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TWENTY-FOUR PAGES OF ILLUSTRATIONS IN FULL COLOR

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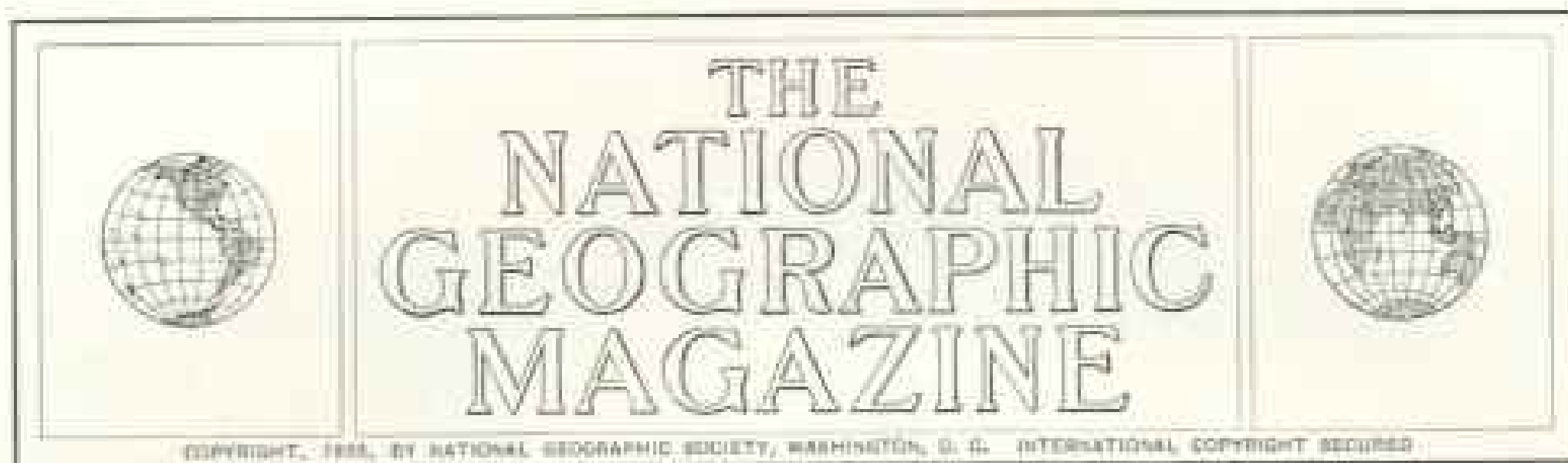
27 Natural Color Photographs

## The Second Stratosphere Expedition

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## EXPLORING THE ICE AGE IN ANTARCTICA

BY RICHARD EVELYN BYRD

*Rear Admiral, U. S. Navy, Retired*

HUBBARD AIRD SPECIAL GOLD MEDALIST, NATIONAL GEOGRAPHIC SOCIETY; AUTHOR OF "THE FIRST FLIGHT TO THE NORTH POLE," "OUR TRANSATLANTIC FLIGHT," "FLYING OVER THE ARCTIC," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

**W**HAT had happened to Little America? What had the South Polar Ice Age done to that southernmost city in four years?

On January 17, 1934, the world awaited an answer to that question, for that morning at 9:30 our flagship, the *Jacob Ruppert*, had reached her journey's end, and now, in the early afternoon, was moored to the ice of the Bay of Whales, about two and a half miles from our former home.

A small party of us had gone ashore and headed with keen anticipation toward Little America. Only the rim of a snow hill hid the site of the base from our view.

Little America had been founded New Year's Day, 1929, by a half dozen members of our first expedition who had explored for the camp site over nearly the same route we were now taking across the great ice Barrier.\*

My own curiosity was intense. For the past several years I had asked myself, and had been asked by hundreds, the same questions over and over again.

Had the movement of the ice cap crushed our houses and how far had it carried them? Had the drifting snows of an ice age buried Little America so that we could not dig down to it? How about the two planes we were forced to leave behind? Would the food be edible?

So uncertain were we of the answers to these questions that we brought with us a completely equipped expedition. We should not have to depend upon one single item of the many we had been obliged to leave in camp. We had new houses, radio poles, and more than 14,000 other different items.

### EXPLORING AN ICE-BURIED CITY

As we neared the rim of the snow hill, I felt one of the big moments of my life was at hand. A black object suddenly loomed dead ahead. Then two more similar objects appeared close to the first. They were the tops of the towers of the Adolph Ochs radio station (see page 404). We had seen them that morning from the masthead of the *Ruppert*.

As more of the towers came into view, we saw that one of them was a bit askew; but we should not have been surprised had they all been blown over and buried deep.

Suddenly the site of Little America emerged. It was in an attractive shallow basin about half a mile away. I raised my field glasses and instantly I knew it was all there—somewhere under the snow.

I could see a stovepipe, ventilators, and long bamboo poles sticking up here and there through the snow. The weather man's anemometer pole still marked the Administration Building.

A mile or so over to the left, on the top of a wind-swept snow hill, I saw what appeared to be the tip of the wing of the *Floyd*

\* See "The Conquest of Antarctica by Air," by Richard Evelyn Byrd, in the NATIONAL GEOGRAPHIC MAGAZINE, August, 1930.



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NOME AND PUPPIES GREET ADMIRAL BYRD WHILE JEALOUS BUNKIE GROWLS

Such a pet did Bunkie (under the camera) become that he expected to monopolize every one's attention (see illustrations, pages 410 and 432). In such low temperatures fine machinery does not function smoothly, but the expedition's photographers kept their camera shutters from sticking by removing all the oil. Poles supporting radio antennas rise in the background.

*Bennett*, our Ford airplane that we had been forced to leave behind, because our supply ship could not get through the ice. We wanted to recover that splendid plane that had carried us to the South Pole. We had placed it where we had hoped the strong winds would prevent the snow from piling too high over it.

We headed for the Administration Building and forgot about our tired legs that were sinking deep into the soft snow. The midnight sun was bright and the quiet of the place after the turmoil of the ship was pleasant.

Our party consisted of Charles J. V. Murphy, Commander George O. Noville, William C. Haines, and Carl Petersen. The last two were veterans of our first Antarctic expedition, and Noville of my North Pole expedition and transatlantic flight. I could see that this was a big moment for them.

Others followed by dog team. The new men were excited, too, at reaching the

promised land. We had now come to the Administration Building, where Bill Haines and I had bunked. We paced some measurements from the anemometer pole and eagerly set to with shovels.

In a half hour we had a hole through to the tunnel that led to the door. Haines entered first, and the rest of us followed. The roof of the tunnel was thick with icicles that resembled the stalactites of a cave (see page 402). As we stepped into the building, the only burning match went out. Instead of complete darkness we saw a blue fluorescent light that came through the snow packed hard against the windows.

"HOME" WAS AS THEY HAD LEFT IT

The rooms were in disorder, for we had vacated Little America in a hurry. I remembered my reading lamp improvised from a fruit jar; it should be by my bunk. There it was, half full of kerosene, exactly where I had left it four years ago.



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#### COUNTLESS ICE PEAKS REAR THEIR JAGGED HEADS ALONG THE ROSS BARRIER

Many times expedition members heard ice rumblings near camp. For a time the party feared the ice beneath might break out and Little America would become a "city-on-a-raft." In case of such an emergency, they built Retreat Camp, about a mile back on the Shelf Ice from Little America (see text, page 429).

By the light of the lamp the place looked as if a hurricane had hit it. Some of the timbers had broken and the roof, settled in places from the weight of the snow, rested on the double-tier bunks.

The roof had not entirely collapsed because a bridge of hard snow that would itself stand considerable weight had formed over it. A blanket of snow, which had come through where the roof had caved in, covered part of the floor.

#### AN AREA SAFE FROM THIEVES

We had certainly not left Little America in good order for reoccupancy. Clothes were draped over the bunks. Chairs were overturned amid debris. There was no alibi, for no stranger had entered since our departure. We did not have to worry about thieves.

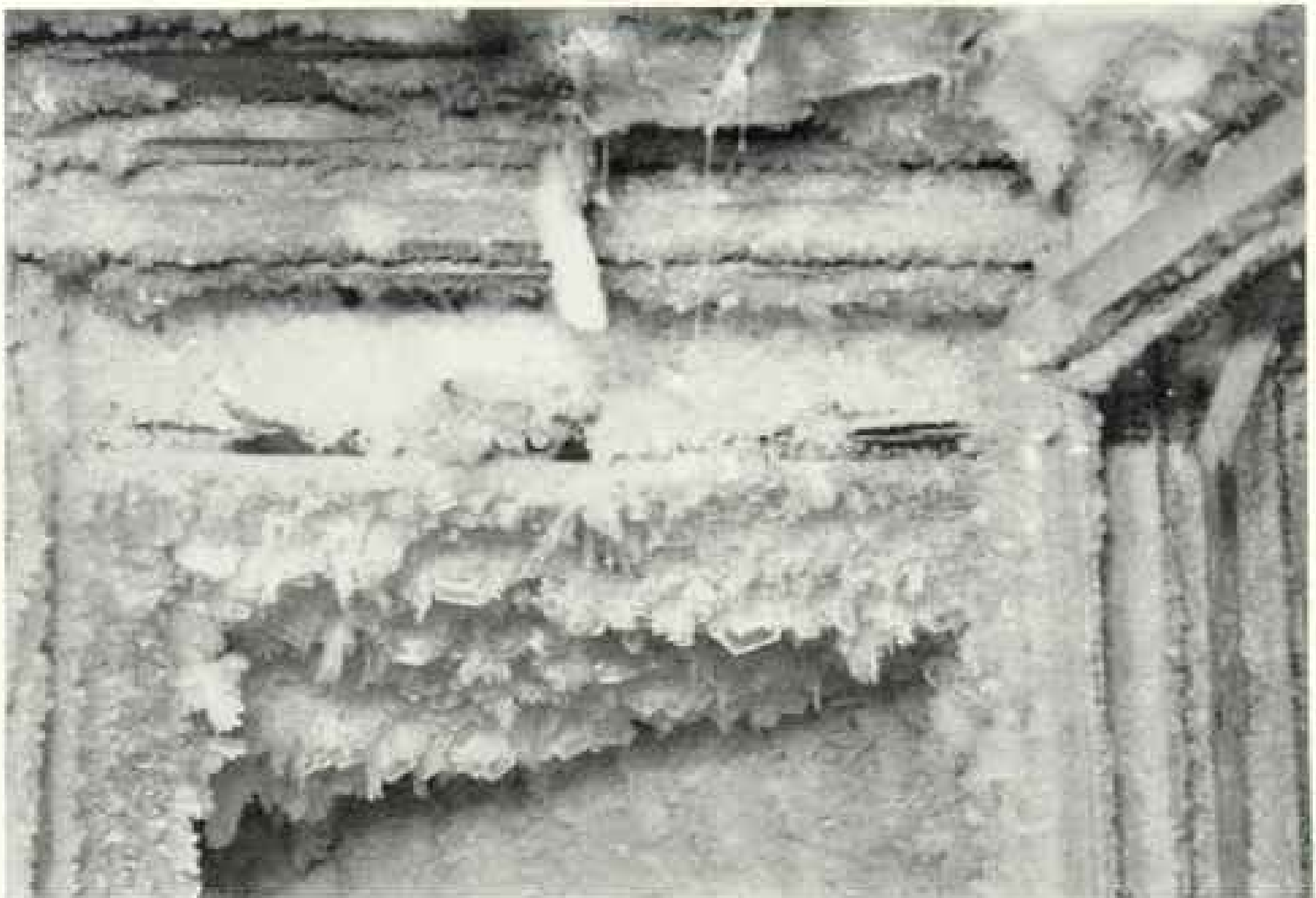
Hanging by my bunk was my dog Igloo's summer suit that Martin Ronne had made for him, and on the table by my bed was

a copy of the NATIONAL GEOGRAPHIC MAGAZINE with a page turned down where I had been reading when we had received a radio from the *City of New York* that she had at last broken through the ice that had separated her from us.

There were four or five of us in the bunk room chuckling over familiar relics, when we suddenly turned toward Finn Ronne, who had walked over to his father's bunk. There on the wall Martin Ronne, now dead, had printed his son's name. I knew that he had fervently hoped the boy would join our second undertaking. Finn Ronne's eyes blazed. I was to find that he was a worthy son of his fine father.

Many of my questions were answered now. The sides of the houses were not askew or crushed. The whole basin upon which Little America rested must have moved as a unit, if it had moved at all.

Luckily, no crevasse had opened up in line with the houses—luckily, for there



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HOW THE INSIDE OF LITTLE AMERICA VILLAGE LOOKED WHEN ADMIRAL BYRD RETURNED

A four-years' growth of ice crystals, some five inches long, festooned the tunnel to the Administration Building, like stalactites in a cave. As the men entered, their only match went out. A bluish-green light filtered through the snow banked high against the windows. Part of the roof had collapsed under the weight of the ice, and snow had sifted to the floor like heaps of spilled flour (see text, page 400)

were some twelve or fourteen hundred feet of water under the snow on which Little America rested. The snow had deepened three or four feet over the houses.

LIGHTS TURN ON, AND THE TELEPHONE WORKS!

How about the food we had left behind?

We were beginning to feel hungry. Soon the gang was above the old mess hall, digging at the spot where we estimated the door should be. We hit it quite close by breaking through the tarpaulin covering the entrance to the aerial photographic laboratory where my loyal friend, Captain McKinley, our executive officer and aerial surveyor, had developed his mapping photographs.

Entering the mess hall, Petersen idly flipped a switch and an electric light bulb went on. He pressed the telephone buzzer to the "Ad Building," and, to his astonishment, someone over there answered. It was uncanny. Even batteries held up in an ice age.

