least hope to be able to show why it is not possible to do so, and I feel assured that my results may be just as valuable as if it were.

The social organism is extremely complex, and any effort to reason from the association of two or more conditions to the probable causative relations between them is always dangerous, and when figures are suborned for such purposes the results are notoriously inaccurate. With the elaborate means used of late years by the governments of all civilized nations for the collection of statistics, it is but natural that the figures obtained should be applied to all sorts of social conditions, and thus we are treated by the authorities to elaborate tables which show the month, day, and hour when suicide is most prevalent in a certain country, the season of the year in which crimes of violence reach their maximum, the effects of temperature, barometric pressure, humidity, wind velocity, and precipitation upon various phases of conduct, such as attendance at school, infractions of discipline in prisons, clerical errors in banks, &c., &c.

In view of all these facts, it is my function tonight to inquire whether the prevalence of insanity in the various regions of the United States can be shown to have any definite relation to any one or more of these environmental conditions; whether insanity is more prevalent at certain elevations above sea-level or between certain degrees of latitude; whether it prevails more especially in regions of a certain average



Outline Map No. I.—Ratio of Total Insane per 100,000 Population, Census 1880



Outline Map No. II.—Number Population for Each Insane Person, Census 1880

temperature and barometric pressure, or, on the other hand, where the mean humidity is high or low, and, further, if these conditions can not be shown to have a causative effect upon its distribution, what has?

Let us start our inquiry by a study of a map of the United States upon each state and territory of which the ratio of insane to 100,000 population is indicated, in accordance with the census returns for 1880 (see outline maps Nos. I and II). We are at once confronted with a condition of affairs which is so well marked that when I first saw it I was very much surprised. The greatest proportion of insanity is in the Northeast—in the New England and Middle States—of which New Hampshire, Vermont, Massachusetts, Connecticut, and New York all have one insane person to less than 400 of the population. If from this center of greatest prevalence of insanity we draw a line in any direction—West, South, or Southwest—we see that no matter which way we go we find a steady decrease until we strike the Pacific slope. A slight interruption of the continuity of the decrease is noted in Michigan as we go west, but is, I think, of little consequence. As we go south along the coast Delaware appears as a marked exception. This is due to the fact that previous to the organization of the Delaware state hospital in 1889 no statistics of insanity were reliable. The insane were county charges and the care given them was so atrociously bad that every one took pains to conceal cases occurring in their families. Despite these minor variations the decrease of insanity as we go from the northeastern part of the United States—South, West, or Southwest—must strike you as being remarkably uniform and constant. This uniform decrease only takes place if we start from this northeastern center. If, for instance, we drop a line from any of the Northwestern States, as Idaho, Montana, or Minnesota, we find no uniform results, and if we go South from the Dakotas we will find that the proportion of the insane actually increases. The notable increase when we strike the Pacific slope I will speak of later.

If we now attempt to explain this condition of affairs by the topographical or the climatic conditions we are at once met by insuperable difficulties. If variation in temperature is alone responsible, why does not the proportion of insane diminish as we go south from the Dakotas as well as from the New England States? Or, on the other hand, why should Maine have a smaller proportion of insane than any other New England State? Montana, which is as far north as Maine, has a higher ratio than the states immediately south of it. If meteorological conditions are determining factors, why do we not find a marked variation in the proportion of the insane in the states bordering on the Great Lakes? Here we have conditions quite different from anywhere else in the United States. This region, a large area of which is occupied by these immense island seas, is directly in the course of the greater proportion of storms which come from the Northwest and pass through here on their way to the Atlantic coast; sudden variations in temperature, barometric pressure, and wind velocity are the rule, and with the immense areas of evaporation, fogs and rains are frequent and the percentage of cloudiness unusually high (66 per cent), still there is nothing in the proportion of the insane to call our special attention to this region.

I might continue in this wise, but it is only necessary for me to call your attention to the general results of such reasoning. They are these. The variation in the proportion of insanity in the different states is regular and uniform, while both geographic and climatic conditions are not, but, on the contrary, differ greatly in different parts of the United States, as, for instance, in the region of the Great Lakes just mentioned. If, therefore, we would explan these figures, we must seek a cause as uniform as its effects. This cause, or, more properly, these causes, are the same causes that make for civilization, the same that make for permanency and organization of social institutions, the same that make for concentration of population in great cities, the same, in short, that make for progress in its broadest sense.

Before proceeding to the elucidation of this proposition, let us for a moment return to the consideration of some first principles.

I did not intend to convey the idea by the remarks I just made about the influence of climate on conduct that no such influence could be demonstrated. On the contrary, I think it can be, and in fact has been. Dexter* has recently shown this in a most admirable and exhaustive study of the effects of climate on different phases of conduct. For instance, his studies show that as humidity increases assaults, necessity for prison discipline, and the number of arrests for insanity decrease, while the data also show an increase in these same occurrences when the barometer is low.

Granting for the nonce that these various meteorological conditions could actually produce insanity, they could not account for the uniform variation of the proportion of the insane in the different states to which I have called your attention. Weather changes are transitory, and conditions that are inimical to mental health are quickly followed by others that are highly beneficial. This is especially true of those regions of the United States where the proportion of insanity is high. The ratio of insane in

* Edwin Grant Dexter, A. M.: Conduct and the Weather. Psych. Rev., Vol. II, No 10, May, 1899.

the semi-tropical regions, which are relatively free from the sudden changes of weather so common in the northeastern and northern central regions, is comparatively low. If we turn to the seasonal influences the same criticism applies, though the changes take a somewhat longer time. As regards climate and seasons, Berkley,* an eminent American authority, says: "These are factors of very minor importance in the evolution of insanity. The harmful effects of heat in the south are more than counterbalanced by the more prevalent abuse of alcohol in colder regions. In a general insane asylum, where the middle and lower classes of the population are received, a study of the records will show that a larger number of admissions in one year may occur during the winter, whereas in other years the same holds good for the spring, summer, or autumn. Hence one is obliged to conclude that the seasons have little to do with the evolution of insanity."

In the last analysis, however, the effects of all these agents which collectively I have spoken of as constituting man's physical environment upon his mind must be only secondary, mediate and not immediate. If we will study the effects of any one of them—for example, temperature, humidity, altitude—we will find them expressed in terms of respiration, pulse rate, evaporation from the cutaneous surface, blood pressure, &c. —effects which I grant you are potent, but which, nevertheless, are not primarily mental.

This whole matter reminds me very forcibly of the learned judge who could not understand why the expert called upon to testify as to the mental condition of the defendant should have measured his feet. The medical profession have been largely responsible for this conception, especially our misguided friend, the gynecologist. This gentleman has insisted that all forms whatsoever of mental disease affecting the female were traceable to an affection of the uterus or its appendages, and has devised all manner of operations to relieve such conditions. True, the insane female who may have a local pelvic condition which is amenable to surgical interference is just as much entitled to the relief that can be obtained from that source as her more fortunate sister, and it is quite conceivable that the relief of a local condition which was painful or debilitating by reason of frequent hemorrhages, or other cause, would place the organism in a better condition to rally from any abnormal state. But the sort of stuff that mind is made of is not to be found in the abdominal cavity.

This brings us again to the basis of our argument. If we are to seek for an adequate cause to explain the conditions to which I have directed your attention, we must seek for a mental cause, not a physical one.

If we look back over organic nature we shall see that in the progress of evolution the nervous system has come to play a progressively more and more important part until we get to the higher animals—the vertebrates—in which the brain comes to be of paramount importance.

Still, in the lower races of men, although the brain is of such great importance in the struggle for existence, that struggle is, after all, in the main and relatively a physical struggle; it consists largely of collecting food which is often ready at hand in the tropics, of pursuing and killing game, and often of personal encounters with his fellowman, as a result of which the conquered is killed or reduced to slavery. When we get to civilized man, however, the picture is different. Here the struggle for existence has become an essentially mental struggle, and success is a func-

* Henry J. Berkley. Insanity: General Etiology. Reference Handbook of the Medical Sciences, Vol. V.

tion of intellectual capacity. I can in no better way illustrate the severity of this struggle than by calling your attention to the fact that it takes twenty-five years of preparation nowadays before a young man is considered equipped to cope with his fellows.

The brain then becomes, as it were, the storm center in the organism. Here, in the habitation of the mind, do all the problems of subsistence meet their solution, and here also do all those mighty emotions which ever and anon stir the soul take their origin. It is here in the brain that vaunted ambition has its sway, and here that the sweet pains of love tune one soul in harmony with another.

The mind, delicately adjusted as it is to its environment, responding as it does to the slightest changes therein, occupies a dangerous position and becomes at once liable to great stress and to the multiplicity of disorders that result therefrom. The savage in his simplicity does not know what it is to suffer from the cares and worries which are the daily portion of the average European, and it is little wonder that the latter, beset by all manner of disappointments and vexations, should more frequently break down in mind than his less-gifted brother.

If you have followed me thus far, you will note that in my attempt to account for the geographical distribution of insanity in the United States I have discarded the influences of the physical environment as being efficient causes because of their indirectness, and have appealed to the immediate results of mental stress, the results of the contact of man with man in the struggle for existence; in short, the results of that struggle itself as exemplified in civilization.

If my contention is true, that insanity is the result of the stresses incident to the progressive civilized state, it must be possible to educe further proof of this by a study of some of the phenomena that accompany civilization. We would thus expect to find that in those localities where civilization was furthest advanced, where the social institutions were stable, where class distinctions had crystallized—in short, where the stresses of intellectual life were greatest—the proportion of insanity was highest. Let us see if this is so.

One of the most marked results of civilization is the concentration of population in certain areas. Let us study this condition in the United States with reference to the distribution of insanity. The census for 1890 shows that for the different regions of the United States the population per square mile is as follows:

North Atlantic Division	107.37
South Atlantic Division	32.98
North Central Division	29.68
South Central Division	18 94
Western Division	2.58

The North Atlantic Division, comprising the New England States, with New York, New Jersey, and Pennsylvania, has more than three times the number of inhabitants per square mile of any of the other divisions—in fact, more than all the rest put together. Of these states, Rhode Island, the smallest, has the greatest density of population, with 318.44 to the square mile; then comes Massachusetts with 278.48, Connecticut with 154.03, and down the coast, New York with 125.95, New Jersey with 193.82, and Pennsylvania with 116.88. From this center of density the proportion of inhabitants to the square mile diminishes regularly in every direction. If we go south, we find Maryland with 105 and Delaware with 86 per square mile, until in the extreme south we find but 30 or 40. Westward from Pennsylvania, however, we find a belt bordering the Ohio River, containing Ohio with 90, Indiana with 61, aud Illinois with 68 per square mile, and from here the dimiuution is rapid to Louisiana with but 24, Minnesota with only

16, and the extreme West, where the proportion is less than 1.

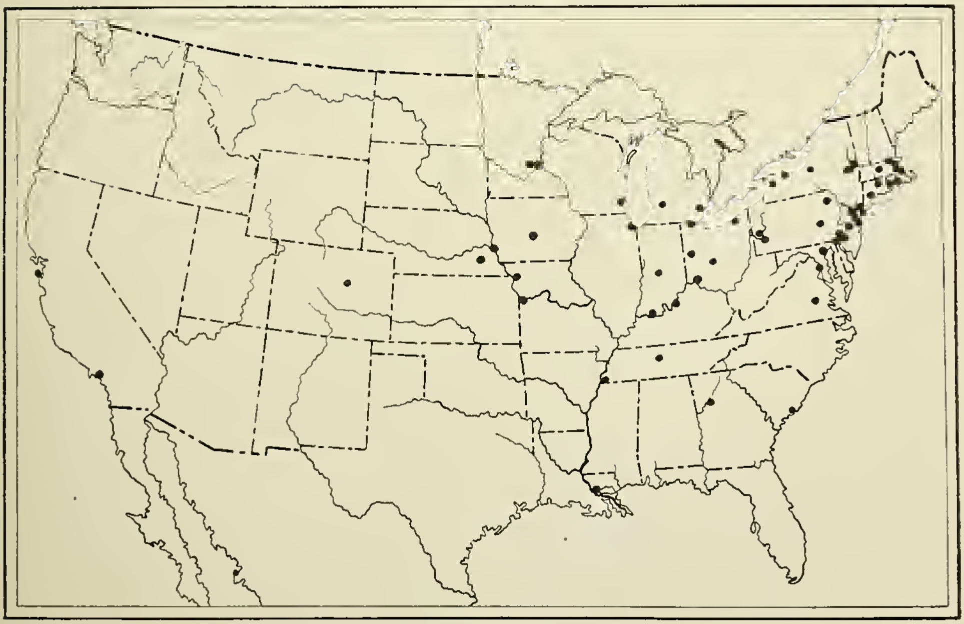
Here, you see, we have an almost exact parallel with the distribution of insanity.

Closely connected with this peculiarity of civilized communities to concentrate in certain areas—in fact, a part of the same phenomena—is the growth of great cities. The Eleventh Census shows that the percentage of the population of the United States living in cities of 8,000 or more inhabitants for the different regions was as follows:

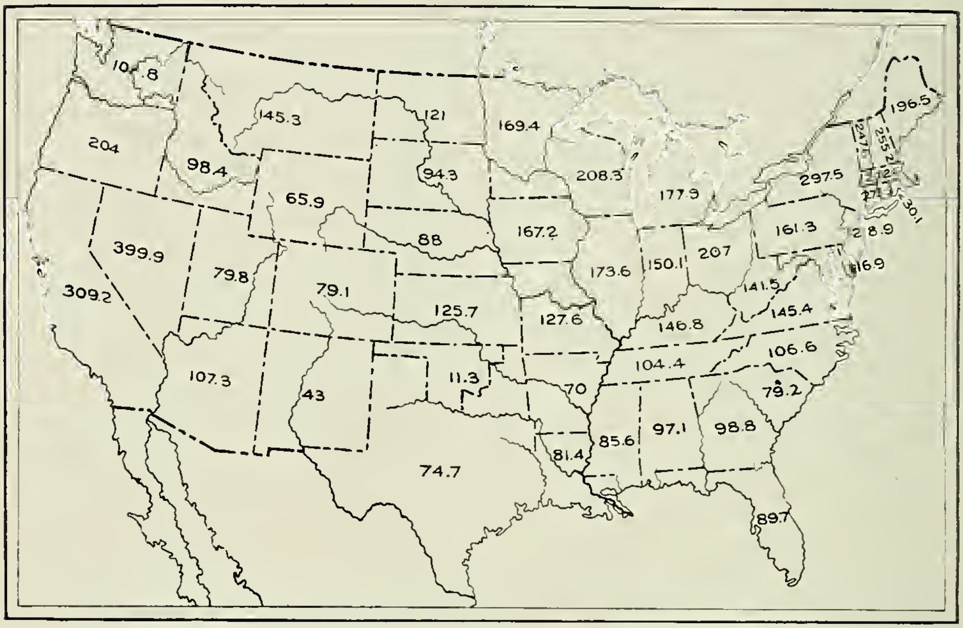
North Atlantic Division	51.58
North Central Division	25.91
South Atlantic Division	16 03
South Central Division	10.45
Western Division	29.99

Here again we see the same parallelism between the degree of manifestation of a phenomena of civilization and the proportion of insanity. The North Atlantic Division contains almost twice the percentage of urban population of any of the other divisions, and here, as we know, we find the highest percentage of insane.

If we calculate the proportion of insane per 100,000 in all cities of the United States containing 50,000 or more inhabitants, we will find that in 1880 the ratio was 231.6 as against 183.3 for the whole country, while in 1890 the ratio was 242.7 as against 170 for the whole country. Thus we find that the ratio of insane in cities of this size has not only increased in the decade from 1880 to 1890, but that the ratio for the whole country has decreased. It is also significant that, while in 1880 there were only 35 cities containing 50,000 or more inhabitants, in 1890 there were 58 such cities. We further find that of these 58 cities 26, or nearly one-half, are located in the North Atlantic Division. Of these 26, 6 are in Massachusetts, 7 in New York, 5 in New Jersey, 5 in Pennsylvania, 2 in Connecticut, 1 in Rhode Island, and none in Maine,



Outline Map No. III.—Location of Cities Having a Population of 50,000 or More, Census 1890



Outline Map No. IV.—Ratio of Total Iusane per 100,000 Population, Census 1890

New Hampshire, and Vermont, so that our findings thus far are still further harmonized by these additional facts, for the deusity of population in Maine, New Hampshire, and Vermont is very much lower than for the other states in this region. (See outline map No. III.)

If, now, we study the movement of population duriug the past century we meet again the same coufirmation for our views. * Mayo-Smith makes the statement that in 1790, 95 per cent of the population were on the Atlantic seaboard, with an average depth of settlement at right angles to the coast of only 255 miles. The stream of population spread westward along three lines—one the valley of the Mohawk, one from Virginia southwest into Kentucky and Tennessee by way of the Appalachian Valley, and one over the Alleghenies to the Ohio River. This latter course was the principal one, aud from the junction of the Ohio with the Mississippi we find further westward migration occurring aloug the valleys of the Missouri, Arkansas, and Red Rivers. This course of the westward spread of population has been maintained, for, though river valleys furnish the natural highways for migration, when railroads come to be built they are built in the valleys, and the general course of events is not materially changed thereby.

See how closely these facts correspond with the distribution of insanity. From the northeastern coast states—Massachusetts, Connecticut, New York, aud New Jersey—there is a progressive decrease southward along the Atlantic coast. There is also a decrease as we go southwest along the Appalachian Valley; but we find the ratio of insane continues high in the Virginias, Keutucky, Tennessee, and North Carolina, and does not show a marked falling off

* Richmond Mayo-Smith, "Statistics and Sociology."

until we get south of these states. Similarly, if we follow the Ohio Valley we find the ratio of insane continues large in Ohio, Indiana, and Illinois. (See outline map No. IV.)

We still have, however, some high ratios unaccounted for, viz., Missouri and Iowa west, Michigan, Wisconsin, and Minnesota north. All these states are in the North Central Division. Let us compare the different divisions of the United States on the basis of their respective increases in population during the decade from 1880 to 1890. The figures are as follows:

North Central Division	4,878,928
North Atlantic Division	2,984,480
South Central Division	1,985,657
South Atlantic Division	1,204,999
Western Division	1,129,641

Thus we see that the increase in population has been by far the most rapid in the North Central Division. This territory has increased approximately 2,000,000 inhabitants more than any other. Let us now turn to the individual states and see what the figures show. The states in the North Central Division which have increased in population the most are in the order of their increase:

Illinois	747,629
Nebraska	603,399
Minnesota	519,069
Missouri	510,262
Ohio	473,856
Michigan	451,170
Kansas	430,167
Wisconsin	367,420
Iowa	287,156

The only other states in the Union that have increased at any such rate as this are:

New York	911,173
New Jersey	313,103
Pennsylvania	972,962
Massachusetts	454,432
Texas	642,357
Arkansas	325,344
Georgia	294,992
Washington	266,999
Oregon	258,300

The significance of these figures seems to me quite evident. They show that the stream of population has continued west of the Mississippi, and the high ratio of insanity in Iowa and Missouri is therefore accounted for, as these states both adjoin Illinois, the western limit of the Ohio Valley lying merely on the other side of the Mississippi River. You will see also that we have incidentally thrown light on the high ratios north. In the three states in this region—Michigan, Wisconsin, and Minnesota—there has been an increase in population in the ten years from 1880 to 1890 of one and one-third millions.

Of all these states Nebraska alone seems to be somewhat exceptional. Although its population has increased rapidly its ratio of insanity is rather lower than we would expect from comparing it with those states where the increase has been correspondingly marked. Of these states Kansas is the only one as far west as Nebraska, and Kansas has a ratio of 125.7 per 100,000, while Nebraska has but 88. It is significant in this connection that Kansas is more directly in the line of traffic from east to west, and a glance at any recent map of the United States will show that many more railroads course through it than do through Nebraska. As both of these states are in the main agricultural, the higher ratio of insanity in Kansas would seem to me to be the result of the degenerate dribble from the great railroad lines as they pass west from the congested centers of population in the East.

The only reports of the railway mileage in these two states I have been able to obtain are one under date of 1893, which shows Kansas to have 8,900 miles of railroads, thus making it the second state in the Union in this respect, and one a year later in 1894, shows Nebraska to have but 5,529.22 miles of railroads.

It would seem, therefore, that my contention that insanity increases in proportion as the stresses incident to the struggle for existence become mental stresses is borne out by the facts. The frontiersman who takes his family and goes west to open up new territory, engage in legitimate agricultural pursuits, and grow up with the country is pretty apt to be of hardy stock, and insanity, if it appears at all, comes in later generations. It is different, however, with those states that have great mineral wealth. Here the attraction appeals to all the wandering, unsettled, rifraff of the country, who hasten to the newly discovered fields in the hope of acquiring a fortune quickly. Arrived there they yield to all the seductions of intemperance; vice and disease wreak their ravages upon a predisposed soil, and our ratios show a corresponding increase. This is the situation with California. This state, and to a somewhat less extent the whole Pacific coast, is still suffering from the effects of the "gold fever" of '49, and its citizens are paying the price even "unto the third and fourth generations." In this connection it is interesting and significant to note that the mining states and the states of the Pacific slope, viz, Montana, Colorado, Arizona, Nevada, Idaho, Washington, Oregon, and California, all show a much greater number of male than female insane, a condition that prevails nowhere else in the country, with the single exception of Minnesota, and it has arisen here almost wholly in the decade from 1880 to 1890, during which period the state has increased in population over half a million. Minnesota also has large lumbering interests, and conditions in a lumbering region are similar to those in a mining region. In the normal order of things we expect to find a slightly higher percentage of insanity in the female sex, but the "get-rich-quick" fever attracts more men than women and mining districts as a rule are deficient in their proportion of women. This state of affairs has apparently not yet been recovered from in California. We must also remember with reference to California in particular that it is a coast state and suffers from the effects of immigration, and that the percentage of insanity is invariably higher in the foreign born than in the native population.

This law of the increase of insanity in the oldest settled districts and its decrease in the newly settled districts is well stated by A. O. Wright in the Proceedings of the National Conference of Charities and Correction, in 1884. He says: "A very powerful cause for the increase of insanity in this country was, so far as I know, first pointed out by the writer in 1881, before the census of 1880 had been tabulated, in the Annual Report of the Wisconsin State Board of Charities and Reform, and was stated in debate at the National Conference of Charities and Correction, at Madison, in 1882. Having made a census of the insane under public care in Wisconsin, the writer, on reducing the number by counties to the ratio to the population of the several counties, was astonished to find here a general law: That the older settled counties had the largest ratio of insane to the population, and that the ratio steadily decreased and reached the smallest ratio in the pioneer counties on the north. This seemed to show that a new country has a smaller proportion of insanity than an old country.

"When the Compendium of the Census of 1880 was published, the writer, from the numbers given then, immediately calculated the ratios to the population and arranged the states and territories geographically instead of alphabetically." From the figures thus obtained he concludes that "* * * allowing for exceptional cases, the proportion of insanity decreases as you go toward the newer settled states, from about one in every 350 of the population in Massachusetts to about one in 1900 in Colorado."

Wright, however, does not go into details nor discuss the causes that have led to this condition of affairs, except to say: "The reason of this I think to be that new settlements are made by a selected population, mostly young and middle aged people of sound minds and bodies. The insane are left behind, as are also those people of bad organizations, from whose numbers the most of the insane will come. The new countries therefore have a small proportion of insanity at the start, and furnish a small proportion of insanity in the first generation.

"The only exception to this is in the case of the Pacific slope and a few other localities, where masses of homeless men, with few women and children, have gone in search of work or wealth; where the vices of drunkenness and licentiousness, with the irregularities and the hardships of life in mining or lumbering camps, and the excessive fluctuations of fortune, have caused an excess of insanity. In these cases it is, however, to be remembered that this is a disease of mature life; and if we add the proper proportion of children who would be found in an ordinary community, and who rarely have insanity, we should at once halve the ratio of insanity in such communities.

"But, in ordinary settlements, where the settlers found homes and live under the ordinary conditions of life, the ratio of insanity in the first generation is small, because they are, as the insurance men would say, 'selected lives.' In the second generation all the complex and varied causes which produce insanity have been at work; and the second generation has a much greater ratio of insanity than the first, and so on for several generations, when the balance is restored and the regular rate of insanity is reached."

After all this, however, Wright says: "It is often claimed that insanity is a disease of civilization, and that it is increasing because civilization is increasing. This I think to be a mistake." Although this is not a very happy way to express it, it seems to me that our figures prove just that, or rather if they do not prove that insanity is the necessary result of civilization, they at least prove that the civilized state offers those conditions in greater number which bring it about, and so if the connection be not one of necessity, it is at least one of fact. Instead, therefore, of attempting to account for insanity by altitude, temperature, and the various other elements of the physical environment, we should only consider these factors as important because of their influence in creating conditions favorable to the growth and concentration of population and the evolution of the social organism. Even here this influence is often secondary or accidental. As regards this whole matter of the influence of the physical environment on population, I can do no better than quote Mayo-Smith,* who, in answer to the question, "How far can the statistics of distribution be said to contribute an answer to the question of the influence of physical environment upon population?" says:

"Statistics show us, in a large way and on a grand scale, the general influence of land, climate, and natural forces upon population. The plains attract, the mountains repel. Cold regions are unpopulated. Moist and warm climates are fatal to human life. Commercial position attracts cities. Navigable rivers are natural highways, and are utilized in the migrations of the human race. An indented seacoast is favorable to settlement and colonization. Statistics confirm the general observations of history. Levasseur, after a long survey of the topography of France and the history of its population, says that at all periods Paris has been the attractive pole and the mountainous region of

* Ibid.

south France the repulsive pole of population.

"But it is absurd to seek by statistics a direct mathematical relation between population and land. The population of a country is not dense exactly in accordance with its topography. Plains do not always have a dense population, and mountains are not always barren. Population does not increase or decrease regularly according to distance from a certain parallel of latitude or longitude. There is no direct proportion between the degrees of temperature or inches of rainfall and the number of iuhabitants in a certain district. In this respect many of the statistics distributing population according to topographical features or natural relations, such as those of the Tenth and Eleventh Census of the United States, are the merest vanity. One searches in vain in these elaborate tables for any illumination. Such influences are not direct, but indirect. Altitude, temperature, rainfall, influence population because they affect the economic resources necessary for population. We must always remember that economy is the basis of social organization. The economic is the fundamental side of civilization. Natural forces control human life in this way. Statistics, by showing the distribution of population, discloses the harmony between population and nature, which is mediated by economic relations, and these are on the one side the result of natural forces, and on the other the conditions of human existence.

"We must also remember, in studying the distribution of population, that there are commonly many influences at work—some of them economic, others historical and political—aud that it is often extremely difficult to disentangle them. We ought, therefore, to expect from statistics not exact data, but only general indications of the influence of natural forces. The density of population in England, for example, is due partly to the richness of its soil, partly to its mineral resources, and partly to its commercial advantages ; but it is due also in part to its insular position, which has given it peace and stable government for generations, and to the energy and enterprise of its inhabitants, which have made the little island the center of a world empire. It is impossible for statistics to disentangle these different influences. It can ouly confirm the observations of history. Who could explain that oasis of population in the great western plain of the United States called Utah, if he did not know the history of the Mormons? Why should the sterile mountain tops of Nevada be populated ? might be asked by one who did not know the history of gold and silver mining. The coast swamps of the United States would probably be nninhabited did not the population of the United States include a large proportion of negroes, who are proof against pestilential fevers. Race explains in this case what physical geography would leave inexplicable.

"Finally, we must remember that all these natural influences are much more powerful over primitive than over civilized man. As Spencer says, 'The earlier stages of social evolution are far more dependent on local conditions than the later stages. Those societies such as we are most familiar with, highly organized, rich iu appliances, advanced in knowledge, can, by the help of various artifices, thrive in unfavorable habitats; yet feeble, unorganized societies cannot do so ; they are at the mercy of their natural surroundings.' Spencer finds here also the explanation of the fact that so many tribes of savages have made no manifest progress during the long period over which human records extend. Statistics observes man only in an advanced state of civilization, when he has been able to free himself to a certain extent from the influence of natural forces, or at least to neutralize them. By clothing and improved shelter man habituates himself to almost any climate, and by sanitary knowledge he makes places formerly uninhabitable safe for human life. In pursuit of wealth, of political independence, of religious freedom, he will risk exposures which would seem to be entirely unnecessary. By improved methods of agriculture man often renders districts formerly uninhabited, or at best only sparsely settled, capable of sustaining large populations. In early times regions covered with forests are thinly inhabited. Civilized man cuts down the forests and turns the land into arable fields. Lowlands, which in early times were at the mercy of the sea or uninhabitable on account of fevers, civilized man, by canals and dikes, renders fertile plains. So also by means of fertilizers, by rotation of crops, by improved ploughing, by the use of machinery, sometimes by irrigation, dry and sterile plains are made productive. Even from year to year changes in agriculture or in the prices of agricultural crops may render it expedient to change arable land into pasture, or pasture land into arable, and either process, if continued, must influence the population-supporting capacity of the country. An example of this is seen in the changing of arable land to pasture in Ireland and the turning of little farms into game preserves in Scotland.

"In the civilized state man often makes use of a country without any reference to its agricultural capacities. He seeks the minerals under the soil either for his own consumption or for export; he turns clay into pottery ; he utilizes water power for his factories; he seeks barren coasts for fishing or gathering sea weed ; he establishes trading posts in the desert or in unhealthy localities—in other words, he seeks his gain without reference to climate or soil. In modern times the improved means of transportation have still further increased man's command over nature. He is no longer held to rivers and valleys as natural highways, but can seek the quickest and most direct route. Cheapness of transportation gives him command over the resources of the world. In this way he can carry on the work of production in any place he likes, without regard to its food-producing capacity. The people of England import three-fourths of the bread they eat. This has the effect of enabling man to concentrate his efforts in places most favorable to the production of the kind of wealth which is demanded. It enables him also to choose climates favorable to his health, as the English seek the Mediterranean, or consumptives of the East seek the dry air of Colorado. Man's intellectual and emotional desires lead him to seek large cities, and this he is enabled to do by the fact that he can carry on his occupation independent of the food supply. This is especially true of occupations demanding intellectual effort.

"It will be seen, therefore, from all these considerations, that man is still subject to the environment; but the development of his power over nature has rendered the cord which binds him down more elastic. He is still subject to nature, but has at the same time, to a certain extent at least, subjected her."

Thus far my lecture has dealt with—

First. The untenability of any hypothesis founded solely upon climatic, meteorologic, or topographic conditions to explain the facts of the distribution of insanity in the United States.

Second. The necessity of assuming primarily a mental cause to explain these facts and the nature of that cause, viz., the mental stresses incident to the progressive civilized state.

Now, as a *Third* line of argument I will take up the discussion of certain collateral evidence—that is, evidence taken along other but related lines and leading to the same conclusion.

Suppose we first examine into the statistics of suicide. Morselli in his admirable work on that subject comes to the conclusion that those sections of Europe show the highest percentage of suicide where the Teutonic element is predominant. Ripley in his excellent work, "The Races in Europe," has examined this proposition critically and with very interesting results.

If, for instance, France is studied we will find the greater proportion of suicides in the north, where the Germanic race is represented in greatest numbers; similarly we find here also the highest divorce rate; but, more remarkable still, we find evidences of the highest degree of culture. In this same region the greatest number of artists were born to whom were granted awards by the Paris Salon, and here also were born the highest ratio of men of letters. If now Italy be similarly studied we find that its different regions are distinguished in much the same way as they are in France by a preponderance of certain phenomena in certain localities. In comparing the two countries, Ripley closes his criticism by saying: "The effect has been to emphasize once more the enormous preponderance of artistic genius all through the north, from Tuscany to the Alps. How does this coincide with our previous deduction concerning France? It seems, perhaps, to corroborate the relation of Teutonism to art, until we secure the fact that all northern Italy is overwhelmingly Alpine by race as compared with the artistically sterile south. Couple with this the fact that in reality Teutonism is a negligible factor in Italy, physically speaking, and that precisely the same ethnic type which is so fecund culturally in Italy is in France the one localized wherever art is not and all doubt as to the predominant cause of the phenomenon is dissipated. We see immediately that the artistic fruitfulness in either case is the concomitant and derivative product of a highly developed center of population. Contact of mind with mind is the real cause of the phenomena. It is not race but the physical and social environment which must be taken into account."

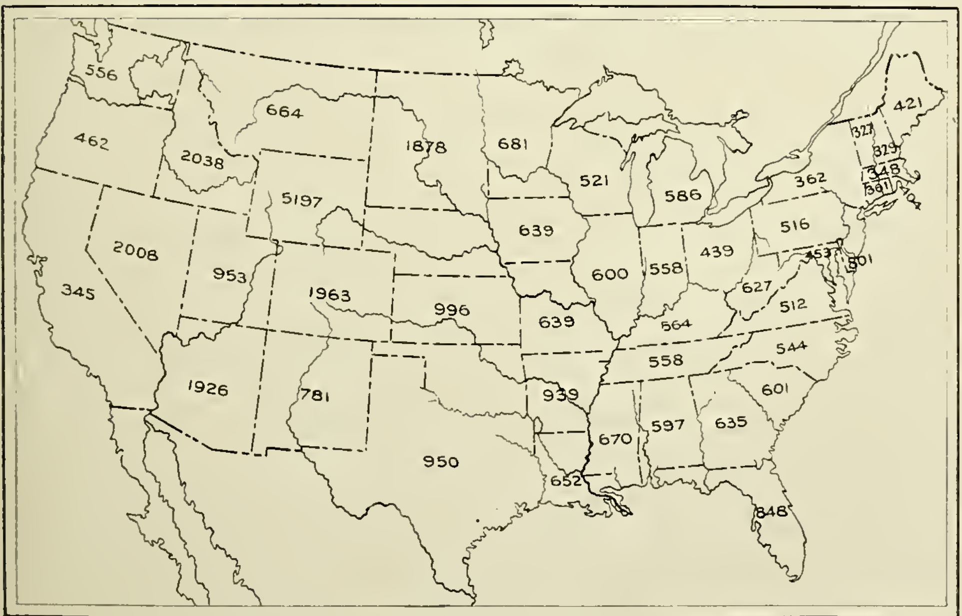
Morselli himself recognized this fact, for he not only reaches the conclusion that "it is those countries which possess a higher standard of general culture which furnish the largest contingent of voluntary deaths," and "The proportion of suicides in all Europe is greater amongst the condensed population of urban centers than amongst the more scattered inhabitants of the country;" but in concluding his work he sums up the whole matter in the following words: "* * * whoever has followed us in the long analytical course which we have pursued ought now to be convinced of the connection between competition and social evolution and the inclination towards suicide. Suicide increases amongst people according to their degree of civilization, not so much because in the high development of the cerebral organism the needs which must be satisfied increase as because the brain shares more largely in the struggle."