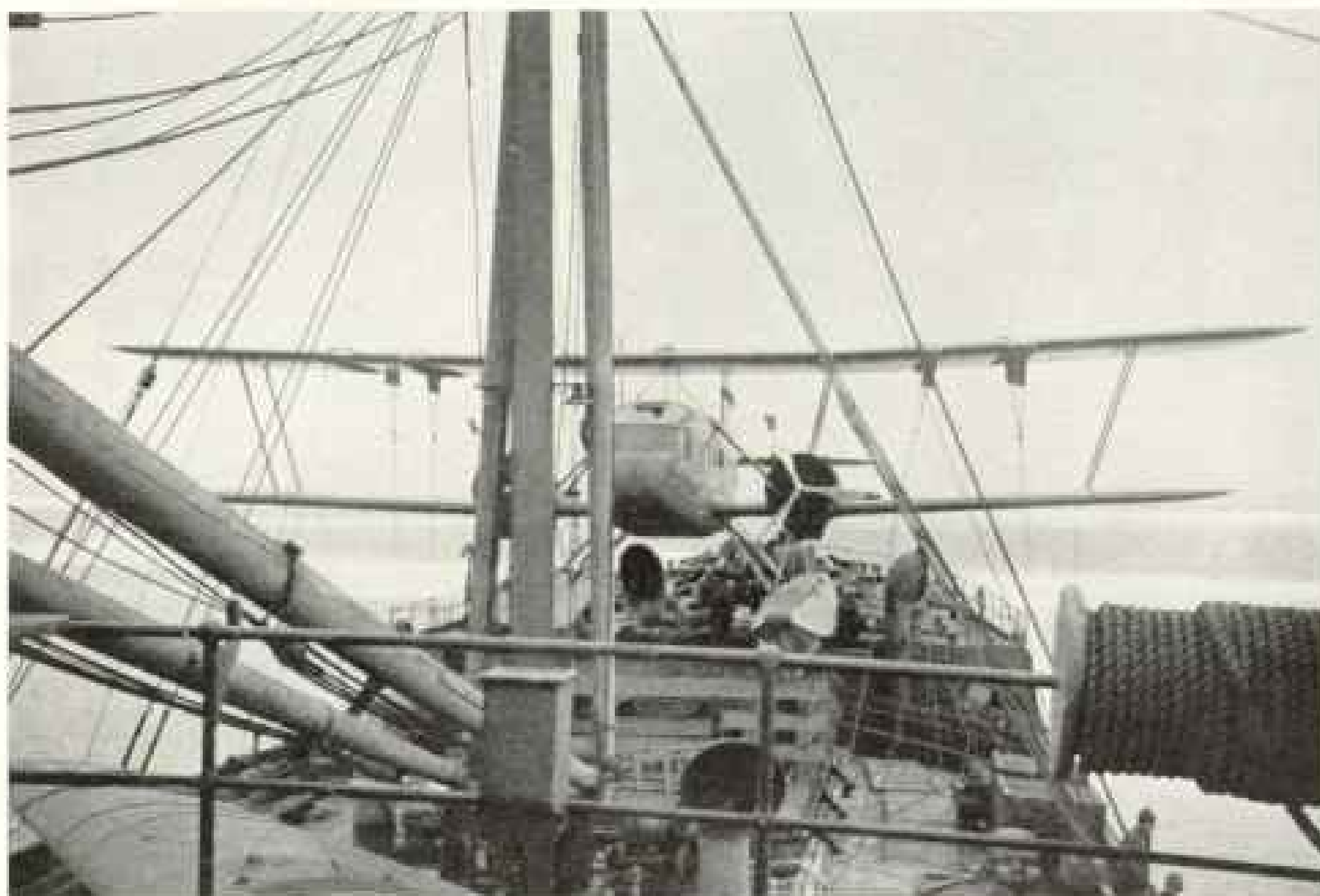
On the table were meat and crackers and a pot of frozen coffee. On the stove were cooking pans of frozen food. Some coal was left. A fire was made in the kitchen stove, the food was warmed, and found to be as good as the day we left, four years ago. The seal and whale meat and beef in the tunnel were perfectly preserved.

In the future I believe medical science will use Antarctica for experimentation, because of the extraordinary purity of its air, and the few germs in that extreme cold. Experts of the Rockefeller Institute and other medical men have shown keen interest in this possibility.

"THE CAPITAL OF THE UNKNOWN"

We went back to Little America to finish our job, because Little America was really the capital of the unknown. The ice age not only was fascinating, but a very fertile field for scientific research—by far the most fertile left in the world, I think.

Though our first expedition accomplished



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WAVES OFTEN BROKE OVER THE "WILLIAM HORLICK," LASHED TO THE "RUPPERT'S" HATCH

The big airplane is here equipped with pontoons for the series of exploring flights made from the ship on the way down to Little America. Considerable portions of the map, hitherto blank, may now be filled in in blue, because the explorers found only ice-covered water in these vast areas (see text, page 418, and map, page 405).

its scientific mission, it left us with some old questions unsolved and some very interesting new problems.

Man will never cease exploring until he can answer every question about this globe we live on.

This expedition served twenty branches of science. Thanks to the thorough advance preparation of the scientific staff, and the knowledge gained on our first trip, our scientific results are six or seven times greater than those of our first Antarctic expedition.

Among the subjects covered on our second expedition were astronomy, meteorology, biology, oceanography, vertebrate and invertebrate zoology, physiology, glaciology, stratigraphy, petrography, paleontology, tectonic and economic geology, geophysics, geography, terrestrial magnetism, bacteriology, botany, physiography, and cosmic rays.

In a number of these we achieved rather dramatic results. For one example, in the field of geography, maps will have to be

remade as a result of our discoveries (see text, page 473).

#### SCIENTIFIC STUDIES REQUIRE LARGE EXPEDITION

I must confess that I like adventure and the far places, and these things alone would have drawn me back to Antarctica. However, had I gone merely for adventure, I should have taken only half a dozen men with me.

Our undertakings are so large and, therefore, so expensive, because the whole expedition is built around service to science. We must have a large staff of scientists, which means more houses, bigger ships, and, therefore, more men and more equipment of every kind.

We took to the Antarctic about one hundred thousand dollars' worth of scientific equipment. In order to map the area we discovered and to transport heavy scientific instruments for other studies, we had to take a very large airplane to carry the big loads which are necessary. A small,



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#### TO HOMING AVIATORS BACK FROM LONG FLIGHTS OVER UNKNOWN WASTES, LITTLE AMERICA WAS A WELCOME SIGHT

A new and larger "city" sprang up around the original village, marked by wireless towers, hurriedly abandoned by the first expedition. Little America rested on the ice, close to the Bay of Whales, an inlet in the Barrier from the Ross Sea, waters of which glint in the sunlight (right background). The bay, still frozen when this picture was taken, is outlined by the parallel ice cliffs which lead across from the northern, or right side. The Barrier ice, many hundreds of feet thick, was found by the expedition to be aground on submerged peaks on the western (upper) and eastern (lower) sides of the bay (see illustrations, pages 440, 442, and 443).







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KLONDIKE AND HER OFFSPRING, ICEBERG, HAD STALLS IN THE WORLD'S FARTHEST SOUTH DAIRY BARN

The stable was fairly warm, for the animals generated body heat and a coal stove was kept burning. The expedition's three cows gave milk regularly, a popular item of the menu. Iceberg, born near the Antarctic Circle on the way south, was a good-sized calf when the expedition returned, but his mother died in Little America.

donated plane that we already had would have suited our purposes, had mere visual observation been our goal.

To transport geologists, physicists, and biologists into the unknown and to help unload our ships, we took four large, heavy tractors and many dogs. All this bulky and heavy equipment required a big ship, very costly to operate, or rather, as will be seen, two ships instead of one. It would cost but one-tenth as much and be one-twentieth of the trouble to go for adventure alone.

#### THE BATTLE OF PREPARATION

If it was a tough job organizing our first Antarctic expedition during boom times, there is no word to describe what we went

through in the midst of a depression. I got so heavily in debt I *had* to keep going. To retreat would have meant personal bankruptcy.

In spite of my predicament, with one or two exceptions, I could not ask my close friends to help, for each had heavy financial burdens of his own. My only hope was to depend upon sufficient public interest to sell our radio broadcasts. I have never had unlimited backing, as many have thought, from any individual, or organization, or the Government. I don't always paddle my canoe so well, judging from financial predicaments my expeditions have got into. The National Geographic Society has generously helped me out of a number of such crises.



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WINGLESS, "MISS AMERICAN AIRWAYS" IS PUT OVER THE SIDE AND LANDED ON THE ICE

A tractor towed the plane well clear of the edge, where its wings were attached. From there it flew to camp. This bay ice broke off frequently, making it dangerous for the iron-hulled *Ruppert* to tie up alongside or to unload supplies for fear of dumping them in the water. By airplane, Little America lay two miles from here, but an impassable pressure ridge in the bay ice increased the sledging distance threefold.

President Roosevelt took a personal interest in our work and, where no expenditure was involved, gave us governmental backing. To have done more would have required an Act of Congress.

We all know what a tough time business executives were having in 1932-33. Yet they were unselfish enough to aid our scientific undertaking. They donated many thousands of dollars' worth of material. That made it possible to take the field, for we were able to raise only about \$150,000 in cash donations.

The largest cash contributors were Mr. Edsel Ford, Mr. William Horlick, and Col. Jacob Ruppert.

I would not have left the country without

every item necessary for the safety of my men; and it would have been futile to do so without adequate scientific equipment.

General Foods had the faith to sponsor our broadcasts on the Columbia networks. An example of the extraordinary friendliness of industry was the help given by Mackay Radio. They received our messages from Little America and transmitted them by Postal Telegraph.

The Tidewater Oil Company donated fuel for our planes, for our tractors, and for the *Jacob Ruppert*.

I wish there were space to thank all of those who helped us.

Despite the greatest care in necessary expenditures, we still have a large debt

which I hope to pay off by the returns from lecturing and writing.

Victor Czegka, marine warrant officer, veteran of my first expedition, was made general manager, in charge of supplies.

#### SUPPLY LIST LIKE A MAIL-ORDER CATALOGUE

For two years he combed the country seeking equipment. Because of our straitened financial condition, he could not purchase the necessary items, but had to persuade manufacturers to lend or donate them. In addition, he took direct charge of seven departments, which included the food and cooking utensils, clothing, shelter, machinery, tools, general equipment, and office and library supplies. Czegka deserves the major credit for selecting and collecting the material.

The expedition was divided into 14 separate departments, such as scientific, commissary, medical, nautical, aviation, personnel, etc.

Not to miss a single item that would be needed, he thumbed, page by page, many manufacturers' catalogues, copying down every item that an expedition would require to be entirely self-supporting. There were more than 52 pages of categories of equipment.

Altogether, we wrote more than 30,000 letters. For example, for overalls Czegka wrote 127 letters without getting a single suit. He wrote letters for a whole year for hickory for our sleds before he was successful. Twenty-seven different kinds of knives were needed and some 20 different types of needles were required by the tailor. When one enters an item such as an airplane, it brings along with it many hundreds of sub-items and accessory details.

After a year's work a huge storeroom in Boston was nearly filled with the equipment. Here Stevenson Corey had from the beginning loyally assisted Czegka as supply officer and prepared the supplies for transportation to Antarctica.

Extreme care had to be exerted in the selection of the material, for men's lives depended upon it. Fur clothing was ordered from Alaska, also fur sleeping bags, parkas, pants, mukluks, and mits. Special ice axes and crampons were obtained from Switzerland. Primus stoves could be had only from Norway, while such important items as pemmican, the concentrated food for men and dogs carried on the trail, had

to be manufactured especially for our use and according to our formulas.

And so it went. The single item of bolts, nuts, and screws comprised an invoice of pages an inch or more thick. We had everything from tiny watch screws to bolts more than eight feet long. Nearly every item of machinery, tools, and material taken along was eventually put to some active and important use.

Dozens of times it looked as if we would not get off. Yet retreat was impossible.

Paul A. Siple and Kennett L. Rawson, veterans of former expeditions, stuck at my elbow and greatly strengthened my arm. We seldom quit before midnight.

And so it went, up to the very day of our departure. I could write half a dozen volumes about that preparation period.

It is a great regret to me that I cannot mention every one of my deserving men by name. There is not space in a magazine article. Some of my best men necessarily have been left out here, but my gratitude to them is none the less.\*

#### THE PROBLEM OF PERSONNEL

Thousands of men (and many women) volunteered to go south. It is difficult to select the personnel. Untoward things that are certain to occur upon a polar expedition bring out traits that do not show up in civilization. Of course, I have been disappointed in some, but the big majority gave the best they had in them.

There is no precedent for the kind of leadership one has to exercise on such an expedition as ours. If a bad actor develops he cannot be discharged. We can't dock his pay, for he gets none. There is no brig, as they have in the Navy, no jail. The leader must rule by justice and fair play.

I was gratified to have 18 of my old men back with me for the second attack upon the yet unknown. Among them were several New Zealanders. Marriage kept home a number of former comrades. Of 26 unmarried men who were on the ice during my first expedition, 19 now are married. Three of these are over 47 years.

When I take a man back with me a second time for the long winter night, it means that I consider him an extraordinarily good expedition member.

\* For complete list of personnel see "National Geographic Society Honors Byrd Antarctic Expedition," in NATIONAL GEOGRAPHIC MAGAZINE, July, 1935.



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## EXPEDITION SHIPS GAVE THE ROSS SHELF ICE A WIDE BERTH

Soon after this picture was taken, Admiral Byrd and William Haines watched a chunk of the Barrier (the seaward face of the Shelf Ice), large as a city block of skyscrapers, break off and crush into the sea. They estimated that the mass of ice, nearly a quarter of a mile long, weighed more than 200,000 tons. Then and there, they decided to moor the ships to the thinner bay ice instead of the Barrier (p. 427). Here is the historic *Bear of Oakland*, glimpsed from the deck of the *Jacob Ruppert*.

As I have explained, we had to have a very large ship, because of our large scientific program. For a long time we were completely stumped. Dozens of vessels offered us would cost ten times the amount I could consider paying. Finally, I learned that the United States Shipping Board had a number of war-time freighters laid up at Staten Island. I asked for and was granted the loan of one of them, an 8,527-ton oil burner, which I named the *Jacob Ruppert*, for my friend, the well known Colonel Jacob Ruppert. We now had a ship large enough to take our huge Curtiss-Wright Condor airplane which I named for my old friend, William Horlick.

To take a metal ship deep into the Antarctic, where she must lie alongside granite-hard ice floes for unloading, is always a

hazard. Therefore, I took a polar ice ship, the *Bear of Oakland*, as a safeguard for my men. Besides, she would be able to do some important exploring in dangerous unknown waters. The city of Oakland, California, was most generous in putting this historic old ship up for public auction so that I could get her for my expedition. Every one was astonished when a local junk man, who wanted the ship to break up for junk, bid \$1,000 for her. I, therefore, had to bid \$1,050.

Knowing how easy it is to crash a plane in the Antarctic, I took two other planes, a Pilgrim single-engined monoplane, which we named *Miss American Airways*, and a Fokker single-engined plane, loaned by Mr. Alfred P. Sloan of General Motors, which we named the *Blue Blade*. The Pep Boys



© Byrd Antarctic Expedition

#### BUNKIE, A BOTTLE-FED PUP, GREW TO BE A HUSKY IN THE ANTARCTIC

When the mother became ill and could no longer feed her offspring, all hands wondered what to do with the pup. Captain Taylor, in charge of transportation, consulted with supply officer Corey and appeared with a nipple and a bottle of milk! Because the pet was raised in a berth he acquired the name "Bunkie" (see illustration, page 400). Most of the buildings were called "heim," meaning "home" in Norwegian. Taylor's quarters were always full of dogs and dog drivers, so the shack was christened "Dogheim." One building in which blubber had been burned as fuel in the stove on the first expedition was called "Blubberheim."

of Philadelphia loaned us a Kellett Autogiro.

The *Bear of Oakland*, under command of Lieut. R. A. J. English, U. S. Navy, and a crew of 34, was much slower than the *Ruppert* and therefore had to go ahead. She left Boston September 25, 1933.

The *Jacob Ruppert* left Boston October 11, 1933, and Norfolk, October 22, 1933.

Many of us were utterly exhausted, but the necessary material was all there.

On December 12, 1933, the *Jacob Ruppert* left Wellington, New Zealand. The New Zealand people had, as before, extended us wonderful hospitality.

We had a strange assortment aboard—95 men, chickens, cats, pups, 135 dogs, three cows (one of whom was soon to become a mother)—and in the holds of the ships materials to make up a village and sustain its inhabitants for a year and a half.

We even had talking motion pictures, thanks to my friend Will Hays. These were in charge of John Herrmann, Paramount News cameraman assigned to cover the expedition.

Farmers back in the United States had loaned us three Guernsey cows. We believed we could get them through alive, and felt that fresh milk where there are no fresh things would add to the health of the men and be an asset in case of sickness.

#### HEADED FOR A GREAT ADVENTURE

Steve Corey, the supply officer, was the only one who knew where everything was; he turned out to be a wizard at finding things. I remember once, later on, a mother dog got sick and was unable to nurse her new-born pups. Corey produced from somewhere a nipple and a bottle full of fresh milk for the pups!



© Byrd Antarctic Expedition

REINDEER SKIN, LIGHT AND WARM, PROTECTED BYRD'S MEN FROM THE UNBELIEVABLE COLD

Steve Corey, supply officer, delves into the fur cache for a pair of pants for Siple, leader of one of the dog sledge parties. The fur from the Far North was made into parkas (hoods), mukluks (boots), mittens, and sleeping bags.

The *Jacob Ruppert* was headed for a great adventure. Instead of going straight to the Bay of Whales, we were bound for an unknown area between Little America and South America. The northern boundary of this area was just within the Antarctic Circle and its eastern and western boundaries were Hearst Land and the 170th meridian of west longitude, respectively. It shows on the last National Geographic Society map of Antarctica as a blank white space.\*

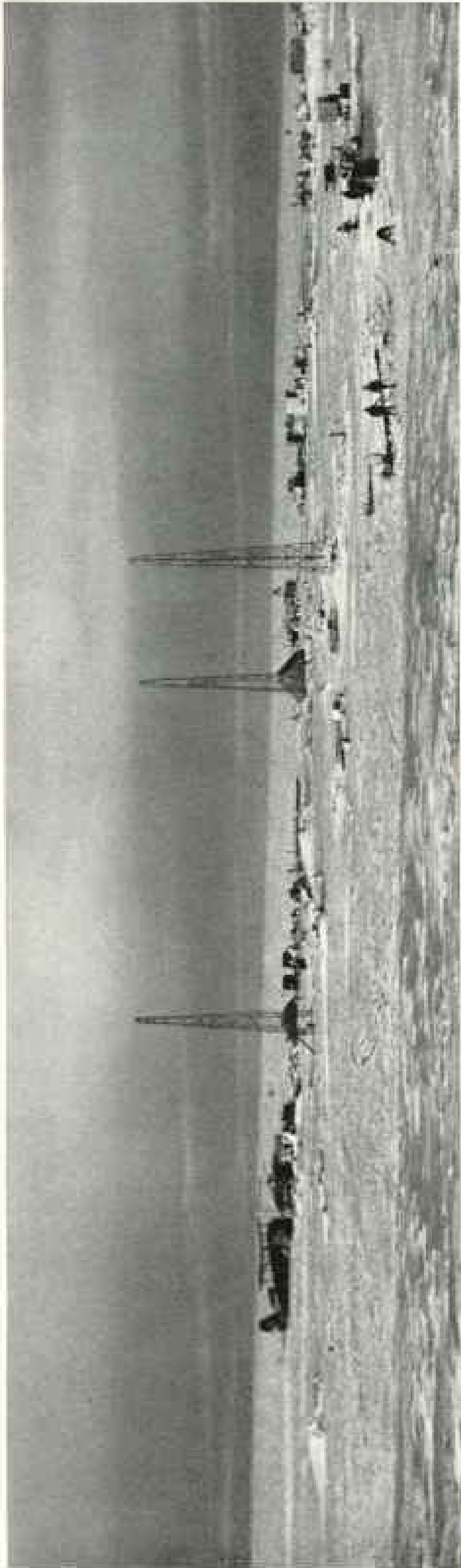
In the past all attempts to reach the shore line of Antarctica in this sector by the only available method of forcing a ship through the pack had failed, and so dense are the fields of ice guarding these shores that it seemed unlikely a ship could negotiate them. But with the use of a seaplane operating from a ship moored in the shel-

tered pools of the outer pack we felt we had a new weapon which the densest pack was powerless to thwart. Therefore we determined to devote the early part of our first summer season to making aerial thrusts from the *Jacob Ruppert* toward this unknown coast line.

There were several places between Graham Land and King Edward VII Land where for many years curious indentations have been found in the pack ice. These seemed to persist nearly unchanged in position and extent from year to year and might easily be caused by near-by land damming or deflecting the ice.

There was a vast region of unusually dense pack in the northeastern part of the Ross Sea which might also be accounted for by the presence of islands or a peninsula of the continent proper. Intending to make flights into these critical areas, we had mounted the *William Horlick* on pontoons and rigged the wings, so that with a

\* See map in color, "The Antarctic Regions," issued as a supplement to the NATIONAL GEOGRAPHIC MAGAZINE, October, 1932.



© Byrd Antarctic Expedition

LIKE ANTS, THE MEN BEGAN TO BURROW NEW TUNNELS IN LITTLE AMERICA SOON AFTER THEY ARRIVED

Some of the old buildings here are partly excavated, but none of the new ones has yet been erected. The towers supported radio antennas during the first expedition, but on the last one telegraph poles were used because they were found better adapted to the many different kinds of antennas.



© H.A.E.

A TRACTOR HAULS A BIG SLEDGE LOADED WITH SUPPLIES FROM THE BAY OF WHALES TO CAMP—SAVING A DOZEN TRIPS BY DOG TEAM

Photograph by E. H. Byrd



© Byrd Antarctic Expedition

THE PLANES WILL SOON BE STORED IN SNOW HANGARS, FOR LONG SHADOWS FORECAST THE APPROACH OF FOUR MONTHS OF NIGHT

The Autogiro (left) later cracked up, because of snow collected in its fuselage, making it "tail heavy." *Miss American Airways*, the *William Herlick*, and the second *Blue Blade* all performed without mishap and were brought home. The *Floyd Bennett*, buried five years before, had not yet been dug out of the snow (see illustrations, pages 444 and 447). In the foreground rest two "snowmobiles," errand runners over a radius of about ten miles around camp.





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SLEDGES BROUGHT TO LITTLE AMERICA THE 120,000 LETTERS THAT HELPED  
FINANCE THE EXPEDITION

Through courtesy of the United States Post Office Department, a special Byrd Antarctic Expedition 3-cent stamp was issued. Covers mailed with this stamp and addressed to Little America were carried down to the Antarctic, canceled at the U. S. post office on the ice, returned by supply ship to New Zealand, thence forwarded to their destination by regular mail routes (see text, page 427).

minimum of time and effort the plane could be lowered into the water and made ready for flight.

Any blank spot on the map fascinates me. You can never be entirely sure what is there until you have a look. This type of flight was an uncertain enterprise, as is all such pioneering. All my flying in the south polar regions had been from snow.

Lieut. William Verleger, U. S. N., Retired, had been made captain of the *Ruppert* and Commander Hjalmar Fr. Gjertsen, Norwegian Navy, I made senior officer afloat when I was absent, with the title of Commodore. He did the navigating and ice piloting, assisted by Rawson, and had command of the ship's operation.

Gjertsen was one of the few men in the world who had experience in the ice of the Ross Sea with a metal ship. He had acted as ice pilot for a large metal Norwegian whaler. I felt that he was a safeguard for my men and ship. W. K. Queen had been appointed chief engineer.

Neither on deck nor in the engine room

was it easy going, for we had to break in mostly inexperienced men.

On and on we went, making about 230 statute miles\* a day toward our goal. At the southern end of the shrieking sixties we struck a terrific gale which greatly endangered the *William Horlick*. This huge plane was aft on number 5 hatch, resting on a 7-foot tier of 12 x 12 timbers bolted together. It was a tough storm and there was difficulty preventing severe damage.

By the 19th the *Ruppert* had reached little-known waters and was only a few days' steaming from the edge of the entirely unknown. Icebergs were sighted on the midnight watch and by 4 a. m. 800 bergs had been counted. None of us had seen so many before so close together.

"KLONDIKE" CRASHES THROUGH!

The 19th was notable for another event. The most complacent members of the expeditionary unit were the three cows on

\* For convenience in comparison all mileage referred to in this article is in statute miles.



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#### THIRTEEN OF THE EMPERORS LIVED TO VISIT "BIG AMERICA"

Penguins have so little fear of man that one can walk among such a flock from the Bay of Whales and grab a bird by the wings. Oily, thick feathers make them hard to hold. These were kept in a corral, but frequently they escaped by wriggling through the meshes (see page 421). On board ship they were provided with a refrigerated tank. The small birds (right) are Adélies.

the shelter deck: "Klondike," "Southern Girl," and "Deerfoot." Klondike was the expectant mother, and the whole Guernsey clan back in the States were praying that a bull would be born within the Antarctic Circle (see page 406).

Cox, who had charge of the cows, had sat up with her all night, as the 19th was the date set for the blessed event. He continued his vigil on into the morning, when he went up on deck to watch a four-mile iceberg off the starboard quarter. Klondike had temporarily slipped from mind.

Down on the shelter deck young Dustin, able seaman, was working. Suddenly he looked up.

"Oh, boy! Oh, boy!" he yelled, and called for Cox and the doctor.

"Klondike," to quote Murphy, "had declined to wait for destiny. Though the Antarctic Circle was not quite reached, 12,700 miles were behind her. The frosty breath of icebergs informed her that her journey was about run, and not caring about a few degrees of latitude, she quietly achieved the everlasting duty of her sex."

It was a bull calf, and by unanimous consent he was called "Iceberg."

We were in 24-hour daylight now, which was good, because of the hundreds of icebergs around us. It would be impossible to get through them on a night with zero visibility.

#### A RECORD SOUTH WITH SHIP AND PLANE

Captain Cook had the farthest-south record in this area. We passed the track of his ship and headed into unknown and uncharted waters. There is a deep pleasure in sailing into the unknown. There is a satisfaction in finding out what is there.

On December 20 we passed the Antarctic Circle. We followed the 150th meridian south and soon came to loose ice and icebergs so large that when we first sighted them we thought they were fixed barriers.

To our astonishment, the *Ruppert* was able to push south to 67°09'. We were stopped there by an ice pack that became dangerous to the flimsy sides of our ship. The only extra protection was some plating on the bow at the water line.



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**HERE THE SCIENTISTS BUSILY STUDY AND RECORD THEIR DISCOVERIES WITH THE AID OF DELICATE INSTRUMENTS**

Blackburn (left) indexes rock specimens, and Black, next, adjusts his transit. Rawson (seated) charts the course of a future flight, while Paige (in the background) paints June's portrait. Lindsey (beneath the globe hanging from the ceiling) cleans a gun. Bramhall reads the cosmic ray instrument, while Zubin, behind him, records his observations. Siple and Perlins (right) examine with microscopes a plankton haul from the Bay of Whales. On the table is the hollow lead sphere covering the cosmic ray instrument.



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**THE MESS HALL BECAME A THEATER WHEN THE EXPLORERS ATTENDED "FORTY-SECOND STREET" ON MIDWINTER NIGHT, JUNE 22, 1934**

Here the group of explorers, some temporarily bearded, celebrates the beginning of the sun's southward swing which will bring daylight again in about two months. Heavy boots and woolen socks were worn because the temperature near the floor of the room was about 10 degrees Fahrenheit above zero. Shoulder high, the thermometer registered 40 degrees! Canned goods on shelves line the walls of this building that served as kitchen, dining hall, and recreation center.