I need only call your attention to the frequent association of suicide with actual insanity, or at least with an abnormal mental condition, for you to see the bearing of these results on the problem in hand.

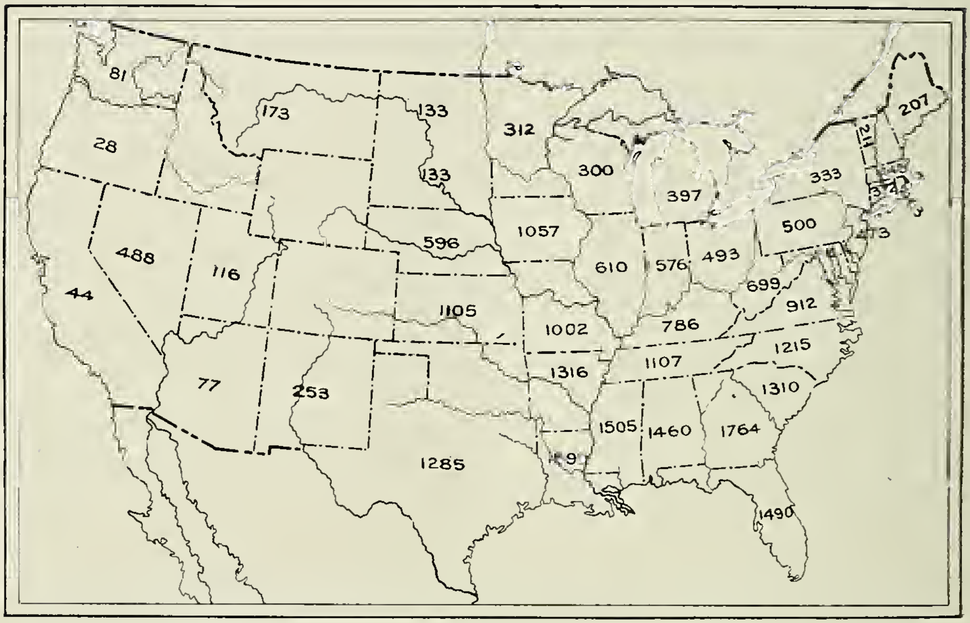
Pauperism is another allied condition to which I would direct your attention. The census of 1880 shows that there were then 66,203 paupers in the several almshouses of the country. Now, pauperism is to an extent a symptom of mental defect. The individual who, unless absolutely incapacitated by physical disability, so far fails in the struggle for existence that he must be supported at the public expense is certainly suffering from some form of mental defect. F. H. Wines, the special agent of the Census Office for the collection of the statistics of the defective, dependent, and delinquent classes at the Tenth Census, says about pauperism: "The law which governs the distribution of pauperism in the United States (and which, we believe, has not been suspected by any student of the subject—at least I have never seen any reference to it) is brought out as clearly by the census of 1850 as by that of 1880, and it is confirmed by every census that has been taken. This law is as follows: The ratio of paupers to the total population diminishes alike from north to south and from east to west. In other words, if New England, or the principal New England state (Massachusetts), be taken as a starting point, it matters not in which direction a line be drawn, the largest amount of pauperism relatively to the population will be found to exist in Massachusetts, and the smallest in the state farthest removed from Massachusetts, while the intervening states will exhibit, on the whole and with scarcely an exception, a gradual decline in something like the degree of their removal from the extreme northeast." As clearly as Mr. Wines defines this law, it is rather strange that he did not discover the practically identical condition relative to the insane.

We have one other state of affairs in the United States that is worth while looking into. I refer to our large negro population. The ratio of insanity in the negro population is smaller than in the white population, being as 1 to 1,069 in the former and 1 to 505 in the latter (Census 1880). Although this is so, it is generally admitted that the percentage of insanity has been gradually increasing since the Civil War. Berkley* says on this point: "Before the Civil War there were few or no psychoses among them, and such organic degenerative diseases as syphilitic insanity and dementia paralytica were practically unknown. Today in communities where many are collected, as in Washington or Baltimore, the percentage of insane

* Ibid.



Outline Map No. V.—White Insane Only, Census 1880



Outline Map No. VI.—Number Colored Population for Each Colored Insane, Census 1880

Ratio for United States	1,069
Ratio for Southern States	1,277
Ratio for United States minus Southern States.	542

negroes, not to mention idiots and imbeciles, is already fully up to that of the Caucasian races, with whom they are associated, and bids fair to surpass it."

*"The negro has been thrown upon his own physical and mental resources and has entered the strife for existence as an inferior; he is syphilized, alcoholized, his food is ofttimes unsuitable, * * * his surroundings are usually unhygienic, and tuberculosis finds in him an easy prey. No wonder it is that under these circumstances we have in our asylums an ever-increasing number of idiots, of imbeciles, and of all types of the dementias from the colored race."

There are, however, some extremely interesting facts relative to this increase. The percentage of colored insane increases rapidly as we leave the natural home of the negro and go in any direction. In other words, as soon as the negro goes North and enters into active competition with the white, who is mentally his superior, he succumbs to the unequal struggle. So in Georgia, where we find the greatest number of negroes, there was 1 insane negro to 1,764 of the colored population in 1880, while in New York the ratio was 1 to 333, or almost exactly the same ratio as for the white population. (See outline maps Nos. V, VI.)

Then, again, if we take the Southern States alone, viz., Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia, we find the ratio of colored insane 1 to 1,277, while for the whites in the same territory it is 1 to 456. For the

* A Treatise on Mental Diseases.

remainder of the United States the ratio of colored insane as shown by the Tenth Census was 1 to 542, while for the whites it was 1 to 520. The ratio of colored insane in the United States, minus the Southern States, is then almost exactly the same as the ratio for the white insane.

It seems that all the lines of evidence I have followed up lead to the same conclusion; they are mutually confirmatory of the general law that the proportion of insane is highest where we find the greatest congestion of population, and, therefore, where the stresses incident to active competition are most severe. Our inquiry thus far, however, has been nothing if it has not been an inquiry into the causes of insanity, and I think I may fitly close by a general discussion of causes with a view to indicating some general conclusions relative to the comparative influence of these mental stresses I have been discussing in the actual production of insanity.

If we will take up any annual report of an institution for the insane and turn to the table giving the causes of insanity in the several patients under treatment, we will find assigned such causes as these: "business anxiety," "death of mother," "disappointment in love," "domestic troubles," "excessive study," "loss of property," "political excitement." How many of us but have suffered at some time or other from one or perhaps all of these so-called causes of insanity? Certainly we have all had business worries; certainly we have all lost property at some time, otherwise our good fortune is phenomenal; certainly we have all been subject to political excitement many times, and all of us presumably have lost a dear friend or relative, perhaps a father or mother. Dr Carlos F. MacDonald says very forcibly on this subject, "* * * that substantially every individual at some time during his life is exposed, in many cases repeatedly, to many of the so-called exciting causes of insanity, both mental and physical, and yet, despite this fact, we find that sanity is the rule—insanity, the exception."

In ascribing these causes what has been done is simply this: The particular set of conditions that happened to maintain at the time the patient was attacked with insanity have been tabulated as the causes of that attack, whereas the true cause was in all probability far removed from these which were in reality only accidental contemporaries. In reality the true underlying condition in all these cases for which such causes are assigned is the predisposition to insanity.

Predisposition to insanity may be either inherited or acquired. The former is more generally recognized and is what is referred to when insanity is said to be hereditary. Of all causes of insanity heredity is recognized as being by far the most important and as being most frequently present. The average for all countries has been estimated at from 60 to 70 per cent. This I believe, as a matter of fact, falls below the truth. But any one who is at all familiar with the collecting of statistics must know how impossible it is for them to fully represent the facts in such a matter.

Next to hereditary predisposition comes acquired predisposition as a factor in causation, and the two most important agents in bringing about this acquired predisposition are generally acknowledged to be, first, alcohol, and second, syphilis, both of which, however, may act as true exciting causes at times. It is further conceded that both of these causes are much more prevalent in civilized communities, and in fact seem to be fostered by that irregular life which the active struggle after wealth necessitates.

The inadequacy of predisposition alone to account for insanity, especially acquired predisposition due to alcohol, syphilis, and tuberculosis, without the element of mental stress is well illustrated by the condition of the American Indian. Sorely afflicted as he is by the diseases and vices of civilization, his tendency is to an outdoor life, and as his land has disappeared and he has become physically incapacitated, the government has supported him, so that his sufferings have been in the main physical and not mental. Careless, slovenly, and improvident, he does not know much of worry for the morrow, and so we find that among his race "insanity is of rare occurrence." *

Without wearying you with further figures I will simply call your attention to the new light in which our conclusions now appear. Insanity is most frequent in the older civilizations, in the more thickly settled communities, in urban centers—in short, where competition is most active. Here the weakling, the man whose mental faculties are not quite up to grade, who enters in the struggle handicapped by a poorly equilibrated mind, goes to the wall. He is the victim of heredity. Here are bred all the vices which only a high grade of intelligence can call into being; stimulants, narcotics, drugs of all kinds are available to help the overburdened on their way, until at last they react and bring ruin and desolation. The victims who fall a prey to these temptations are the victims of an acquired predisposition.

Of these two varieties of causes heredity is by far the more important. While civilization furnishes the environment that makes a bad heredity doubly dangerous, still it is the heredity which is the prepotent factor and not the environment. A bad heritage is always a source of danger, and its possessor can never know when the environmental conditions may appear which will make its latent activity kinetic. No people in the world are freer than we are from the taints of vicious inheritance. Inhabitants of the most glorious country on earth, a country whose future for greatness and power and good seems to have no limit, let us see that we make the best possible use of the bounties nature has showered upon us with so prodigal a hand.

But power and greatness are double-edged; they cut both ways; and already we are threatened with the dangers they have brought in their wake. The offscourings of all Europe are hastening to our shores for that wealth they expect to find ready at hand, and today 50 per cent of the nearly 25,000 insane of New York State are foreign-born. The result of this great influx of defectives must of necessity have a constant leavening effect on the whole population. The danger from this source, however, is as nothing compared to that from war, the greatest curse that can afflict a nation.

In war it is not the defective that goes down to death, but the flower of a nation's manhood, and if modern theories of heredity are correct, their place can never be filled. Once gone, they are gone forever, while the maimed, the diseased, the imbeciles and degenerates, unable to sustain the hardships of campaigning, stay at home and help populate the country with their ilk. I believe one of the principal reasons for this country's great prosperity lies in its freedom from foreign wars, and I am convinced that no more terrible calamity could happen to it than to be engaged in one.

If we can control these two sources of evil successfully, I am sure that internal affairs will so shape themselves as not to seriously interfere with a future which, I believe, can today only be dimly imagined, a future which will outshine the glory of ancient Rome as good outshines evil.

* "The Civilized Indian, His Physical Characteristics and Some of His Diseases", by A. D. Lake, M. D. Trans. N. Y. Med. Soc., 1902.

PEARY AND THE NORTH POLE

THE announcement of Commander Robert E. Peary that he is to make one more attempt to reach the North Pole has been received with much enthusiasm. Every one has been hoping that he would be able to carry out the plan which he has adopted for his next Arctic campaign, a plan which he outlined some months ago when it was doubtful whether he would ever go north again. This plan differs in one very important respect from all his former campaigns in that he proposes to make his winter camp fully one hundred miles north of his previous winter quarters; so that when he is ready to start on his dash in spring he will be 100 miles nearer his goal. The distance thus saved—from Cape Sabine to Cape Joseph Heury—is the most difficult of traverse, and to overcome it has in the past taken several weeks of the short working season.

The distance from Peary's proposed winter camp near Cape Joseph Henry to the Pole and back again is less than the average distance of four sledging trips which he has made, and each of these trips was over rougher ice than it is believed will be encountered beyond the 84th parallel. Mr Peary will start north in July, 1904. He hopes to be able to reach Cape Joseph Henry with his vessel in the fall of that year, and to make his dash in 1905. In case he does not reach the cape in 1904, he will spend 1905 in getting there, and make his dash in 1906. His plan is outlined in the following letter, addressed to the Secretary of the Navy, asking for three years' leave of absence:

WASHINGTON, D. C.,
September 2, 1903.

SIR: Referring to my application for leave of absence accompanying this, I beg to state for your information that I propose to secure a suitable ship, put her into one of our best shipyards, have her reënforced and strengthened to the maximum degree and fitted with American engines, possessing the maximum of strength and power with the minimum weight and space, so that she may go north as an exponent of American skill and mechanical ability.

With such ship I should sail north about the 1st of next July, and on reaching the Whale Sound region should take on board my Eskimo, establish my permanent sub-base at Cape Sabine, and then force my way northward to my proposed winter quarters on the northern shore of Grant Land, establishing caches as far as practicable en route. By the earliest returning light of the following February I should start due north over the polar pack with a small, light pioneer party, followed by a large, heavy main party. I should expect to accomplish the distance to the Pole and return in about 100 days or a little more, an average travel of about 10 miles a day. Returning, I should break the ship out late in the same season and return home.

If ice conditions the first year were such as to prevent reaching the northern shore of Grant Land, I should winter as far north as practicable and force the ship to the desired location the following year. In this event the expedition would be gone two years.

This plan is the result of some twelve years of almost continuous experience in those latitudes, and is based upon an extended personal acquaintance with the region from Sabine to 84° north latitude and a thorough familiarity with climatic and other conditions and with Eskimo.

The distinctive features of my plan are: The use of individual sledges with comparatively light loads, drawn by dogs, giving a traveling unit of high speed and radius of reach, as opposed to the man sledge, with its heavy load, slow speed, and limited radius; the adoption of Eskimo methods and costume and the fullest utilization of the Eskimo themselves.

The advantage of my plan and route are a fixed land base 100 miles nearer the Pole than on any other route, a more rigid ice pack extending Poleward than is to be found on the opposite side of the Pole, a wider land base upon which to retreat, and a well-beaten line of communication and retreat from winter quarters to comparatively low latitudes, which is practicable at any season of the year.

The work outlined above comprises two distinct stages, viz., the navigation of the ship to the northern shore of Grant Land, the traverse of the polar pack with sledges from the northern shore of Grant Land to the Pole and return. In connection with the former, four ships (the *Polaris*, the *Alert*, the *Discovery*, and the *Proteus*) have accomplished this feat. In regard to the second, I have already made four trips in those same regions, in which the average air-line distance from start to finish was the same as the distance from Grant Land to the Pole. The air-line distance from start to finish of my 1900 sledge journey was such that had my starting point been the northern shore of Grant Land it would have carried me beyond the Pole and return. I beg to state for your consideration the following:

The North Pole is the last great geographical prize the earth has to offer. Its attainment will be accepted as the sign of man's final physical conquest of the globe, and it will always stand as one of the great milestones in the world's history.

The attainment of the North Pole is, in my opinion, our manifest privilege and duty. Its attainment by another country would be in the light of a reproach and criticism.

The sense of all the foremost geographers, practical and theoretical, now converges upon the Smith Sound or "American route," along which I have been working for years past. Other routes have been eliminated. If we delay in preëmpting this route some one else will step in and win the prize.

I believe that my experience, gained in years of practical work; my special methods of travel and equipment, the evolution of years of practical work; my personal acquaintance with every feature of my chosen route and region, and my command of the full resources and utmost efforts of the entire little tribe of Whale Sound hyperboreans, who have lived and worked with me for years, give substantial reasons for anticipating a successful outcome to an expedition based on the above lines.

Very respectfully,

R. E. Peary,
Civil Engineer, U. S. N.

The reply of Hon. Charles H. Darling, Acting Secretary of the Navy, granting Mr Peary's application, is as follows:

Dear Sir: In granting you leave of absence for the purpose of prosecuting your Arctic work, I am moved to remark that I believe you are better equipped than any other person in the country to undertake this work. You have the requisite courage, fortitude, and physique. You have had a longer term of service within the Arctic circle than any other explorer. You have had large experience in sledge journeying, both upon the land and upon the polar pack. You are familiar with ice conditions through the Smith Sound route and north of Grant Land and the continent. You have demonstrated your ability to maintain yourself in that latitude for a longer period in health and safety than any other explorer. You have reduced the inconveniences and hardships of the Arctic service to a minimum.

You are conversant with the language and customs of the Whale Sound Esquimaux and are personally acquainted with every individual in the tribe.

They have become accustomed to your leadership, and if you succeed in transporting the selected hunters and the best families to the north shore of Grant Land, as you propose, you will thereby establish a base which will enable you to live in safety and comparative comfort for an indefinite period.

Grant Land as such base has great advantages over Spitzbergen, Franz Josef Land, or any other known point, in that it has an extensive shore line, which a party retreating from the Pole cannot fail to find, whatever may be the extent of the polar drift.

In establishing a colony of Esquimaux at this point, you thereby establish a self-sustaining base at the nearest practicable point to the Pole. Such self-sustaining base has not heretofore been established in any such high latitude. Your ability to force your ships to a high northing with this Esquimau colony is all important to your success. Such northing has been made by the *Polaris*, the *Alert*, the *Discovery*, and the *Proteus*. There would seem to be no reason why you can not do the same. Knowledge of ice conditions that has been gained since that time will certainly enable you to provide a ship better adapted to the purpose than either one of these.

The attainment of the Pole should be your main object. Nothing short will suffice. The discovery of the Poles is all that remains to complete the map of the world. That map should be completed in our generation and by our countrymen. If it is claimed that the enterprise is fraught with danger and privation, the answer is that geographical discovery in all ages has been purchased at the price of heroic courage and noble sacrifice. Our national pride is involved in the undertaking, and this department expects that you will accomplish your purpose and bring further distinction to a service of illustrious traditions.

In conclusion, I am pleased to inform you that the President of the United States sympathizes with your cause and approves the enterprise.

With best wishes for your health and confidence in your success,

I am, respectfully,

CHARLES H. DARLING,

Acting Secretary.

The Peary Arctic Club, which so generously supported Mr Peary's explorations 1898–1902, have contributed the funds that make this new expedition possible.

THE INFLUENCE OF FORESTRY UPON THE LUMBER INDUSTRY OF THE UNITED STATES*

By OVERTON W. PRICE,

ASSISTANT FORESTER, BUREAU OF FORESTRY

THE development of the lumber industry in this country is without parallel. It now ranks fourth among the great manufacturing industries of the United States, and represents an invested capital of about $611,000,000 and an annual outlay of over $100,000,000 in wages. It af-

* Republished from the Year Book of the Department of Agriculture for 1902.

fords through its three great branches—the logging industry, the sawmill industry, and the planing-mill industry—a means of livelihood to considerably over a million persons. The annual value of the products, which has multiplied nearly ten times in the last half century, is $566,000,000.

But although the rapid development of the lumber industry has had far-reaching results in furthering every branch of manufacture which depends upon wood, it has been fundamentally unsound in principle. The settler who cuts and sells trees without forethought from land fit only for forest growth has not enriched himself in the long run. The havoc which has been wrought in the forests of the United States has turned trees into money, but has put the balance on the wrong side of the sheet by rendering vast areas unproductive. It is the history of all great industries directed by private interests that the necessity for modification is not seen until the harm has been done and its results are felt. This fact has been emphasized in the lumber industry—in the earlier days by the instinctive feeling of the colonist against his natural enemy, the forest, and later by the remarkable inducements offered by lumbering for present profit only.

The first settlers had two objects in view in their attack upon the forest—the one to clear land for their farms, the other to procure wood for their buildings, fuel, and fences. As the tide of colonization rose, and as the uses for wood in manufacture increased in number and extent, lumbering rapidly assumed the proportions of a business enterprise, and from supplying only personal wants it became profitable to supply also those of others. With an apparently inexhaustible supply of timber available, and with an insistent and growing demand, the lumber industry came to offer remarkable opportunities for money-making. Step by step with its development improvement in tools and machinery took place. The changes that enterprise and ingenuity have wrought in the American sawmill are no less wonderful than those which have taken place in the American locomotive. From "whip-sawing," in which the boards were sawed out by hand, to the modern steam sawmill, with its railroad, its planing mill, and its cut of nearly half a million board feet per day, is a long step, but it has not taken much over fifty years to accomplish it. In effective methods for the harvesting and manufacture of lumber the American lumberman has no superior, nor is he equaled in his disregard for the future of the forest which he cuts.

It is natural that the lumberman should not turn eagerly from a system whose only aim is to secure the highest possible present profit from the forest to one which includes provisions for the production of a second crop upon the lumbered area. Under conservative methods lumbering becomes a legitimate industry for the production as well as for the consumption of its staple. It no longer offers, however, the short cut to fortune which it proved to be so long as an abundance of timber rendered the old methods of lumbering possible. It is difficult for lumbermen generally to realize that the time for practical forestry has fully arrived, but signs more significant than any existing statistics point to the imminent failure in the supply of certain timbers in the United States. From the data available there is no way to foretell accurately the time necessary to exhaust this supply of merchantable timber at the present rate of consumption. A good many estimates of the merchantable timber standing have been made, some of which have already proved fallacious.

To predict accurately how long it will be before the United States is con-

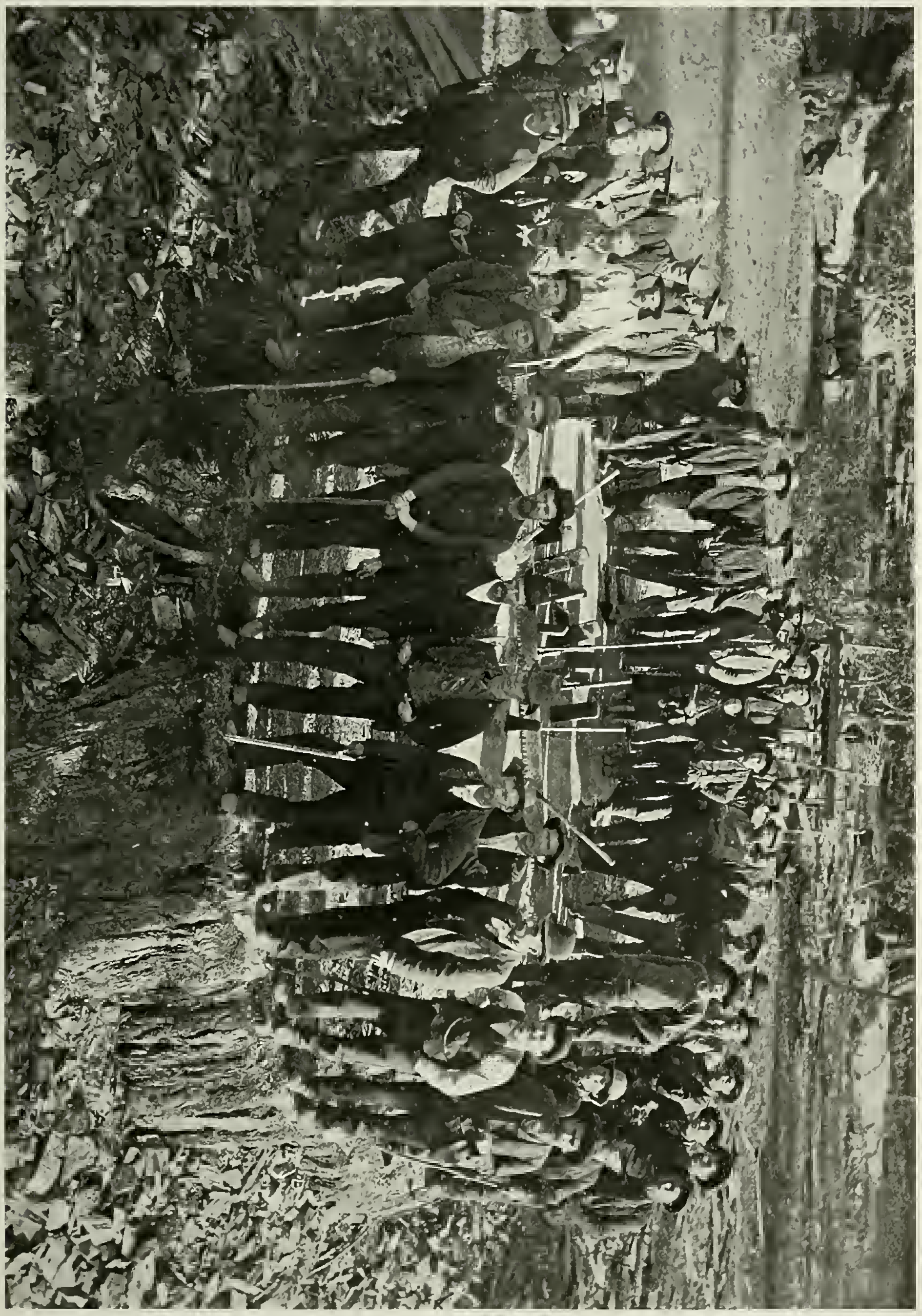
From the American Museum of Natural History

The Cross Section of a Giant Sequoia

fronted by a timber famine would require first of all a knowledge of the composition, quality, and condition of the forests, which it would take many years to obtain. At present such an estimate is of little practical value. We do know that the supply of timber of many kinds is failing. of other kinds is almost exhausted, and of others is practically gone; that black walnut is no more to be had except in small quantities and at enormous expense; that first-growth white pine is growing rapidly to be a rarity on the market; that where the supply of spruce for pulpwood and for lumber for the next ten years is to be found is a grave question before the lumbermen today. The list of woods accepted as merchantable lengthens from year to year, species hitherto considered valueless being harvested more and more willingly as the result of the exhaustion of more valuable kinds. In spite of steady improvement in tools, logging outfits, and mill machinery, all tending to cheapen the cost of lumbering, the price of lumber increases steadily and rapidly. These are facts more significant than predictions in terms of years of the life of the lumber industry. The exact period for which the existing supplies are sufficient is a matter of detail. The vital point lies in the crisis which the lumber industry is approaching in the exhaustion of the material on which its existence depends.

The general application of forestry to forest lands owned by lumbermen will probably result in the gradual elimination of the large sawmill and the substitution of those of moderate size. The mammoth milling plant will be rare when only second growth is left to supply it, for the area of timber land sufficient to produce the logs necessary to run such a plant is enormous. It is reasonable to expect that the mill of moderate size, supplied by a forest whose production is equal to the mill's annual capacity, both under the same management, will become more and more the rule. The very existence of the enormous mill is the result of an abundance of timber resources, which exist no longer except in a very few sections. In Europe the long-continued application of conservative measures in lumbering has resulted in a distribution and type of sawmill little known in this country. Sawmills of large size do not exist, but in their stead small sawmills, for which water generally supplies the power, are distributed throughout the country wherever the local demand is sufficient to keep them running. Their annual cut is for the most part exceedingly small, according to our standards, and sufficient only to supply the wants of the immediate adjacent country. The mills saw largely on order, and the fact that their construction is permanent and their motive power cheap enables them to run intermittently without loss. The results are upon the whole exceedingly satisfactory. The man who wants lumber gets it promptly, and without paying an added cost for long transportation. The antiquated construction of European sawmills is often such that the American lumberman would find in them but a proof of his superior ingenuity; but the European distribution of milling plants has its strong advantages in several ways.

The general application of conservative methods in lumbering will inevitably result, as has been the case in Europe, in the development of a permanent class of men trained to forest work. Under present methods this result can never be attained to the same degree. The lumbering in one community is generally so short-lived that there is neither time nor necessity to train up a body of men on the ground to carry out the work. The result is that Maine and Michigan woodsmen are found working in the hardwoods of the Southern Appalachians; loggers from



From the American Museum of Natural History

The Stump of a Giant Sequoia

Wisconsin and Minnesota are helping to cut the redwood on the Pacific coast, and in each of the great timber regions there is a mingling of lumbermen from several of the others. The effect has been to develop, by constant labor at their trade under widely varying conditions, a force of men who are unequaled for enterprise and skill in their profession ; but the system has very largely failed in what is of infinitely greater importance to the permanent welfare of the lumber industry—the upbuilding throughout the country of a stable class of workers in the woods, locally trained and carrying on their work each in his own community. The advantages of such a condition lie in an equitable geographical distribution of labor, in the wholesome influence throughout the country of a class whose means of livelihood is forest work, and in the fact that all the operations of lumbering may in this way be conducted more cheaply than in any other.

The effect upon the prices of lumber which will result from the application of forestry to the lumber industry will be strongly marked. The wide fluctuation characteristic of lumber values today is much more the result of conditions within the industry itself than of variations in the demand for the product of the forest. The uncertainty of available supplies, the lack of true proportion between stumpage values and lumber values, the speculative features which the industry now presents, have all tended to produce an exceedingly unstable and abnormal fluctuation in the prices of lumber, with a marked disposition toward rapid increase. Under forestry the speculative element can not exist. The cost of producing timber, plus a legitimate profit, will be the basis upon which the value of it will be fixed. The annual output of the country will be no longer a matter of conjecture, and a steady and normal range of prices for lumber will be the inevitable result.

The influence of forestry upon the lumber industry is not a matter of conjecture. The details will have to work themselves out, but the broad results of conservative forest policy on the part of private owners are plain. The lumber industry in the United States is approaching a crisis. There is no more doubt that conservative methods will be applied to lumbering in this country than there is of the development of irrigation, of regulation of grazing, of the application of improved methods in agriculture, or of any other modification to which private as well as public interests point the way. How long it will be before the results of practical forestry make themselves generally felt it is impossible to foretell ; but the fact remains that there will be established in this as in other countries in which conservative lumbering has followed wasteful lumbering a legitimate and permanent industry, characterized, as has been stated, by conditions under which speculation can not exist. Prices will continue normal and steady, and the quantity of timber produced will be the main factor iu regulating consumption.

GEOGRAPHIC NOTES

GUILLEMOT EGGS

THROUGH the courtesy of Mr Joseph Stanley-Brown, formerly Secretary of the National Geographic Society, the National Geographic Magazine is able to publish the remarkable illustration of guillemot eggs shown on page 387. The photograph was taken by Mr H. D. Chichester at the boat landing on St Paul Island, Pribilof group, and is a result of one of the an-

Guillemot Eggs—St Paul Island, Pribiloff Group nual trips of the Aleuts, who live on St Paul, to the barren rock called Walrus Island, which lies a little to the eastward of the extreme northern point of St Paul. In the spring, when the guillemots ("arries," they are called by the natives) and gulls begin to lay eggs on this isolated, and hence protected, rock, the natives go there in their boats and sweep clean a large area. Returning two weeks later they find a vast number of eggs which have not been set upon sufficiently to be spoiled. The photograph represents the results of such an expedition to Walrus Island. The egg of the guillemot is somewhat larger than a hen's egg, and the contents make an excellent article of food, not quite so palatable to the white man's taste as the hen's egg, but still a most excellent substitute for it in the land where hen's eggs are few and far between.

SKULL OF THE IMPERIAL MAMMOTH

THERE has just been placed on exhibition in the Fossil Mammal Hall of the American Museum of Natural History a superb specimen of the tusks and palate of what may be known as the "imperial mammoth," described in 1858 by Joseph Leidy as *Elephas imperator*, from a single tooth found in Indiana.

The specimen was discovered in the sands of western Texas many years ago by an amateur collector, and was only recently secured by the American Museum. The upper portions of the skull have been reproduced in plaster, but the entire lower portion of the skull, the large pair of grinding teeth, and the gigantic tusks are complete. The latter fall little short of being the largest elephant tusks thus far described among either living or fossil members of this family. So far as preserved they measure 13 feet 6 inches from the base of the tusks to the tips, and there is at least a foot broken away from the end of the tip, making the total estimated length 14 feet 6 inches.

On leaving the skull, the tusks (which were undoubtedly used for fighting purposes) in young and middle-aged animals curve downward and outward; then, in old animals, upward and inward until the tips almost meet each other. The height of this animal must have been at least 13 feet, 2 feet higher than that of the famous African elephant "Jumbo," the skeleton of which is also in the Museum.

The single molar or grinding tooth is distinguished from that of the mammoth of the extreme north (*Elephas primigenius*) and that of the Columbian mammoth of the middle United States (*Elephas columbi*) by its very large size and by the comparatively small number of its enamel plates, which are set widely apart and surrounded by broad bands of cement. In the grinders of the northern mammoth the enamel plates are extremely numerous and closely appressed and there is little or no cement.

This specimen of the imperial mammoth, therefore, adds greatly to our knowledge, and, together with the giant fore limb, which is placed on exhibition near by, gives an impressive idea of the enormous size attained by the early Pleistocene or preglacial elephants in this country.

EIGHTH INTERNATIONAL GEOGRAPHIC CONGRESS

PURSUANT to the action of the Seventh International Geographic Congress held in Berlin in 1899, the geographers and geographic societies of the United States are considering plans for the ensuing congress, which is to convene in September, 1904. It is proposed to have the principal scientific sessions in Washington early in the month, and to have social sessions in New York, Philadelphia, Baltimore, and Chicago, with a final session in conjunc-

From the American Museum of Natural History

Skull and Tusks of the Imperial Mammoth Discovered in the Sands of Western Texas tion with the World's Congress of Science and Arts in St. Louis. It is provisionally planned also to provide an excursion from St. Louis to Mexico, and thence to points of geographic interest in western United States and Canada.

A preliminary announcement is in press and will shortly be issued to officers and members of geographic societies in all countries, and to geographers who may express interest in the Congress and its work. Details have been entrusted to a committee of arrangements made up of representatives from geographic societies in all parts of the United States. The officers of the committee are: Dr W J McGee (Vice-President National Geographic Society), chairman; Mr John Joy Edson (President Washington Loan and Trust Company), treasurer, and Dr J. H. McCormick, secretary. The office of the committee is in Hubbard Memorial Hall, Washington, D. C., U. S. A., where communications may be addressed.