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#### THE ADMIRAL TOSSES A FLAPJACK ON THE STOVE THAT NEARLY COST HIS LIFE

Hair grown long and grayish, he sits by his converted coal burner, which used kerosene. Escaping fumes poisoned him and sapped his strength during the four-months-long vigil, so that sometimes he had to crawl on hands and knees to reach the radio apparatus and contact Little America. Admiral Byrd knew that if he failed to maintain his regular schedule, his men would become worried and might risk their lives in an attempt to reach him through the Antarctic night. This tiny home was a hole dug in the ice, lined with boards and insulating material and fitted with the barest essentials. Here the Admiral made his detailed study of the Antarctic weather, including wind velocities and temperatures, and the aurora australis (see text, page 431, and illustrations, pages 419 and 420).

Some miles to the north, at latitude  $66^{\circ}45'$  S., longitude  $149^{\circ}45'$  W., we found open water in the pack and, with some difficulty and risk, got the *William Horlick* overboard. We were sure now that we could fly from the water.

We flew directly south 214 miles to latitude  $69^{\circ}51'$ . As we went the pack grew more ominous, but there was no evidence of land. By plane and ship we had penetrated 350 miles farther south in the vicinity of the 150th meridian than Captain Cook. It was important to prove whether or not land existed in this unknown area.

Believing that if any land existed it would be farther to the eastward, we decided to

head over that way toward the 120th meridian, where Dr. Charcot had made a deep penetration. It was about 805 miles away as the crow flies, but we should probably steam much farther getting there, dodging bergs and ice pack.

A slight bump from even a small iceberg, or "growler," would put a hole in the *Ruppert*. But we felt that, by exercising utmost care, our chances of getting through were good. We perhaps should have used the *Bear* had not a storm off the Carolinas put her too far behind. She would have to hustle even to reach Little America on time.

This was an enticing region! Its ice bulwarks had withstood man's attacks for



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CALCIUM FLARES PIERCE THE BLACK NIGHT AS ADMIRAL BYRD ERECTS HIS  
WIND GAUGE

He kept a long, lone vigil in the hut that lies entombed in the ice near this mast, after his assistants returned to the main camp, 108 miles away. The anemometer at the top of the pole registered the velocity of the wind on an automatic recording device in his cabin. The brilliant torches burned for about 10 minutes, and furnished light when movies were taken during the darkness.

more than a century. Here were 345,000 square miles that man had not penetrated. Our first attack had been unexpectedly fruitful.

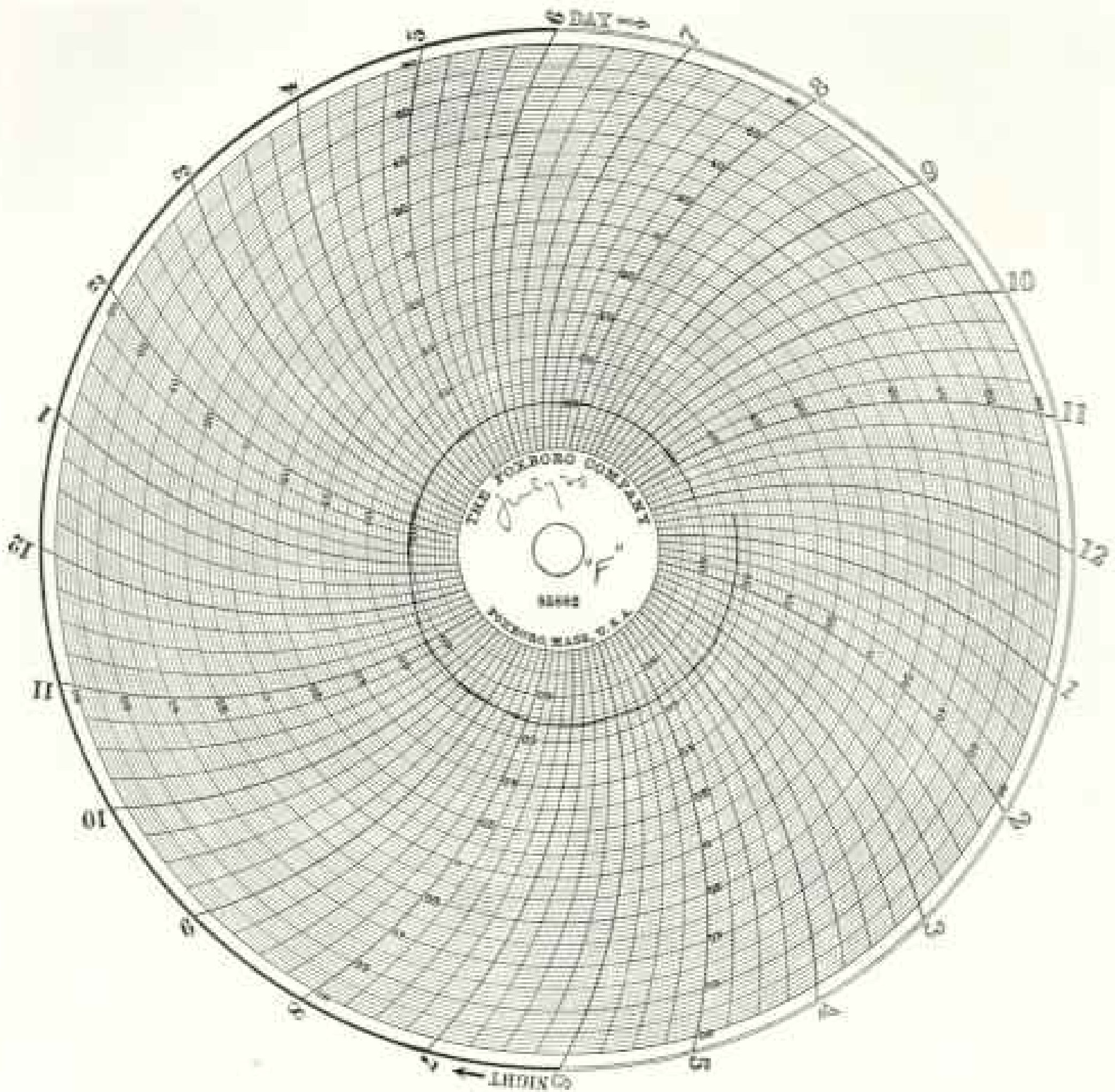
IN THE DEVIL'S GRAVEYARD, WITH NO  
SUN

We attempted to pierce the pack to the eastward and encountered some old, dangerous, jagged ice. There was only one thing to do—to make for the open sea. Finally, by retreating cautiously, we got out of the pack, but the worst was ahead. We entered the heart of the greatest ice-berg-producing region in the world, which we called the Devil's Graveyard. For days we never saw the sun. Those many miles of easting no man aboard that iron vessel

is likely to forget; it was impressively instructive as to why this area had so long resisted invasion.

The ship felt her way past innumerable bergs in fog. There was one bright day. Dr. Thomas C. Poulter, senior scientist, estimated we saw 8,000 bergs in 24 hours.

Once there was a gale with thick, foggy weather. Bergs were all around us. We had to keep going ahead, otherwise the wind and sea would in a very short time drift us on to a berg or growler, and just a brush of our flimsy sides against the underhung ice would sink us. Many times, on account of the force of the wind and seas, we were barely able to keep the nose of the ship up into the wind. That often made it difficult to dodge the bergs.



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THIS HISTORIC CHART RECORDS A REAL "COLD SPELL" AT ADMIRAL BYRD'S  
ADVANCE WEATHER STATION

The ink record begins at the right center and proceeds around the circle clockwise. At 12:30 p. m. on July 19, it shows the mercury stood at 65 degrees below zero Fahrenheit, and that at 3:30 in the afternoon it "warmed up" a degree! From then on the temperature gradually receded to 80 degrees below zero at 2 a. m. next day, where it remained until noon. These weather observations were among the many contributions that Admiral Byrd made to scientific knowledge during his isolation (see illustrations, pages 418 and 419, and text, page 431).

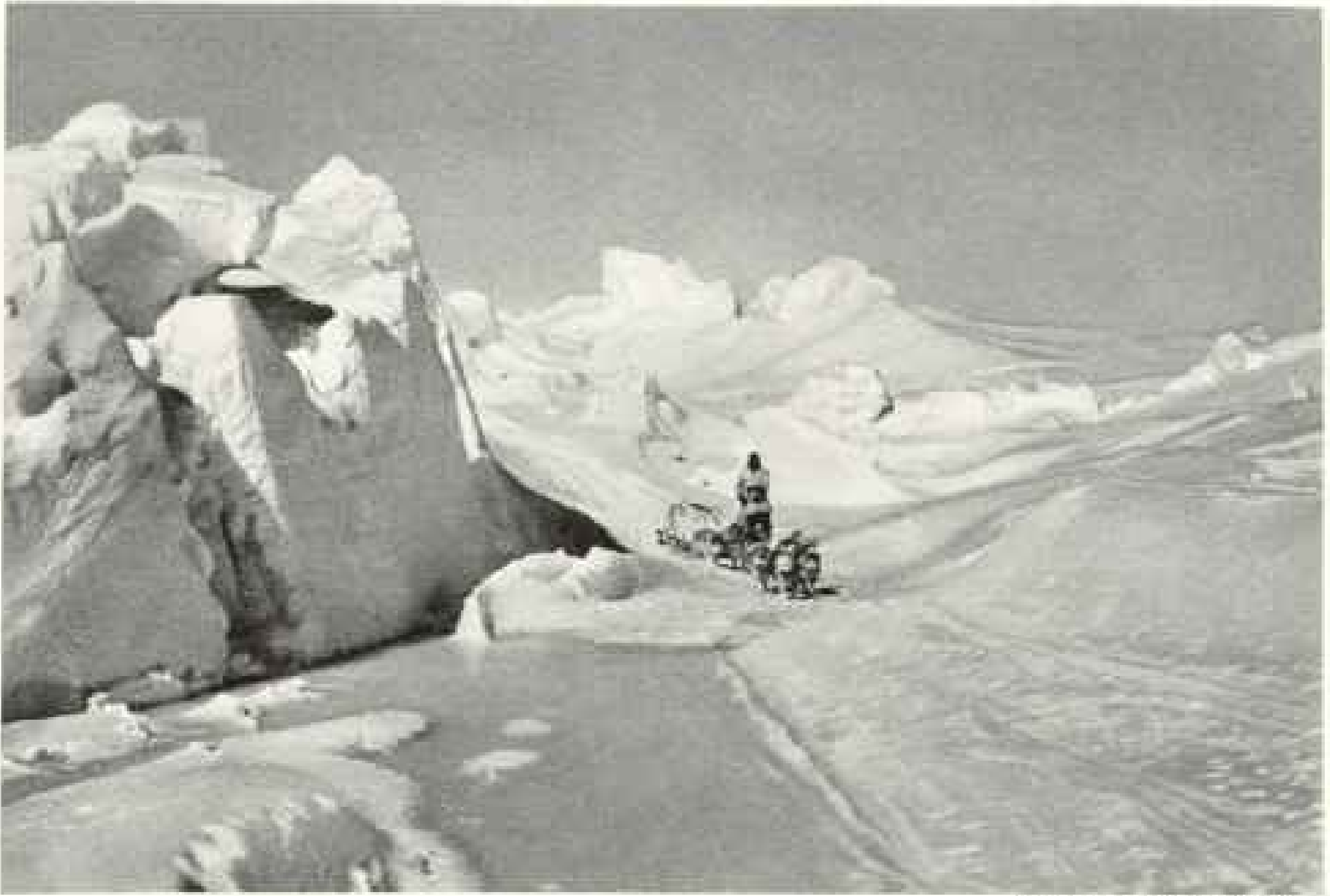
Enormous, ghostly ice castles would suddenly loom ominously in the gray mist, and every hundred yards gained by the *Ruppert* raised a new flotilla with spray dashing up their icy green bulwarks.

Once the engine room reported that water had got into the oil. The steam pressure dropped from 175 to 90 pounds—not enough steam to keep her head into the wind. The *Ruppert* rolled heavily in the trough of the sea with spray sloshing across her decks. Growlers, green and

hard, passed perilously near. But the engine room force was doing its best and the steam gradually rose.

There were many men on that ship who don't today know how near they were to burial in the Devil's Graveyard. Commodore Gjertsen did a good job, and he was ably assisted by Captain Verleger and the officers of the watch.

Still we persevered, until we had steamed a zigzag course over a thousand miles along the edge of the unknown. At the 120th



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**FOUR HUNDRED TONS OF SUPPLIES HAD TO BE HAULED OVER SUCH TRAILS**

A dog sled or man on skis first broke the trails to Little America, marking crevasses. Then the construction crew would follow along and throw a bridge, supported by telephone poles, across the widest crevasses. So great was the movement of the ice during warmer weather that the bridges often had to be shifted daily.