PHILIPPINE CENSUS

THE field work of the Philippine census has been practically completed. All that remains to be done is the tabulation, compilation, and publication of the returns, a very small matter compared to the difficulty of obtaining the information.

A rough count shows that the total population of the islands is 6,976,574, of which number about 650,000 are included in what are termed wild tribes.

The civilized population, by provinces, is stated as follows: Abra, 37,928; Albay, 235,798; Ambos Camarines, 233,183; Antique, 133,674; Bataan, 43,606; Batangas, 258,802; Benguet, 917; Bohol, 268,397; Bulacan, 220,289; Cagayan, 143,438; Capiz, 224,581; Cavite, 134,438; Cebu, 651,621; Ilocos Norte, 167,717; Ilocos Sur, 171,619; Iloilo, 399,236; Isabela, 69,076; Laguna, 147,660; La Union, 127,966; Lepanto Bontoc, 2,413; Layte, 389,911; Manila, 319,941; Marinduque, 51,801; Masbate, 44,045; Mindoro, 31,331; Misamis, 138,329; Negros Occidental, 309,950; Negros Oriental, 186,397; Nueva, Ecija, 132,271; Pampanga, 218,766; Pangasinan, 397,443; Paragua, 27,481; Rizal, 123,422; Romblon, 52,858; Samar, 265,509; Sorsogon, 120,123; Surigao, 98,714; Tarlac, 135,397; Tayabas, 149,289, and Zambales, 100,953.

Some difficulty was experienced by the census enumerators in the provinces of Bulacan, Rizal, Laguna, Batangas, and Albay, due to roving bands of ladrones, and in four instances the enumerators were held up; but, with a single exception, the schedules were not molested. In the Island of Camiguin, Misamis, the enumerators met with armed opposition, but probably the census was a pretext and not the real cause of the hostile demonstration.

The census was most successful in every respect, and reflects great credit on the American administration and especially on the gentlemen in charge of the work, General Sanger, Mr Henry Gannett, and Mr V. H. Olmsted.

CORRECTION

IN a letter to the NATIONAL GEOGRAPHIC MAGAZINE heartily approving the suggestion of a comprehensive exploration of the volcanic belt of Central America, a suggestion that was made in this Magazine in July, 1903, Hon. Antonio Lazo Arriaga, Envoy Extraordinary and Minister Plenipotentiary of Guatemala, states that the reports of loss of life and property by volcanic disturbances in Guatemala during 1902 and 1903 have been vastly exaggerated. Mr Arriaga refers particularly to the effects of the earthquake at Quezaltenango April 18, 1902, and of the eruption of Santa Maria in November of the same year.

"On each of those occasions and under the excitement of the first moment news was sent abroad telling of 'fearful destruction of life' and of 'thousands of lives destroyed.' When the facts were investigated it was found that a few persons, most of them Indians, who were not numbered by hundreds, and even less by thousands, had lost their lives. It was indeed very unfortunate, but we all felt less depressed when we found that the first published news was exaggerated out of all proportion with the real loss of life. The same was the case with the loss of property, estimated at a great many millions of dollars by the first news, and reduced later on to the real ones—that is, the loss of a part, not the largest, of the latest coffee crop, and some damage caused to the cities and towns. Since then almost all the coffee plantations of the affected zone have recuperated, thanks to the fertility of the lands and to the washing of the sand by the heavy rains which followed the eruptions."

Nearly one million immigrants, 921,315, were adopted by the United States during the twelve months ending June 30, 1903. This was 275,000 more than during 1902 and 130,000 more than during the banner year of 1882.

Of this total nearly one-half came from Italy and Austria-Hungary, Italy sending 230,622 and Austria 206,011, which were respectively 52,247 and 34,022 more than for the preceding twelve months. Russia came third with 136,093, Sweden fourth with 46,028, Germany fifth with 40,086, and Ireland sixth with 35,310. Japan sent 19,958, China 2,209, and the West Indies 8,170.

In addition to those admitted, 8,769 would-be immigrants were denied admission, and 547 more were returned to countries whence they came within one year after landing. The grounds for disbarment were: Pauperism, 5,812 cases; disease, 1,773; contract laborers, 1,086; convicts, 51; insane and idiots, 24; women for immoral purposes, 13; aided paupers, 9, and polygamy, 1. Of the total number admitted, 631,885 landed at the port of New York, 62,838 at Boston, 55,802 at Baltimore, and 32,943 by the northern border.

The United States Geological Survey has just issued a list, complete up to June, 1903, of its serial publications, consisting of annual reports, monographs, professional papers, bulletins, mineral resources, water-supply and irrigation papers, topographic atlas of the United States, and geologic atlas of the United States. Monographs, topographic sheets, and geologic folios are sold at cost of publication—topographic sheets (of which indexes, free on application, are published from time to time) are sold at 5 cents each, or $2 per 100 in one order; geologic folios usually at 25 cents each; the other publications are distributed free.

A North Polar Expedition, a cablegram from England announces, is being organized by Captain Drake, who proposes to build a vessel of barkentine rig, with auxiliary steam power. She will be of 380 tons and will be provisioned for six years. With a crew of twenty, Captain Drake will leave London in December, 1904, for Vladivostock, and go thence to Point Barrow, Alaska, which he expects to reach in July, 1905. Thence he will proceed easterly to Prince Patrick Land, where the winter of 1905–1906 will be passed. In 1906 he will endeavor to push his ship as far north as 86°, and then make his dash for the Pole.

A cablegram from South America announces the successful ascent of Mt Sorata, 21,500 feet, by Miss Annie S. Peck.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE WRANGELL MOUNTAINS, ALASKA*

Walter C. Mendenhall

Of the United States Geological Survey

MOUNT WRANGELL, the active volcano in the valley of the Copper River, was named in honor of Baron Von Wrangell, governor of the Russian colonies in Alaska from 1831 to 1836. The peak was no doubt first seen by white men during some of the various official attempts by the Russians in the early part of the century to explore Copper River, although they seem to have known of it, under the name Chechitno Volcano, in the eighteenth century, probably from native accounts. The last, the most promising, and the most tragic of the Russian exploring expeditions was that led by the creole Serebrenikoff in 1848. He, with two white companions, was sent by Tebenkof, at that time chief director of the Russian colonies in America, to examine the Copper to its source, then to visit the distant Kwikpak, as the Russians called the Yukon. The work was carried through the Chugatch Mountains which border the coast to some point beyond the mouth of the Copper's western tributary, the Tazlina, where Serebrenikoff and his companions were murdered by natives, whom their behavior had goaded to desperation. Afterward the natives returned the records of the explorers to the Russian authorities.

Probably Russian traders visited the Copper Valley and the Wrangell Mountain region between 1848 and 1867, the date of the transfer of the territory to the United States, for they knew of the easy route from Cook Inlet, where they had strong colonies, by way of the Matanuska Valley to Lake Plevezenie; but there seems to have been no further official attempt to explore in this direction.

After the purchase, our first clear account of the mountain is from the diary of a prospector, John Bremner, who in 1884 ascended the Copper with the interior natives who were returning from the coast to their winter homes. Bremner was in search of the great blocks of native copper which were currently reported to exist in the region. His trip must have seemed hazardous, for he was without white companions, and the Copper River Indians had sustained a

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bad reputation since the days of the Russian occupation. Bremner expected to winter at Taral, just below the junction of the Copper and its great eastern tributary, the Chittyna, and he carried out his intention in spite of the difficulties which the undertaking involved. The Indians stole his flour, so he snared and ate rabbits. They tested his powers as a shaman by calling him in in cases of sickness. He prescribed thorough baths and applied mustard plasters, curing his patients and making illness a thing to be dreaded at Taral. All of this and more is recorded in a diary whose English and spelling are as original as the tale they tell.

Bremner describes the phenomena which he witnessed of Mount Wrangell in eruption, and gives a brief account of his attempt during the winter to climb the volcano. He estimated it to be 25 or 30 miles from Taral ; its actual distance is 40 miles. The natives, always superstitious concerning the mountain, declined to go with him, so he started out alone. He failed of course in midwinter to reach a summit 14,000 feet above the sea, and had his ears and toes badly frozen as a result of the attempt.

In the early spring of 1885, under orders from the War Department, Lieut. Henry T. Allen, U. S. Army, the present efficient head of the native constabulary in the Philippine Islands, undertook an exploration of the Copper and of the Tanana and Koyukuk Rivers. Because of the resolution displayed, the difficulties overcome, and the results achieved, Lieutenant Allen's work stands as a model to this day. At Taral he found Bremner and added him to the party which already contained, in addition to Sergeant Robertson and Private Fisher, Bremner's partner, Peder Johnson. Allen reached Taral over the ice from Alaganik on April 10, and a few days later began a difficult journey up the Chittyna, the great eastern fork of the Copper, and explored it nearly to its source. Later the ascent of the Copper was resumed, and the portage was made from the Indian village of Batzulnetas on the upper Copper to the Tanana Valley by way of Suslota Pass. While within the Copper Valley, Lieutenant Allen went almost around the group of mountains of which Mount Wrangell is the center. He made constant observations on the individual peaks of the group, and later published, in an account of his work, the first map upon which the companion peaks of Wrangell appear. These he named Blackburn, in honor of Senator Blackburn ; Sanford, after an ancestor of the explorer ; Drum, for the Adjutant General of the Army, and Tillman, in honor of Professor Tillman of the U. S. Military Academy. Mount Wrangell had already been named by the Russians, so that upon Lieutenant Allen's map five great peaks are shown where one had been known before. The actively volcanic character of Mount Wrangell, which had been referred to in Bremner's diary, is repeatedly confirmed by Allen, to whom the smoke column was frequently visible.

After Allen's explorations, the next geographically important work in the area was done by Dr C. Willard Hayes, who in 1891, in company with Frederick Schwatka and Mark Russell, made the long journey on foot from Fort Selkirk on the Yukon to the Copper Valley. Discovering and crossing Scolai Pass, unknown before this time, the hardy explorers built a boat on the upper Nizina from the canvas in which their blankets had been wrapped, and in this frail craft floated down the Nizina and the Chittyna to the Copper. Scolai Pass, which with its approaches was mapped by Doctor Hayes, is properly to be regarded as the eastern limit of the group whose dominant summits had been indicated by Allen.

In 1898, during the first year of the

Photo by W. C. Mendenhall

Mount Wrangell

View taken from the government trail above Tonsina bridge, 45 miles from the summit of the mountain rush to Alaska, some additional mapping in the Copper Valley was done by army officers and by prospectors, and especially by Schrader and Mahlo, attached to Military Expedition No. 1. This work was confined, however, to the district south and west of the mountain group and added little to our knowledge of their geography. In 1899 a journey was made, which in its daring and success equals those of Allen, Hayes, and Schwatka as a geographic feat. The distance covered was not nearly so great, but the time consumed was also much less. Oscar Rohn, topographer and geologist to the military expedition under command of Captain Abercrombie, with a small pack train, penetrated for the first time with animals the rough country lying between the Chittyna River and the south slope of the Wrangell Alps. Reaching the Nizina or north fork of the Chittyna in September, and seeing, as he thought, the possibility of crossing the range to the north of him by way of one of the glaciers tributary to this stream, Mr Rohu sent the pack train back to Valdez and with one companion, Mr McNeer, started across the mountains. The pass at the head of the glacier proved to be 8,000 feet above sea-level, and the distance from the beginning of the journey over the ice on the Nizina side to its end at the source of the Chisana (Tanana) was nearly 50 miles. The route, the character of the ice to be traversed, the distance, and the point to be reached on the other side were unknown. After 15 days on the glacier and many delays from the storms which prevail at this season of the year in these latitudes, the two explorers found themselves at the source of the Chisana, the eastern fork of the Tanana, nearly out of supplies and with a difficult and little-known region separating them from the Copper Valley. On foot, and carrying their light outfit, they crossed Cooper Pass to what they hoped would be the Copper, only to find that it was the Nabesna, the great western fork of the Tanana, and that the Copper was still to the west of them. Ice was forming in all the streams and snow lay thick in the passes, but with the aid of natives they reached the Copper in early October, Copper Center a week later, and crossed Lowe River divide to Valdez through 3 feet of new snow on the 25th. This work, although a reconnaissance, added valuable details to our knowledge of the northern and southern flanks of the Wrangell Mountains.

All of the work which has been outlined, up to the close of the season 1899, was general in its character. Allen had indicated the presence of five great peaks in the Wrangell group where four existed, and his longitude was in error by 30 minutes. Mahlo, in 1898, corrected much of this error in longitude, but since he descended the Klutena to Copper Center, and then went down the Cooper, he could add little to the geography of the mountain group proper, which lay well to the northeast of his route. Rohn, in his work along the southern flank of the range, sketched details previously unknown there, and in his trip from the Nizina to the Tanana studied a high area which is not likely to be investigated soon again. Peters and Brooks, during the same year, contributed to our knowledge of the Chisana and the Nabesna and outlined the northern edge of the range.

In 1900, however, Messrs Gerdine and Witherspoon, of the U. S. Geological Survey, as members of a party in charge of Mr F. C. Schrader, carried a stadia line into the interior from a Coast Survey base on Prince William Sound. From locations given by this line a triangulation network was expanded and extended eastward over practically the entire valley of the Chittyna and its tributaries. For the first time Mount Blackburn was measured accurately, and the topographic features of all this southern side of the range were delineated in detail and with fidelity.

In 1902 the same workers continued their surveys, Mr Gerdine along the western flanks of the mountains and Mr Witherspoon along the northern, so that we at last have topographic data of a definite nature for nearly all of the group. The area which is not as yet accurately mapped extends east from the head of Nabesna glacier to the head of White River, and includes the glacial drainage of the upper Chisana. Over the remaining portion of the group we have topographic sheets on the scale of 4 miles to the inch, drawn with a contour interval of 200 feet. These give sufficiently complete data for an accurate definition of the geographic relations of the mountain mass.

In carrying on this work the surveyors travel from place to place by pack train, occupying, successively, high points, which are located by intersection on other previously determined positions. From these points—"stations," as they are called—the positions of all prominent features in sight—peaks, streams, lakes, and glaciers—are fixed by horizontal angles, and elevations are determined by vertical angles. With these locations and elevations as a foundation, the streams are drawn and the outlines and slopes of the mountains shown by contours, each feature being sketched while the map-maker is looking at it. The work is precisely similar to that carried on in the rougher parts of the United States, except that the scale is smaller, the spacing of stations is not so carefully done, and less detail is preserved.

CHARACTER OF THE MOUNTAINS

The Wrangell group occupies a rudely elliptical area, with the extensive lowlands of the Copper and the Chittyna valleys on the south and west, but connected toward the east with the somewhat greater heights of the St Elias Alps. A well-marked depression on the north, which extends from the upper Copper across the Nabesna and the Chisana to the White, separates them from the neighboring Nutzotin and Mentasta ranges. Measured along the greater diameter of the ellipse from Scolai Pass northwestward to the outer base of Mount Drum, the extent of the group is about 100 miles, while the other diameter at right angles to this is approximately 70 miles in length. Within this area of 5,500 square miles are at least ten snow-clad peaks 12,000 feet or more in height. Several of these are unnamed, and two of them, Mounts Sanford and Blackburn, are higher than Mont Blanc or any of the peaks within the borders of the United States.

A partial list of the principal peaks and their elevations has appeared in an earlier issue of this Magazine, but a fuller list is appended here:

Mount Sanford	16,200
Mount Blackburn	16,140
Mount Wrangell	14,000
Mount Regal	13,400
Mount Zanetti	12,980
Mount Jarvis	12,300
Mount Drum	12,000
Capital Mountain	9,697
Mount Gordon	9,100
Snider Peak	8,345

In addition to these summits, to which names have been applied, there are two or three unnamed points on the ridge between Wrangell and Blackburn which are 10,000 feet or more in height, while between Blackburn and Regal one peak is 13,400, another 12,925, and a third 12,185 feet high.

These latter are merely the culminating points of a lofty ridge, and lack the dignity and impressiveness of the isolated summits, Sanford, Blackburn, Wrangell, and Drum, which are by far the most conspicuous mountains in the group. The fact that great height is not essential to grandeur is well illustrated by Mount Drum, which is surpassed by none in beauty and impressiveness, although but 12,000 feet high. Its effectiveness is due to its situation well out in the Copper River plain and to its isolation.

The Wrangell Mountains lie between the meridians of 142° and 145° west longitude and the parallels of 61° 20′ and 62° 30′ north latitude. The 144th meridian and the 62d parallel intersect just east of the crater of the central peak—Mount Wrangell.

The group is as distinct in form from the neighboring ranges north and south of it as it is in origin. The Chugatch Mountains, which lie between the Wrangell Mountains and the coast, represent an uplifted and eroded plain, and this origin is now recorded in the level sky-line presented by the tops of the individual peaks and ridges which make up the range as a whole.

The Alaskan Mountains to the northwest owe their relief to profound fracturing of the earth's crust, the rocks to the north of the break being lifted high above those to the south. Erosion, acting on this broken edge, has carved the serrate crest as we now see it, leaving the areas of harder rock in high relief.

The Wrangell Mountains, on the other hand, are for the most part masses of lava and volcanic mud, which have been piled up on an earlier surface, of considerable diversity, burying the old land forms and substituting for them the present splendid group.

The heights rise from the valley of the Copper River, which along the west base of the mountains stands at from 500 to 1,500 feet above sea-level. This valley is a gently sloping, moss-covered, lake-dotted plain, in somber green, accentuating by its level character and its dull coloring the great heights and the dazzling white of the adjacent summits.

Indian travelers say that Mount Everest is dwarfed by the elevation of the land mass from which it rises and by the surrounding close-set peaks, which are but little lower than Everest itself. At Yakutat, one is in doubt at first as to which of the great summits in sight is St Elias. Logan's superior height was recognized only after the angles to its top were solved. McKinley alone stands out in solitary grandeur. But each of the four striking peaks of the Wrangell group has its own individuality and seems to accentuate, not to dwarf, its neighbors. Each, as it were, serves as a scale which helps the eye to comprehend the magnitude of all.

The shapes of the peaks are the combined products of vulcanism and erosion. Either predominating gives a distinct type. Intermediate forms are due to the partial ascendency of one or the other force. Mount Wrangell owes its outlines almost wholly to volcanic action. Erosion has modified this original form but little. Mount Drum's contour, on the contrary, is that due entirely to denuding agencies. The original built-up form is gone. Mount Sanford is a volcanic dome, one-half of which has been mined away by a sapping glacier. Mount Blackburn has been etched on all sides until only its summit has the gentle original slope; all below this is the precipitous wall due to undercutting ice.

Wrangell is a great flat cone nearly three miles high and eight times as broad. Its gently arched surface is a glistening snow-field, broken here and there by a smoking rock or touched at the summit by a smudge of ash from the crater which sends up intermittently rolling columns of smoke and vapor. From its eastern slope flows Nabesna glacier, a frozen river fifty miles in length. On its western face, in a shallow valley, a dozen jets of steam may be seen on a still morning issuing from as many vents, and the glaciers from this basin are black with the breath of the mountain.

It is not recorded that the summit

Mount Drum

Photo by W. C. Mendenhall

has ever been reached. John Bremner, who was a prospector and a man of imagination, reports that he got to within a mile of the top. It is probably well that he did not attempt the last mile. A report is current in the Copper Valley that some years ago two miners attempted to reach the crest on snowshoes, but, after traveling the greater part of the day and finding the summit still distant, wisely decided to return.

If you interview the Copper River native about Mount Wrangell you will find him reticent; but if you finally win his confidence and gratitude by a square meal and a pipeful of tobacco without demanding some service in return, he may reward you by telling you in compact but fragmental English the native legend of the tragedy of the mountain. "Long time ago two Siwash go look see; mountain him smoke. One Siwash come back. Hiyu (much) smoke. No good." As he tells you he squats on his haunches in the door of your tent, fingers all of your personal belongings, and reeks with the accumulated odors of generations of unwashed fish-eating ancestors.

You are tempted to wish that more Siwashes had gone to the "Mountain that Smokes." It is an unworthy wish. The native is but a brown child of the wilderness, curious, uncontrolled, timid, uncomprehending. The white invader is feared for his numbers, his energy, and his ability, but he is past understanding. His restless, all-sacrificing search for gold or copper or other useless stuff, his abundance of all the greatly desired things—clothing, food, guns, tobacco—which come off the great water in unlimited quantities, but are dispensed to the needy Siwash most grudgingly; his curious doctrines about right and wrong, and property and work, doctrines which he seems to expect the native to observe, but which he himself so often ignores—altogether the white man is quite beyond native comprehension.

FEASIBLE ROUTES FOR THE ASCENT OF MT WRANGELL AND THE HIGHER PEAKS

But, in spite of the native's fear of it, the "Mountain that Smokes" should be climbed, and climbed soon. It will not be a difficult feat, and the reward will be unique. It is not likely that the summit of Mount McKinley will be reached at an early date, and so Mount Wrangell should be the first of the great interior peaks of Alaska to be scaled. The attempt is earnestly recommended to any one of the numerous active mountaineering clubs of the United States. The line of perpetual snow is at about 6,500 feet, and the summit rises 7,500 feet above this. At this summit is a crater which sends out columns of smoke 3 miles high. The relation of the crater to the ice cap will be most interesting, and the mere feat of first reaching the summit of the only known active volcano in the interior of the continent north of the Mexican line may well appeal to any man.

There are at least four feasible routes of approach. One is from a plateau at the head of Dadina River, between Mount Drum and Mount Wrangell, and the way leads southeastward past the base of Mount Zanetti, the spur to the summit. A temporary camp can be placed on the mesa at the edge of the ice cap from the valley of the Dadina or the Sanford. It may be possible to take horses up on this mesa from the Dadina Valley, but the matter has not been put to a practical test. From such a camp the march to the summit would be long, 10 or 11 miles, but would lead past the foot of Mount Zanetti over a snowfield which is very smooth.

Two routes, either of which is probably feasible, lead from the head of the valley of the Chetaslina River. The middle fork of this stream rises from a double glacier, which owes its compound character to a nunatak about 3 miles long, rising above the ice level at about an equal distance back from the foot of the glacier. The lobe of the glacier, which lies to the west of this nunatak, is smooth and easily crossed. Pack animals could be taken over it nearly, if not quite, to the nunatak. From a camp near the upper end of the nunatak, to which fuel would have to be taken, the ice cap is easily accessible at an elevation of about 6,500 feet and only 6 miles, air-line distance, from the summit. This route, however, lies across the crevassed basin forming the western face of the peak, and although most interesting, since it passes the "Field of the Jets," a region of steaming rock points, is likely to offer some difficulties and dangers.

The other suggested route from the head of the Chetaslina follows the eastern edge of the glacier and by a steep rock climb gains the ice, at 7,000 feet or over, not more than 5 miles in an air line from the summit. By traveling almost due east over the ice for about 4 miles, this route would avoid the Field of the Jets and would converge with that next to be described, near a long, low ridge of steaming rocks which lies a couple of miles south of the summit at an elevation of 11,000 feet.

What appeared after an inspection of the peak from all sides in 1902 to be the surest and safest route, although not the shortest, is from the northern end of the broad mesa which separates the Cheshnina from the Chetaslina drainage. Pack horses can be taken up on this mesa from the east fork of the Chetaslina and a base camp pitched at about 6,000 feet. From the edge of the ice cap, a mile above this camp, to the summit, is 7 miles, and the route lies over the long, low, smooth spur of which the mesa is the continuation. The intervening snow-field appears to be perfectly smooth and safe and the approach by it is the one recommended. Last summer (1902) members of the Survey party climbed this thin spur through rain and fog to between 7,500 and 8,000 feet and experienced no difficulty except that caused by the soft snow. In the course of geologic work the ice cap was reached and traversed for perhaps a mile from the nunatak at the head of the Chetaslina also, so that the lower portions of both these lines of advance have been tested.

In an attempt of any of the high peaks of interior Alaska, it is essential to be on the ground ready to make the climb early in the season. After July 1 the weather becomes warm and the snow-clad higher summits become storm centers, which condense the vapor from the heated lowlands, and as a consequence are hidden for much the greater part of the time in clouds. It is needless to say that one cannot climb unknown peaks successfully through a fog which conceals all their features. In an average season, a perfectly clear day after July 1 cannot be reckoned upon until late in the fall, when the nights have lengthened and the summits are covered with new snow. The proper time to climb is about June 20. In addition to the good weather, which is much more probable then than later, the days are the longest of the year, and although the sun is below the horizon for two or more hours, there is no real darkness. With clear weather the air chills quickly at the greater altitudes as the sun sinks, and a crust forms over the snow, so that rapid progress can be made. This is particularly important in climbing Wrangell, because the slopes of the peak are so gentle that just above the line of melting there is a wide zone of snow, which is soft and greatly impedes climbing unless a crust is formed over it.

Ordinary precautions will have to be taken, of course, in crossing these unexplored snow-fields, even where no crevasses are visible. During 1902 two employés of the Survey were crossing a glacier on the north flank of Mount Wrangell to reach a high point which it was intended to occupy for topographic work. The snow seemed per-

Photo by W. C. Mendenhall

Snider's Peak, as Seen from the West

fectly safe, and the rope which was always carried on such trips was not in use. Suddenly the crust gave way beneath the feet of the man in advance and he sank, but throwing out his arms was sustained by them until dragged out of danger by his companion. Fortunately for him, the concealed crevasse was narrow at the top. The rope was used for the rest of that day.

After Mount Wrangell, the peak which will no doubt prove most interesting from the point of view of the mountain climber is Mount Sanford, the highest one in the group, 16,200 feet above sea-level. This magnificent summit, when viewed from the south between Mounts Drum and Wrangell, presents an outline so totally different from that exhibited by its northern slopes that Allen in 1885, from the mouth of the Chetaslina, named it Mount Tillman, and then from the upper Copper, failing to recognize it, rechristened it Mount Sanford. His supposition that there were five peaks where there are in reality but four, together with the changing aspect of the mountains as one encircles them in following Copper River, led to further confusion. Therefore, in his sketch from 6 miles above the mouth of the Gakona, Mount Drum is called Mount Tillman and Mount Sanford is called Mount Drum. The fact that Allen's Mount Tillman is a myth has been a matter of common knowledge for some years. Mahlo's map of 1898 shows three peaks where Allen had four, and Mr R. S. Dunn, who is now en route to Mount McKinley, has called attention to the error in a recent magazine article.

The southern face of Mount Sanford is a 12,000 foot slope of 60 or 70 degrees—practically a cliff, too steep even for much glacial ice to accumulate. This precipice faces the southwest, and in early summer must be scored by splendid and constantly recurring avalanches. The ice accumulations at the foot of the declivity form Sanford glacier, the source of Sanford river. In remarkable contrast to this precipitous southwest slope, the cirque of Sanford glacier, is the northern face of the mountain. Viewed from any point on the upper Copper River or the foothills beyond it, Mount Sanford appears a smooth, rounded dome of snow, so even, except as glacial erosion has eaten into it around the base, that it appears to be possible to travel over it in almost any direction. Really, however, there are probably few feasible approaches, because the smooth upper reaches of the mountain break off just above the base into cliffs.

A glacier, which is one of the sources of Boulder Creek, appears from below to form an easy way through these encircling cliffs to the even snow-fields above. When these are gained, reaching the summit will depend upon weather and preparedness. It is not possible to make the climb from below snowline in one day, and a well organized party, equipped to stay on the mountain a week with an upper camp at 10,000 feet, will stand the best chance of success.

The writer has not been nearer to Mount Blackburn than the head of Kotsini River, a dozen miles from the peak, and he has not seen it except from the west. Viewed from this direction, its aspect is most forbidding. Near the top the slopes are gentle enough, but up to 12,000 or 13,000 feet its western face is a series of crags and cliffs, scarred by ice falls or covered by steep, deeply crevassed glaciers. Its southern side is reported but little better, so that the most hopeful direction from which to approach it seems to be the north or northeast, from one of the tributaries of the Kennicott or of the Nabesna glacier. Both of these are long glaciers which have not been traversed, or at least we have no record of their exploration, so that in addition to the possibility of finding the mountain inaccessible after reaching its northern or eastern base, there is the further possibility of difficulty in getting to this position.

Mount Drum is lower than either Mount Sanford or Mount Blackburn by more than 4,000 feet. Its base is more accessible than that of any of the other peaks, as it stands out in the Copper River Valley well to the west of its companions. The air-line distance from Copper Center to the summit is less than 25 miles, and the lowest point in the divide connecting it with the Mount Sanford-Wrangell pile is about 5,000 feet; hence one may travel entirely around the mountain by way of the Dadina and Sanford River valleys without having to make any difficult climbs.

But this little 12,000-foot peak appears to be one of the hardest of the group to scale. It is really but the skeleton of a mountain, having been so eaten away by the Nadina drainage that its summit is only a sharp crescent-shaped ridge, surrounding the amphitheater in which Nadina glacier heads. The prospectors of the region speak of it appropriately as the "shell." Other drainage than that of the Nadina has been active, so that all of its faces are steep, and the ice masses which hang on them are greatly crevassed. It is these which present the difficulties. If Drum were free from glaciers it would be merely interesting as a rock climb. As it is, the only route to the summit which appears to be at all practicable is that by the ridge between the Nadina and Klawasina glaciers. Pack animals may be taken 5 or 6 miles above the foot of Nadina glacier, and camp established on a little flat just west of the glacier, within an air-line distance of less than 5 miles from the summit. By climbing westward, up the valley of a little brook, the ridge in question may be reached at between 6,000 and 7,000 feet, and, so far as may be judged from below, its ascent will not prove difficult up to 10,000 feet. Beyond that it is very narrow, the ice overhangs, is crevassed, and probably unsafe, but careful mountaineers may be able to make their way over it to the summit.

Snider's Peak—Little Drum, it is sometimes called—lies just south of the main peak. It is 8,300 feet high, and although sheathed in ice on its north slope, is free from it on the south and very precipitous.

IMPORTANT GLACIERS OF THE GROUP

Several of the important glaciers of the mountain group have already been mentioned incidentally. The whole central mountain mass above 7,000 feet is a nevé field above which project occasional points, too sharp to permit the accumulation of snow. From this central snow-field Alpine glaciers drain in all directions down canyon-like valleys which the glaciers themselves have moulded. As the divide between the northward and the southward flowing streams lies nearer the southern line of the group, and so near the southern line of the high area in which snow accumulates, it follows that the greatest glaciers flow to the north. The largest of these are the Nabesna and Chisana, ice streams 45 and 30 miles long respectively and the sources of the two great branches of the Tanana River.

Kennicott glacier on the south side of the range, draining the slopes of Mounts Blackburn and Regal, is probably the third of the ice streams in magnitude. Then follow a host of smaller glaciers—Nizina, Kuskulana, Copper, Nadina, Jacksina—all sources of streams of the same name and none of them less than 10 miles in length. The glaciers of the Alps are few in number and insignificant in size, by comparison.

From each of these glaciers flows a turbulent river. Usually, as it issues from beneath the ice foot, the stream spreads out over a wide flood plain, built up of coarse material, upou which it constantly shifts its numerous channels. After a course which varies from a few to many miles over such a flood plain, the channels unite and enter a canyon cut in the flood plain material or in the rock beneath it, and in this canyon the tributary continues to or nearly to its junction with the master stream. Sometimes just above this junction a second flood plain is developed.

These rivers, like all others with glacial sources, are at their highest stages during midsummer, when melting of the snow and ice is at the maximum, and are lowest in the late winter, when this is at a minimum. In the summer they are muddy, overloaded with ground-up rock fragments; in the winter they are clear, and the trout, driven from them in summer, return to them.

The greater part of the drainage of the Wrangell Mountains is gathered into the Copper River, whose basin of nearly 25,000 square miles includes a large proportion of mountainous territory, in which glaciation is at present active. Among the large streams of the continent, it is perhaps the most nearly purely glacial in its sources of supply, and a comparison of its grade, which is dependent, in part at least, upon this fact, with those of other streams becomes interesting.

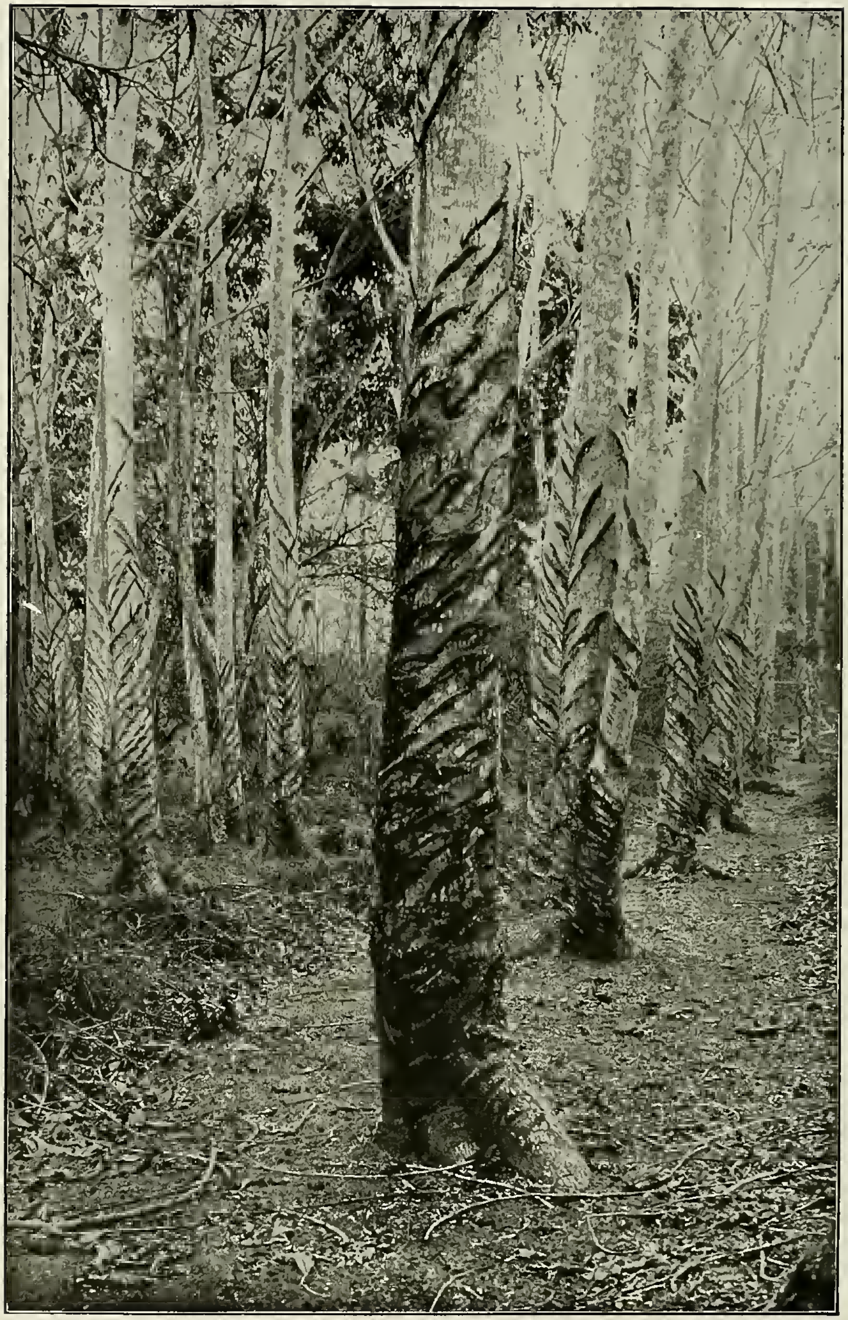
The total fall of Copper River, from its sources in Copper Glacier to the sea, a distance of about 300 miles, is 3,600 feet—an average of 12 feet per mile. The lower half of the river, from Copper Center to the mouth, has an average fall of nearly 7 feet per mile, while the upper half, between Copper Glacier and Copper Center, falls about 17 feet in each mile.

Compare with this the fall of the Yukon, which between White Horse and the sea is approximately 1.2 feet per mile, and below Fort Yukon about .5 feet per mile, or that of the Ohio, which between Pittsburg and Cairo is .435 feet per mile. The relatively torrential character of the Copper as a type of glacier-fed stream thus becomes strikingly evident.

Copper River drains the southern, the western, and a part of the northern slope of the mountains. The central part of the northern face drains into the Tanana by its two great tributaries, the Nabesna and the Chisana, while some of the glacial drainage from the extreme northeastern limit of the mountains passes down the valley of the White to the Yukon.

The district embraced by the group offers many attractive problems to those interested in physical geography or geology and the allied sciences. The problems of land forms as determined by vulcanism and as modified by glacial erosion, questions of ice accumulation and shrinkage, of glacial deposition, of the aggradation of glacier-fed streams, unique problems of vulcanism and glaciation, such as subglacial lava streams, and modifications of glaciers by the heat attending volcanic activity are a few of the questions which immediately occur for investigation here.

The opening of the military trail from the port of Valdez, on Prince William Sound, and the establishment, by prospectors and others, of various secondary trails to points within the foothills of the Wrangell Mountains have made the whole region comparatively accessible. It is quite probable that the next few years will see a railroad built to the copper properties in the Chittina Valley, which will remove the present necessity of making a trip of 150 miles by pack train and will place the traveler in the interior valley of the Copper at any season of the year. When that time comes, the Wrangell Mountains should prove an attractive field for students and for those tourists who desire to get a little beyond the usual summer frontier. The maps which are now drawn and will soon be publicly available will serve as guides until the time shall come when larger-scale work is required, and the preliminary geographic studies which have been carried out will serve to indicate the tenor of the closer studies of the future.



From O. F. Cook, Department of Agriculture

Picture No. 1.—A Plantation of Castilla Rubber Trees

The trees are about 14 years old. They can be tapped when they are eight years old, and after that every few months

RUBBER PLANTATIONS IN MEXICO AND CENTRAL AMERICA

NEXT to coffee and sugar, crude rubber is the largest of the tropical imports of the United States. It is the only one of these three for which we are entirely dependent on foreign countries. The value of the crude rubber that we import every year, 55,000,000 pounds, reaches about $30,000,000, but none of it comes from Porto Rico or the Philippines. Over one-half of the total is imported direct from Brazil, while considerable quantities come from the United Kingdom, presumably the products of her colonies, and from Belgium, chiefly the product of the Congo Free State.

It occurred to the Department of Agriculture, while pondering what new industries might be found for Porto Rico and the Philippines to improve conditions on the islands, that rubber trees might be grown profitably on them. An agent of the Department, Mr O. F. Cook, was therefore sent to Central America and Mexico, where millions of dollars are invested in rubber plantations, to study rubber culture and to report on the advisability of starting similar plantations in our new island possessions. Mr Cook spent several months at the different rubber plantations, and his preliminary report has been published by the Department.

It is yet too soon to state definitely whether rubber trees can be successfully grown in Porto Rico, but the prospects seem favorable for growing the Castilla rubber tree, as the southwestern part of the island is dry and hot. It should be noted that crude rubber may come from three different kinds of rubber trees, each requiring different climate and soil. There is the Para rubber tree (*Hevea*), which thrives in the wet valley of the Amazon, but which will not grow in a dry climate; the Assam rubber (*Ficus elastica*) of Java, also needing a humid atmosphere; and the Castilla rubber tree of Central America and Mexico, which prospers best where it is dry and hot and will not grow in swamps or wet soil. Mr Cook recommends that experiments be begun by planting a number of Castilla rubber trees in Porto Rico and the Philippines, but he warns the American public against investing large sums in starting rubber plantations until it has been proved that the rubber tree will grow successfully on these islands.

The accompanying illustrations, for the use of which the NATIONAL GEOGRAPHIC MAGAZINE is indebted to Mr Cook, give interesting information about the rubber tree and the native Mexican method of tapping it for its milk.*

It would seem to be a very simple matter to improve on the rude gashes made by the machete of the rubber gatherer, but this has not proved to be easy. The rubber milk is not the sap of the tree and can not be drawn out by boring holes in the trunk, as is done with the sugar maple. The milk is not in the tissues of the tree, but is contained in delicate tubes running lengthwise in the inner layers of the bark, and to secure milk in any quantity it is necessary to open many of these tubes by wounding the bark. The rubber is formed in floating globules inside the tubes and can not pass through their walls, so that even a suction apparatus would not bring it out unless the tubes were cut.

The method by which the natives of Soconusco, Mexico, have been accustomed to extract the milk is shown in

* Consult "The Culture of the Central American Rubber Tree." By O. F. Cook. U. S. Department of Agriculture: Bureau of Plant Industry—Bulletin 49.

From O. F. Cook, Department of Agriculture

Picture No. 2.—A Native Tapping a Castilla Rubber Tree

At Zacualpa, Chiapas, Mexico. The tree shown in this picture is a small one. Many of them exceed five feet in diameter, with trunks going straight up for 30 feet

Fig. 1

Fig. 2

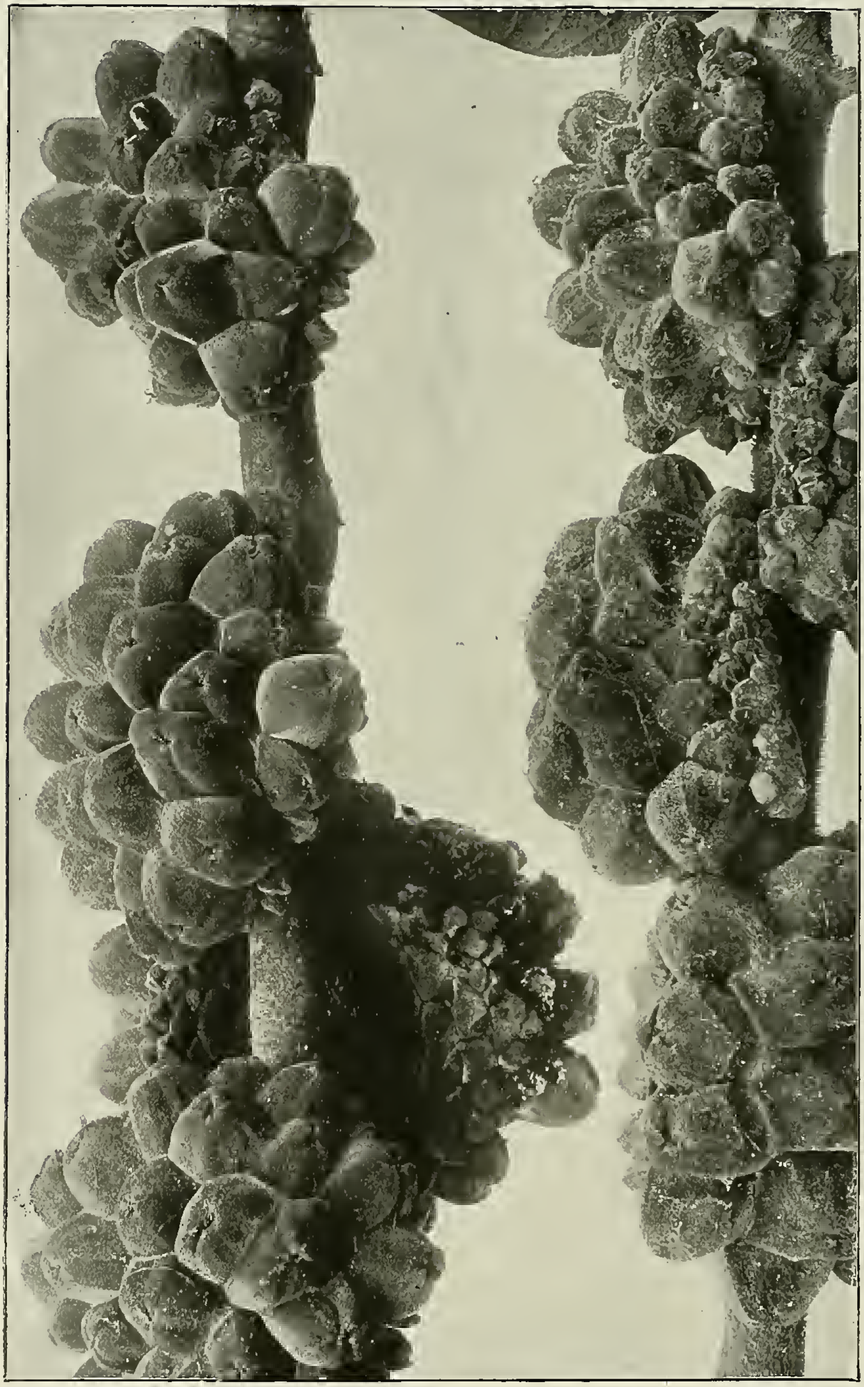
Fig. 3

Fig. 4

From O. F. Cook, Department of Agriculture

Picture No. 3.—Native Method of Coagulating the Latex or Milk of the Rubber Tree

Fig. 1.—Spreading latex on Calathæa leaf; a leaf already coated shown at the right, lying in the sun to coagulate the rubber. Fig. 2.—Pressing the two coated leaves together to unite the two sheets of rubber. Fig. 3.—Pulling the leaf away from the rubber. Fig. 4.—The finished sample of rubber, marked by the veins of the leaf.



From O. F. Cook, Department of Agriculture

Picture No. 4.—Clusters of Ripe Fruit of the Castilla Rubber Tree

Natural size. The fruit is fleshy and of a reddish orange color picture No. 2. The ulero makes with his machete diagonal lines of gashes, extending nearly around the tree, like the letter V, the point being downward. The milk flows down these channels to one side of the tree, whence it is led down to a cavity hollowed in the ground and lined with large, tough leaves. These are dexterously lifted up, and the milk is poured out into a calabash or other vessel and carried away to be coagulated. The diagonal channels are from two to three feet apart, and those of each successive tapping are inserted between the older scars. The milk will all run out of the tree in about an hour.

A Castilla tree 5 feet in diameter will yield when first cut about 20 gallons of milk, making 50 pounds of rubber. The tree may be cut again after the lapse of a few months. That the trees at La Zacualpa shown in picture No. 1 have been able to survive so much of this barbarous treatment and are still vigorous and heavily laden with fruit seems to indicate great tenacity of life, and yet even this rough handling represents an improvement upon the former custom of cutting the trees down entirely or hewing steps in them for the ulero to climb up. Instead of the forked stick used as a ladder at La Zacualpa, the large forest trees are ascended for 30 feet or more by means of ropes, vines, climbing irons, and steps cut in the trunk.

The studies which the Department of Agriculture is making in regard to starting rubber plantations on American soil are specially important in view of the disappearance at no distant day of the rubber forests of Brazil and Africa, whence nearly nine-tenths of the supply of rubber now comes. The world is almost entirely dependent on savages, or on natives too barbarous to be called civilized, to get the rubber out of the forests. They, tempted by the high price which rubber brings, swarm into the rubber forests and chop the trees down to save time in collecting the milk.

Mr K. K. Kennedy, U. S. consul at Para, Brazil, has recently sent to the Bureau of Statistics of the Department of Commerce and Labor the startling reports of two expeditions which have been examining conditions in the rubber country.* Captain Gerdeau, after exploring, investigating, and canvassing the territory of the upper Amazon and its tributaries in the richest rubber belt in South America for more than a year, advises him that the rubber gatherers are cutting down the forests with amazing rapidity and improvidence, far beyond what his previous information had led him to expect. He expresses grave doubts if the supply can be kept up unless stringent measures to protect the rubber forests be immediately taken.

Robert Blair Ewart was a member of an American exploring expedition which started inland from Lima, Peru, crossed the Andes, and then descended the tributaries of the Amazon and the great river to Para. Mr Ewart described to Consul Kennedy the rubber-hunting in eastern Peru, along the Ucayali River, a tributary of the Amazon:

"The Ucayali is a magnificent stream, as large as the Mississippi, and traverses one of the finest rubber districts in South America. In all this great territory there is but one man who is producing fine rubber. All the rest are caucho hunters. These latter are the bane of the country, and have done incalculable damage in the past few years. They do not bleed the trees in the regular way, but cut them down and extract the gum by the wholesale. Thus every year enormous forests are destroyed, and each year the supply grows less and less and the rubber gatherers are compelled to go farther back from the rivers. This makes the production of rubber more difficult, dangerous, and expensive each year, and it is only a question of time when this immense and most important rubber-producing terri-

*Daily Consular Reports, October 21, 1903 (No. 1780).

tory will be entirely stripped of its rubber forests. I found that caucho is selling on these far upper rivers for 20 to 22 soles ($10 to $11) per arroba of 32 pounds."

Recently the French government started an industrial school in the Sudan to teach the natives the best methods for rubber gathering. The school has proved a success, as the natives soon realized that the practical suggestions they obtained at the school meant a better quality of rubber and hence greater profit to them.

THE ZIEGLER POLAR EXPEDITION

THE latest news of the Ziegler Polar Expedition is contained in a letter to Mr Ziegler, written by Commander Fiala ten days after leaving Vardö, Norway, and received by Mr Ziegler in New York the later part of September. As far south as 75° north latitude the expedition came upon a compact barrier of ice, which they followed to within sight of Nova Zembla without finding an open lead. At the time of writing they were returning toward the west, intending to try and force a way northward through the ice barrier between the 46th and 47th parallels of east longitude. The ice conditions were thus exceedingly unfavorable at the

Photo by W. S. Champ

Edward Haven, First Officer
W. J. Peters, Representative of the National Geographic Society, Chief Scientific Staff and Second in Command
Captain Coffin
Commander Anthony Fiala
H. P. Hartt, Chief Engineer

Photo by W. S. Champ

Some of the Dogs of the Ziegler Polar Expedition

Photo by W. S. Champ

A Deck Scene on the *Amerika*

Photo by W. S. Champ

S. S. *Amerika* of the Ziegler Polar Expedition

start, but probably after forcing their way through the barrier they found open water beyond. Mr Fiala's letter is as follows:

BARENTS SEA, *July 20, 1903*.

DEAR MR ZIEGLER:

We are rapidly nearing a sail, and in hopes of this reaching you I write hastily.

We left Archangel on the 4th of July, but as Mr Champ has probably told you, we were delayed by a storm in the White Sea, reaching Vardö, Norway, July 9. At Vardö we took on coal and water, leaving there the evening of the 10th. Since then we have been skirting the edge of the ice pack, vainly looking for a lead. We made a direct course from Vardö, striking the ice at 38° 30′ E. long., 75 N. lat., and then went into the ice to the 75° 38′; but it was so solid that we returned and went eastward and southward along the edge of the pack, looking for a lead, until we were near the shores (in plain sight) of Nova Zembla last night in latitude 72° 45′. Not finding a lead of any character worth going into the north ice, we are returning northward and westward, where we intend to push into the ice between the 46th and 47th parallels of E. long., as Captain Coffin thinks it will be the best place to try to *force* our way.

Instead of being a particularly good year as to ice conditions the indications thus far seem to prove otherwise, and the strange silence, from the lack of life, that broods over this waste of ice is peculiar. Dr Shorkley said to me that it seemed to him like a graveyard of ice. We have indeed struck a peculiar season; numbers of dead birds strewn on the cakes of ice and not one polar bear has been sighted, and only a stray seal once in a great while. It either indi-

Photo by W. S. Champ

Embarking the Siberian Ponies at Solombala, Siberia

cates immense fields of ice north or lots of open water. Let us hope for the latter.

Everything aboard has been pleasant and harmonious. Men are in splendid condition and happy, though impatient to get north. The horses and dogs are in particularly good form and we are particularly thankful for the coal we took on at Vardö, for we feel we shall need every ounce of it, as we look at the long unbroken mass of ice.

Yours sincerely,
ANTHONY FIALA.

The *Amerika* has been entirely refitted the past year—new decks, new rigging, new boilers, new engines. She makes 8 knots an hour without any help from the wind and rides very easily in spite of her tremendous cargo. The dogs and ponies were taken aboard at Solombala, near Archangel, and seemed in splendid condition.

The expedition left Vardö in excellent spirits and excellent condition. Most important of all, the men and crew had had a chance of working together for several months before the actual start, and it was the unanimous opinion of all that harmony and good-will would continue.

The *Amerika* left Trondhjem June 23, Tromsö June 27, Archangel July 4, and Vardö July 10.

At every port and wherever the expedition or any members of the party went they were received with great courtesy and everything was done by the officials and people to help the work of the expedition. This courteous treatment was much appreciated by all, and acknowledgment of this kindness to them is gratefully made by Mr Ziegler. Special thanks are due to Professor H. Geelmuyden, the distinguished observatorist at the University of Christiania, for loaning the expedition a 20-cen. alt. azimuth circle by Repsold.

THE MINING BUREAU OF THE PHILIPPINE ISLANDS

By Charles H. Burritt,

Chief of the Mining Bureau

THE Mining Bureau of the Philippine Islands was reëstablished on March 10, 1900, by order of Major-General Otis, U. S. Military Governor of the Philippines, and was made successor of the "Inspección General de Minas" of the Spanish Philippine Government and with the same duties. These duties were divided into three divisions, viz:

(*a.*) Supervision and administration of titles and grants.

(*b.*) Supervision and direction over mines, including inspection, sanitation, and police.

(*c.*) Geological and mineralogical surveys and scientific studies.

These duties have nevern bee changed by the American Government, either civil or military, with the exception of subdivision (*a*) above quoted. By the act of Congress of July 1, 1902, the supervision and administration of titles, so far as issuance thereof is concerned, upon all claims for mineral lands instituted after August 14, 1903, was vested in the Insular Bureau of Public Lands. The Spanish titles and grants remain in the Mining Bureau. A thorough examination of these titles and grants has been made, the validity and regularity of each has been determined, and a bulletin has been issued by this Bureau with a classification of all such titles and grants, whether valid or invalid, and with full information as to their inception, location, survey, and other steps of procedure. This is our Bulletin No. 2.

Owing to the insurrection and disturbed conditions, but little could be done under subdivision (*b*). Many mining claims have been instituted and a vast amount of prospecting has been done since the American occupation, and in several provinces a considerable amount of development work has been done. On the Island of Batan the Spanish corporation, "Minas de Carbón de Batan," with a capital of $1,000,000, is now developing the Spanish coal mining grants of Gill Brothers and are proceeding rapidly with a corps of employés, consisting of Spanish and Japanese miners, and with a large force of native employés and laborers. The Villanueva and Muñoz Spanish coal grants on the west of the same Island of Batan have recently been acquired by the United States Government, and by order of the Secretary of War these mines are now being opened up and developed. The work is under the supervision of Lieut. H. L. Wigmore, Corps of Engineers, U. S. A., and I have no doubt of the success of this enterprise. Its importance from an economical and commercial standpoint is not less than its importance as an international factor.

The investigation of the coal measures of the Philippines was the first subject taken up by this Bureau after its reëstablishment, with a view of securing for the United States within its own territorial boundaries in the Orient a supply of steam coal that could be made available in case of an emergency for all governmental purposes and especially for supplying coal to the Philippine and Asiatic Squadrons of the U. S. Navy. Many hundreds of documents were carefully read and studied, and the result presented in the report on "The Coal Measures of the Philippines," by Charles H. Burritt, 1st Lieutenant, 11th U. S. Vol. Cavalry, officer in charge of the Mining Bureau, and published at Washington in 1901. This report was supplemented by a visit of inspection to the principal known coal deposits by Lieut. Edward M. Markham, Corps of Engineers, U. S. A., under directions of the Secretary of War. As the result of these investigations and reports, the western portion of the Island of Batan was recommended and selected for governmental experiments, and this work is now in progress with every prospect of success.

In 1902 a field party was organized and sent out from this Bureau to make a reconnoissance of the well-known iron region of Angat, Bulacan, and to submit a report thereon as a basis upon which to institute and build up a systematic geological and mineralogical survey of the archipelago and to disseminate such information as to the mineral resources and other conditions as to enable capital to be intelligently directed in the mining industry. Mr Hiram D. McCaskey, B. S., and the mining engineer of this Bureau, a graduate of the Lehigh School of Mines, was placed at the head of this expedition, and his report on "A Geological Reconnoissance of the Iron Region of Angat, Bulacan," a work of 62 pages, with 14 maps, sketches, and tables and 41 half-tone illustrations, has just been issued as "Bulletin No. 3" of this Bureau and from the Bureau of Public Printing of the Government of the Philippines. This work covers a brief description of the class and character of the field work, with subdivision, physical and geographical, geological, lithological, and mineralogical ; with a well illustrated description of the iron-mining industry as carried on by the natives and which is one of the oldest mining industries of this archipelago. The Zúñiga theory of the Taal volcano is discussed at length, and the authorities upon that subject are carefully compared. In addition to the iron deposits, the author has also treated of the gold, graphite, and lignite deposits of that region, and has also added a chapter on lime-burning. The tables of analyses of ores are very complete, and the practical questions of labor and transportation are fully presented. The famous mineral springs of Bulacan are also described.

The Bureau has also issued a bulletin (No. 1) on "Platinum and the Associated Rare Metals in Placer Formations" for the use of miners and prospectors.

This completes the publications of the Bureau, but it represents only a small portion of the work that has been done by the Bureau. Questions of titles have constantly arisen, and the manuscript reports on this line make several large volumes. The mining engineer has made a careful study of both the geological and economic conditions so far as the same could be learned from the voluminous records and archives, as well as from prospectors and miners, and scientific expeditions have been made to Culion and Paragua, with preliminary reports thereon. These expeditions, which were only cursory, together with the field work in Bulacan and the study of the archives and records, have enabled this Bureau to frame and recommend to the U. S. Philippine Commission a proposition for the reorganization of this Bureau, transferring all titles to the Bureau of Public Lands, in order that titles on mineral lands may be more economically administered, and placing this Bureau in a condition to take up the work of (*a*) geological and mineralogical surveys and studies and (*b*) the promotion and encouragement of the mining industries, the work in the future to follow along the lines of state geological bureaus or state bureaus of mines in the United States. That there is an urgent demand for this reorganization, and that under it the mining industry will be promoted and in a reasonable time become an important factor in these islands, the writer has no doubt, while the field of geological research is one of untold wealth.

RECORD ASCENTS IN THE HIMALAYAS

DR WILLIAM HUNTER WORKMAN and Mrs Fanny Bullock Workman, members of the National Geographic Society and authors of "In the Ice World of Himalaya," have completed their second consecutive season of high climbing and exploration in the northwest Himalayas, in the region lying between 74° 55′ to 75° 40′ east longitude and 35° 45′ to 36° north latitude. As previously stated,* their attention last year was given to the first exploration of the long Chogo Loongma glacier and its large terminal tributary glaciers, and to ascents of various peaks and passes on these glaciers.

The party consisted this season of Doctor and Mrs Workman, J. Petigax, C. Savoie, and L. Petigax, guides of Courmayeur, and B. Hewett, of London, surveyor. The Hoh Lumba and Sosbon glaciers, running northwest from the Bralches Valley, were first visited. Neither of these had been previously explored, and they were found to be of quite different topography from that indicated on Indian Survey Map, 27*a* N. E. In fact, the Sosbon is sketched on said map only as a small branch of the Hoh Lumba. From the village of Hoh, altitude 9,400 feet, the Hoh Valley was ascended for about 8 miles to Nanghmah Tapsa, a grazing ground at 11,800 feet. From here the ascent was continued over a large old moraine, covered with great blocks and well wooded. This old moraine is followed by one of much newer appearance, covered with smaller rocks and scanty vegetation, and there are evident signs of a rapid retreat of this glacier of late years. Above all this was a large moraine ridge rising to 50 feet above the glacier level. Crossing this the real glacier was attacked at 13,000 feet. Beyond here, it being early summer, the glacier, lateral moraines, and lower mountain spurs were all heavily coated with winter snow and snow camps were everywhere necessary.

One night was passed at 14,400 feet and two at 15,600 feet, at the base of the only depression in the chain of mighty rock needles which encircle the upper end of the Hoh Lumba. This depression, instead of being a long, easy snow pass crossing to a glacier connecting with the Hispar glacier, as marked on the survey map, is an immense overhanging snow cornice surmounting a high, difficult sérac fall. It was ascended in six hours by Dr and Mrs Workman and guides from the highest camp. The height, calculated by hypsometer, later compared with lower-station mercurial barometer readings taken at the same hours, was 18,600 feet. From the great cornice overlooking an abyss of 7,000 feet a medium-sized glacier was observed running in a westerly direction, probably to the Hispar glacier. The length of the Hoh Lumba from its snout to the base of the great col is about nine miles. On the west side of the southern end three small glaciers debouch into the main stream, and on the east a larger feeder enters near the south end. Above this on the east, four miles from the snout of the Hoh glacier, a large glacier of similar importance with the Hoh Lumba comes in, called the Sosbon. Its course is approximately parallel with the Hoh Lumba, and its length from its junction with this is five miles to the col at its source.

Camps were established on this glacier, which was ascended and surveyed, and measurements and angles were taken to determine the rate of movement, and angles also taken to ascertain the heights of various peaks on this and on the Hoh Lumba.

The middle of July the party returned to the chief camp of last year at 14,000 feet on the Chogo Loongma glacier. Here they were imprisoned nearly the whole of the last two weeks of the month

* NAT. GEOG. MAG., Vol. XIII, pp. 405–406.

by severe snowstorms. During a short break in the prolonged storms the only upper branch left unexplored last season was ascended. As the glacier enters the Chogo Loongma at over 16,000 feet and ends at its source, between 18,000 and 19,000 feet, the ascent over new surface snow to the depth of more than 2 feet was most laborious. At a glacier camp at 17,000 feet, one of the highest sun temperatures of the season was taken by a solar radiating thermometer—sun temperature at noon 204° Fahr., shade 56° Fahr.

In August the weather conditions improved and on the 9th, taking advantage of clear, settled weather, Doctor and Mrs Workman and guides, with only high climbing tents and eighteen coolies, left the main camp and ascending Basin glacier, an upper branch of the Chogo Loongma, camped at the base of a high snow peak in the range separating this glacier from the Chogo Loongma. The next day the ascent of its snow slopes was begun and camp brought to 18,400 feet on a small plateau. The third day, in spite of much opposition from coolies, a last camp was pushed to another snow slope at base of the final high cone at 19,355 feet. More than half the coolies were here prostrated by mountain sickness. Late in the afternoon steps were cut by the guides for upward of a thousand feet on the ice slopes, and on the fourth day, leaving camp at 3 a. m. by moonlight, the ascent was begun. The whole of this part of the climb was made in zigzags over slants rising at angles of between 60 and 70 degrees, measured by clinometer, and the summit, 21,770 feet, was reached at 7 a. m.

A narrow ridge connects this peak a few hundred feet below its summit to the north with an elevated snow plateau, from which rise two higher peaks. The party crossed the ridge and ascended the second peak, the summit of which was reached in three hours. The weather was cloudless and the view of the northwest Himalayas unsurpassed. There being little wind, it was possible to take careful boiling point readings which, compared since with a mercurial standard at the lower station of Skardu, fixes the height of this mountain at 22,568 feet.

Mrs Workman has thus broken her former world record for women on Koser Gunge, 21,000 feet, twice on the same day, by 770 and 1,568 feet respectively. While she and one of the guides remained on this summit, Dr Workman and the two others crossed the pleateau and ascended to 23,394 feet on fixed peak 24,486 feet, which gives him the world record for men, the greatest height hitherto attained being the summit of Aconcagua, 22,860 feet, the highest of the Andes. The high camp was again reached at 7 p. m., after an absence of over fifteen hours.

After the 16th of August the whole camp was carried up the Balucho glacier, running east from the Chogo Loongma, where, after two high camps, a new and difficult snow pass of 17,200 feet was ascended by the entire caravan. The difficult descent over a 1,000-foot snow wall was also accomplished after much argument with the coolies, and the expedition found itself on the third day at the junction of a side glacier with the Kero Loongma. This is the first time that a passage over the range separating the Kero and Chogo Loongmas has been effected.

The party next marched to the entrance of the Hucho Alchori glacier, where they were joined by the surveyor. This glacier was explored for the first time, and a snow col 18,200 feet at its source ascended by Mrs Workman and guides.

This season of climbing on new ground adds much valuable material to last year's work. The combined work of the two seasons makes the Workman expedition one of the most important exploring and high-climbing expeditions yet carried out in the northwest Himalayas.

THE NEW CONE OF MONT PELÉE

THE accompanying photographs by Dr E. O. Hovey show the remarkable tooth or spine of solid rock that has pushed up the throat of Mont Pelée since the eruption of May, 1902. The peculiar formation has been previously noted in this Magazine (p. 167, April, 1903). The photographs were taken by Dr Hovey on his recent trip to Martinique and the West Indies in behalf of the American Museum of Natural History. Dr Hovey's report has recently been published in the *American Journal of Science*.

The lofty tooth is rifted and fissured in every direction, and great fragments of it are constantly breaking off. The tooth rests on or is connected with fluid

The New Spine of Mont Pelée from the Basin of the Lac des Palmistes

Looking about S. 60° W. The apex is about 358 meters (1,174 feet) above the rim directly in front. The remains of Morne Lacroix are visible at the right on edge of the crater. Photographed March 25, 1903, for the American Museum of Natural History by Dr E. O. Hovey.

lava beneath. At night the lower portions of it glow with light. Dr Hovey says that in the light of the rising sun the spine looks like an enormous white monument rising above the mountain. Its true color is more a reddish brown with a whitish incrustation over it. No one can say exactly what the nature of the spine is, but the probabilities are that it is largely pumiceous in texture. The masses constantly falling from the sides of the spine, which grows as rapidly as it wears away, will probably in time completely bury the old crater.

The new cone of Mont Pelée, with its great protruding tooth, is not central within the old crater. It has been built up northwest of the center of the old crater. There is no central opening or pit-like depression in the top of the new cone corresponding to the general idea of a crater. Steam issues from all parts of the cone, especially from the top, but none from the tooth.

The Top of the New Spine of Mont Pelée from the Crater Rim

Looking about N. 30° W. Photograph taken March 26, 1903, for the American Museum of Natural History by Dr E. O. Hovey.

Dr Hovey's subsequent studies of the Grande Soufrière of Guadeloupe and the peak of Saba on the same expedition lead him to the conclusion that they have passed through the phases through which Mont Pelée is now passing, and that they all substantiate the cumulo-volcano theory. "This is especially clear in the case of the Grande Soufrière, the cone of which rises above an old crater rim which it has buried in the same way that Mont Pelée is now striving to bury its surrounding crater-walls." *

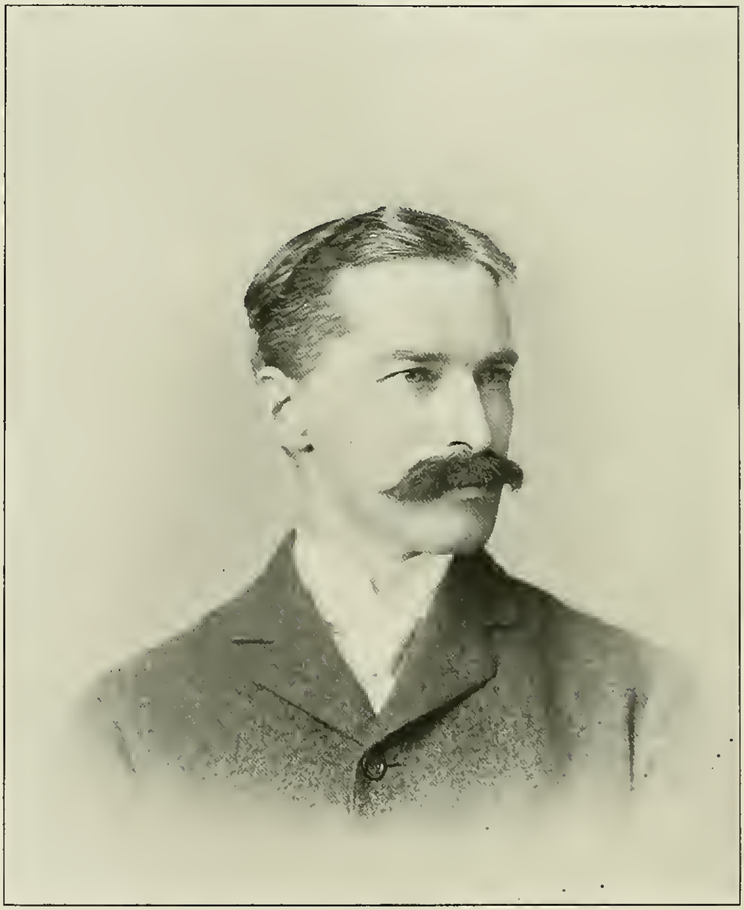
* American Journal of Science, vol. xvi, October, 1903.