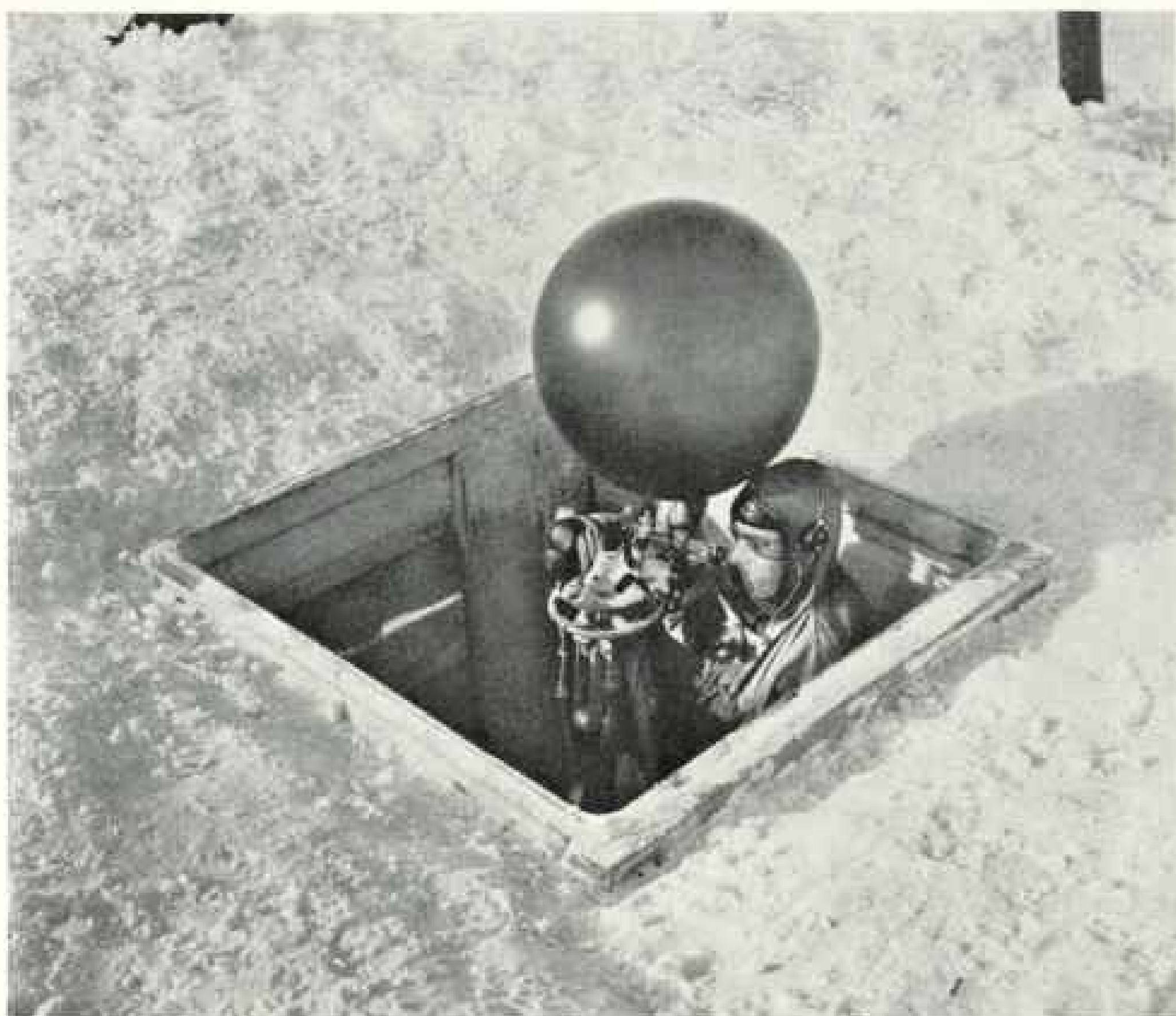


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**WHY SHOULDN'T THEY BE PROUD? THEY ARE F. F. A.'S—FIRST AND ONLY  
PERMANENT FAMILIES OF ANTARCTICA**

Emperor penguins feed on fish and tiny crustacea inhabiting the icy waters. They cannot fly, but use their short, stubby wings as fins while swimming (see illustration, page 415).





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#### WITH BALLOON AND THEODOLITE, A SCIENTIST CHECKS UP ON THE GOD OF WINDS

George Grimminger, meteorologist, is about to release a hydrogen-filled balloon from an aperture excavated in the snow outside the "Ad" Building. By following the course of the sphere with his instrument, he can determine the speed and direction of the air currents. The balloons were bright hued, and the observer chose the color that would be most clearly defined against the cloud formation of that day. During the winter night, glass-shaded candles were made fast to the balloons for the ascensions. Using a telephone head set, Grimminger relayed his observations to William C. Haines, below (see opposite page).

meridian the way south was barred by heavy pack; so we worked to the 116th meridian. The ice here was none too favorable, but time was getting short. On December 31 we reentered the pack, forcing the ship 46 miles south to latitude  $70^{\circ} 2'$ .

#### THE SECOND FLIGHT INTO THE UNKNOWN

From this point we withdrew nearly 6 miles to take advantage of open water for a take-off, and on January 3, 1934, made our second flight, this time to latitude  $72^{\circ} 30' S.$ , longitude  $116^{\circ} 35' W.$  We broke the farthest-south record for this longitude.

Fog closed in, and on the return to the ship we had to fly blind part of the way.

The air-speed indicator froze and the plane was on the verge of icing up. Flying quite low, we twice burst over huge bergs with barely 50 feet of clearance. We flew over the edge of one berg at least 23 miles long. We had to dodge snow squalls and we ran a grave danger of missing our ship. That would have been just too bad. The ship was a small speck to hit in the thick, squally weather.

Carl Petersen and Harold June, who take danger very casually, said this was about as risky a flight as they had ever been on. Well, I guess it was risky, now that I look back on it.

As before, the pack ran to the limit of vision.



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WILLIAM HAINES, ONE OF LITTLE AMERICA'S VETERAN WEATHER EXPERTS, JOBS DOWN A BALLOON'S RECORD

When Grimminger released his balloons and followed their ascent, he kept in constant communication by telephone with Haines in this farthest south "weather bureau." Strength and direction of upper wind currents were charted regularly (see text, page 443).

Having already overstayed the time allotted for these eastern operations, and still facing the formidable job of reestablishing the winter base of Little America, we started the long voyage back to the west.

ON TOWARD LITTLE AMERICA

There were at least 3,400 miles of steaming between us and Little America. We withdrew from the pack and commenced to run along the front of it. Fortunately, the wind and current had carried much of the pack out of our path, and, edging southward from the 67th to the 69th parallel, the ship again broke into unknown waters.

On January 10, when she stopped to let aviation resume the assault, she had reached latitude  $69^{\circ}50'$ , longitude  $152^{\circ}21'$ . Here we made our third aerial thrust into

the unknown, flying to latitude  $71^{\circ}45'$  along the 152d meridian.

We had now explored in the vicinity of the 150th and 152d meridians about 500 miles beyond any of our predecessors. This was quite a substantial wedge into this unknown area. However, we had not made as thorough an investigation as we wished, and so, looking ahead, we decided that in February, after the ships were unloaded, we should strike from the south with a different weapon. In short, we would use the famous old *Bear* to get in through the back door.

While we had been exploring to the eastward, Lincoln Ellsworth had been in the Bay of Whales with his airplane on the bay ice, waiting for good weather to make a flight to the Weddell Sea.



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#### "DOC" POTAKA PULLS AN ACHING TOOTH FOR "IKE"

There was only occasional dental trouble on the expedition because the men's teeth were examined by Dr. Clyde Nelson in Boston before departure. Schlossbach had another toothache just as the expedition was leaving Little America. The dentist performed an emergency extraction with a pair of pliers because his instruments had been taken aboard ship.

Early in January Ellsworth reported that there had been a great upheaval in the bay. His plane had been so badly damaged that he couldn't use it, and he was returning to the United States. This was a great pity, after all the time, trouble, and expense he had put into the undertaking. Balchen, pilot, and Braathen, mechanic, who had been with me before, were with him at the time.

It was high time to get to Little America, so the *Ruppert* headed for the Bay of Whales. By tradition and experience, passage in the vicinity of the 178th meridian East was accepted as the safest and quick-

est entrance into the Ross Sea. Ellsworth had just recently been caught for many days in the pack in that direction and we dreaded the passage through with our flimsy ship. It was considered foolhardy to try to break through anywhere else than in the vicinity of longitude 178° East; nevertheless, we decided to explore.

#### FOUND—AN ICELESS PASSAGE!

We had the amazing luck to find an opening along the 169th meridian West, and met no ice at all. On January 17, at 9:30 a. m., we reached the Bay of Whales, our destination.

After our rediscovery of Little America and when the *Ruppert* had finished unloading, with Lieutenant English in command, we took the *Bear of Oakland* on this fascinating voyage of exploration. Before the worst sea ice I have yet seen stopped the plucky old ship, we had worked our way east to latitude 75° 6', longitude 148° 8' W. within 100 miles of the

Edsel Ford Range, then north to latitude 73° 22', longitude 149° 34' W., and thence westward to the 159th meridian. Thus, for all practical purposes, the gap between the flight tracks we had made with the *William Horlick* along the 150th meridian and the known coast was closed. Our able ice pilot and sailing master, Bendik Johansen, had his hands full because of the heavy pack.

Finally we became completely surrounded by dangerous ice and the *Bear* had one of the toughest fights of her 62 years' service to get out. I know she was never in worse ice. It couldn't have been worse.

Lieutenant English and his crew did a splendid job. The *Bear* had traveled many miles in an unknown sea, perhaps as hazardous as any in existence, and, with the wonderful sonic depth finder, Edward Roos had charted the bottom.

The significant result of this voyage, together with the *Ruppert's* explorations in the eastern sector, was to identify a vast unknown area as Pacific Ocean and extinguish the hypothesis of an archipelago reaching into it west of longitude 140° W.

Interestingly enough, off Scott's Nunataks we obtained a very shoal sounding, showing that the Alexandra Mountains extend out into the sea as a submarine ridge.

#### THE PERILS OF UNLOADING

The bitterest task facing a wintering party is the establishment of the base camp. As I have said, the old buildings were available, though the roofs of several had been crushed by the snow.

New buildings had to be constructed for the larger personnel and a vast amount of stores had to be unloaded from the ships and transported to Little America.

The *Ruppert* could get to within two miles of Little America, but a direct approach was barred by impassable pressure ridges. A circuitous trail, more than six miles long, was cut through the ridges, and at one point a 10-foot gap of open water was bridged with telephone poles. The ice was moving and every day or so we would have to bridge a fresh crevasse.

More than 400 tons had to be hauled over that road. Night and day, for three



© B.A.E.

Photograph by Charles G. Morgan

"BUD" WAITE TALKS TO LITTLE AMERICA FROM A TRACTOR

Each detachment, in this case the Plateau party, carried a portable radio to keep in touch with "headquarters" (see text, page 454). Sometimes contacts were established every few hours, but often two or three days elapsed between messages. The operator's mittens, camera, and tool kit rest on the floor of the cabin built on the tractor chassis.

weeks, tractors and dog teams shuttled between the caches. One plane made 26 flights from the ship to Little America to expedite the movements of vital equipment.

It was astonishing that the Cletrac and the Citroën tractors stood up under the beating they got on that trail. Half the time they were sliding sideways on some hummock. Using tractors was an experiment—this was the first time they had performed in the Antarctic. The Cletrac hauled ten tons in one load. We should have failed without it.

Noville had charge of unloading the ship; June, of all operations on the ice; Taylor



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"YOU SCRUB MY BACK, AND I'LL SCRUB YOURS!" SAYS BOB YOUNG, VETERAN OF TWO ANTARCTIC EXPEDITIONS

For his bath in a wash tub, each man had to "make" his own water by melting the necessary ice, usually a half-hour operation. Behind the coal stove (right) there is a large tank connected to the firebox by two pipes through which the hot water circulates. Snow dumped into the tank through a hatch above melts when it comes in contact with water already warmed. One day this building, the old mess hall, caught fire. One of the men picked up a can of precious water to throw on the fire, protesting, "Gee, do we have to use this just to put out a fire!"

was responsible for transport, and Demas was in charge of tractors.

This period was a white nightmare. Men worked until they dropped. The surging outrushes of the bay ice menaced the ship, also the stores cached on the ice, and, finally, jeopardized even Little America itself.

The bay ice where the ships were tied up broke many times. Frequently this would happen suddenly, and twice men and supplies fell with the broken ice blocks. The jagged, underhung pieces rose rapidly to the surface, endangered the hull of the *Ruppert*. When the wind and waves were from the seaward, it was very difficult to prevent the ship from being dashed

against the underhung ice. We shored the ship out with telephone poles against planks of wood in the snow, but many times these gave way and we had to put to sea.

We saw that we could unload far more easily if we could get alongside the Barrier, for we should have smooth going and a short distance to Little America. There were no pressure ridges on the Shelf Ice—only smooth snow. The bay ice was 30 or 40 feet thick, while the Barrier, at its edge, averaged about ten times that.

We decided to take another look around the bay for some low Barrier wall that would not be hazardous to the ship. I had hesitated to berth alongside the Barrier because on the first expedition we had nearly

lost the *Bolling*, when some of the Barrier broke and fell on her decks. But the unloading situation was desperate.

Therefore, on January 18, we got under way and cruised slowly along the Barrier wall.

#### BARRIER FALL LIKE A SKYSCRAPER'S COLLAPSE

Near the place where the *Bolling* unloaded in 1929, the Barrier seemed to drop within 40 or 50 feet of the water along the outer edge. Haines was with me on the bridge. I asked him what he thought of that place. He started to reply, but before he finished something happened no eye was fast enough to see.

One moment we saw that wonderfully fine cliff face, seemingly as solid as the Palisades. Next moment there was a sound like a skyscraper collapsing.

A quarter mile of Barrier was streaming downward, spilling and tumbling into the sea. The impact rocked the ship, and several hundred thousand tons of ice came spreading out fanwise, covering the water.

Silence followed, and then Bill Haines got out his answer to me. "Admiral," he said, "I don't think I should care to tie up there." That was enough ice to sink a whole fleet of warships. It looked like a warning from Providence.

Reluctantly we went back to our old berth alongside the bay ice. It was the less of two evils. I was glad some of my men had a chance to see how Antarctic icebergs are formed.

#### A CRASH LANDING AVERTED

At 11 o'clock the night before, the *William Horlick* had been lowered onto the bay ice. By 4 o'clock she was ready to fly, and June and Bowlin and radio operator Hutcheson took off on a flight for Little America.

The plane rose smartly into the air, but the men on the ship were appalled to see that the two huge skis had broken from their horizontal position and were dangling vertically from their pedestals. What had happened was obvious. Rubber pongee cords are anchored to the plane and the toes of the skis to keep the skis from tipping below the horizontal. A wire is used to prevent the skis from being forced into a vertical position by the pressure of the wind. This preventer wire had inadvertently been left off.