Alaskan Boundary Decision.—The award of the Boundary Commission has defined the boundary according to the American claim in practically every respect. This line is shown in a map published in the NATIONAL GEOGRAPHIC MAGAZINE on page 90, March, 1903. The award makes one change in this map, in Portland Canal. Portland Canal has two parallel channels, with four islands between them. Canada claimed that the northern channel and the United States that the southern channel was Portland Canal and the boundary. By the decision Portland Canal—*i. e.*, the boundary—passes north of Pearse and Wales Islands (which are the innermost islands of the four) and enters the ocean through Tongass Passage, between Wales and Sitklan Islands. Canada thus acquires Pearse and Wales Islands, and the United States Sitklan and Kantgunut Islands, the two outermost of the four islands.

RICHARD URQUHART GOODE

MR RICHARD URQUHART GOODE, Geographer of the U. S. Geological Survey and one of the most interested members of the National Geographic Society since the organization of the Society in 1888, died from pneumonia at Rockville, Md., June 9, 1903. His death was entirely unexpected and came as a great shock after an illness of only three days.

Mr Goode was born at Bedford, Virginia, in 1858. After a course at the University of Virginia, he joined the Engineer Corps of the Army in 1878. In 1879 he became a topographer of the U. S. Geological Survey, and from 1882 to 1884 was attached to the Northern Transcontinental Survey as engineer and topographer. In 1889 he was appointed to the rank of geographer in the Geological Survey, and has had special charge of the surveys in the Pacific Coast States—California, Oregon, and Washington.



Richard Urquhart Goode

He was a member of the Washington Academy of Sciences and the author of several bulletins published by the Geological Survey.

During 1901–1903 Mr Goode was the chairman of the Committee on Technical Meetings of the National Geographic Society. He has been an occasional contributor to the NATIONAL GEOGRAPHIC MAGAZINE, his last article being published in January, 1900, "The Idaho-Montana Boundary Line."

Mr Goode was a man of exceedingly attractive personality, whose sudden death in the prime of life is mourned by a large circle of warm friends.

NATIONAL GEOGRAPHIC SOCIETY

PROFESSOR A. J. HENRY, Secretary of the National Geographic Society since November, 1899, because of the pressure of responsible official duties and ill-health, was obliged to resign from the secretaryship October 2, 1903. The prosperity and continued activity of the National Geographic Society during the last four years have been largely due to the personal attention and zeal which Professor Henry has freely and constantly given to the Society. His resignation has been accepted by the Board of Managers with exceeding regret.

The new Secretary of the Society is Hon. O. P. Austin, who was unanimously elected by the Board of Managers. Mr Austin is Chief of the Bureau of Statistics of the Department of Commerce and Labor, and has been a member of the Board of Managers of the Society since January, 1903. By means of the original monthly monographs and other contributions of the Bureau of Statistics, as well as by his personal publications, he may be said to have originated a new school of commercial geography in the United States.

The expedition of Dr Frederick Cook for the ascent of Mount McKinley, and also the expedition of Miss Annie S. Peck for the ascent of Mount Sorata, were unsuccessful in gaining the summits of these lofty mountains.

A new division has been established in the U. S. Geological Survey, entitled the "Division of Alaskan Mineral Resources," which will embrace all of the investigations and surveys being carried on in Alaska. This division is coördinate with the others of the geologic branch of the Survey, and its chief will report to the director. Mr Alfred H. Brooks has been made chief of the new division.

GEOGRAPHIC LITERATURE

Elements of Geology. By Joseph Le Conte. Revised and partly rewritten by Herman Le Roy Fairchild. Fifth edition. With over 1,000 figures in the text. Pp. xii + 767. 6 x 9 inches. New York: D. Appleton & Co. 1903. $4.00.

This fifth edition of a work which for 25 years has been the standard textbook of geology is most welcome. Prof. H. L. Fairchild, who has edited this latest edition and partly rewritten the volume, is the head of the department of geology at the University of Rochester and formerly Secretary of the Geological Society of America. He is eminently qualified to bring the work down to date and to incorporate the latest theories and conclusions, giving proportionate weight to each new hypothesis advanced since the last edition of the work. One of the most important of these is the theory of Prof. T. C. Chamberlin concerning the origin of the earth.

He opposes the nebular theory of the earth's origin and asserts instead the "planetesimal" hypothesis. According to this theory, "the earth, and the moon as well, have grown by slow accretion, or infall, of small, cold, discrete particles (planetesimals), which formed the earth-moon ring or zone. The ocean and the atmosphere have slowly accumulated from the gases originally held in the planetesimals, being forced to the earth's surface by interior consolidation due to gravity. The heat of the earth's interior is, under this theory, due to gravitational compression similar to the production of the sun's heat." The oceanic stage was reached long before the earth attained its present size. To summarize, the Chamberlin school believe that the outside of the earth has always been cold, and that the heat inside is due to gravitational compressions. The nebular theory is that the globe was once a fiery mass. The outside has cooled, but the inside is still as hot as it was eons ago. The planetesimal theory is unsettling some long-accepted theories of geology.

Geography of Commerce. By Spencer Trotter. With many maps and illustrations. Pp. xxiv + 410 5½ x 8 inches. New York: The Macmillan Co., 1903. $1.10 net.

As the author very correctly remarks in the preface of this volume, "The unrelated facts of commerce have slight educational value; they should be made to illustrate some underlying principle, to make clear a natural law, to stand in relation to the great stream of causes and effects." Dr Trotter has kept this principle in mind while writing his commercial geography; when he describes the great business centers or the principal producing areas of the country, he invariably explains what causes, physical, political, etc., make them prominent. The result is he has produced a book that not only describes the special industries and occupations of the various sections of the United States and of the world, but also imparts a great many facts about the physical and political geography of the countries. The illustrations, diagrams, and references are admirably chosen. The one serious criticism that might be made of the volume is that the author has tried to include too much information; his chapters sometimes resemble condensed cyclopædic articles; the style is also heavy, so that while the book will be a useful help to the teacher it may prove rather dull for the pupil.

The Philippine Islands, 1493–1803. Explorations by early navigators, descriptions of the islands and their peoples, their history, and records of the Catholic missions, as related in contemporaneous books and manuscripts, showing the political, economic, commercial, and religious conditions of those islands from their earliest relations with European nations to the beginning of the nineteenth century. Translated from the originals (Spanish, French, Italian, Latin, etc.), many of which are now published for the first time. Edited and annotated by Emma Helen Blair, A. M., of the State Historical Society of Wisconsin, assistant editor of *The Jesuit Relations and Allied Documents*, and James Alexander Robertson, Ph. B., with historical introduction and notes by Edward Gaylord Bourne, Professor of History in Yale University; also a full bibliography and analytical index. With maps, portraits, and other illustrations. Fifty-five volumes, large 8vo, about 325 pages per volume. Cleveland, Ohio: The Arthur H. Clark Company. 1903. $4.00 *net* per volume.

The purpose of this magnificent series of volumes is to place within reach of the American public the most important of the hundreds of manuscripts, letters, and documents relating to the Philippine Islands and written between 1493 and

1803. The writers were mainly soldiers, government officials, and ecclesiastics of the various orders. Some of the letters are personal and others administrative reports and recommendations. Five volumes have been published, and others will follow monthly. These five alone contain much information about the early conditions on the islands that cannot be obtained elsewhere.

The Spaniards in the Philippines from the very first conceived a great contempt for the Chinese across the China Sea. One general offered, with less than 60 good Spanish soldiers, to march from Canton to Peking and subdue the whole empire, though there were "many very populous cities on the way" and the king was "well prepared for war and the frontiers are well fortified with many forts with artillery and garrisons wherein strict watch is kept." Other generals repeatedly urged the conquest of the Chinese Empire, and every one guaranteed to do it with less than 2,000 or 3,000 men. This was during the last half of the sixteenth century when Spain was too much occupied with her European designs to spare the men or money to enter China.

The Training of Wild Animals. By Frank C. Bostock, edited by Ellen Velvin. Illustrated. Pp. xvii + 256. 5x7 inches. New York: The Century Co., 1903.

A book on this subject by the celebrated trainer, Frank C. Bostock, is not only interesting, but gives much insight about the characters of the larger animals. Temperaments and dispositions differ as much among lions or tigers or other animals as among men. Cruelty is useless as well as dangerous in training the great beasts. Intelligence, pluck, vigilance, and patience are the requisites of a trainer.

"There are three essentials in the care and feeding of wild animals—good food, cleanliness, and exercise. Food and cleanliness come first, but exercise is nearly as important, and this is one of the main reasons why animals in traveling shows are so much healthier and stronger than those kept in zoölogical parks. In the parks they get food and cleanliness, but little exercise; for wild animals are proverbially lazy, and, unless compelled by hunger or force of circumstances, will not exert themselves in the least, preferring to lie about and sleep rather than even to walk round their cages."

In a chapter on "How Wild Animals are Captured," Mr Bostock tells how the natives in India catch tigers:

"The leaves of the sycamore and large plantain are smeared with a sticky substance and left in the trail of the tiger. The moment the animal puts his foot on one of these leaves he immediately rubs it over his head in order to get rid of it. This naturally makes his head sticky and uncomfortable, which causes him to roll on the ground. By doing this he becomes covered with the leaves, and when he is mad with rage the natives come cautiously up and cover him with strong nets and sacking."

Texas. By George P. Garrison. With map. Pp. v+320. 5x7 inches. Boston: Houghton, Mifflin & Co. 1903. $1.10 *net*.

The book is a disappointment, or perhaps it would be more just to say the title is a misnomer. The romantic history of the great territory is well told, but the author stops there. A single chapter of 12 pages is all he has to say of the tremendous development of the state since 1876. A few paragraphs only are devoted to describing what Texas is today. There is hardly a word about her unrivaled natural resources, which are going to make her the greatest producer among the states. The reader wants to know not only how the Texan won his freedom, but how he developed the state after it was won and what the state is now.

PROGRAM OF MEETINGS OF NATIONAL GEOGRAPHIC SOCIETY, 1903-1904

THE National Geographic Society has recently moved into its new home, the Gardiner Greene Hubbard Memorial Hall, Sixteenth and M streets. As the building is not entirely completed, the formal opening of the hall will be deferred for the present.

The National Geographic Society presents during the season of 1903–1904 three courses of meetings—a Popular Series of 10 illustrated lectures, a Scientific Series of 10 meetings, and an Afternoon Series of 5 popular lectures.

The Society aims to present in the Popular Course subjects of a geographic character that possess an immediate interest for the public.

The Scientific Meetings are planned particularly for men actively engaged in geographic work. While these meetings are designed for scientific workers, they have proved during the last two winters of great interest to a large number of others, who do not profess to be geographers, but who wish to follow what is being done by the scientific departments of the government and by specialists throughout the United States.

POPULAR COURSE

The lectures in the Popular Course will be delivered in the National Rifles Armory, 920 G street, at 8 p. m., on the following dates:

Saturday, October 24.—"Arctic Exploration." By Commander Robert E. Peary, U. S. N. Illustrated.

Friday, November 13.—"On the action of Radium, Roentgen Rays, and Ultra Violet Light upon minerals, with radium of 300,000 and 1,800,000 activity." By Mr George F. Kunz and Dr Charles Baskerville.

Friday, November 27.—"Taking the Census of the Filipinos." By Mr Henry Gannett, of the U. S. Geological Survey Illustrated.

Saturday, December 12. — "Marches and Movements of Arnold and André." By Mr W. W. Ellsworth, of the Century Co. Illustrated.

Announcement of definite dates for the following lectures in this course will be made later:

"Joys of the Trail," by Mr Hamlin Garland, author of "The Captain of the Gray Horse Troop," etc. Illustrated.

"Conditions in Macedonia," by Dr Edwin A. Grosvenor, of Amherst College. Illustrated.

"The Louisiana Purchase Exposition," by Hon. David R. Francis, President of the Louisiana Purchase Exposition. Illustrated.

"Travels in Arabia and Along the Persian Gulf," by David G. Fairchild, Special Agent of the U. S. Department of Agriculture. Illustrated.

Provisional arrangements have also been made for addresses on—

Little Known Peoples of Mexico.
Russia and Japan in Korea.
The Alaskan Boundary Decision.

SCIENTIFIC COURSE

The first three meetings of this course will be held in the Assembly Hall of the Cosmos Club, Fifteenth and H streets. The succeeding meetings will be at the new home of the Society, Hubbard Memorial Hall.

November 20.—"European Methods of Checking Advancing Sand Dunes." A. S. Hitchcock, Assistant Agrostologist, Department of Agriculture.

December 4.—"The Work of the Bureau of Plant Industry." Dr B. T. Galloway.

December 18.—"Early Spanish Cartography of the New World," by Prof. E. L. Stevenson, of Rutgers College.

At later meetings the geographical work of the Bureau of Insular Affairs, of the U. S. Fish Commission, of the National Bureau of Standards, of the Biological Survey, of the Bureau of Immigration, and of the Bureau of Statistics of the Department of Commerce and Labor will be discussed.

AFTERNOON COURSE

The general subject of the Afternoon Course of popular lectures is "The Growth of Diplomacy." The special topics and the names of the speakers will be announced in a later program. The first of the series will be given on Tuesday, February 23, and the succeeding lectures on March 1, 8, 15, and 22.

These lectures will be illustrated.

LECTURE TICKETS

Each member of the Society can purchase one season ticket, admitting two persons to all lectures, for three dollars.

Persons not members of the Society may purchase one ticket, admitting two persons to all lectures, for six dollars.

Single admission tickets, at fifty cents each, may be obtained at Hubbard Memorial Hall or at the lecture-hall door.

APPLICATIONS FOR MEMBERSHIP

Applications for membership in the Society should be sent to the Secretary, who will present all nominations to the Board of Managers for action by them. The dues for members are two dollars per annum. All members receive the NATIONAL GEOGRAPHIC MAGAZINE, an illustrated monthly, issued by the Society. Annual dues may be commuted and life membership acquired by the payment of fifty dollars. The membership fee of two dollars, for persons elected to the Society in November and December, includes all dues to January 1, 1905.

Office Hours: 8.30 A. M. to 5 P. M. Telephone, North 306

NATIONAL GEOGRAPHIC SOCIETY

Hubbard Memorial Hall
Sixteenth and M Streets, Washington, D. C.

The National Geographic Magazine is sent free of charge to all members of the National Geographic Society

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Recommendation for Membership in the

NATIONAL GEOGRAPHIC SOCIETY

The following form is enclosed for use in the nomination of persons for membership

Please detach and fill in blanks and send to the Secretary

DUES: Annual membership, $2; Life membership, $50. If check be enclosed, please make it payable to order of the National Geographic Society, and, if at a distance from Washington, remit by New York draft or post-office money-order.

____________________ *1903*

To the Secretary, National Geographic Society, Washington, D. C.:

Please propose ______________________________

address: ______________________________

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for membership in the Society.

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PRESS OF JUDD & DETWEILER, WASHINGTON, D. C.

THE NATIONAL GEOGRAPHIC MAGAZINE

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WASHINGTON, D. C.

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THE NATIONAL GEOGRAPHIC MAGAZINE

THE VALUE OF ARCTIC EXPLORATION*

By Commander Robert E. Peary, U. S. N.

It is entirely appropriate that the first public exposition of the present phase of Arctic exploration and my own plans for the coming season should be given in the National Capital and under the auspices of the National Geographic Society. It is unnecessary for me to note here the continued and unfailing interest in and courtesy toward my Arctic work which has been shown by this Society during the past twelve years. You are well aware of it; I am well aware of it.

I shall endeavor to place clearly before you tonight the plan of my campaign, and the means by which I hope to accomplish the object which you all know that I have before me. I hope that I may be fortunate in sending every one of you away with definite ideas, which will enable him or her to keep in touch with events as they materialize during the next two or three years.

EARLY PROGRESS OF DISCOVERY

Before taking up present plans, let us go back a bit. Some forty-five centuries ago the known world lay within a little circle whose circumference touched the Black and Caspian seas, the head of the Persian Gulf and the Red Sea, and the eastern end of the Mediterranean. Centuries later the fearless Phœnicians had dared the terrors of the infinite ocean which lay beyond the Pillars of Hercules, and sailed along the coasts both north and south. East they had pioneered the way to India. The fabled voyages of Ulysses and Jason dwindle beside their splendid distances. Still later came the work of the great explorer-conquerors, Alexander and Cæsar, opening up far-distant lands as the Phœnicians opened up far-distant seas.

Then came that great burst of exploration, the principal facts of which we know so well. Vasco de Gama to the south; Othere and the Vikings to the north, Erik and Leif, Columbus and Cabot to the west, lifted Africa, the northern headlands of Europe, and the western world from the mists.

Magellan, following close upon their heels, circled the globe, and the world, as we know it now, lay revealed in its rough, broad masses.

Since then exploration has, of necessity, been a work of large details, baring

*An address before the National Geographic Society, October 24, 1903.

the hearts of continents, and pushing northward and southward, till today only the northern and southern apices of the earth still hide in the mists and gloom of the polar nights.

A little less than four centuries ago the first expedition started out toward the North Pole. Since that time, with periods of greater or less intensity, practically all the civilized nations of the earth have made attempts to reach that charmed spot.

Millions have been expended in the efforts, and, though they have brought back information and accessions to scientific knowledge which have fully repaid the expenditures, the main object remains still unattained. The ablest writers, scientists, geographers, statesmen, and rulers have been interested in the matter, and have urged the prosecution of the work with all the eloquence at their command. Many of their remarks upon the subject have become historic.

THREE NORTH POLAR ROUTES

As a result of all these explorations extending through nearly four centuries, the possible routes to the North Pole have dwindled to three. In my own personal opinion, they have dwindled to two, but I note the three. First, the drift method as devised, inaugurated, and put into execution by Nansen. The possibilities of this method are acknowledged by every one, but it by no means follows that another ship, or even the *Fram* herself in a second attempt, would be as fortunate as she was in the first voyage. Again, it requires a man of exceptional temperament and a crew of almost superhuman qualities to undertake a voyage which means that for four or five years at least ship and people are but a helpless bit of flotsam entirely at the mercy of the ice in which they are drifting and practically unable to control their own fortunes or contribute by their efforts to success. Presumably Nansen and Sverdrup are advocates of this route; yet neither has, to my knowledge, expressed a desire to repeat the experience of the *Fram's* voyage. Bernier is reported as contemplating a repetition of the voyage.

The second route is the so-called Franz Josef Land route. Wellman, Baldwin, and Mr Ziegler are advocates and adherents of this route. If there are others, I do not recall them at present.

Payer and Weyprecht, Leigh Smith, Jackson, Wellman, Abruzzi, and Baldwin have all exploited the Franz Josef Land route with greater or less success. Of these various expeditions, however, Abruzzi's is the only one that has succeeded in pushing beyond the northern limit of the Franz Josef Archipelago. He is not at all in favor of this route. In fact, he uncompromisingly advocates, in words I shall quote to you later, the third—the Smith Sound, or "American" route.

PLANS FOR COMING EXPEDITION

To come down to the present, I assume that all of my hearers are familiar, in a general way, with what I shall attempt to do and how I shall attempt to do it, but I have noticed so many misapprehensions as to details on the part of otherwise well-informed people, that I feel a brief exposition of certain points may not be out of place.

I plan to take two ships—one a steamer with engines of maximum horse-power and minimum weight and bulk, and an auxiliary vessel to carry coal. With the steamer I plan, in the summer of 1904, to push up Smith Sound, Kennedy Channel, and Robeson Channel, and then to station her for the winter on the north coast of Grant Land, carrying her, if possible, farther north than the *Alert* or the *Polaris*. If she can get me as far as that, I do not care what becomes of her—she will have served her purpose of getting me to 82° 50′, Cape Joseph Henry, which will be my base of action. The second vessel will carry a large freight of coal, which will be landed on Grant Land, near the northern entrance of Robeson Channel. With this reserve of coal I will not have to economize the fuel of my steamer, but can keep the furnaces and engines going at utmost tension through the ice. The reserve will also be there to take my steamer back after her work is done, if she is still alive. From Cape Joseph Henry the march toward the Pole will begin in 1905. The distance from this point to the Pole and back again is less than the average distance of my four sledging trips in 1892, 1895, 1900, and 1902. There is no reason why I should not equal this distance on my next sledging trip, thus gaining the Pole and getting back again in one season of 100 days. I shall take my Eskimos with me to my northern base.

On my return to Cape Joseph Henry after the polar dash, I plan to return in my steamer from that point if conditions are favorable. If the ice is impenetrable or my steamer is unable to carry me, I shall proceed by land southward to Cape Sabine, over the route which I laid out and which I have traveled so often in the past. At Sabine my auxiliary vessel would meet me and bring me home.

The principal departures in my new plan are: First, using a powerful steamer to force my way through the ice, instead of a sailing ship with auxiliary engines; and, second, making my base on the shore of the Polar Sea, more than 200 miles north of my previous base at Cape Sabine.

Abruzzi's remarks upon the subject of the attainment of the Pole are particularly valuable as well as extremely interesting. His words are given in full:

"It would be useless to repeat the attempt (of reaching the Pole) by following the same plan (the route from Franz Josef Land). It would, at most, be possible to push a few miles farther towards the north if the ice of the Arctic Ocean was in an unusually favorable state; but the results would not afford any compensation for the fatigue and privations undergone. While following, therefore, the invariable plan of setting out from some point on land, and not from a ship drifting on the ice, on account of the reasons put forth in the first chapter of this work, it will be necessary to find some other method of shortening the distance which has to be traveled with sledge. What I should recommend would be to sail along the western coast of Greenland to the north of Kennedy Sound, where it ought to be possible, under favorable conditions, to go to a still higher latitude than that reached by the *Alert* off Grant Land."

This is the plan of campaign which Assistant Secretary Darling has been pleased to commend, and for the execution of which he has granted the necessary leave. This is the plan which has the approval and sympathy of President Roosevelt.

Assistant Secretary Darling, in granting leave for the purpose of this expedition, has continued the traditions of the Navy Department, and has associated himself with Dobbin, Kennedy, Robeson, and Chandler, all of whose names are inscribed on our Arctic charts. He has also put himself in line with a long list of British Lords of the Admiralty, who have seen the moral as well as the material utility of Arctic exploration, and have fostered and encouraged it with all the means at their command.

President Roosevelt, in expressing his sympathy and approval of the work (as was naturally to be expected from his big, active temperament), associates himself with a long list of illustrious names in the past—Ferdinand of Spain, Charles V, Henry VII, Elizabeth, etc., all patrons of exploration. He has also abundant company among foreign rulers of the present time. The expeditions of Scott, Drygalski, Nordenskjold, Nansen, Sverdrup, and De Gerlache have had respectively the strong personal support and approval of Edward of England, William of Germany, Oscar of Sweden and Norway, and Leopold of Belgium. Charcot's French expedition has the lively support and approval of President Loubet.

It may possibly interest you to know that up to the present time editorial comment from over 500 different newspapers throughout the country have come to my eye, and there is not a hostile note among them; but two or three points have been brought up in these notices which it may be well to touch upon briefly. I do not speak of them in a captious mood, but with a desire to set the points straight.

One is the statement of the President of the Royal Geographical Society of London, that "after Nansen's voyage, there is no longer any geographical object in going to the North Pole, except for the sake of deep-sea soundings, for it is merely a point in the polar ocean, the economy of which has been made known by Nansen. That great explorer finally removed the veil which concealed the secret of the Arctic regions."

The President of the Royal Geographical Society is a strong personal friend of mine, but I cheerfully disagree with him on some points, and particularly the one which assumes that we have practically reached the North Pole, and, in substance, know all that is necessary to know about it. I have never been entirely in sympathy with the claims put forth immediately after Nansen's return from his voyage in the *Fram*, that he had practically reached the Pole; that we now knew everything that it was necessary to know in regard to that region, and that any further efforts were not worth while.

A distance of 260 miles from the Pole is a long ways from the actual attainment of the Pole, and to assert that the secret of the Pole has been penetrated and the veil lifted, at a range of 260 miles, and that the economics of the polar basin have been revealed, when 3,000,000 square miles of it have not been trodden by human foot or seen by human eye, is an enthusiastic view.

ERRONEOUS THEORIES OF EXPLORERS AND GEOGRAPHERS

There is no portion of the earth's surface where it is more distinctly impossible to prophesy or forecast what is beyond the horizon of actual vision than in the Arctic regions. The truth of this statement has been most strikingly exemplified in the past.

In 1818 Sir John Ross made a voyage to Baffin Bay, and returning reported that body of water to be a closed sea. To the westward, at the head of an inlet which he called Lancaster Sound, he showed on his chart a striking range of mountains.

A few years later Parry entered the Sound, and before a favoring wind went spanking away to the westward beyond the hundredth meridian, and never saw these mountains. Later explorations showed the great inlet of Smith Sound extending, as we now know, to the central polar basin, and Jones Sound penetrating far to the northwestward, also leading from this "closed sea."

Again it was conclusively determined theoretically, by geographers, that the interior of Greenland was a fertile, or at least an ice-free country, surrounded by an ice barrier near the coast. Further explorations show the interior to be absolutely and completely buried under an enormous ice-cap.

Kane and Hayes stood upon the shores of the open polar sea, as they supposed; yet that open polar sea has not only retreated but absolutely disappeared before the footsteps of subsequent explorers.

Petermann, one of the greatest of geographers, proved conclusively, in a theoretical way, that Greenland was one extremity of a great Arctic continent extending across the Pole, and Wrangel Land the other. Later the *Corwin* determined Wrangel "Land" to be an almost insignificant island of contracted dimensions, and we know now that Greenland ends 450 miles short of the Pole.

For years Franz Josef Land was supposed to be the southern extension of an Arctic continent, yet the *Fram* drifted across its meridian north of it, seeing no land; so the instances could be duplicated.

As a matter of fact, there may be land within 30 miles of Nansen's or Abruzzi's farthest, and yet neither of them the wiser for it. Until we reach the Pole no one can say what there is there, whether land or water.

In the light of these facts, it appears that one man's views are as good as another's, assuming the men to be of equal intellectual caliber.

I feel, therefore, that the opinions of Assistant Secretary Darling are entitled to as much weight as those of Sir Clements or other geographers. To a careful and enthusiastic study of Arctic voyages, extending over a number of years, Judge Darling brings deep thought, clear perception, exceptional ability, and the judicial bent of long legal training. He is strongly impressed with the great probability of finding land in the central polar basin.

For myself, as a practical worker in the field, taking what I find rather than theorizing as to what I ought to find, I recognize fully this probability; and that I have not urged it—in fact, have leaned the other way—is due to the confirmed pessimism which long years of Arctic work and disappointments have taught me—pessimism as to any conditions which will simplify or render easier the work I have laid out for myself.

The existence of land anywhere between the northern shore of Grant Land and the Pole would so greatly simplify my work and reduce its difficulties that I do not let myself dwell upon it. But the possibility is there; an isolated island continent, an Arctic Atlantis, with a fauna and flora of its own, with one day and one night in the year, lying there through the blinding days and opaque nights of countless geologic ages, as completely isolated from the world as if it were on Mars.

Think of the satisfaction of lifting such a land out of the heart of the polar sea with the Stars and Stripes of "Old Glory." Think of writing upon that land some name to endure indelibly till that day when "the heavens shall wither like a scroll," to show forever that we own the top of the earth. Believe me, there is room yet in this prosaic world for a new sensation.

NORTH POLE THE LAST GREAT GEOGRAPHICAL PRIZE

My statement that the North Pole is the last great geographical prize which the earth has to offer has also been criticised in some quarters, and it is claimed that it is nonsense to say that the North Pole is a greater prize than the South Pole. I repeat advisedly that the North Pole is the last great geographical prize which the earth has to offer.

That the particular mathematical point of the North Pole possesses greater interest or value than the South Pole is not asserted, but the North Pole is that apex of the earth which is in the center of the hemisphere of civilization. The North Pole has been sought by men for nearly four centuries; the South Pole for less than a century. The North Pole has a striking place in history, in literature, in poetry, in romance. It has been the subject of infinite speculation, and, finally, when the North Pole has been attained, the attainment of the South Pole will follow naturally and rapidly and will attract much less attention.

In this connection it is well to note also a popular misconception, namely, that the attainment of the South Pole is more difficult than the attainment of the North Pole. This is not so. In spite of the close approximation to the North Pole by recent expeditions, the actual attainment of the North Pole is a very different proposition from the attainment of the South Pole and much more difficult. The conditions are almost diametrically opposite. In the case of the North Pole it is a polar sea which must be traversed and conquered. In the case of the South Pole it is a polar land which must be traversed and conquered. In the light of recent explorations, the region about the South Pole offers facilities for the realization of the favorite popular ideas of attaining the Pole, namely, the colonization method, the method of relay stations short distances apart connected by wire, etc., etc. Plans of colonization, of relay stations, of telegraph connections, etc., etc., fall to the ground in the North Polar region because of the impossibility of effecting anything of this kind upon the moving ice pack of the central polar sea.

The attainment of the South Pole, granted sufficient funds, is only a matter of time and patience. The work can be carried on in any season of the year, and each mile of advance can be permanently secured.

The attainment of the North Pole means the ability to so refine and perfect one's equipment, supplies, and party as to be able to cover a distance of 500 miles each way without caches and without support from the country, and to cover this distance in a time limit of three or at most three and one-half months.

FUNDS FOR THE EXPEDITION

A partially erroneous statement has been generally disseminated which I am glad of the opportunity to correct here. It is to the effect that the Peary Arctic Club will furnish the funds necessary to send out the proposed expedition. This is true only to a certain degree.

The Peary Arctic Club, an unincorporated association of my personal friends, with Morris K. Jesup, of New York city, at its head, furnished the funds for the financing of my last four years of Arctic work. After my return last fall there was a general feeling of disinclination to drop the work uncompleted, when success had been so nearly won. This feeling took form in the proposition of the majority of the club to contribute in varying sums toward the outfitting of another expedition. Unfortunately, however, the total amount which these members of the club felt they could contribute, even with the accession of some new members, was not sufficient to properly fit out an expedition. Had it been sufficient I should have gone north last summer, and should now be settled down in winter quarters somewhere on the Grinnell Land coast.

The same status holds today. The total amount which the continuing members of the Peary Arctic Club feel that they can contribute to another expedition is insufficient to properly outfit the expedition. Additional members, either individuals or associations, are necessary to complete the total amount.

And it is to be said in this connection that it is essential that the total amount should be assured without delay; \$150,000 to \$200,000 between now and the 1st of January will meet all requirements and give ample time to properly fit out the expedition. Six months from now it will be impossible to fit the expedition even with a half-million available, because of lack of time.

Somewhere in this broad country I am satisfied that the money is waiting, ready and anxious to do this work as I, if only the connection can be established. One thing is to be clearly understood, the government is not financing the work. The funds must come from private sources.

It may be said without egotism that a practical experience equaled by that of no other worker in Arctic regions; an interest in the work at least equal to that of any other man; the utmost assistance of the Eskimos, never before available; the time and the opportunity, thanks to Assistant Secretary Darling and the President—all these are assured; the only thing lacking is the money.

I assume that if it were demonstrated that the erection of a monument costing $150,000 would redound to the great credit of its builder or builders and of the city wherein it stood, not only now, but for generations to come, it would not be a very difficult proposition to secure that amount from some public-spirited citizen or citizens in many a prosperous city in this country.

The Pole is a grander monument than any structure of stone or bronze, and a name inscribed upon it would be read and known by future generations when granite and bronze had crumbled to dust and rust.

There is no way by which a man of large means may win for himself in these days a more enviable and lasting name than by assuming the rôle of patron of some large effort to increase our knowledge of the earth.

The principal thing we remember of Ferdinand of Spain is that he sent Columbus to his life work.

All that most of us remember of Grinnell, of New York, is that he sent Kane to his work.

To the millionaire, whether he be young and just starting in life, or elderly and retired from business, it offers a broad and elevated field.

In the words of old Martin Frobisher, it is "the one thing left of this world by which a notable mind may become famous and fortunate."

CONQUEST OF THE POLE SIMPLY A BUSINESS PROPOSITION

The conquest of the Pole is today a business proposition, pure and simple; and, like any business proposition, it can be presented in three sentences of four words each. Can it be done? What will it cost? Is it worth while?

Can it be done? There is not a geographer, a scientist, or an intelligent person conversant with Arctic matters who doubts that the Pole *can* be reached, and that it *will* be reached in a few years.

The requirements are simply those for any large project; sufficient money; proper equipment; adequate time; energy, experience, and determination.

What will it cost? The cost of various Arctic expeditions has ranged from a few thousand to a million dollars each.

On my plan, and with my methods, an expedition which would in all probability secure the Pole, can be fitted out for two years at a cost of $150,000. The only expensive item in that outfit will be a powerful ship which shall push me to the northern shore of Grant Land.

There are hundreds of men in this country today who could defray the expenses of an expedition and never feel it; thousands who could defray a tenth, hundreds of thousands who could defray a hundredth.

We have spent and are spending hundreds of thousands of dollars for an idea or a principle.

Take a single example, the international yacht races. A reliable New York paper stated recently that the cost of the last yacht race to the American side alone was in the neighborhood of $900,000, and that it has cost us to defend the cup in the last five years some $2,200,000.

For less than one-fourth of the former sum, less than one-tenth of the latter, we can secure the Pole.

And how do the races compare?

The races for the America's cup have been in progress for tens of years, between two nations; the race for the Pole hundreds of years between practically all the civilized nations of the world.

There have been numbers of cup-defender syndicates, and will be numbers more.

The syndicate that lifts the Pole will have no successor and can never be beaten.

The winning of the yacht race is a matter of today; the winning of the Pole is for all time.

Is it worth while? Certainly it is worth while.

As a matter of the valuable additions to geography and science it is worth while.

The head of the Smith Sound route is the one point from which can be reached and welded the links still lacking to make the Arctic exploration a finished job.