To land thus would have made a frightful crash. June looked down and saw that something was wrong. Clay Bailey radioed Guy Hutcheson from the *Ruppert* that the skis were hanging straight down. Bowlin opened a window, crawled out on the wing in the freezing propeller slip stream, and made a valiant but futile effort to push the skis back into place.

The doctor was routed out and fire extinguishers made ready. It looked like a crash landing. June came down on a long, curving glide. Just as the plane leveled off, June pulled her nose up close to the stalling angle. The sudden decrease of air speed threw the skis into a horizontal position, and just at that moment June put her down. This was a good piece of work. Two hours later the plane was safely flown to Little America.

Finally we got the *Ruppert* unloaded. But, unfortunately, we had not been able to get the bulk of the material to Little America. Tons of it were cached back on the treacherous bay ice. But the season was getting late and the *Ruppert* would have to return. There must be no risk of her freezing in. She left for New Zealand February 5, 1934.

On February 19 the *Bear* went north to meet the British exploration ship, *Discovery II*, to bring back Dr. Potaka, of New Zealand, replacing Dr. Guy Shirey, who had to resign because of ill health just as the *Ruppert* left the Bay of Whales. For this assistance I owe the British great gratitude. Without a doctor I should have taken all the ice party back to New Zealand rather than expose them to a year cut off from medical aid.

On this trip the *Bear of Oakland* fought her way back into the Bay of Whales through rapidly thickening new ice. No ship had ever been in this bay so late in the season. Only by the most courageous and skillful maneuvering did Lieutenant English and ice pilot Johansen fight their way through. She was unloaded with desperate haste, and in a few hours was on her way north, this time assisted by a heavy southerly gale. Both ships were to winter in New Zealand.

#### UNITED STATES MAIL TO LITTLE AMERICA

On September 22, 1933, the United States Post Office Department honored the Second Antarctic Expedition by issuing a special 3-cent postage stamp known as the



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#### AIRPLANE MOTORS UNDERGO REPAIRS AT THE AVIATION WORKSHOP

Ralph Smith (left background) and William Bowlin tinker with a cylinder, while William McCormick (foreground), the pilot of the *Autogiro*, who was injured when it crashed, scrapes carbon off a piston (see text, page 444, and illustration, page 454). Paul Swan inspects airplane rigging and struts hanging on the wall.

"Little America Stamp," a commemorative issue for use on mail sent through the U. S. Post Office established at our base camp at Little America (see page 414).

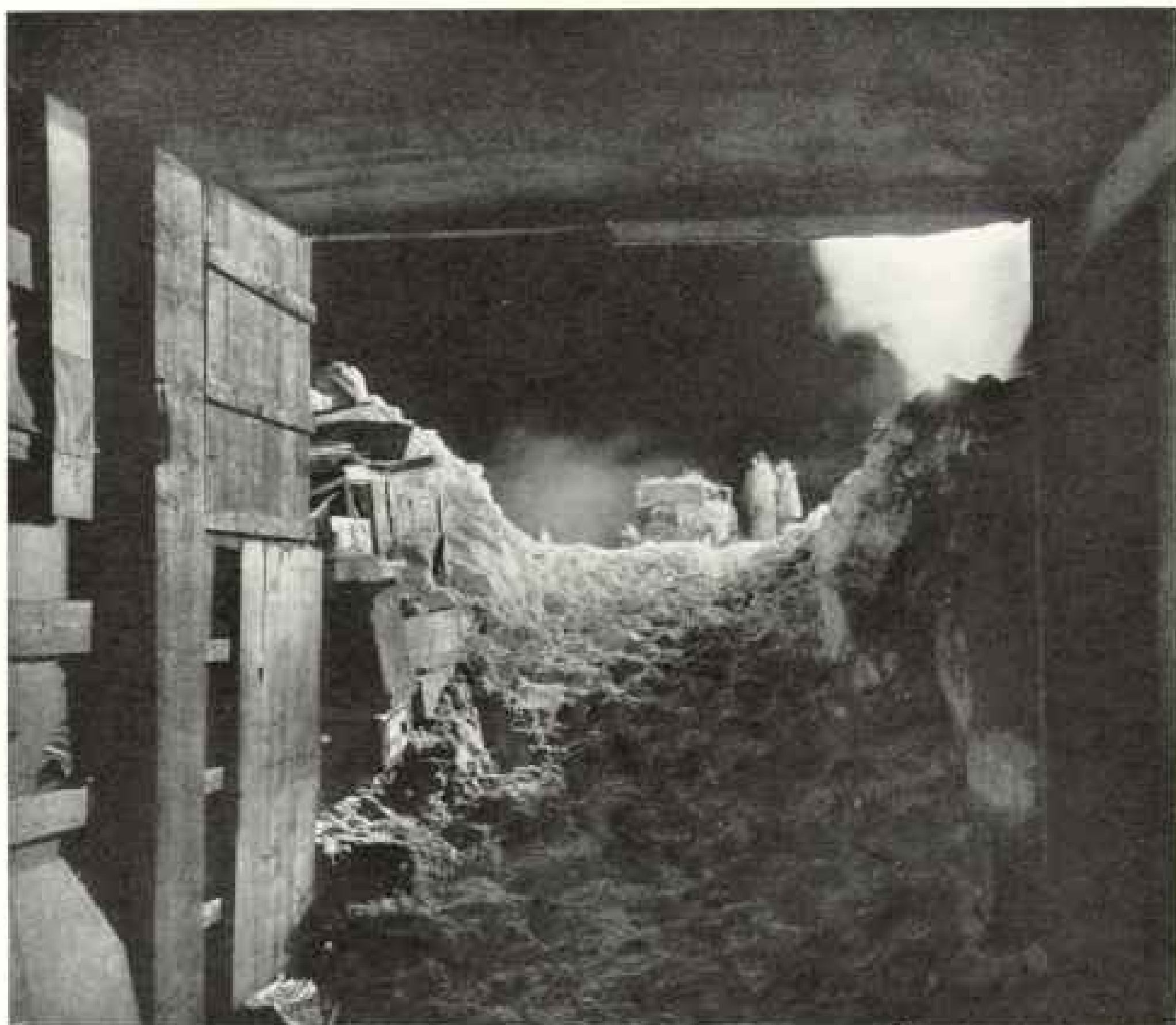
Many thousands of self-addressed envelopes, bearing this special stamp, were received at Norfolk and loaded aboard the *Ruppert* before our departure in October, 1933. Many more of these letters were received at New Zealand and taken with the ships when they left to establish the base camp on the ice.

However, the man in charge of the mail, because of illness and a critical unloading problem, found it impossible to cancel and return all of the mail before the supply ships were forced to leave to winter at New Zealand. This caused me deep regret.

The pressure ridges and crumbling ice

made the unloading difficult and complicated. Many people have told me that they valued their letters far more because they remained at Little America during the winter night.

Additional thousands of letters were received during the winter and shipped to New Zealand. These letters, together with a government cancellation expert, were brought in with the ships when they came to return the expedition to the United States. All of the mail, including that retained at Little America through the long winter night, was hauled to the Barrier and loaded on the ships. It was transferred at New Zealand to a fast, regular mail steamer, which carried it to San Francisco. There the letters were dispatched to the senders, who, by paying the service charge



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THE CLETRAC TRACTOR IS ABOUT TO BE WHEELED INTO THE GARAGE FOR REPAIRS

The shed was built of the cases in which the expedition's three Citroën cars were shipped. They were kept outside, except when they needed repair, because to enter the garage a sloping runway had to be dug each time, requiring 12 men a half day.

on the mail became, in a small way, patrons of the expedition.

A NEW LITTLE AMERICA CITY

Meanwhile, under the direction of Dr. Poulter, a new city was built around old Little America. It could boast electric light and power, telephones, a well-equipped science laboratory, a first-class weather observation station, the Adolph Ochs radio station and a broadcasting plant, medical facilities, a machine shop, a tailoring establishment, a carpenter shop, a dairy housing three cows and a bull, and a transportation system geared to the varying gaits of dog teams, tractors, and aircraft. Little America was unique in the diversification of talents enlisted among a company of 56 men and in its fortification against the contingencies latent in isolation.

When the recession of ice from the Bay of Whales made it seem possible that even Little America might float away, we built an emergency base, called "Retreat Camp," on the high Shelf Ice about three-quarters of a mile to the south-southeast, and stocked it with the bare essentials for survival.

The vast ice cake upon which Little America rested was separated from the Bay of Whales only by about a half mile of bay ice. That bay ice, I knew, might readily break out, for it had done so within two years of our arrival at Little America in 1928. Therefore, when the ice in the Bay of Whales clear up to this bay ice fronting Little America began floating out to sea, toward the west, our situation looked perilous. Fresh cracks appeared all around our city, and the ice under us began to move up and down with the swell.





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#### METEOR WATCHERS MADE ONE OF THE EXPEDITION'S MOST STARTLING DISCOVERIES

Because of the clearness of the atmosphere, they saw as many as 60 shooting stars a minute, proving that the earth intercepts many more meteors than scientists had hitherto suspected. Sometimes the men would sit thus for hours at a time. Here is Lindsey jotting down the observations of Poulter and Smith, above. Skies in the far south were scanned nightly during the season when there was no midnight sun, from March to October (see text, page 438).

We might easily have suffered the unenviable fate of being the first city to float seaward on an iceberg. It was too late for the *Bear* to get back to us, so I was relieved when cold weather cemented the cracks and crevasses.

In spite of the many remaining difficulties, on March 1 we were able to free Captain Innes-Taylor and a southern party of six men and five dog teams for the vital mission of running a chain of food depots to latitude 80° 56' S., in preparation for the major journeys of the spring, and to dispatch Chief Pilot June and Demas southward with a fleet of four tractors carrying the equipment and stores necessary for occupancy throughout the winter night of the advanced meteorological base we pro-

posed to establish inland on the Ross Shelf Ice.

Except for the crash and destruction of the airplane *Blue Blade*, on a test flight, with the lucky escape of the personnel, and an emergency operation for appendicitis performed on Pelter, hard upon the alarms excited by a fire that threatened to destroy the surgical cache, the fall operations closed uneventfully.

#### STRANGE LIGHT EFFECTS OF BAY OF WHALES

Every day when it was possible I would go for a short walk, usually down into Ver-sur-Mer Inlet, where I could command a view of the old pressure ice thrown up in the Bay of Whales. Daily the ice itself

changed, although the major formations were relatively unaltered. When the sky was overcast and there were no shadows, I could walk up to the nearest of the ridges before I could discern it.

Then there was a faint, formless blue reflecting from the hard blue ice of the pressure, while the snow covering was enveloped in white light. This made the snowy landscape invisible. Still such intense light reflected into my eyes, as I strained to see the way about, that if I had not worn dark snow glasses I would have become snow-blind.

On other days, when the sky was clear and the sun was high, shadows of the pressure appeared black in contrast to the snow, and everything stood out like newly chiseled marble. Visibility was excellent. On the horizon every detail was clear. But distances and sizes then are frequently underestimated; objects seem unusually small and the horizon very far away.

At this season the long shadows were cast from every grotesque pinnacle of the pressure ridges. Slowly the shadows would lengthen and reflect the beauties of a glorious sunset that in warmer climates would swiftly fade and die. Here it seems that Nature has time and unhindered space to exhibit her beauty. The sky and the whole snowy earth are alive with lingering colors.

The convection currents (in a warmer climate we should call them heat waves) add movement to the colors, so that the reds are often burning and leaping flames, while the soft yellows and greens wave about as if the world were enveloped in a gossamer scarf. Things seem unreal; the confusion is increased because there are no familiar objects—trees, shrubs, or houses—to act as a mental measuring stick.

#### ALONE, AT 80 DEGREES BELOW

On my first expedition we learned the importance of getting inland Antarctic weather data. Those collected had mostly been on the coast, which fell within the moderating influence of the ocean. No fixed station had ever been established in the interior where conditions more truly representing continental meteorology prevail.

Hence we decided to erect an inland weather station. Personally, I have long been tremendously interested in Antarctic weather. Here is the "home of the blizzard," and, as I have said, this region af-

fects directly the weather of the Southern Hemisphere and possibly, indirectly, the weather of the whole world.

Aside from the establishment of a weather observatory a study made south of Little America of the aurora australis would be of scientific value. This southern aurora corresponds to the aurora borealis of the North.

To establish an inland scientific observatory we had prepared carefully by bringing with us the necessary scientific apparatus.

The observatory was planned for three men. Three bunks were crowded in the tiny portable shack built by Iver A. Tinglof and secured to the walls. However, because of the terrific job we had of unloading, the winter night and cold were close upon us. We could not take supplies for three men. A two-man station was out of the question. The chances were very small that two men could achieve temperamental harmony.

In the woods it would be another story. Even the trees are alive. There is noise from their rustling and from birds on their branches, and the call of the wild. The sun rises and sets.

But two men living alone, buried far under the snow of an ice age! I wonder how they would fare? Jammed together in a silent, dark, dead, bitter cold environment, staring at each other for six months. Could it possibly work out? Personally I would prefer the grave hazard of being alone.

Some one had to go. I wouldn't ask two men to go and I couldn't ask one. It seemed to be up to me.

Besides, I wanted to go, and welcomed the opportunity to go alone. I believe no one else wanted the job.

It appeared wise, too, to expose as few as possible to the risk of being without the services of a doctor.

I felt that I had good leaders and had confidence in my men. There would be no hazardous operations during the winter; therefore, I had no apprehension about leaving the base without its commander. After all, I should have radio contact. Just before my departure I appointed Dr. Thomas C. Poulter second in command, Harold June chief of staff, William Haines third in command, and George Noville I made executive officer.