THE MORAL PRESTIGE OF GAINING THE POLE WORTH TEN TIMES THE COST

As a matter of prestige it is worth while.

Abruzzi's expedition, costing two hundred thousand dollars, was worth many times its cost to Italy in increased prestige.

Abruzzi drove home to the civilized world the fiber of which Italians are made.

Nansen's expedition, fitted out by his King, his Parliament, and wealthy private citizens, impressed the world with the material which makes up the descendants of the Vikings.

And should *you* some morning read in your paper that an American had placed the Stars and Stripes upon the Pole, each one of you would feel a thrill of pride and enthusiasm, and be glad that you are an American; and every true American at home and abroad would feel the same pride, and that increment of justifiable pride and enthusiasm to each of millions of citizens would be worth ten times the cost in dollars and cents.

As a matter of patriotism based upon the obligations of our manifest destiny, it is worth while.

The North American world segment is our home, our birthright, our destiny. The boundaries of that segment are the Atlantic and the Pacific, the Isthmus and the Pole. We are fully able, I think, to take care of the Atlantic and the Pacific. We are negotiating for the Isthmus. It would be a shame for others to find and mark the Pole for us.

Believe me, the winning of the North Pole will be one of the great mile-stones of history, like the discovery of the New World by Columbus and the conquest of the Old by Alexander; and the man, or the association, or the community, or the nation that makes its discovery possible will write its name to be read and known when, perhaps, the very civilization of today is forgotten.

Let us attain it, then. It is our privilege and our duty. Let us capture the prize and win the race which the nations of the civilized world have been struggling for for nearly four centuries, the prize which is the last great geographical prize the earth has to offer; the race which is far greater than the international yacht races. Then let us take a hand with England, Germany, Sweden, Scotland, and the others for the conquest of the South Pole. As Assistant Secretary Darling well says, the attainment of the Poles is all that remains to complete man's domination of the earth.

Six years ago we were sleeping content within our borders, drowsy of our strength and possibilities. Since then we have embraced the earth, and now right hand clasps left in the far East in a grasp never to be loosened. What a splendid feat for this great and wealthy country if, having girdled the earth, we might reach north and south and plant "Old Glory" on each Pole. How the imagination stirs at the thought!

SURVEYING THE PHILIPPINE ISLANDS

By George R. Putnam,

Assistant, United States Coast and Geodetic Survey, in Charge of Work in The Philippines

THE work of the Coast and Geodetic Survey in the Philippine Islands is at present conducted under a joint arrangement between the national and insular governments, whereby each defrays certain classes of expenditures. It is under the general supervision of the Superintendent at Washington, but the local administration is conducted mainly through a sub-office established at Manila. In all relations with the Philippine government this office acts as a bureau reporting to the Philippine department of commerce and police, in accordance with the act of the Philippine Commission passed September 6, 1901.

An officer of this survey visited the islands during the summer of 1900 to make a preliminary investigation of the need of and conditions for the carrying on the work of the organization. The first survey parties arrived in Manila in December, 1900, and the present office quarters in the Intendencia building were assigned and field parties commenced work in January, 1901. At that time active military operations were in progress throughout the islands and Manila was under martial law. No one

Surveying Party Crossing a River on an Improvised Raft

Landing from an Outrigger through the Surf

was allowed on the streets of the city after 10 o'clock at night without authority, so that it was necessary for the longitude observer to be provided with a pass. For a while the field work was confined to the vicinity of garrisoned posts, but after a few months the general conditions in the islands greatly improved and survey operations have been extended as needed. No serious difficulty has been encountered because of the hostility on the part of the natives, although in instances parties have been in towns that were "shot up." On several occasions the surveying work, and especially the triangulation signals, have aroused the suspicions of over-zealous local officials. In one instance an observer climbing a hill to occupy a triangulation station met the municipal police of the neighboring town coming down the hill carrying the triangulation signal with its wide, outspreading legs still on it; they were industriously cutting a wide path through the thicket so as to be able to produce this suspicious object intact, evidently believing it a beacon of the insurrectos. They were persuaded to carry it up the hill again.

The development of the field work has necessarily been controlled by various conditions, and it has been extended along the lines which appeared most feasible with the means available and most likely to yield results of immediate usefulness.

The wide extension by the Signal Corps of the telegraph system for military purposes suggested the determination of base positions, including telegraphic longitudes and zenith telescope latitudes. It was fortunate that this work was carried out promptly, as with the passing of military necessity many lines have been abandoned. Thirty-six latitudes and thirty-six differences of longitude have been determined, the points being fairly well distributed over the archipelago from the north coast of Luzon to Zamboanga. These stations have all been marked and described for future reference. At most stations a meridian has been laid out or an azimuth measured, and magnetic observations have generally been made.

The surveying steamer *Pathfinder*, under command of J. J. Gilbert, assistant, U. S. Coast and Geodetic Survey, arrived at Manila from Alaska in November, 1901, and has since been continuously at work in the islands, except during intervals when docking or repair work on the vessel has been required.

Harbor surveys at Cebu, Ormoc, and Romblon have been made, and during the past year this vessel has completed important surveys of San Bernardino Strait and Albay Gulf, and of San Pedro Bay and the south coast of Samar, as well as a thorough examination of the much-used passage southwest of Leyte, where a danger had been reported. The *Pathfinder* is a well-equipped, modern survey ship, and carries two steam launches.

U. S. Coast and Geodetic Steamer *Pathfinder*

A small wooden steamer was purchased in Manila and adapted to survey work. This vessel, the *Research*, has made a number of harbor surveys on the west and southeast coasts of Luzon and on Mindoro and Culion islands, and is at present working on the coast of Negros.

Chartered launches have been employed in some cases for hydrographic work, and the survey of Lingayen Gulf by this means has recently been completed. Harbor surveys have been made at a number of other places, using various means.

The abrupt coral reefs along many of

the coasts of the archipelago materially increase the difficulty of carrying on hydrographic work.

In connection with the hydrography, tidal observations have been made at 31 places. At Manila an automatic tide-gauge has been maintained for more than two years. The tide staffs are referred to bench-marks. The tide records are used in reducing the soundings and in predicting the tides, to be included in the annual Tide Tables published in Washington.

A continuous triangulation has been carried along the northwest coast of Luzon from Lingayen Gulf to Cape Bojeador, and this is now being extended eastward along the north coast. This triangulation is for the control of the coast line, and extends from the shore to the first line of hills. It is joined to the various astronomical stations and is sufficiently controlled by base lines and observed azimuths. Nearly all the harbor and other survey work is based on triangulation, and is generally connected with one of the astronomical stations, and all the points are marked and described. A triangulation has been carried to the entrance of Manila Bay, which it is proposed to extend to the southward among the islands.

Topographic surveys with the plane-table have been carried out in connection with nearly all the other work, usually executed simultaneously with the triangulation, but controlled by the latter. A scale of $\frac{1}{10000}$ has generally been used for harbor work and $\frac{1}{20000}$ for general coast work, though these have been varied as conditions required. The topography has been confined to the shore line and adjacent towns and highways, with the location of elevations visible from the coast. In the work along the northwest coast of Luzon native ponies were used by the observers, and bull carts for the transportation of instruments. The work progressed satisfactorily under the conditions there found, which were more favorable than in many other districts. The numerous substantial church edifices with which the country is dotted furnish the best of artificial landmarks and are a decided assistance in all parts of the survey work. In some localities few additional signals are necessary for hydrographic or other work.

Triangulation Party Starting Out from Manila

In the office of the Survey in Manila detailed plans for the field parties are arranged, the distance from Washington rendering this necessary. The records and survey sheets are sent to this office, and preliminary charts are prepared and published by lithography in Manila.

In this office there have also been compiled and published a series of seven pamphlets of Sailing Directions for the Coasts of the Philippine Islands, and from time to time there are published Notices to Mariners, giving new information of immediate importance to navigation, as dangers discovered, changes in aids to navigation, and other corrections to charts.

The computations are revised and carried as far as may be needed for immediate use, the soundings are plotted or examined, and the drawings are reduced to the scale required for publication. Besides the American experts in charge of each part of the work, ten Filipino draftsmen and one Filipino computer are employed. The almost entire lack of technical education in the Philippines has been a barrier to testing the ability of the natives in the survey work in the field.

To furnish a knowledge of the coasts and adjacent waters that will be satisfactory to an enlightened nation will require a large amount of coast-survey work in the Philippine Islands. While considerable information exists, a careful examination of it proves that for only limited areas does it approximate completeness. Many parts of the coast have been only roughly sketched. A glance at the map of the islands shows that the natural highways of this region are on the water, so that a large part of the commerce of the islands will always be carried by water. A few geographical facts will emphasize these conditions. The islands have a general coast line of about 11,444 statute miles, or double that of the main part of the United States, while the total area is 115,026 square miles, or less than that of New Mexico. There is a mile of coast line to every 10 miles of area, while in the United States the proportion is 1 to 555. There are nearly 1,700 islands having names and it is possible to count 3,000 islands and islets on the charts. Even the larger land masses are so elongated in figure that no point in any island is more than 60 miles distant from some part of the coast.

MUIR GLACIER

FOR four years it has not been possible for the excursion steamers visiting Glacier Bay to closely approach the Muir Glacier. As that glacier has been the Mecca of many of the Alaska tourists, the failure to see the glacier at close quarters has been a grievous disappointment. During the season of 1899 the conditions were unchanged, and the boats made their entrance into Muir Inlet and landed their passengers as usual, but with the season of 1900 and the following seasons they were able to get no nearer than from five to ten miles below the usual landing. From that distance it could be seen that great changes had occurred in the appearance of the front of the glacier, and that the ice had receded to a considerable extent.

Desiring to know the extent of the changes, on May 5, 1903, Mr Case, a photographer, of Skagway, Alaska, and myself left Skagway for Glacier Bay in an open boat. We followed in the bay, in all probability, close on the track of Professor Muir and Reverend Young when on their exploration trip in 1879. Going through the passages between the Beardslee Islands and keeping near

A. Muir Glacier in May, 1903

A and B give a panoramic view of the frontal cliff of the division of the glacier passing east of the nunatak. Beyond the nunatak at the left appears a part of the main or western division

the east shore, we entered Muir Inlet, passed back of the small island, and reached the moraine of the glacier. At this point the ice completely blocked further progress, filling the inlet from shore to shore in a solid mass of bergs, large and small. Landing here, we went up to where a view could be had of the inlet and glacier. From this point the ice in the inlet looked as though so closely packed that, from the island on the eastern shore across to the western shore and up to the front of the glacier, one might cross the inlet on the ice at almost any point. At scarcely any place could any water be seen, and to one not knowing that water extended underneath the ice, it would have been hard to believe it possible. It had the appearance of a great ice-jam in a river, except that the larger bergs were lifted above the mass higher than any jam could raise them. The space of clear water which formerly extended in front of the ice, forming one of its greatest contrasts, was entirely filled.

The glacier had receded until the point of the island in the center of the glacier, shown as being about three miles from the ice-front on the map of the glacier by Professor Reid, in the NATIONAL GEOGRAPHIC MAGAZINE, February, 1892, was clear of ice except such as lay on the water in front of it. The main branch breaks from there to the mountain at the west, and

B. Muir Glacier in May, 1903

the western tributary is entirely separated from it. On the other side of the island, or nunatak, the break of the glacier front extends toward the mountain above the Dirt Glacier in two hollowing curves, leaving a point in the middle extending into the inlet as though resting on a sand-spit or other support. From there it turns west toward the Dirt Glacier and presents an ice-wall of perhaps 100 feet in height or more, nearly to the place the Dirt Glacier enters the inlet. This part of the glacier presents a different front from the main branch. The top of the ice is nearly level, and as it approaches the water it cracks in immense crevasses at varying distances back, and cubical blocks break from it, making much larger bergs than were formerly thrown off by the Muir. Bergs that appeared to us to be fully 75 feet out of the water were seen 10 miles down Glacier Bay.

The Dirt Glacier pushes its black front out into the inlet from the southeast, forming a separate glacier.

This description will enable any one familiar with Professor Reid's map, or any one who has visited the glacier, to understand the marked changes which have occurred.

Judging from the appearance, it is not improbable that the end of the career of the Muir as a tidewater glacier is near at hand.

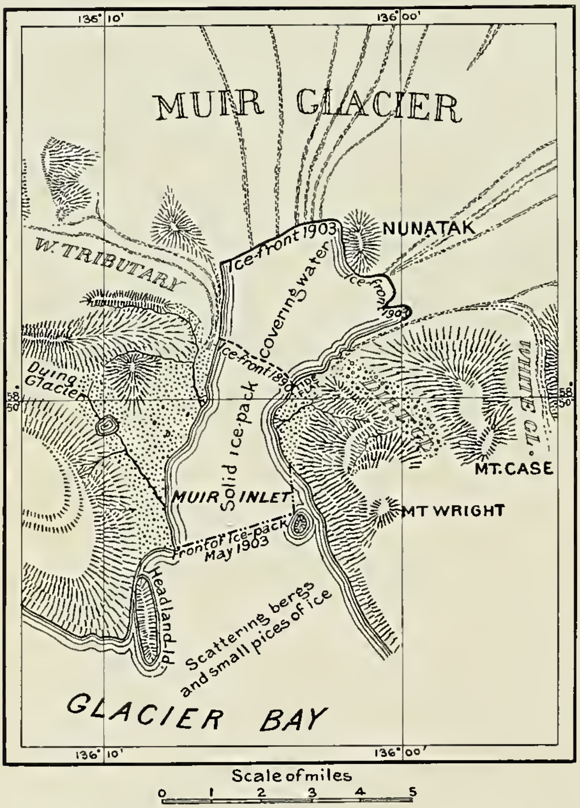
Many attribute the sudden changes to the earthquakes which occurred in

September, 1899. At that time the part of Alaska in which the Muir Glacier is situated was visited by several severe shocks of earthquake. Previous to that the steamers had experienced no great difficulty in landing their passengers within a short distance of the front of the glacier, but during no season since have they been able to get nearer than five to ten miles, owing to the immense quantities of floating ice. Instead of receding a mile in seven years, as has been estimated heretofore, it has drawn back about two and one-half miles since 1899; consequently, to assign the changes to that cause is not at all unreasonable.

I append a sketch, based on Professor Reid's map heretofore referred to, showing changes, and also photographs by Mr Case and myself, showing some of the existing conditions.

C. L. Andrews.

Skagway, Alaska.



Sketch Map of Muir Inlet and Front of Muir Glacier, Showing Positions of the Ice Front in 1890 and in May, 1903

The main features are taken from the map published by H. F. Reid in volume IV of the National Geographic Magazine. The ice front in 1903 and the data as to the condition of the inlet in that year are by C. L. Andrews.

NOTE BY G. K. GILBERT

The Muir Glacier is the best known and also one of the most interesting of American glaciers. It is not a narrow river of ice of the ordinary alpine type, but rather a broad lake of ice fed by tributary streams from many directions, and discharging through an outlet valley to Glacier Bay. The bottom of this valley of discharge is below sea-level, so that whatever position in it the glacier front occupies the ice is washed by the water of the ocean. The part of the valley not occupied by the glacier is known as Muir Inlet, and is a branch of Glacier Bay. In 1792, when this part of the coast was mapped by the English navigator, Vancouver, nearly the whole of Glacier Bay was filled with ice, the Muir Glacier being tributary to a broader stream. This broader stream ended in an ice cliff at a point more than 20 miles farther seaward than the present front of Muir Glacier. In 1879 the region was visited by John Muir, who explored Glacier Bay and its various inlets. He found the front of Muir Glacier well within Muir

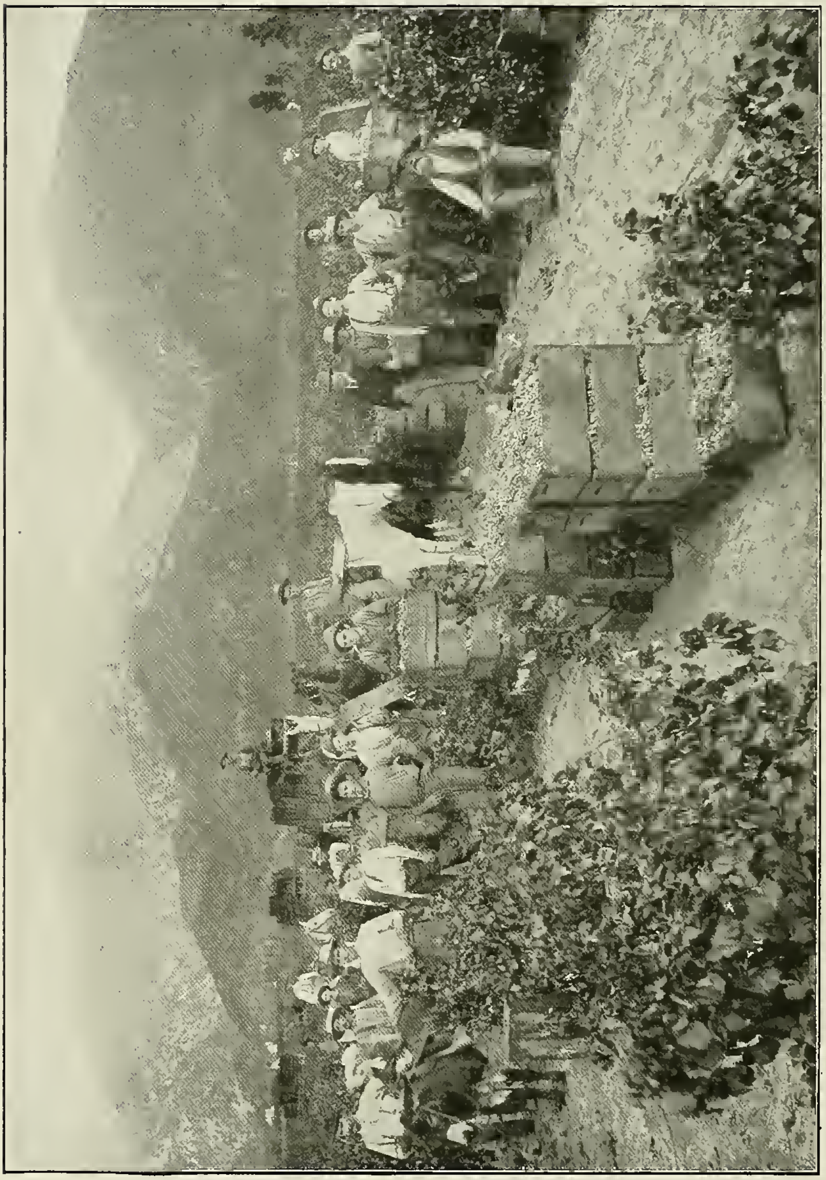
Inlet, the retreat since the time of Vancouver having been more than 15 miles. In 1886 Rev. G. F. Wright made a study of the glacier, and it was surveyed and more elaborately studied by Prof. H. F. Reid in 1890 and 1892. In 1899 it was visited by the Harriman Expedition, and changes in the outline of the front were recorded in a sketch map by Mr Henry Gannett. Each successive observation up to 1890 showed the retreat of the ice front. Between 1890 and 1892 there was a slight advance, and there was a moderate amount of retreat before 1899. The history of the locality since 1899, as set forth in Mr Andrews's letter, indicates that some very important change was made by the earthquake which occurred a few months after the visit of the Harriman Expedition. As the amount of ice thrown into the inlet was so great that approach by water is not yet possible, it is probable that the greater part, or perhaps the whole, of the falling away of the glacier front took place suddenly and as a consequence of the earthquake. Professor Reid's map shows two nunataks, or islands of rock, projecting above the glacier a few miles back from the front. The summits of these nunataks were used by him as topographic stations, and they were afterward occupied for the same purpose by Mr Gannett. I also, as a member of the Harriman Expedition, visited them in 1899, and noted that the portion of the glacier lying between them and the ice front was at that time practically stagnant. The portion between them and the east wall of the basin seemed also to be nearly motionless, but there was evidence of a strong current west of the nunataks. That which has since broken away includes portions of both the inactive and the active divisions of the glacier, and the maps and photographs suggest that the ice in the vicinity of the nunataks has suffered loss in depth as well as area. Where Reid mapped two small nunataks, Gannett found two of larger area, and Andrews indicates a single one, including the positions of both those observed by Reid. The retreat of the ice front has extended practically to the face of the confluent nunatak, though a remnant of ice appears to cling to the rock, forming a terrace about its seaward slope.

THE GRAPE-GROWING INDUSTRY IN THE UNITED STATES

THE cultivation of grapes for the market, for raisins, and to make wine has become an important business of the United States during recent years. Two hundred million dollars of capital are invested in this and dependent industries. California supplies the people of the country with practically all the raisins that they eat, 100,000,000 pounds, and the same state, with New York and Ohio, produces annually 24,000,000 gallons of wine. The annual grape crop, before any of the grapes are changed to wine or raisins, reaches $15,000,000 in value and nearly 750,000 tons in weight.

The early settlers of the Atlantic coast found wild vines everywhere, but their attempts to start vineyards in the East failed miserably, as they tried to grow varieties imported from Europe. It was not until they began to experiment with some of the wild varieties growing so luxuriantly on the coast that they had any success.

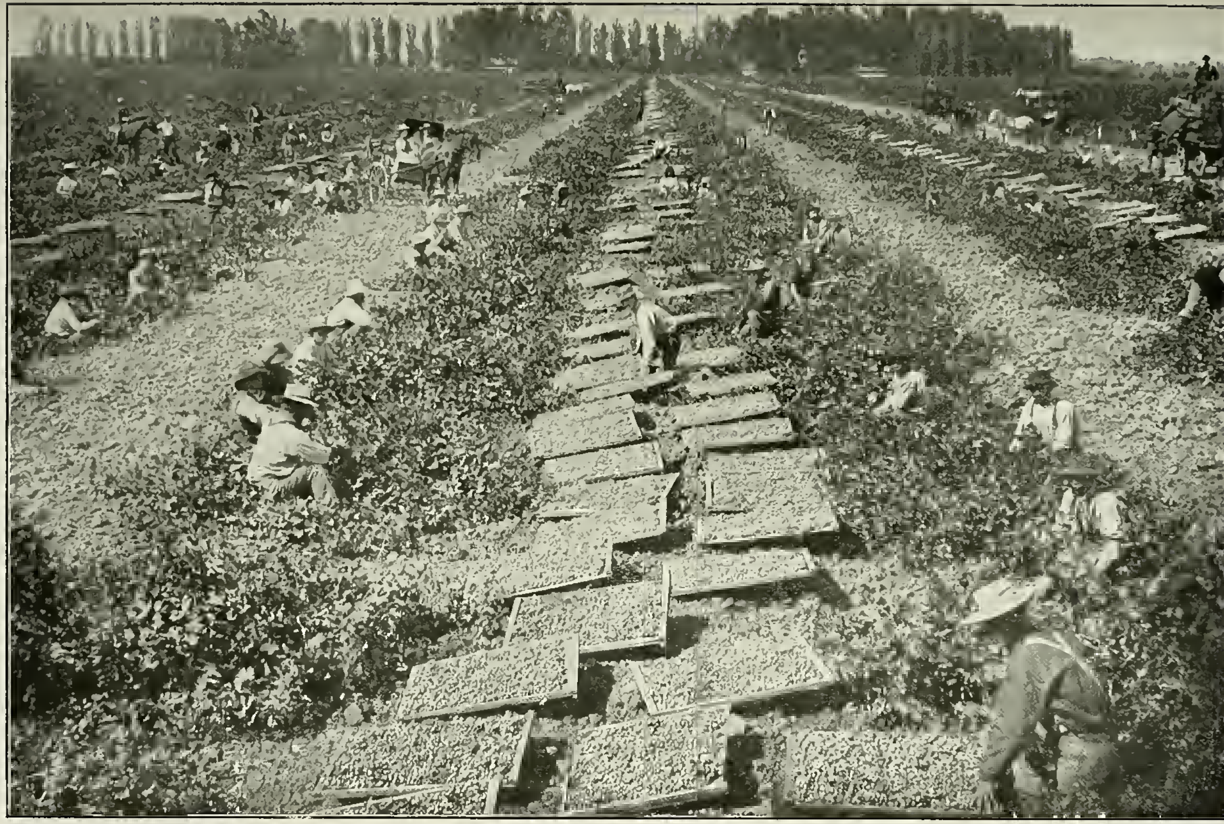
About 1824 Mr John Adlum, of Georgetown, D. C., obtained the well-known Catawba grape by improving a



From George C. Husmann, U. S. Department of Agriculture

Picking Grapes in California

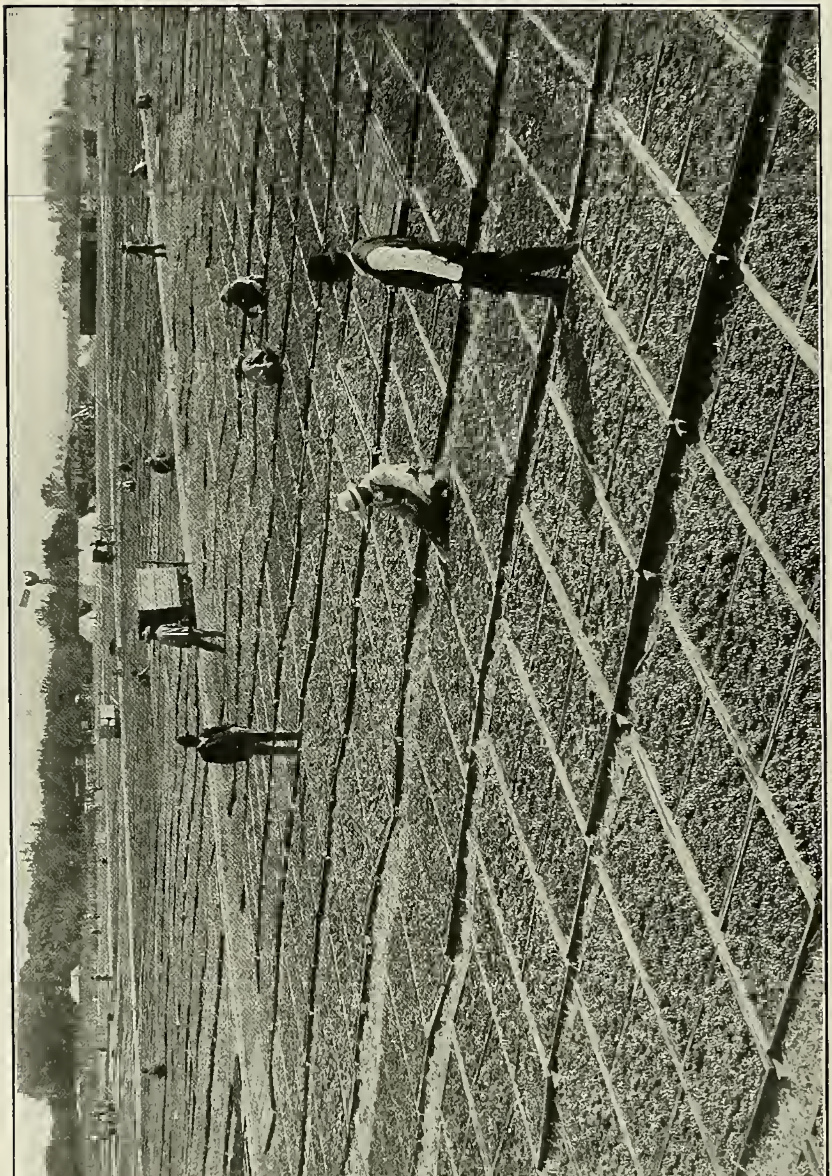
California produces about 22,000,000 gallons of dry and sweet wine yearly. The California Wine Association, at its own wineries in 1902 crushed 150,000 tons of grapes and at its leased wineries enough more to make 225,000 tons. In the fall of 1902 the association paid out in cash over $5,000,000 for grapes.



From George C. Husmann, U. S. Department of Agriculture

Picking Raisin Grapes in California

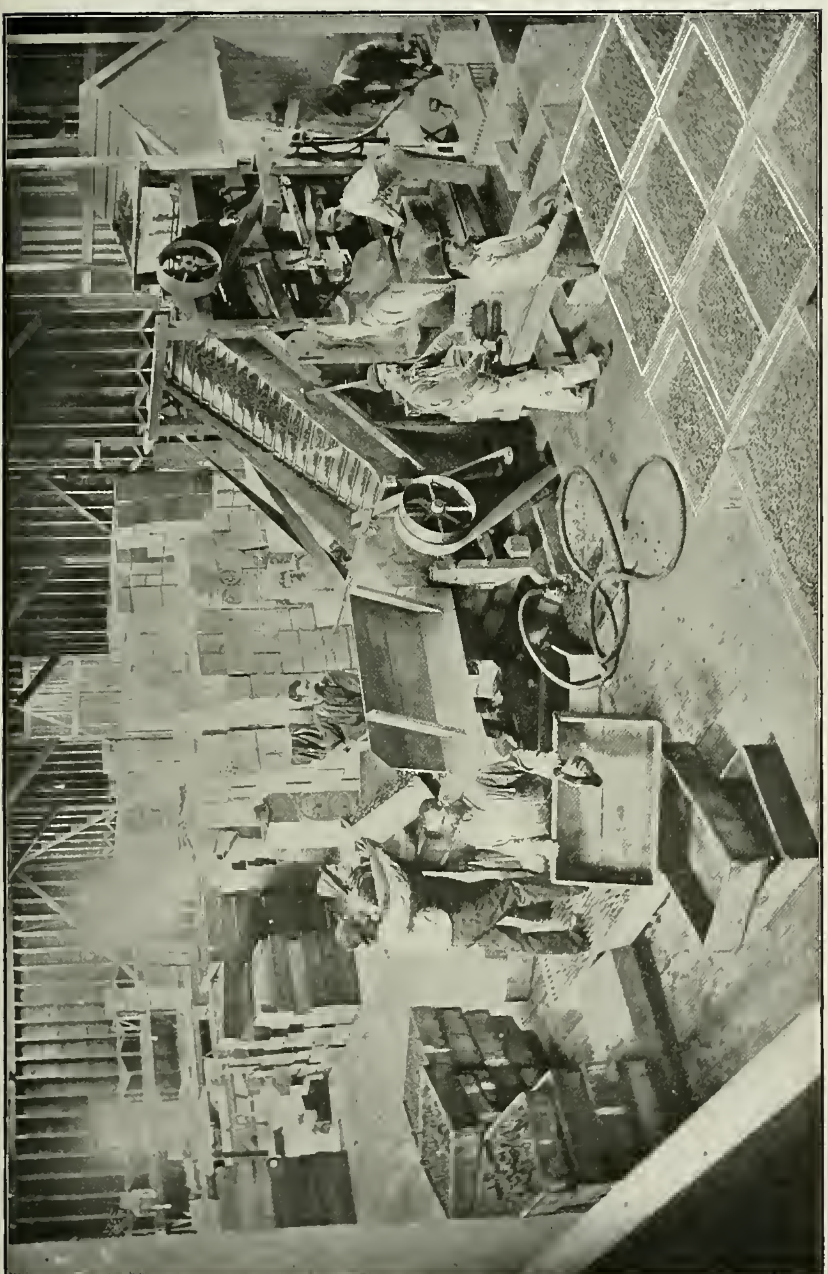
It takes from 3 to 4 pounds of grapes to make one pound of raisins. Frequently it rains enough in November to cause considerable damage to partially dried raisins and grapes. It is then that the Japanese laborers watch the predictions of the Weather Bureau, and when rain is indicated ask as high as 50 and 75 cents an hour for turning and covering the trays of raisins that are out in the vineyards. So familiar has this practice become that the school children who are large enough get excused from school for the work. In fact, the labor question is one of the most serious problems the growers have to contend with. The Chinese and Japanese laborers (especially the Japanese) control the situation, and make from \$2 to \$3.50 and even as high as \$4 per day picking grapes.



From George C. Husmann, U. S. Department of Agriculture

Drying Seedless Raisins in California

The average time of drying and curing a tray of raisins is about three weeks. Some of the larger growers, in order not to run so much risk in drying on account of rain and to save time in handling the crop, have curing houses, where the curing is finished after having been partially done outside.



From George C. Husmann, U. S. Department of Agriculture

Stemming Raisins in California

California produces 100,000,000 pounds of raisins yearly. These supply the American people with practically all they want. We now import only six million pounds annually, although as recently as 1885 it was necessary to import 53,000,000 pounds from Spain and Greece.

From George C. Husmann, U. S. Department of Agriculture

Packing Raisins in Layers in California

wild American grape. He was exceedingly elated with his discovery, and in a letter to a friend says that "in bringing this grape into public notice I have rendered my country a greater service than I would have done had I paid the national debt." Though the national debt was then $90,000,000, Mr Adlum probably did not exaggerate the value of his discovery.

Twenty years later, in 1844, Mr Ephraim Wales Bull, of Concord, Mass., obtained the famous Concord grape from the seed of another wild variety. The Concord has since become the most widely known, most generally planted, and for all purposes the best American grape yet introduced. Nine-tenths of the great crop of 85,000 tons of grapes from the Chautauqua grape belt on Lake Erie, in 1900, were Concords. The first Concord vine, from which stock the millions of vines of this variety have come, still lives in the garden of Mr Bull's cottage.

In 1830 there were 88 varieties of American vines known. Today there are at least 1,000.

In California the Mission fathers succeeded at an early date in growing a European grape for their own use. They had but one variety, which is still largely grown, and is known as the Mission. The Mission vine planted at Montecito, Cal., in 1795, was exhibited at the Centennial Exposition in Philadelphia. Some of the choicest European varieties have since been introduced and have thriven in their new home.

Mr George C. Husmann, of the Department of Agriculture, has recently published an exceedingly valuable paper on "Grape, Raisin and Wine Production in the United States," from which these facts are derived.*

In the United States there are two distinct grape-producing sections—one

* Year Book of the Department of Agriculture, 1902, pp. 407–420.

east of the Rocky Mountains, where the American varieties are largely and profitably grown; the other in California, where the foreign or Vinifera varieties have found a congenial home.