On March 25 I flew to my winter home, which I named for my mother, the Bolling Advance Weather Station. The trail party already was there with the shack and sup-



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#### STRANGE BUNK MATES IN LITTLE AMERICA

Fred Dustin shared his berth in the "Ad" Building with Nome and her puppies. In the "upper" slept Dick Black, who habitually draped his "long-handled" underwear on the rope clothesline, the legs and arms dangling down over the "lower." His repeated warnings of "Rig in your underwear" going unheeded, Dustin one night took a pair of shears and trimmed off legs and arms, leaving a shorn suit for Dick's use in subzero weather.

plies. The shack was erected with the temperature at 65° below zero. A chill beginning to the coldest outpost ever inhabited by man.

It was my job to keep the following weather records:

- a. Continuous recording of wind direction.
- b. Continuous recording of wind velocity.
- c. Two observations daily of cloud and weather conditions.
- d. Two readings daily of two outside dry thermometers.
- e. Continuous recording of temperature with two instruments.
- f. Continuous recording of barometric pressure.
- g. Two readings of barometer daily.

The aurora australis observations had to be made simultaneously with those at Little America. I took four readings daily and sometimes more. It was necessary

to record the intensity of the aurora and its shape and form, direction, extent, and height in the sky. At times the aurora filled nearly the whole sky.

I was in communication with my friend Charles J. V. Murphy by radio. He was my personal representative. I am glad he had the fortitude not to tell me of the storm of protests from my friends back in the States when they learned of my lonely vigil. It was too late to retreat. My bridges were burned behind me the day the tractors left me to return to Little America. The sun was already low in the sky, the winter night was closing in, and it was bitterly cold. I couldn't ask my men to risk coming back to the advance base.

#### A UNIQUE EXPERIENCE IN SILENCE AND SOLITUDE

All went well during March, April, and May. This was one of the greatest and most satisfying periods of my life. I en-



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"NEW YORK? NEW YORK?"—"YES, LITTLE AMERICA, WE CAN HEAR YOU!"

Murphy, before the microphone, has charge of the sending and Hutcheson, opposite, modulates the tones. Others who talked during the same broadcast stood before a microphone in the middle of the room. This shack was the combined studio and operator's bunk room. There were no actors among the members of the expedition, so that all performances put "on the air" from Little America had to be improvised by amateurs (see text, page 459).

joyed the solitude and silence. I enjoyed watching the stars and the aurora in the darkness of the winter night. I really liked everything about it except the cooking, until I found my cook book.

The only notice I had posted in my shack was: "There will be no gossiping."

The last part of May I began to feel seedy. I learned later that the fumes from the faulty burner of my oil fuel stove had been getting me down. On May 30 I was knocked out by the fumes from the engine of my radio generating set, which, of course, I had to run under the snow. Alone and prostrated, with my weakened system I couldn't take hold (see page 418).

The fumes from the stove continued to poison me. It was either bitter cold and less fumes or less cold and more fumes. My instruments were showing the lowest average temperature ever recorded. The recording thermograph read as low as 70°

and 80° Fahrenheit, below (see page 420). I don't yet understand how I got through, for I was stricken down three weeks before the middle of the winter night and the fumes kept me down.\*

The latter part of June Dr. Poulter radioed that he would like to attempt a trip to my base for meteor observations. These could not be carried on by one man. He had made some startling discoveries and wanted to study the phenomena at my Advance Station and take readings simultaneously with those made at Little America.

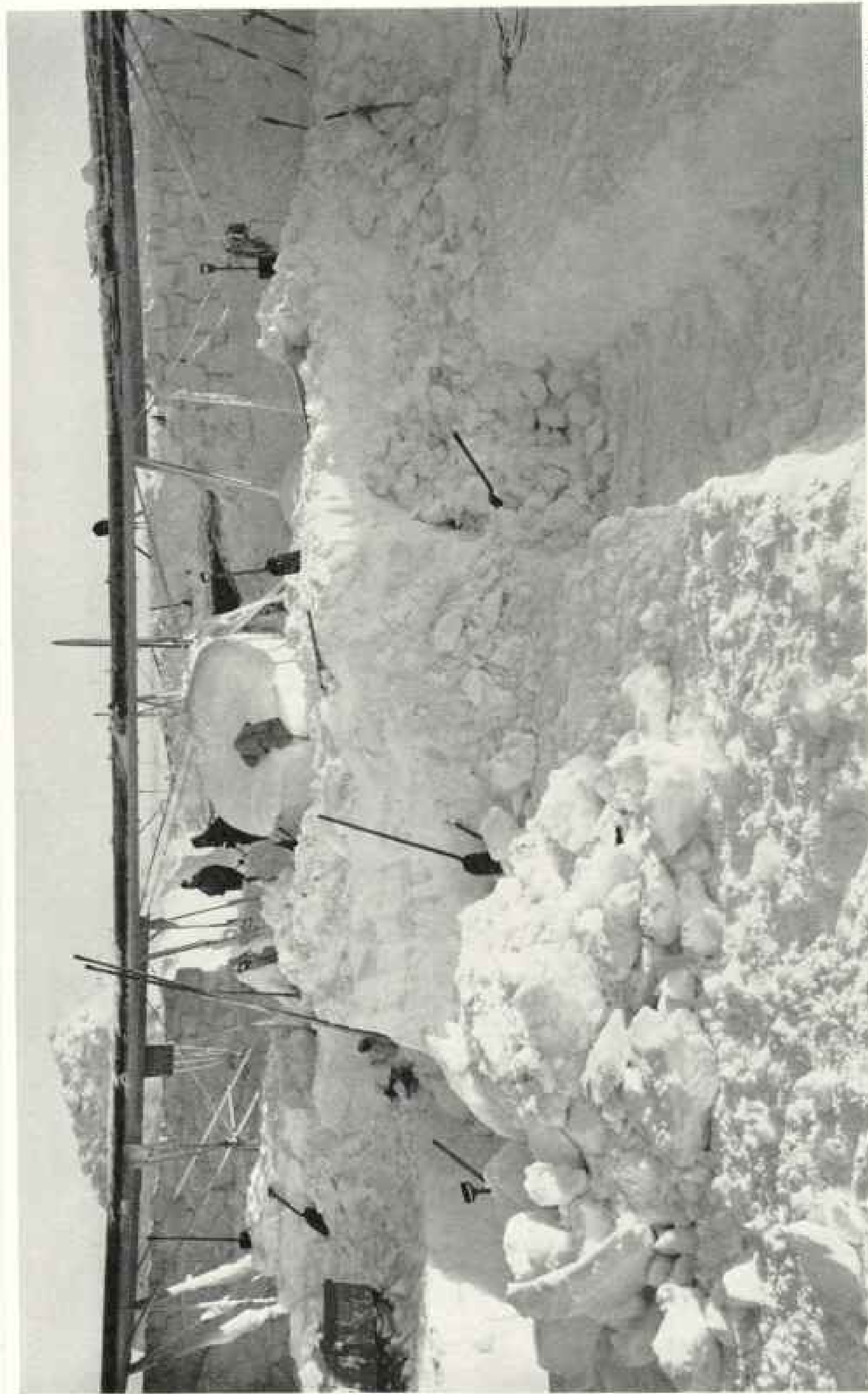
\* Admiral Byrd has omitted to explain why he did not inform Little America of his physical condition. His personal diary reveals that he determined not to do this lest he risk the lives of his men on a midwinter rescue trip. At times he had to crawl to the radio to send his messages because a lapse in the communication schedule would have been tantamount to an S. O. S. call. Cranking the hand generator added greatly to the exhaustion already caused by poisonous fumes.—THE EDITOR.



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SHADOWS OF TWO EXPEDITION PLANES PLAY LEAPFROG AS THEY RACE ACROSS THE ICE OF SCOTT LAND

On this flight the *Mission Airways* accompanied the *Hovick* as far as the Rockefeller Mountains, in the distance, made aerial motion pictures, and then headed for home. The other plane continued to the eastward and mapped the Edsel Ford Range, about 300 miles from Little America. To determine the contours of unexplored areas, the aviators dived and skimmed close to the surface of the ice, reading the altimeters. Peaks could not be measured in this way, because air currents might suck the planes to destruction on the pinnacles if they flew too close.



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#### IT TOOK A WEEK TO DIG THE GIANT "WILLIAM HORELICK" OUT OF THIS SNOW HANGAR

When winter night ended flying, the aviators lowered the *Condor*, its upper wing level with the surface, into a deep, T-shaped pit and stretched tarpaulins across it. During blizzards snow drifted over and around the plane, making a snug ice cave in which the crew worked on the engines and gear during the long, dark months. On the return of the sun, all hands dug long inclined trenches down to the skis, and cleared ramps for the wings. Several times heavy winds blew fresh snow into the excavation, and the work had to be done again. When all was ready, two tractors pulled on a towline, and the big ship climbed from its berth.



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## HOT APPLE PIE WILL BE THE DESSERT FOR DINNER TONIGHT

Al Carbone made many a tasty cake and pastry. The expedition's daily menu was very much like one would find at home, except that in place of fresh vegetables the men ate dehydrated or canned goods. Before Al could cook meat, he had to hang it in a warm place to thaw for two days. When first brought in, beef, solidly frozen, would splinter if dropped. Canned soups were blocks of ice if opened before thawing for 24 hours. Cooking and much of the heating were done by coal stoves.

He would wait until there was some twilight at midday from the returning sun.

On July 5 my radio engine broke down. From then on, I had to crank a hand generator.

A month after deciding to come, Poulter started on July 20, but when he had got nearly halfway, he was forced to turn back.

On August 7 he started again, accompanied by Demas and Amory H. Waite, Jr. About that time they came to know what Murphy had suspected, that from my pauses and the weakness of my radio signal, something was wrong with me. Nothing could hold them then. They came through, undergoing great hardships, and reached me August 10.

I was mighty grateful to those three fellows, and gladder to see them than they knew.

Though I wasn't so nearly prostrate as I

had been the first part of June, I was still so weak I had to remain at Advance Station for two months. I became still more indebted to Poulter, Demas, and Waite for their friendly care of me. We were packed in that little shack like sardines.

My records were nearly continuous for six and a half months. They are now being correlated with the Little America records. They are not important compared to what Haines and Grimminger did, but may help some in the final conclusions regarding Antarctic weather.

I flew back to Little America October 12.

## THE LONG WINTER NIGHT AT LITTLE AMERICA

Preparations at Little America for spring operations commenced almost as soon as the fall work was completed. As most of the men had not had actual experience on



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#### THIS WISE OLD DOG KNEW WHERE TO WARM HIS NOSE

Electric lights went out at 10 o'clock, but each man had his own kerosene bunk lantern with which to read or work overtime. Fires died out and doors were thrown open during the night. On his early morning round the night watchman closed the outside doors and lighted the fires so that the rooms would be comfortable when the men "crawled out." Every man had to carry a flashlight to negotiate the maze of dark tunnels beneath the snow.

the trail and in camping under Antarctic conditions, it became the duties of Innes-Taylor, a veteran of the North, and Siple, of the first expedition, to pass on their knowledge to the novices. The former, in charge of the dog department and field operations, established a school for the drivers and classes met every day. The radio department taught the trail men to use the Morse Code.

Blocks of the dog pemmican were weighed out and pressed into a mold, each representing the pound-and-a-half ration for one day. There had to be enough food available for more than one hundred dogs for at least three months.

Trail rations for the men had to be made up. Sleds had to be repaired and relashed after the unloading operation. Miller had the big task of making all the tents and wind-proof clothing to meet the individual needs of each party.

Soon after we landed in the Bay of Whales, Dr. Ervin H. Bramhall and Arthur Zuhn were relieved from other camp duties and proceeded at once with the construction of the magnetic observatories. These were located some distance from the rest of the camp, out of range of disturbing metallic influences. The largest building, flat-topped and sunk deep in the snow to avoid radical temperature fluctuations, housed the variation instruments.

To check these mechanical recording devices, a delicate magnetometer was erected in a separate building on top of a heavy wooden pier, frozen deep into the snow. On the roof of this building was Little America's astronomical observatory, where Bramhall and Rawson, the expedition navigator, took many series of sun and star observations, determining their astronomical position to within the smallest error, and obtaining the true bearing of the mag-





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#### A LITTER OF PUPS MAKE THEIR FIRST VENTURE OUTSIDE

Mother, close behind, keeps a sharp eye peeled for danger. The youngsters have not yet acquired names. Though the temperature was below zero, they did not seem to mind the cold. Several families were born at Little America, all of which were cared for by the "Dog Department."

netic tunnel for measuring the variation of the compass needle.

The magnetic observatories were connected by a tunnel system an eighth of a mile long, which eventually joined the labyrinth of tunnels under the camp. In an adjoining room delicate thermostats were planted into the snow walls to show the fluctuations in temperature to a depth of 25 feet below the surface. A maze of wires almost as complicated as a telephone switchboard ran from the magnetic tunnels up into the science laboratory for communication and for the recording of the thermal measurements.

Cosmic ray observations were taken in a region several thousand miles nearer the South Magnetic Pole than any such measurements have yet been made.

Dr. Poulter also was senior scientist of the expedition and worked with all the scientific departments. For two years before our departure he had gathered scientific material. His own research lay in the physical sciences, and after turning over much of his work to Bramball and Zuhn, he reserved for himself the study of auroras and

meteors and, later in the summer, the geophysical study of the regions surrounding the Bay of Whales.

By use of cameras and spectrographs pictures of aurora formations were made throughout the winter, with various color filters.

Our meteor work was a portion of a world-wide program. There were three long lines of stations encircling the earth from north to south, and our station was on the southern end of all these.

#### METEORS FLASH BY—ONE A SECOND

Our observations were attended with surprising success, largely because of the very clear atmosphere. A group of four men, arranged on a pedestal supported by chairs near the ceiling, gazed with their naked eyes into the clear heavens, reporting to a recorder the moment any of them saw a meteor flash by (see illustration, page 430). By a wire screening between them and the stars, they could indicate the direction the meteor was traveling, and its length, and also estimate its brilliancy, color, and the length of time it remained visible.