To the late Senator Leland Stanford, founder of the Leland Stanford Junior University, belongs the distinction of having had the largest vineyard in the world, comprising nearly 5,000 acres and being over 7 miles long. The wineries on the place cover more than 6 acres of roof surface, and during the years Mr Husmann had charge of them from 2½ million to 3 million gallons of wine were made annually, from 400 to 850 tons of grapes being crushed daily. Throughout California there are a number of vineyards of 500 acres each.

At Asti the Italian-Swiss colony has 1,700 acres in bearing vineyards. On the place are extensive wineries, with the largest wine vat of the world, holding 500,000 gallons. Near Cucamonga the Italian Vineyard Company has, during the last three years, planted nearly 2,000 acres in one field. The Riverside Vineyard Company during the same time planted 2,500 acres in one vineyard.

The amount of wine made in the United States is, however, very small compared to that produced in the countries of Europe. Even Turkey, whose Mohammedan population drink little wine, produces nearly twice as much wine as the United States.

In 1901 France produced of wines 1,523,233,200 gallons; Italy, 1,013,760,000; Spain, 520,080,000; Portugal, 155,760,000; Austria, 116,160,000; Roumania, 87,120,000; Chile, 85,120,000; Russia, 76,560,000; Bulgaria, 73,920,000; Germany, 60,720,000; Argentina, 55,440,000; Turkey, 50,160,000; Greece, 32,300,000; Switzerland, 31,680,000; United States, 29,500,000, and Servia, 23,760,000 gallons. The industry in the United States is as yet in its infancy. A beginning has just been made in a commercial and business-like manner to improve methods and expand markets. California has produced and sold annually the last ten years an average of 20 million gallons of wine, 2 million gallons of brandy, and 80 million pounds of raisins. Her wines and brandies have taken high honors at all important expositions, including that at Paris in 1900, and they are rapidly finding their way into all the principal markets of the world.

So far the raisin industry of this country has only supplied the small home demand of 100 million pounds, whereas the present population, were it to consume as much per capita as some other countries, say Great Britain, would now use 400 million pounds annually, not to say anything of extending markets and exporting to other countries.

When it is considered that France in 1901 produced 1,523,233,200 gallons of wine, while this country produced 29,500,000 gallons, and that the Golden State alone has a grape and wine producing area almost equal to the whole of France, some idea can be formed of the great possibilities of this important industry.

PRECIOUS STONES

THE United States can supply all the wants of its people for coal, iron, copper, petroleum, and all the useful minerals; gold and silver also are found in generous quantities; but of precious stones, the diamond, the ruby, the emerald, the topaz, etc., it has practically none, except what it has bought abroad. In 1902 we paid $25,000,000 to foreign countries for precious stones that we imported, while during that year precious stones of the value of only $338,000 were found within our borders. These were principally sapphires from Montana, turquoises from New Mexico, Arizona, Nevada, and California, and tourmalines and chrysoprases from California.

The United States Geological Survey has just published a report by Mr George F. Kunz on "The Production of Precious Stones in 1902,"* which contains much interesting information as to the origin of the different stones.

Nearly all the diamonds come from the Kimberley mines.

The South African mines have recovered from the set-back of the Boer war, and apparently have an inexhaustible supply of diamonds. In the various mines a total of over 40,000,000 loads of blue or diamantiferous ground is blocked out, meaning probably more than 10,000,000 carats of diamonds. The largest pile of diamonds ever brought together was collected at the De Beers mine in South Africa in July, 1900. The directors wanted to know the quantity of diamonds necessary to fill a certain measure. Diamonds of all kinds were put in just as mined, and it was thus ascertained that a cubic meter of diamonds weighs 11,976,000 carats and has an approximate value of about $76,000,000. Up to the present time the Kimberley mines have produced more than $500,000,000 worth of uncut diamonds.

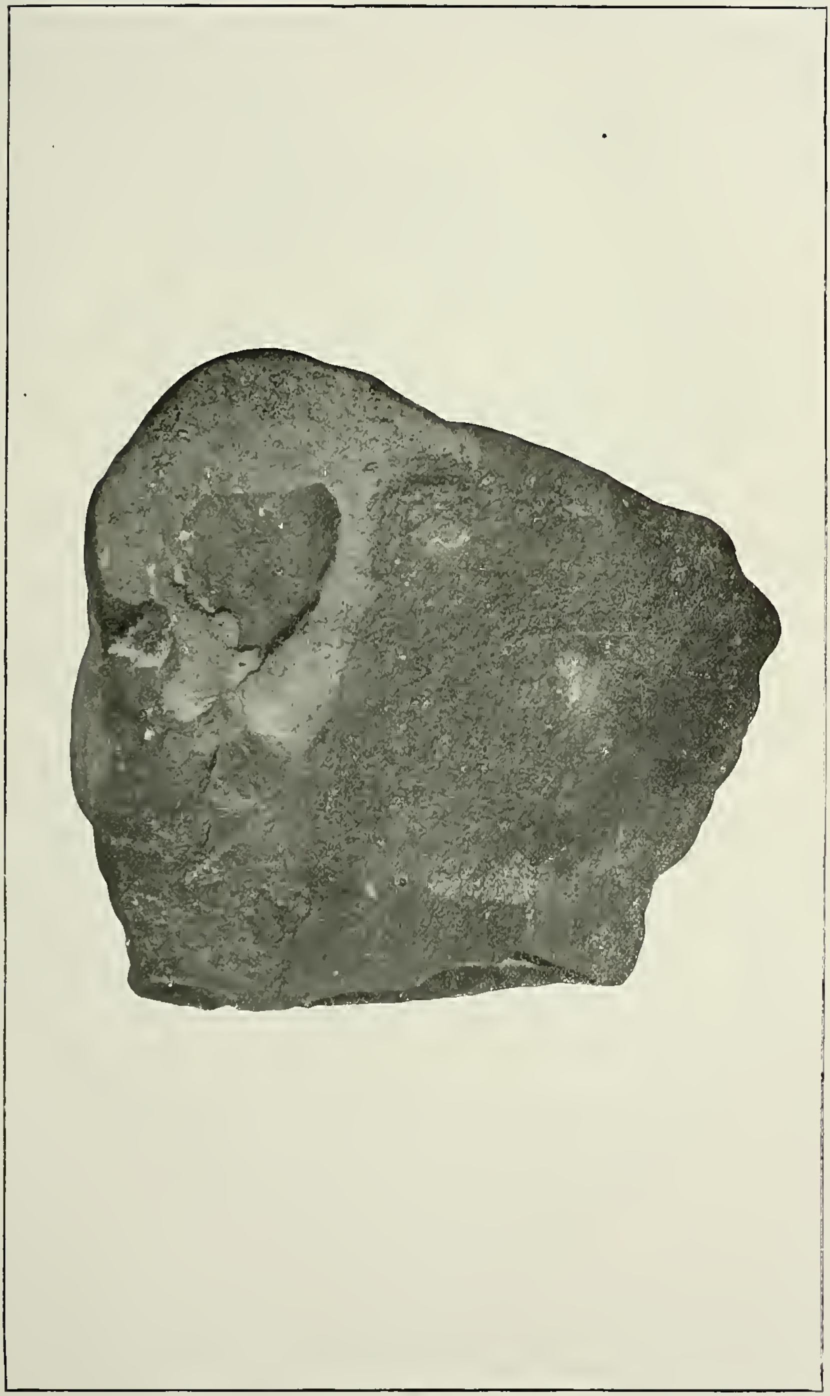
The number of diamonds from Brazil has fallen considerably during the last several years, because of the crude and unsystematic methods of hunting for them. Some 5,000 people are engaged in diamond mining there, but their tools are the commonest—a hoe, a crowbar, an iron hook on the end of a pole, or a hammer and two basins for washing the gravel. The accompanying illustrations show two remarkable carbons from Brazil found on one claim—the first in 1894 and the second in 1901. The carbons are split into many pieces and used for diamond drills. The present output of 2,500 carats of carbons a month cannot supply the demand for them for mining and drilling machinery. The price per carat demanded by the miners in the field has jumped to $11 and $11.20 for carbons, which is more than is paid for average uncut diamonds.

A new diamond field is being exploited in southwestern Borneo, where diamonds have long been known to exist. In the region of the Landak River, near the mouth of the Soran River, a piece of so-called serpentine has been obtained which incloses a diamond apparently in its true matrix. The Rajahs of Panembohan and Pongerans possess an immense belt studded with diamonds, said to be from this district, one stone weighing 67 carats. It is a peculiar belief of the natives that the gold and diamonds in the earth are a sort of bank, and should be worked only when they themselves need money, since they believe that gold and diamonds are always there when they desire them. The great Borneo diamond of Mattam, said to weigh 367 carats, is believed to be from this same region.

India, so long renowned in history and tradition as the source of gems, produced in 1902 no diamonds and no precious stones, with the exception of considerable numbers of rubies mined in Upper Burma. The leading gem dealers of Paris and Amsterdam have agents at Mandalay who buy the rubies directly from the Shans. The finest rubies go to Paris.

In examining rubies the Shans never use artificial light, holding that full sunlight alone can bring out perfectly

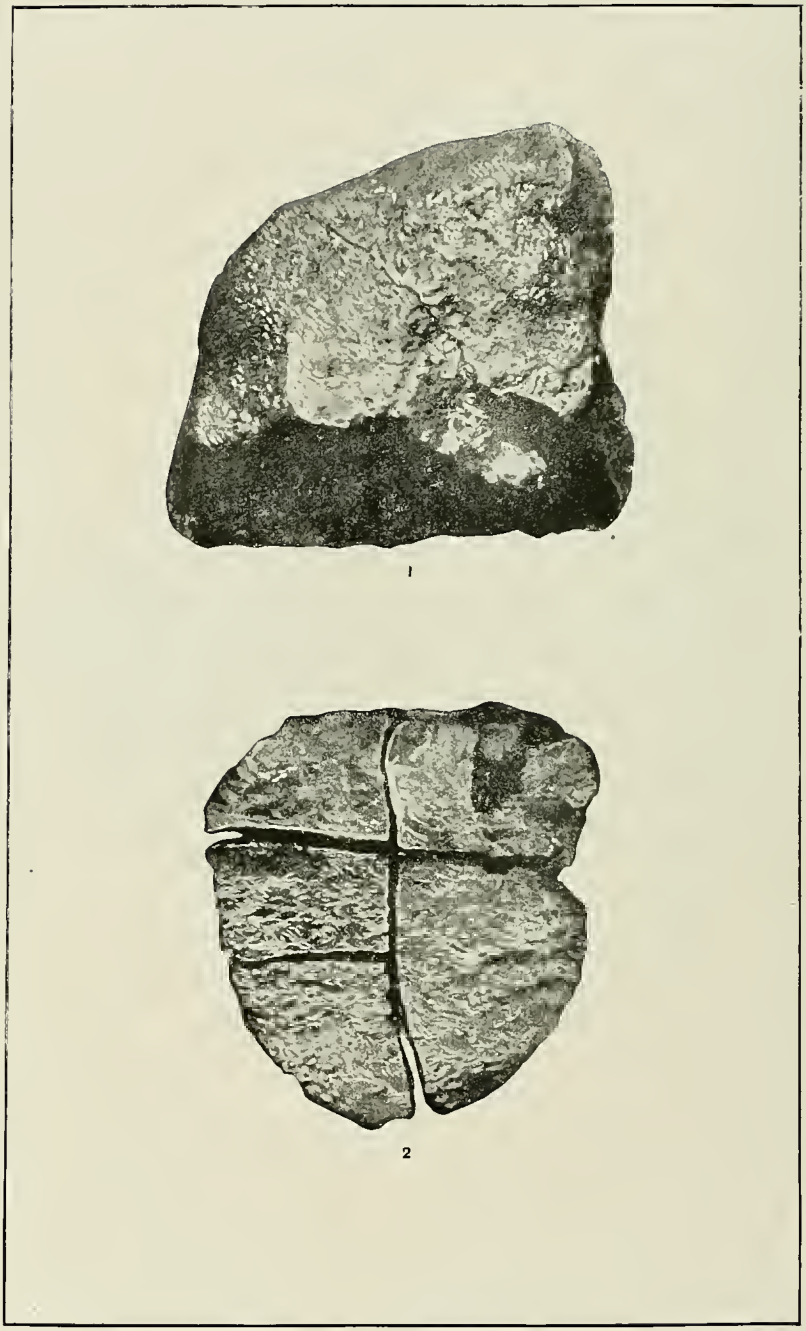
*The Production of Precious Stones in 1902. By George F. Kunz. Extract from mineral resources of the United States, calendar year 1902: David T. Day, Chief of Division of Mining and Mineral Resources. Washington: Government Printing Office. 1903.



From George F. Kunz, U. S. Geological Survey

The Largest Piece of Carbon Ever Found. Actual Size

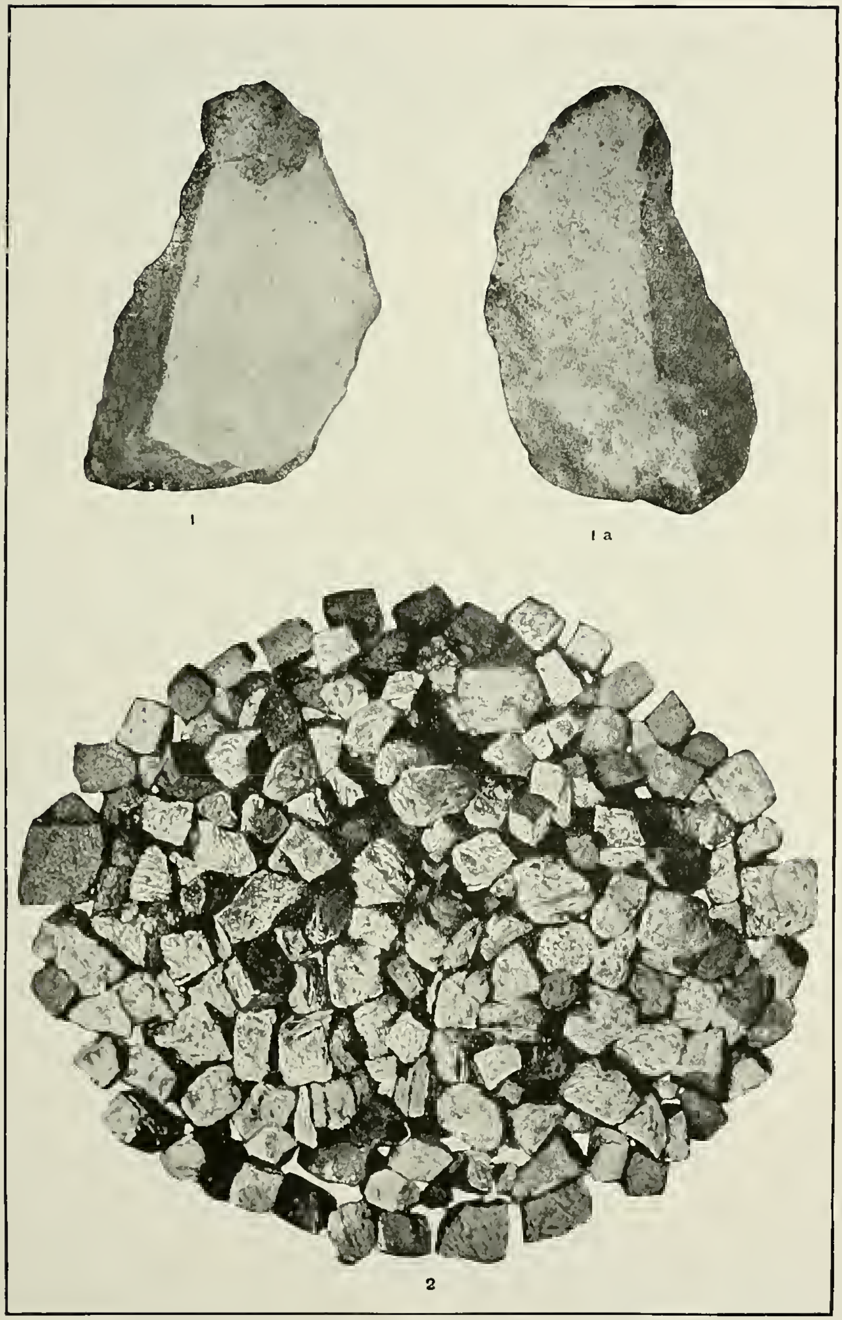
The carbon was found in Brazil in 1894. It weighed 3,078 carats or 20.3 troy ounces. The finder sold it for $16,000 to a speculator, who resold it for $32,000. After it had been broken into pieces for use as a diamond drill its value was about $130,815.



From George F. Kunz, U. S. Geological Survey

Process of Breaking the Third Largest Piece of Carbon Ever Found. Weight, 750½ Carats; Value, $23,600. Found in Brazil, 1901

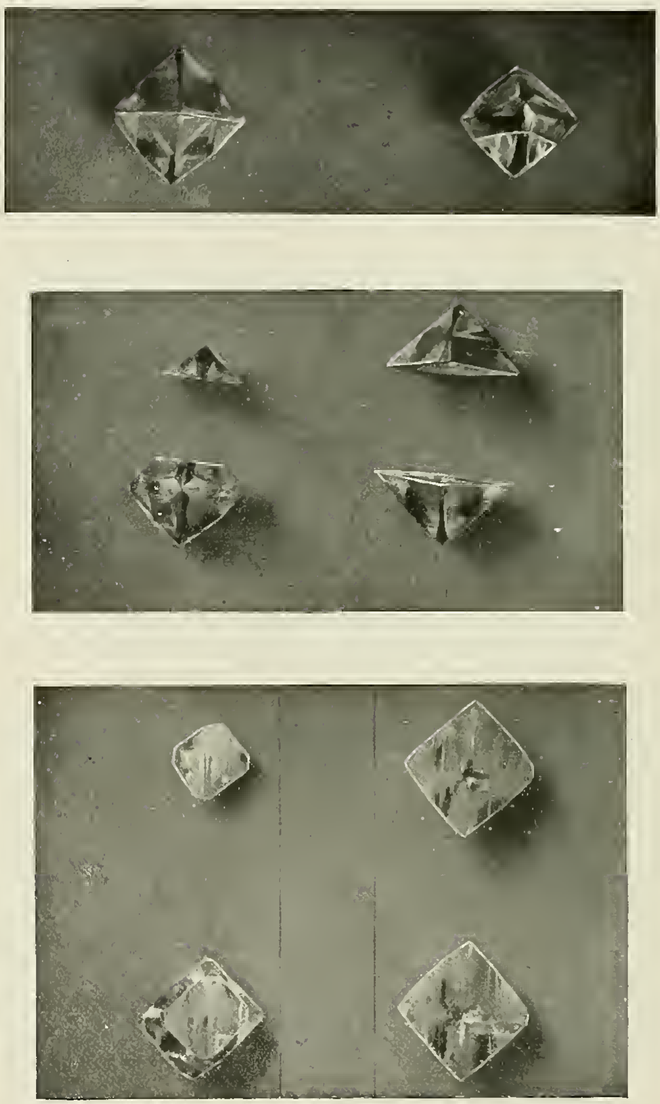
1. Outer half of the piece, showing a break diagonally across it. 2. Reverse (inner) side of 1, showing three breaks, making five pieces of the half of the carbon



From George F. Kunz, U. S. Geological Survey

The Carbon Shown on the Opposite Page as Finally Broken into Pieces for Drills

1, 1*a*. Inner sides of upper part of the carbon shown as Fig. 2 in the preceding illustration. 2. The entire piece of carbon broken into pieces weighing from three to four carats each, the sizes generally used for diamond drills.



From George F. Kunz, U. S. Geological Survey

Diamond Sawing by a Process Recently Invented by an American

The diamond is held firmly and very steadily under pressure against a rapidly revolving disk of sheet iron or "phosphor" bronze. The wheels are much like those used in sawing thin sections for microscopic rock sections or for cutting jade, rock crystal, and other hard stones. It is claimed that in thus dividing an octahedron at the center or girdle as little as 2 per cent of the weight of the crystal is lost—a great saving of material. As evidencing the wonderfully keen responsive business acumen which has always characterized the "rough" syndicate, the price of all rough diamonds that could be improved or advanced in value by such sawing was immediately advanced when the process became known.

the color and brilliancy of the gems. Sales must therefore take place between the hours of 9 and 3, and the sky must be clear.

The purchaser, placed near a window, has before him a large copper plate. The sellers come to him one by one, and each empties upon the plate his little bag of rubies.

The bright copper plate has a curious use. The sunlight reflected from it through the stones brings out a color effect with true rubies different from that with red spinels and tourmalines, which are thus easily separated.

The buyer and seller then go through a very peculiar method of bargaining by signs, or rather grips, in perfect silence. After agreeing on the fairness of the classifications, they join their right hands, covered with a handkerchief or a flap of a garment, and by grasps and pressures, mutually understood among all these dealers, they make, modify, and accept proposals. The hands are then brought out, and the prices are recorded.

The larger single stones are valued according to color and shape for cutting, the very fine ones bringing high prices. A ruby of 36½ carats from the Mogok mine some years ago brought 90,000 rupees ($30,000) at Calcutta.

Cutting is an important industry at Mandalay, and the Burmese workmen have remarkable skill, especially in avoiding loss in weight. European cutting they consider very wasteful, and at Mandalay a man would not be employed who sacrificed more than one-fourth of a ruby, while at Antwerp a loss of two-thirds is not uncommon. The tools are extremely simple. The stone is first shaped with a small steel chisel and wooden mallet, as far as possible, according to its cleavage. The facets are then ground and polished on a copper wheel with ruby dust, the stone being held with wax or lac on a curved piece of ox horn. A month or six weeks may be occupied in cutting and polishing a ruby of one carat.

The pale stones, cut rounded (cabochon) with a concave base, are much used for ornamental work, especially upon gold vessels. The luster of the gold beneath appears to enrich and darken the ruby and give it the true pigeon's-blood color.

Agates, amethysts, rock crystal, and golden topazes are shipped in great quantities from Brazil. Almost all of them go to Idar and Oberstein, in Germany, where they are cut into ornaments. Last year 200,000 pounds of agate and six tons of rock crystal were cut into seals, paperweights, and faceted stones. One wonderful geode yielded over 40,000 pounds of amethyst.

A great quantity of sapphire of a very dark blue, almost black, color, with a greenish tint, and occasionally entirely green, was imported from Australia. The tourmaline, principally the red (rubellite) and also the aquamarine from Brazil, have been sought for, and considerable quantities of both have been sold at Idar.

It is interesting to note the increasing variety of ornamental and semi-precious stones now being brought into use, and particularly the introduction of jade.

This beautiful stone has from prehistoric times been the especial favorite of uncivilized or semi-civilized peoples, and in China, Japan, and India it has yielded the choicest objects of oriental art. At the Paris Exposition of 1900 a remarkable exhibit was made of Siberian jade wrought by European artists, and now the Oceanic jade of New Zealand, long prized and carved by the Maoris, is becoming immensely popular with the civilized world.

Great bowlders of it have recently been discovered in New Zealand, in the river beds, from one of which two panels, translucent and of a rich pure green color, were cut, which were over one yard long, two-thirds of a yard wide, and only one-eighth of an inch thick. Nearly all the jade of New Zealand was sent to Germany and there cut into stones for rings, scarf-pins, studs, and for ordinary jewelry purposes, such as those for which sard and agate have heretofore been used.

The diamond syndicate, composed of the South African mine owners, manage the sale of their diamonds very shrewdly. A purchaser must buy not only the variety of diamond he wants, but also all the other varieties from the mines. The syndicate sells its diamonds in parcels or series; each parcel is made up of the different varieties of diamonds in the proportion in which each diamond is found. In this way the unpopular varieties are disposed of as quickly as the popular ones.

The diamond-cutting industry in the United States has advanced very rapidly during recent years. American diamond-cutters would now be able to cut all the diamonds for this country if they could get enough rough diamonds. As it is, the rough diamonds sent over supply only one-half of the demand. The American cutters have invented a number of new mechanical labor-saving devices, which have given them a great advantage over the European cutters, where diamond cutting is done by the ancestral "rule of thumb" handed down from father to son.

NOTES ON PANAMA AND COLOMBIA

IT is supposed by some that Panama derived its name from the native word for butterfly. Explorers of the interior tell of swarms of butterflies which at times rise on the slopes of the mountains in dense clouds, darkening the sunshine. Others maintain that the name is from an Indian word meaning abounding in fish.

The Republic of Panama is believed to have about 300,000 people, living in towns and hamlets. It extends east and west for about 450 miles, with an average breadth of 70 miles from sea to sea. Its area is about 31,500 square miles. Thus the population of the state about equals that of Washington, D. C., while its area is a little greater than the area of South Carolina. The commerce of Panama amounts to $3,000,000 per annum. These figures are supplied by the Bureau of Statistics of the Department of Commerce and Labor, and are from reports of the United States consuls at Panama and Colon, which have just been received by the Bureau and are not yet published.

The principal ports are Panama, on the Pacific coast, and Colon, on the Atlantic side, and these ports are visited annually by more than one thousand vessels, which land over one million tons of merchandise and nearly one hundred thousand passengers, chiefly for transfer over the Panama Railway, 47 miles in length, connecting the Pacific port of Panama with the Atlantic port of Colon.

Colon, sometimes called Aspinwall, has a population of about three thousand persons. It was named in honor of Columbus, who discovered the bay in 1502. The city of Panama has a population of about twenty-five thousand. It was founded in 1519, burued in 1671, and rebuilt in 1673. During the sixteenth and seventeenth centuries Panama was one of the wealthiest of the Spanish towns in the New World, as all the plunder from the Pacific coast passed through the city. It "had eight monasteries, a cathedral, and two churches, a fine hospital, 200 richly furuished houses, nearly 5,000 houses of humbler sort, a Genoese chamber of commerce,

Photo by Robert T. Hill

An Uncompleted Section of the Panama Canal

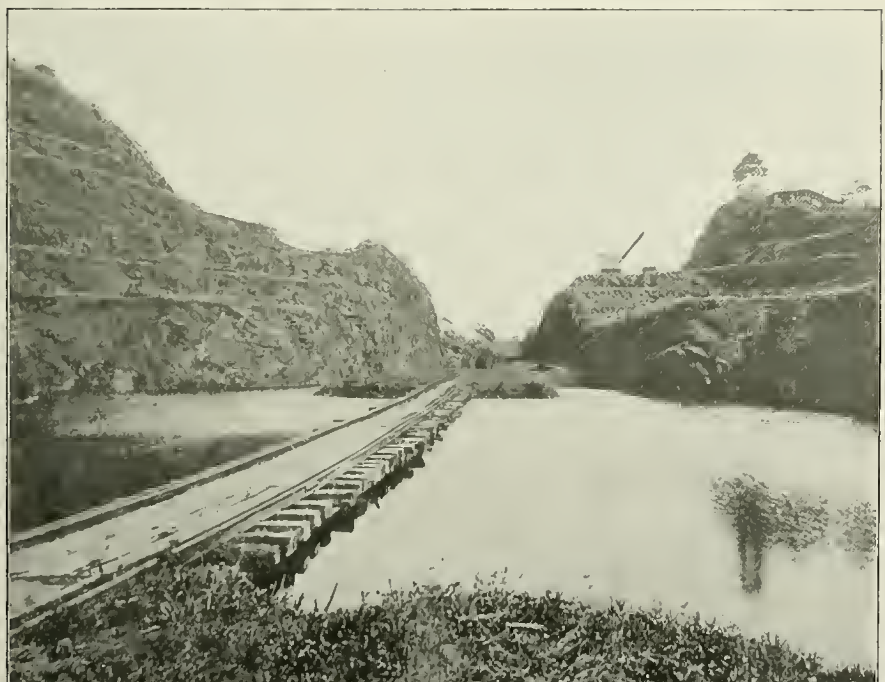


Photo by Robert T. Hill

Canal Cutting Through Massive Basaltic Rock

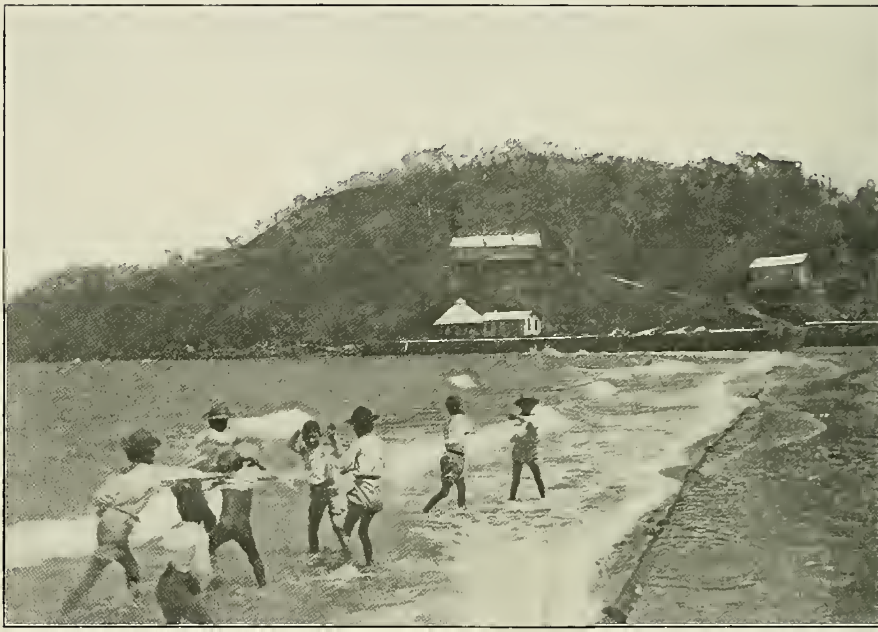


Photo by Robert T. Hill

Panama Bay. The Island of Toboga, Famous for its Delicious Pineapples

Photo by Robert T. Hill

Washerwomen—Isthmus of Panama

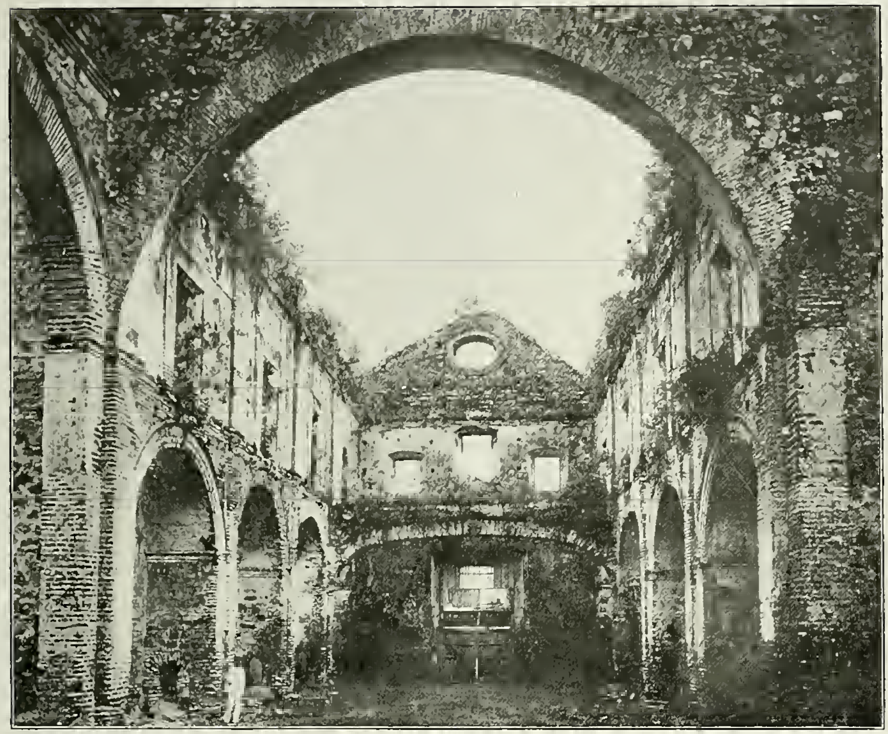


Photo by Robert T. Hill

Panama. Interior of Ruins of Old Cathedral

In the back of the picture will be seen a brick arch of about 30 feet span and less than 4 feet spring. The preservation of this arch testifies to the freedom of this region from serious earthquake disturbances.

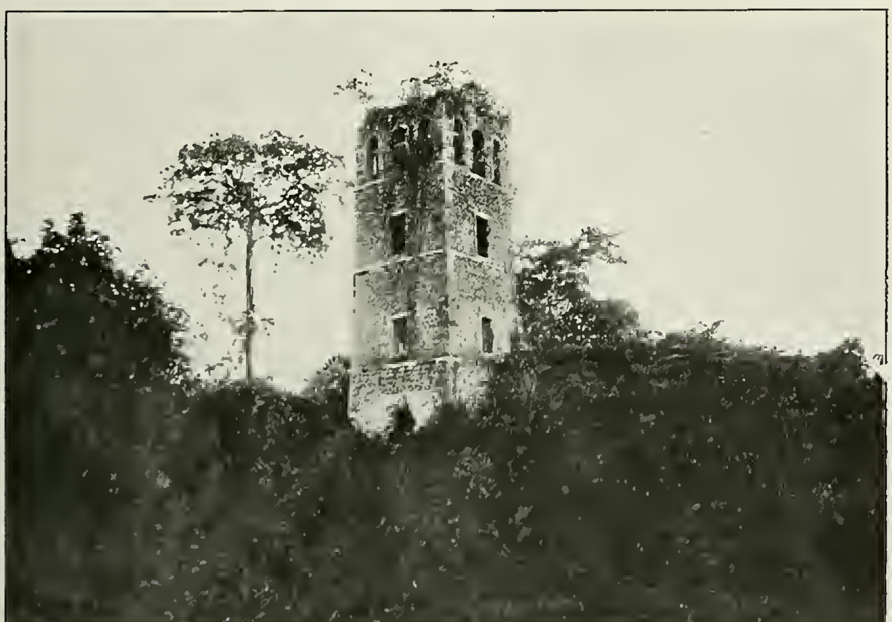


Photo by Robert T. Hill

Panama. This Tower Alone Remains to Mark the Site of the Great City befor it was Sacked by Sir Henry Morgan and 200 warehouses, and was, after three weeks of rapine and murder, burned February 24, 1671, by Morgan's buccaneers, who carried off 175 laden mules and more than 600 prisoners."* Colon is of much more recent date, having been founded in 1855.

The population, which, as already indicated, amounts in number to about three hundred thousand, is composed of various elements—Spanish, Indian, Negro, and a limited number of persons from the European countries and the United States, especially those engaged in commerce and transportation and the operation of the Panama Railway. Since the abolition of slavery in Jamaica a considerable number of blacks and mulattoes have settled on the Isthmus as small dealers and farmers, and in some villages on the Atlantic side they are said to be in the majority, and as a result the English language is much in use, especially on the Atlantic side. Some of the native population have retained their customs, speech, and physical type, especially those in the western part of the province, and claim to be descendants of the natives found in that section by the Spaniards when they discovered and conquered the country.

Of the commerce of Panama, the United States supplies a larger share than any other country. The importations at the port of Colon during the fiscal year ended June 30, 1903, as shown by the report of the United States consul, amounted to $952,684, of which $614,179 was from the United States, $119,086 from France, $118,322 from England, $76,386 from Germany. The exports to the United States from Colon in 1903 amounted to $173,370, of which $75,432 was bananas, $54,960 cocoanuts, $12,472 turtle shells, $9,400 ivory nuts, $6,460 hides, and $5,924 coffee.

From the port of Panama the exports to the United States in the fiscal year 1903 amounted to $193,342, of which $56,767 was hides, $49,974 India rubber, $27,805 cocobolo nuts, $16,598 ivory nuts, $13,372 deerskins, and $6,908 coffee. The consul at Panama states that the imported articles come mostly from England, Germany, France, Italy, and the United States, but gives no statistics of the imports.

Panama is connected with San Francisco by a weekly steamer schedule operated by the Pacific Mail Steamship Company, and with Valparaiso by a weekly steamer schedule operated by the Pacific Steam Navigation Company and South American Steamship Company. Two passenger and two freight trains leave Panama daily for Colon, and Colon daily for Panama. The time for passenger trains over the 47 miles of railway is three hours.

From Panama there is one cable line north to American ports and one to the south. The actual time consumed in communicating with the United States and receiving an answer is stated by the consul to be usually about four hours. There are also lines from Colon to the United States and Europe.

The money of the country is silver, the rate of exchange having averaged during the past year about 150 per cent.

The climate of the isthmus of Panama has proven most deadly in the past. Even the tough negroes imported from Jamaica have quickly succumbed to the marsh fevers and tropical diseases of the country. The excessive death rate has been principally due, however, to an utter disregard of sanitary laws. A sensible and efficient administration will be able to improve conditions and to make the lives of all on the Isthmus safer.

Along the route of the canal the country is accurately surveyed, but there are large sections beyond which are unexplored.

COLOMBIA

Colombia has more than ten times the population of Panama. The last census

*Travels of Pedro de Cieza de Leon, Hakluyt Society, 1864.

Photo by Robert T. Hill

A Street of Colon

Photo by Robert T. Hill

Colon—Driveway of Christofer Colon, the Canal Suburb

The ground is made from débris of the Canal dumped into the bay

Photo by Robert T. Hill

Colon. Residence of the Superintendent of the Panama Railway Company at the Entrance of Limon Bay

Photo by Robert T. Hill

Panama Bay. The Island of Naos, Terminus of the Pacific Mail Line was taken 32 years ago; but an official estimate made in 1881 gave her about 3,600,000, not including the people of Panama. Colombia has no army to speak of, no ships, no money, only a few miles of railway, and hence no means of sending a good force against Panama.

Bogota, the capital, is called the Athens of South America, and has a population of 125,000. The national university is located in the city and there is a valuable library of 50,000 volumes, an observatory, a picture gallery, and several learned institutions.

An intending visitor to Bogota is landed at Barranquilla, at the mouth of the Magdalena River; thence he proceeds by steamer up the river for 592½ miles to Honda, then by rail 22 miles to La Dorada, then by mules 45 miles to Facatativa, and thence by rail 24 miles, when he finally reaches the Colombian capital.

Colombia, exclusive of Panama, is as large as the two states of California and Texas combined. Three high mountain ranges cross the republic from north to south, making high table-lands between, where the days the year round are scarcely hotter than those of a temperate zone. On the Bogota table-land the glass oscillates between 50° and 78° Fahr., while the annual rainfall rarely exceeds 45 inches. In the lowlands, of course, the tropical sun beats down with an intensity that makes those sections uninhabitable by the white man.

The people are a mixture of races. At the time of the Spanish conquest the population of Colombia was estimated at eight million. Wholesale butcheries and enslavement in the mines reduced the number in a few generations to less than a million. Most of the natives were too helpless to resist, but "some retaliated and in the Antioquia district poisoned the salt springs so effectually that they remain poisoned to this day." The present Colombian nationality is a fusion in varying proportions of the aborigines with the whites from various parts of Spain, including a considerable number of baptized Jews. This Hebrew element is quite noticeable, especially in the province of Antioquia, which is the wealthiest and most prosperous of the departments of Colombia. There is also a considerable African element in the population.

Colombia has great wealth lying untouched on her plains and in her forests and mountains. Dr A. H. Keane describes her resources in the following glowing terms: *

"So varied and abundant are its natural resources, both above and below ground, that, under a firm and enlightened administration, Colombia, despite the insalubrious climate of many districts, might soon become one of the most prosperous regions in the world. It supplies nearly all the platinum as well as the very finest emeralds brought to the European market, while gold-bearing reefs and washings occur almost everywhere, the total annual yield being about £650,000 and the yield of gold and silver since the discovery nearly £150,000,000. In 1891 as many as 4,960 mines of all kinds were open, including 3,398, 794, and 571 of gold in the three departments of Antioquia, Tolima, and Cauca respectively, besides 32 of emeralds, 14 of cinnabar, 7 of manganese, and several of platinum, silver, lead, mercury, iron, coal, and salt. Extensive coal-fields and reservoirs of petroleum occur in several districts, so that few regions can compare with Colombia for the astonishing variety of its underground products. Scarcely less varied are those of its forests and cultivated lands, including coffee, cocoa, tobacco, sugar, vegetable ivory, rubber, dye-woods, plantains, wheat, and maize; but at present only a small part of the country is under tillage, and the development of its agricultural resources is greatly retarded by the lack of good communications."

*Central and South America. By A. H. Keane. Vol. I, p. 152.

Photo by Robert T. Hill

Houses of the Talamancan Indians

The Talamancans are a tribe of uncivilized Indians living on the borders of Panama and Colombia. They are aborigines, and are practically as wild today as in the time of Columbus

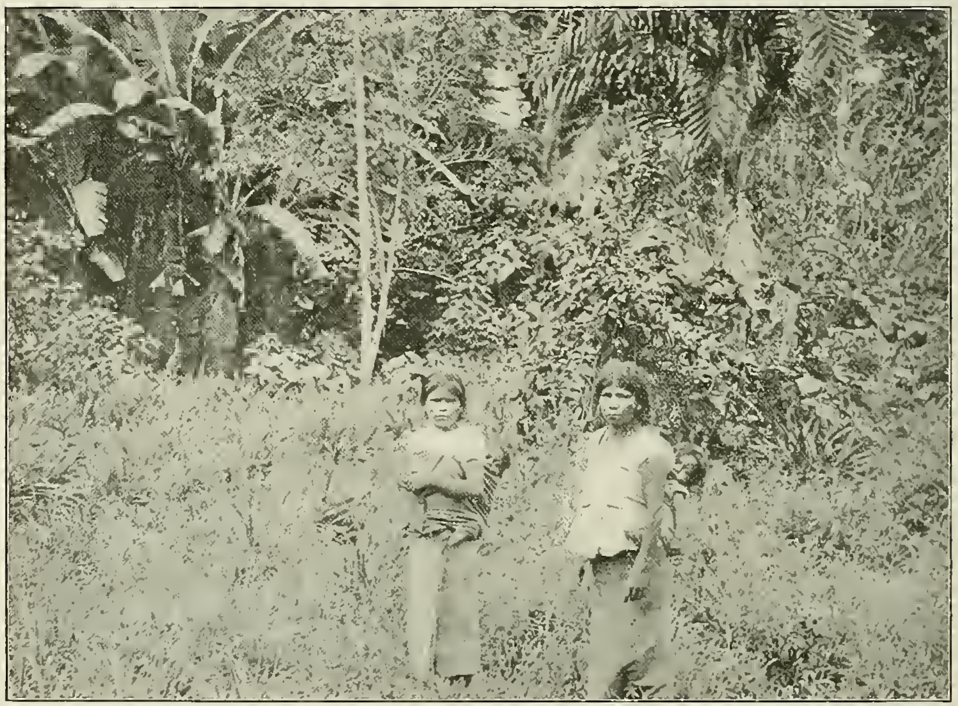


Photo by Robert T. Hill

Typical Vegetation of the Isthmus of Panama. Two Talamancans in the Foreground

THE U. S. SIGNAL CORPS

THE Alaskan telegraph system has been completed by the U. S. Signal Corps. It is now possible to send messages by wire to Valdes, Fort Michael, and to stations along the Yukon River. At present these messages must pass over Canadian lines to the international boundary near Fort Egbert, whence they are carried by the U. S. military lines to their Alaskan destination. A cable has been laid from Sitka to Juneau and up the Lynn Canal to Skagway, connecting by way of White Pass with the Canadian telegraph line, and bringing these important points into instant communication with Washington and London.

Few realize the difficulties that have been overcome in building this network of 1,740 miles of wire. Most of the land lines were put in during the best working season, November to February. The mean temperature for these four months was two degrees below zero. Sometimes it was so cold that the mercury froze solid after it had gone as low as 61 degrees below zero. Gen. A. W. Greely, U. S. A., in his last report as Chief Signal Officer, says of the work:

"It is impossible to adequately set forth the tremendous difficulties under which Alaskan military telegraph lines have been constructed and maintained. In general, it is to be premised that not 20 miles of constructed wagon road exists in the country traversed. As a rule, all material has been sledded into the interior in midwinter or carried by pack animals over the roughest imaginable trails. Conditions were so difficult that some coils of wire were carried 145 miles by pack. The magnitude of the work may be inferred by the statement that from Fort Egbert alone, between November 20, 1902, and June 30, 1903, no less than 220 tons of supplies and material were sledded or packed into the interior, it being impossible to move a ton by wagon.

"The construction parties, consisting almost entirely of enlisted men of the Signal Corps and of the line of the Army, worked steadily the entire winter, although the conditions under which field work was done were of the most hazardous and appalling character. As an illustration may be mentioned the fact that from November 1 to the end of the winter, by official reports, 60 feet and 11 inches of snow fell at Fort Liscum, adjoining the Copper River Valley.

"In the interior, while the snowfall was very much less, being only 4 feet 4 inches at Egbert, yet continued and terrible cold made camp life and construction work almost insupportable. The mean temperature at Fort Egbert from November to February, inclusive, a period of four months, was 2° below zero. There were prolonged periods of extreme low temperature, when the mercury remained frozen, the minimum of 61° below zero occurring in January. While the past winter is believed to have been the most severe in Alaska for many years, yet such was the resourcefulness and endurance of the American soldier that the work of construction in the valley of the Tanana was carried on the entire winter without loss of life and with only one serious case of freezing.

"The cold and snow of the winter were, strangely enough, more favorable to completing the system than were the morasses and fires of summer. The final completion of the telegraph system was made just as an extensive forest fire devastated the upper valley of the Tanana, burning thousands of square miles of valuable timber and destroying more than 100 miles of telegraph line. The damage was the more serious in that the 100 miles of line destroyed were burnt out not as a whole section, but at various points along the distance of 250 miles over which the fire extended."

The cable to connect Sitka and Seattle has been made and is now at San Francisco. It will be laid in the early spring of 1904. The cable was authorized by Congress March 3, 1903. Since that date the entire cable, 1,300 miles long, has been manufactured near New York, transported around Cape Horn, and delivered in perfect condition at San Francisco after its voyage of 16,000 miles; the complicated machinery to handle the cable and the delicate instruments necessary to operate it have been planned by the Signal Corps, made to order in Great Britain, and delivered in San Francisco, and the route from Seattle to Sitka has been surveyed by Capt. J. F. Pratt, of the Coast and Geodetic Survey steamer *Patterson*, through the courtesy of Supt. Otto H. Tittmann, of the Coast and Geodetic Survey. This is a remarkable record of achievement in seven months, March to September, inclusive.

The gradual transfer of the military telegraph and cable lines in the Philippines to the insular government was begun during the year. It is estimated that if a fee of two cents a word had been charged for all official messages the receipts of the lines would have been $1,500,000. The cost of construction and maintenance was less than $500,000, so that there was a net saving to the government of over one million dollars.

GEOGRAPHIC LITERATURE

The Island of Formosa. Past and Present. History, People, Resources, and Commercial Prospects; Tea, Camphor, Sugar, Gold, Coal, Sulphur, Economical Plants, and Other Productions. By James W. Davidson, F. R. G. S., consul of the United States for Formosa. With two new maps, frontispiece in color, one hundred and sixty-eight illustrations from photographs, and colored reproductions of two Chinese posters. Imperial 8vo. Pp. 720. New York: The Macmillan Company. 1903.

Mr Davidson, U. S. Cousul to Formosa since 1895, has written a very comprehensive description of Formosa, past and present. His narrative history of the islanders, of their struggles against the Chinese, the Tartars, the Dutch, and the pirates, and of their frequent rebellions and continual battling against the aborigines in the mountains, makes interesting reading. His chapters on the various industries of Formosa are specially valuable. The island is extraordinarily fertile; it has vast camphor forests, an unlimited supply of coal, gold mines, salt, petroleum, sulphur, and other deposits, and many plants of economic value—indigo, fiber, and paper plants, and many others. Perhaps the most notable chapter of the volume is that describing his visit to Botel Tobago Island.

Botel Tobago (Kotosho) Island is a dependency of Formosa, and some 35 miles from the south Formosan coast. The island is only some 30 miles in circumference, and consists of a single long hill, on the shores of which the savages live. To the ethnologist, the inhabitants of this little land are, perhaps, the most interesting of all the savages in Japan's new colony, and doubtless there are few tribes in the whole East who live in such a primitive manner aud who have had so little communication with the outside world as the Botel Tobago savages. An occasional Chinese junk stops off the island to exchange wares, but otherwise the island had never been visited until a Japanese commission, accompanied by Mr Davidson, landed and explored it soon after the Chinese-Japanese war.

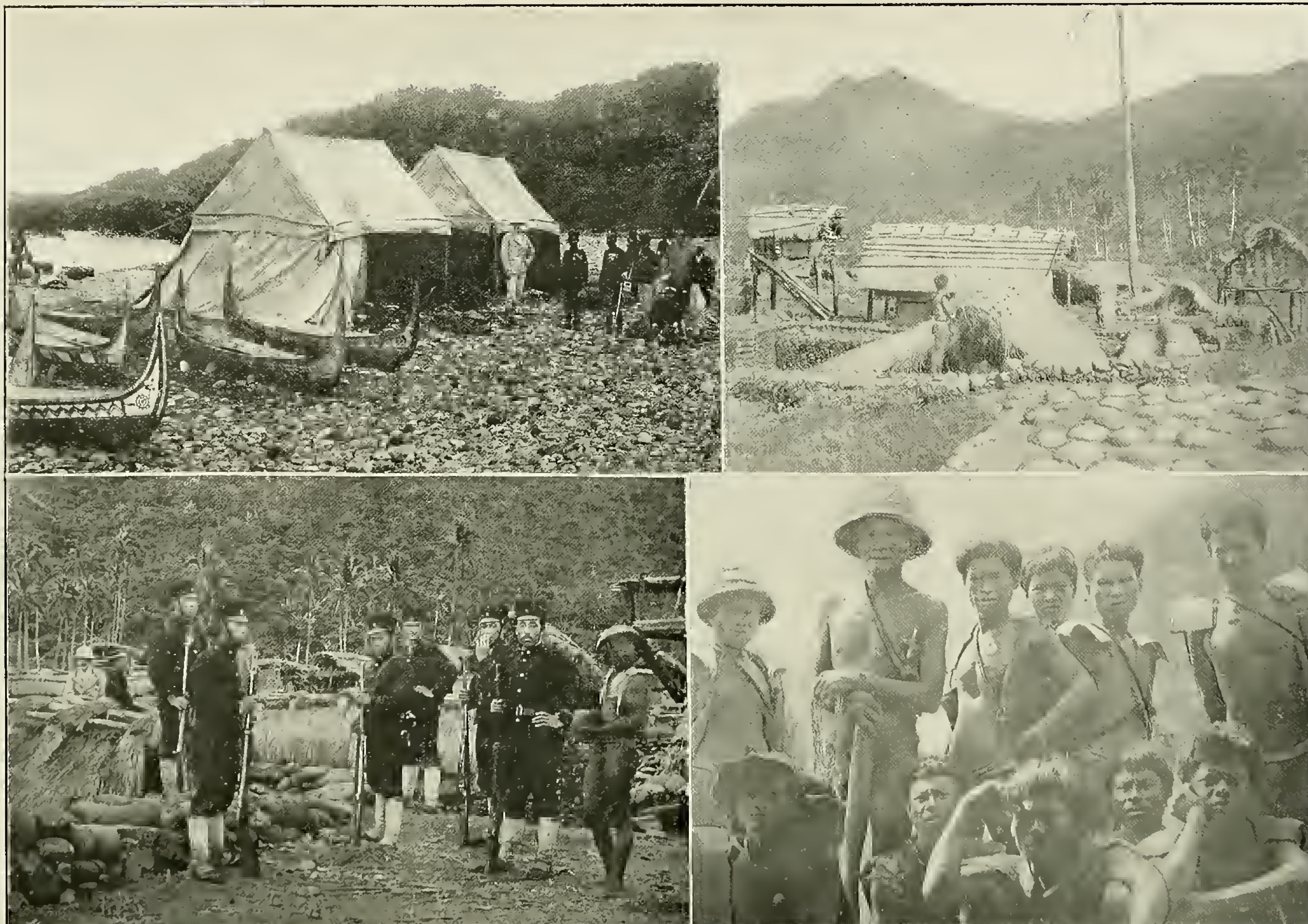
Mr Davidson's account of the island is the first that has been published. The following extracts are reprinted here with his permission. The photographs have not been previously published.

The inhabitants of Botel Tobago, some 1,200 or 1,300 in all, occupy eight villages; Yakunawymen, the largest settlement, being on the west coast and containing about fifty houses. The natives are small, averaging only five feet two inches in height. They are yellowish brown in color, and, with one individual exception, possess straight hair, black with a brownish tint.

The habitations of the Botel Tobago savages are very remarkable, not to say unique. Each family possesses a splendid walled and stone paved compound, wherein are three distinct houses, attesting the cleverness of the natives and their desire to obtain the maximum of comfort. One house, built half under ground, is their winter residence. For the warmer weather they have a comfortable building, elevated some feet above ground, and for protection against the heat of summer they have a tower-like edifice, sufficiently elevated to catch the cool breezes. These huts serve not only as habitations, but also as workshops and storehouses. In construction a considerable amount of wood is used as supports and cross-beams and for the inner floor, ceiling, and walls of the two large huts. The elevated structure is of wood, bamboo, and straw. A shelf projects level with the entrance, and the inhabitants are obliged to mount this and then crawl in on all fours, the doorway not being much larger than the entrance to a good-sized dog kennel.

The room is like a large flat box, some 7 by 8 feet, and is so low that one lying down can almost touch the ceiling with uplifted hands; but the savages always squat, so the place is high enough for them. Human figures and various rather pleasing geometrical designs are engraved on the interior woodwork; the only other decorations (for such they are considered by the natives) are rows of animal jaw-bones, hung from side to side. The roof is thatched with a strong dried grass, and a similar material appears on the outer walls. The two buildings supported on piles have circular boards surmounting each post to keep off the large rats that literally overrun the island at night. During my first two nights in the island I shared a tent with Major Kikuchi, but on the third night a terrific tropical downpour threatened to sweep us out into the sea,

Landing on Botel Tobago



Scenes on the Island of Botel Tobago, Formosa

Photos by James W. Davidson

1. Camping on the shore; several of the beautiful boats of the islanders in the foreground
2. The three houses of a native; one for winter, underground; one for mild weather, and for summer heat. (See page 469)
3. Mr Davidson's Japanese guard
4. A group of islanders

and we then removed to one of the native houses, which we found dry and, under the circumstances, comfortable.

All the boats appear to be of one model. They are beautifully rounded, and both stem and stern are shaped alike, being prolonged upward in a graceful curve ending in a point, from which, in time of festivity, is projected a bunch of feathers or some other decoration. It is a built-up boat, and, considering the crude tools used in its construction, is a remarkably creditable affair. The tribe possess no saws, and consequently each plank is adzed down, thus obtaining but one plank from a tree. These planks, forming the sides of the boat, are so carefully shaped that they fit very closely. Holes are bored near the seams, through which rattan lastings are passed and drawn tightly, literally tying the parts together. The bottom planks are fastened to the strong V-shaped keel in the same manner. As in the Solomon Islands, the principal tool used is an adze. In Botel Tobago this implement is so made that it can be converted into a chisel by inserting the blade end first into the handle.

There are no dogs or cats on the island, which accounts for the great pest of rats. Immense rodents as large as the American musk-rat literally overrun the villages at night. One could see them after dark, chasing about the place without the least sign of fear, as hungry hogs would overrun a garden, and it is no exaggeration to say we feared the rats more than we feared the natives.

The South American Republics. By Thomas C. Dawson. In two volumes. Illustrated with photographs and maps. Vol. I. Pp. xvi + 525. 5½ by 8 inches. New York: G. P. Putnam's Sons. 1903.

Mr Dawson has been for many years American consul to various capitals of South America. This work is in two parts, of which the first is out; the second will be published in a few months. The present volume describes Argentina, Paraguay, Uruguay, and Brazil. It is well written, interesting, and reliable and is commended to all who are seeking a good book on South America.

Two South American Republics, Argentina and Chile, may be called prosperous; there are evidences of an awakening in certain sections of a third, Colombia, which may bring equal good fortune to that state. Brazil is also becoming unified, and, according to Mr Dawson, is developing a solidity as a nation which is not generally realized.

Several of the author's statements about this republic, whose area is greater than that of the United States excluding Alaska, are worth quoting:

"Capital is slowly accumulating, and a healthful tendency toward industrious habits and the employment of reasonable and moderate methods in exploiting the great untouched natural resources of the country is evident.

"Leaving out immigration, the Brazilian people have shown a steady natural increase of nearly 2 per cent per annum during this century. The total population has multiplied from less than three to more than eighteen millions. Not a fiftieth part of the territory is cultivated; its resources have never been studied, much less developed."

The Brazilians have the additional advantage of inheriting directly a European civilization. They "are too firmly established, too numerous and prolific, and possess a too highly organized and deeply rooted civilization to be in danger of expulsion or political absorption. Immense immigration into South America is inevitable as soon as the pressure of population is strongly felt in Western Europe and North America. This may transform Brazil economically, but the new conditions will have to fit themselves into the political and social framework already in existence."

Mr Dawson expresses great faith in the Argentine Republic :

"The industrial impetus already acquired by the Argentine Republic is sufficient to carry it over all obstacles, and it seems assured that there will be a rapid settlement of the whole of this immense and fertile plain. Here Nature has done everything to make communication easy, and a temperate climate insures crops suited to modern European civilization.

"Two grave perils have so far been encountered, namely, a tendency toward political disintegration and an abuse of the taxing power. The former is now remote; for since the railways began to concentrate wealth and influence at Buenos Aires and to destroy the prestige and political power of the provincial capitals, the natural structure built by the patriots of 1853 has stood firmer each year.

"Argentina has had a bitter lesson of the evils of governmental extravagance and still groans under the burden of a debt which seems disproportionately heavy, but the growth of population and wealth will soon overtake it, and the very difficulties of meeting interest are the cause of an economy in administration, of which the good effects will be felt long after the debt itself has been reduced to a reasonable *per capita*. A nation is in the process of formation in the Plata Valley whose material greatness is certain and whose moral and intellectual characteristics will have the widest influence on the rest of South America."

In Search of a Siberian Klondike. By Washington B. Vanderlip and Homer B. Hulbert. With many illustrations. Pp. xiv + 315. 5½ by 8½ inches. New York: The Century Co. 1903. $2.00 *net*.

One of the most interestingly illustrated books of exploration published in a long time. The story is well told. Occasionally the author slips up in his statements—as, for instance, when he recommends the United States to import their reindeer for Alaska from Kamchatka instead of from Lapland. He is apparently ignorant of the fact that the United States Government has been importing reindeer from across Bering Sea ever since 1891, and has only once brought reindeer from Lapland, in the winter of 1898, when deer were needed immediately to rescue the miners in the Yukon Valley. The Alaskan and Siberian herds could not be drawn on then, because navigation had been closed by the winter ice.

BOOKS RECEIVED FOR REVIEW

The Book of Ser Marco Polo. Translated and edited by Col. Sir Henry Yule. Third edition. With memoir of Henry Yule by his daughter. Profusely illustrated. Vol. I, pp. cii + 462; vol. II, xxii + 662. 6 by 9 inches. New York: Imported by Charles Scribner's Sons. 1903. $16.00 *net*.

On the Polar Star in the Arctic Sea. By the Duke of the Abruzzi. 2 vols., 8vo. With maps and illustrations. New York: Dodd, Mead & Co. 1903. $10.00.

Aus Insulinde, Malayische Reisebriefe. Von Ernst Haeckel. Illustrated. Pp. xi + 261. 6½ by 9½ inches. Bonn: Verlag von Emil Strauss. 1901.

Geographic Influences in American History. By Albert Perry Brigham. With many illustrations. Pp. 366. 5 by 7½ inches. Boston: Ginn & Co. 1903.

To California and Back. By C. A. Higgins. With many illustrations. Pp. 317. 5½ by 8 inches. New York: Doubleday, Page & Co. 1903. $1.50 *net*.

Vacation Days in Greece. By Rufus B. Richardson. Illustrated. Pp. 240. 5½ by 8½ inches. New York: Charles Scribner's Sons. 1903. $2.00 *net*.

American Railways. By Edwin A. Pratt. Pp. 309. 5 by 9 inches. New York: The Macmillan Co. 1903.

Austro-Hungarian Life in Town and Country. By Francis H. E. Palmer. Illustrated. Pp. 299. 5 by 7½ inches. New York: G. P. Putnam's Sons. 1903.

Handbook of Climatology. By Dr Julius Hann. Translated by Robert De Courcy Ward. Pp. vi + 437. 6 by 9 inches. New York: The Macmillan Co. 1903. $3.00 *net.*

Special Method in Geography. By Charles A. McMurry. Pp. vi + 217. 5¼ by 7½ inches. New York: The Macmillan Co. 1903.

Yearbook of the Department of Agriculture, 1902. Edited by Geo. W. Hill. Profusely illustrated. Pp. 912. 6½ by 9 inches. Washington: Government Printing Office. 1903.

The Turk and His Lost Provinces. By William Eleroy Curtis. Illustrated. Pp. 396. 6 by 9 inches. New York: Fleming H. Revell Co. 1903.

Winter India. By Eliza Ruhamah Scidmore. With many illustrations. Pp. xvi + 400. 6 by 8½ inches. New York: Century Co. 1903.

American History and its Geographic Conditions. By Ellen C. Semple. Illustrated. Boston: Houghton, Mifflin & Co. 1903. $1.25 *net.*

The Texts and Versions of John De Plano Carpini and William De Rubenquis. As printed for the first time by Hakluyt in 1598, together with some smaller pieces. Edited by C. Raymond Beazley. Pp. 345. 5½ by 8½ inches. 1903. Printed for the Hakluyt Society, 1903.

The Philippine Islands. 1493 to 1808. Volume VI. By Emma H. Blair and James H. Robinson, editors. Pp. 320. 6½ by 9½ inches. Cleveland: The Arthur H. Clark Co. 1903.

The Heart of Japan. Glimpses of Life and Nature far from the Traveller's Track in the Land of the Rising Sun. By Clarence Ludlow Brownell Illustrated. Pp. 307. 5 by 7½ inches. New York: McClure, Phillips & Co. 1903. $1.50 *net.*

A Monograph of the Culicidae or Mosquitoes. By Fred V. Theobald. Vol. 3. Illustrated with plates and diagrams. Pp. xiii + 359. 6 by 9 inches. Published by order of the Trustees of the British Museum. London.

Report on the Collections of Natural History Made in the Antarctic Regions During the Voyage of the *Southern Cross.* Illustrated. Pp. ix + 344. 6½ by 10 inches. Printed by order of the Trustees of the British Museum. London. 1903.

A Monograph of the Tsetse-Flies. By Ernest Edward Austen. With a chapter on Mouth-Parts, by H. J. Hensen. Illustrated. Pp. ix + 319. 6½ by 10 inches. Printed by order of the trustees of the British Museum. London. 1903.

Proceedings of the American Association for the Advancement of Science. December, 1902–January, 1903. Published by the permanent secretary. Volume LII.

Central Europe. By Joseph Partsch. With maps and diagrams. Pp. 358. 6 by 9 inches. New York: D. Appleton & Co. 1903. $2.00 *net.*

Central Asia and Tibet. Towards the Holy City of Lassa. By Sven Hedin. In two volumes. Illustrated from drawings and photographs. Volume I. Pp. xvii + 608. Volume II. Pp. xiv + 664. 7 by 9½ inches. New York: Charles Scribner's Sons. 1903.

Handbook of the Saint Louis World's Fair of 1904. By Charles M. Kurtz. Illustrated. Pp. 115. 5½ by 8½ inches. Saint Louis: Gottschalk Printing Company. 1903.

RECENT PUBLICATIONS BY THE U. S. GOVERNMENT

DEPARTMENT OF AGRICULTURE

Birds of a Maryland Farm. A Local Study of Economic Ornithology: Sylvester D. Judd.

The Animal Industry of Argentina: Frank W. Bicknell.

Egyptian Irrigation. A study of irrigation methods and administration in Egypt: Clarence T. Johnston.

Japanese Bamboos and Their Introduction into America: David G. Fairchild.

Three New Plant Introductions from Japan: Mitsumata, a Japanese paper plant; Udo, a new winter salad; Wasabi, the horseradish of the Japanese: David G. Fairchild.

Storage of Water on Cache La Poudre and Big Thompson Rivers: C. E. Tait.

The Diminished Flow of the Rock River in Wisconsin and Illinois and its Relation to the Surrounding Forests: G. Frederick Schwarz.

A Working Plan for Forest Lands in Hampton and Beaufort Counties, South Carolina: Thomas H. Sherrard.

U. S. FISH COMMISSION

Aquatic Products in Arts and Industries—Fish Oils, Fats, and Waxes, Fertilizers from Aquatic Products: Charles H. Stevenson.

Utilization of the Skins of Aquatic Animals: Charles H. Stevenson.

Statistics of the Fisheries of the Middle Atlantic States: Barton W. Evermann.

NATIONAL GEOGRAPHIC SOCIETY

REGULAR MEETINGS OF THE SOCIETY

THESE meetings will be held in the Assembly Hall of Cosmos Club at 8 p. m. until the new home of the Society, Hubbard Memorial Hall, is completed. No tickets are required for these meetings.

December 4.—"The Work of the Bureau of Plant Industry." Dr B. T. Galloway.

December 18.—"Early Spanish Cartography of the New World," by Prof. E L. Stevenson, of Rutgers College.

January 8, 1904.—Annual Meeting; followed by an address by Prof. Wm. M. Davis, of Harvard University, on "A Summer in Turkestan."

January 22.—"The Work of the Bureau of Insular Affairs." Col. Clarence R. Edwards.

February 5.—"The Work of the Bureau of Statistics" Hon. O. P. Austin.

February 12.—"The Work of the Bureau of Fish and Fisheries." Dr B. W. Evermann.

March 4.—"The Work of the National Bureau of Standards." Dr G. M. Stratton.

March 18.—"The Work of the U. S. Biological Survey." Dr C. Hart Merriam.

POPULAR LECTURES

The Popular Lectures will be delivered in the National Rifles' Armory, 920 G street, at 8 p. m., on the following dates (tickets are required):

Saturday, December 12.—"Marches and Movements of Arnold and André." By Mr W. W. Ellsworth, of the Century Company. Illustrated.

Friday, January 15, 1904.—"Travels in Arabia and Along the Persian Gulf," by David G. Fairchild, Special Agent of the U. S. Depart ment of Agriculture. Illustrated.

Saturday, January 30.—"Joys of the Trail," by Mr Hamlin Garland, author of "The Captain of the Gray Horse Troop," etc. Illustrated.

Announcement of definite dates for the following lectures in this course will be made later:

"Conditions in Macedonia," by Dr Edwin A. Grosvenor, of Amherst College. Illustrated.

"The Louisiana Purchase Exposition." By Hon. David R. Francis, President of the Louisiana Purchase Exposition. Illustrated.

Provisional arrangements have also been made for addresses on—

Little Known Peoples of Mexico.
Russia and Japan in Korea.
The Alaskan Boundary Decision.

The general subject of the Afternoon Course of popular lectures is "The Growth of Diplomacy." The special topics and the names of the speakers will be announced in a later program. The first of the series will be given on Saturday, February 27, and the succeeding lectures on March 5, 12, 19, and 26.

These lectures will be illustrated.

INDEX

Errata.

For Howard read Harvard, p. 82, l. 27, 1st col.
For parallels read meridians, p. 414, l. 14, 2d col.; also p. 416, l. 9, 2d col.

Recommendation for Membership in the

NATIONAL GEOGRAPHIC SOCIETY

The following form is enclosed for use in the nomination of persons for membership

Please detach and fill in blanks and send to the Secretary

DUES: Annual membership, $2; Life membership, $50. If check be enclosed, please make it payable to order of the National Geographic Society, and, if at a distance from Washington, remit by New York draft or post-office money-order.

_______________________________________1903

To the Secretary, National Geographic Society, Washington, D. C.:

Please propose ____

address: ____

____

for membership in the Society.

____

PRESS OF JUDD & DETWEILER, WASHINGTON, D. C.

FOLDOUT WILL BE SCANNED AT A LATER DATE

FOLDOUT WILL BE SCANNED AT A LATER DATE