There is every indication that meteors are streaming into the earth's atmosphere at a much higher rate than has previously been supposed.

One night while Poulter and his men were observing meteors through their cupola, Cox squatted down near the "dome," lit a bundle of papers and kept blowing sparks across the observatory windows. Soon Poulter ran out, highly excited, and exclaimed, "I never saw so many flaming meteors in my life—the heavens are full of them."

During our stay Dr. Poulter and his observers obtained data from over 6,500 legitimate meteors. Some of these observations were made simultaneously with those at Little America at my Advance Station after Poulter reached it, from which data it is hoped we shall be able to determine the altitude and path of these meteors through the earth's atmosphere. Demas and Poulter made these readings outdoors with temperatures ranging from minus 50 to minus 70 degrees.

Five meteors of particular interest were observed, for they left trains visible long enough to measure their drift, and thereby the wind direction and velocity at an altitude of approximately 100 miles. This was found in all cases to be from west to east, and about 150 miles per hour.

#### SOLVING ICE BARRIER MYSTERIES

Ever since Captain Ross first sighted the vertical ice Barrier that barred his path to the south, scientific men have puzzled over its existence, and have asked many questions. How thick is the ice? Is the Barrier entirely afloat, as indicated by the deep water around its edge, or is it grounded? If the ice is grounded, do any of the rock anchorages extend above the level of the sea?

What produces the numerous bays, such as the Bay of Whales and Discovery Inlet, and what makes them hold their form year after year when the water at the Barrier's edge is more than 1,000 feet deep? What produces the vast crevassed areas on the Barrier surface at different points?

The geophysical method of seismic soundings used for the first time in Antarctica has gone far toward solving these interesting problems. During the summer months, Dr. Poulter, working from Little America, assisted by Richard Black, the expedition's civil engineer, ran a field party

of his own, traveling some 2,540 miles in actual field operations, making more than 500 soundings, but still using Little America as a base. He traveled mostly by dog team, but 865 miles were flown in the *William Horlick*, which established stations by numerous landings.

Thus for the first time the human race was learning about the thickness of the ice cap that covers the land during an ice age.

The soundings showed that much of the Shelf Ice is grounded, and that the large elevated area to the southeast of Little America is actually a snow-covered island extending above sea level; that the Bay of Whales keeps its shape because the Barrier surrounding it is anchored on rocks—some of the rocks probably being the tops of submerged mountain peaks.

The crevassed areas, and many other unusual features, are a result of the Barrier ice being disturbed by contact with the underlying rock.

We have reason to believe that there has been considerable movement in the ice about the Bay of Whales. This information will be thoroughly brought out from a comparison of vertical mapping photographs taken on both expeditions, which show many of the beacons that were erected for the triangulation of the bay on the first expedition.

Paul Siple, Boy Scout representative on the first expedition, having fortified himself with university training in biology and geology, was made biologist of the second expedition.

We selected Dr. Perkins, biologist of Rutgers University, to devote his research time to the invertebrate life in the Antarctic seas, and Alton Lindsey, of Cornell University, to serve as the ornithologist, taxidermist, and vertebrate zoologist.

#### MOTION PICTURES OF MICROSCOPIC CREATURES

Siple and Sterrett, the latter a young medical student, were astounded to find bacteria growing in snows thought not to hold life at temperatures of 50 and 60 degrees below zero.

Dr. Perkins was keenly interested in the animal life in the waters of the Bay of Whales. He took many samples of plankton with a small silk net. He would bring his almost invisible catch back to Little America, and there under a microscope he would separate these quaint, minute



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**THIS JAGGED CLIFF OF SHELF ICE FORMING THE WEST CAPE OF THE BAY OF WHALES IS THOUGHT TO BE AGROUND**

A preliminary study of the ice soundings made in the vicinity of the cape, at the junction of the cliff cutting across the center of the picture and the water, indicates that the ice rests on submerged mountain peaks rising from the ocean's floor (see illustrations, pages 404, 442, and 443). Each winter, when the Ross Shelf Ice touches the sea, the water freezes against it, forming thinner ice (foreground). When warm weather comes, this ice, already cracked in several places, breaks out and floats to sea in mammoth flat chunks. Later in the season all of the ice in the foreground cleared out, leaving West Cape as a peninsula.



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"YAKE, YAKE!" SHOUTS FINN RONNE TO HIS PANTING DOGS AS THEY PULL THEIR LOAD OVER A KNOLL

In dog driver language "yake" means "go." Begoggled and smiling, Finn guides the sled by its gee pole, which he holds in his right hand. To turn the dogs to the right, he shouts "Gee!" and to call them left, he commands "Haw!" His glasses are heavy and dark to protect his eyes from the brilliant glare of the snow. The driver of the last team uses his feet as brakes to slow the load as it coasts downhill. These sledges are on their way from ship to camp.



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ACROSS THESE RIDGES AND DEEP CREVASSES SUPPLIES WERE HAULED TO LITTLE AMERICA

During the Antarctic summer of 1934 the ice of the Bay of Whales broke out to the pressure ridges, leaving open water on the northern side (to right). The following winter new ice formed, and where this joined the old, it crumpled and made the rough surface. When Amundsen visited the area in 1911-1913, he called the *Fram* nearly to the head of the bay, for then it was clear of ice.

creatures and study their reactions. Each species was photographed while yet alive, both with a still and a movie camera. Even though the creatures must be preserved in chemicals, their action is recorded for future study.

In the spring when the *Bear of Oakland* returned, Earle Perkins and Roos, the expedition's oceanographer, made several large plankton hauls and tows with their dredges, and specimens of almost every phylum of the animal kingdom were brought to the surface and preserved for identification.

#### A SEAL'S BATTLE FOR LIFE

Lindsey made an extensive study of seals. Some of them were found to remain at the

Bay of Whales instead of migrating north in the fall. Imagine these creatures battling through the long night for existence, living constantly in the water, but depending upon air to breathe.

Any opening in the ice that is free for more than a few hours freezes over solidly, and the seal must keep gnawing open a hole through which to breathe. How they must enjoy the return of the sun!

#### WHY POLAR WEATHER IS IMPORTANT

The bottom of the world is the battleground of a sinister ice age in its flood tide, such as thousands of years ago covered most of the top of the world in North America, reaching as far south as Cincinnati and New York.



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BAY ICE CRUMPLES LIKE CORRUGATED CARDBOARD WHERE ARMS OF THE BARRIER SQUEEZE IT

Warped and buckled for miles, this undulating surface of the Bay of Whales, cut by numerous crevasses, is an example of the tremendous pressure exerted by the Ross Shelf Ice as it moves northward toward the sea (see illustrations, pages 404, 440, and 442).

Since the glacial period up north ended, the top of the world has been almost a balmy place compared to the South Pole areas.

Within the five million square miles around the South Pole there is practically no animal life. Within the same area around the North Pole there are year-round residents, such as the musk ox, polar bear, fox, wolf, Arctic hare, reindeer, seal, and walrus.

Down south there is not a blade of grass. Antarctica has few summer visitors and, on its rim, one permanent resident lives—the emperor penguin, and in the sea a few seals.

This ice age affects the air over the earth and the water of the ocean, and these, in turn, affect the lives of millions of people.

Haines, of the U. S. Weather Bureau, was

on his third polar expedition with me as chief meteorologist. He had been with me to the North, and on our first visit to Little America. He was assisted by George Griminger, also loaned to us by the Weather Bureau.

The various parts of the earth are not constructed as air-tight chambers. Air that is chilled by the frigid wastes of the Polar regions flows toward the warmer atmosphere of the Equator, and the warm tropical air rises and circulates back to the frigid zones.

The interaction of these great masses of warm and cold air makes world weather. To establish long-range forecasting, it is necessary to know the conditions existing at the poles, as well as in the inhabited countries.



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#### THE "FLOYD BENNETT" COMES TO LIFE AGAIN AFTER FIVE YEARS "ON ICE"

The snow shovelers are digging tunnels and trenches around the plane so that the mechanics can walk under the wings and around the fuselage and work on the motors. Tarpaulins protected the tunnels from drifting snow (see illustration, page 447). The *Bennett*, named for Admiral Byrd's heroic companion on the North Pole flight, was later brought back to the United States.

Therefore, in addition to the routine observations of temperature, pressure, humidity, and the surface wind direction and velocities, Haines and Grimminger spent much time studying the winds far above the camp.

A hydrogen-filled balloon, several sizes larger than the toy variety, was liberated and its ascension was followed through the telescope of a theodolite. Thus it was possible to plot the path of the balloon on a chart that would show the direction and velocity of the wind. One thousand separate runs were made. This was cold work, for the sighting had to be done outside.

#### A SPRING DAY—61 DEGREES BELOW

Our Autogiro was used for upper air observations. Early in the spring on a day when the temperature registered 61 degrees below zero, the aviation unit completed adjusting the rotor blades on this aircraft. It was cold business, but the meteorologists

and the pilot, William McCormick, were eager to get the plane into the air, and the aviation crew succeeded.

McCormick carried on the plane complete weather-recording apparatus. For a few thousand feet above the surface, the temperature rose rapidly, and it was often much higher than that on the surface, once as much as 45 degrees higher.

These flights were made successfully for a month. Then on one sad day when McCormick got into the air he found the Autogiro unmanageable. It was impossible for him to land without crashing. As the plane crumpled, his left arm was snapped above the elbow and he became unconscious. An alarmed camp untangled him from the wreckage.

Bill didn't mind the loss of the use of his arm nearly so much as he did the loss of his plane. Later the tail of the Autogiro was found to be full of snow, and thus it had been thrown out of balance. While it lasted



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#### TWO SKIERS ENJOY THE EXPEDITION'S FAVORITE SPORT, PLAYING WITH SEALS

These sleek, fish-eating animals basked in the sun within a mile of camp. A cameraman wanted some "action" shots and tried to force a "fight" between a seal and a man, but never could find an animal pugnacious enough to play its part. Seals, like whales, must breathe. In winter they keep holes open in the ice by gnawing continuously (see text, page 442, and illustration, page 477).

the Autogiro was the object of some good-natured razzing by airplane pilots. Bowlin, especially, referred to it as the "tired wind-mill" and the "galloping merry-go-round."

Once in the fall Bowlin and Bailey went off their course in thick weather and made a forced landing. They anchored their plane, put up a tent, cooked a meal, and waited for some one to find them. It was a long walk home.

I went with McCormick to look for them. Mac, with good luck and an eagle eye, sighted the plane miles from where we expected it to be. When we landed I found them in their sleeping bags. Bowlin poked his head out; then I heard him waking up Bailey. "Well, I'll be damned," he said, "we *would* be rescued by that crazy crate!"

But that "crazy crate" landed many times where none of our planes could have made it.

In spite of the loss of the Autogiro the aerological soundings of the upper air were

continued by special flights and on all the exploration flights by means of an instrument automatically recording temperature, pressure, and humidity.

#### THE TRACTOR UNIT SETS OUT

When we ascertained that tractors could travel at almost any temperature the spring trail preparations were speeded for an early departure. The sun had returned to Little America for a little more than one month when on September 27 a four-man exploration unit set out from our base camp in a Citroën tractor under the leadership of June, with Rawson as navigator. I had discussed the plans for this trip by radio and approved them.

Rawson kept the compass free from the magnetic disturbances of the tractor by lying with his compass on one of the trailer sleds from which all iron had been excluded. By lights on the dashboard inside the cabin of the tractor, Rawson could



blink steering signals to John H. Von der Wall, the driver.

Petersen, radio operator, also rode on the rear sled with Rawson, and, at quarter-mile intervals, registered on the sledge meter, he would jab a little orange flag into the snow to mark the homeward journey. June was to make certain that the trail ahead was free from crevasses and dangers. This was strictly pioneering, for tractors had never made good on the long trails in Antarctica.

The Tractor party had a load of about 3,600 pounds of man food and dog food for the Marie Byrd Land sledging party which was to follow.

The first purpose of the tractor journey was to enable the sledging party to go far afield.

Substantial bases were laid every 35 miles, and a ton of provisions was to be left finally at Mount Grace McKinley, the objective of the tractor, more than 230 miles east of Little America.

Second, it was to pick a suitable airplane landing field in case it should become necessary to use such a field on any of the contemplated eastern flights.

In places the surface became so rough that the party nearly had to abandon part of the 8,500 pound load. Sastrugi, the wind-blown drifts characteristic of the surface after a blizzard, were often 10 feet high and so hard that the tractor continually bounced and clattered, tipping from side to side as it forged over the snow.

The weather was extremely cloudy; the sun shone only two or three times in the course of the trip.

As they progressed farther eastward they began to climb. By the time they reached the location for the depot cache, 173 miles from Little America, theodolite angles on the peaks of the Rockefeller Mountains, visible more than 45 miles away, showed their own position to be considerably above the highest of the peaks, or approximately 3,000 feet.

At 207 miles they were imprisoned by a blizzard that held them for seven days, and it took them more than a day of steady digging to extricate themselves. Under way again, they sighted Mount Grace McKinley. Their estimated altitude by atmospheric pressure was close to 4,500 feet. They had gradually mounted a vast plateau that appeared to be gently rising to the south and to the east.

To the north it fell off quite rapidly in a series of long tongues to Arthur Sulzberger Bay, mapped from the air on the first expedition.

#### NEW PEAKS DISCOVERED

They finally reached their objective and thus were first to set foot upon Mount Grace McKinley.

From the top of the highest peak they saw for the first time peaks that had not been visible from the airplane five years before when the region was first discovered. Rawson took solar and star observations. The latitude of this mountain, the most southerly sighted by the airplane on our flight of December 5, 1929, was found very nearly correct as plotted from the aerial photographs, but was west in longitude of the plotted position.

The tractors had proved their practicability. The discovery of this plateau was surprising. We had photographed Mount Grace McKinley from the air but had not been able to spot the plateau from the photographs.

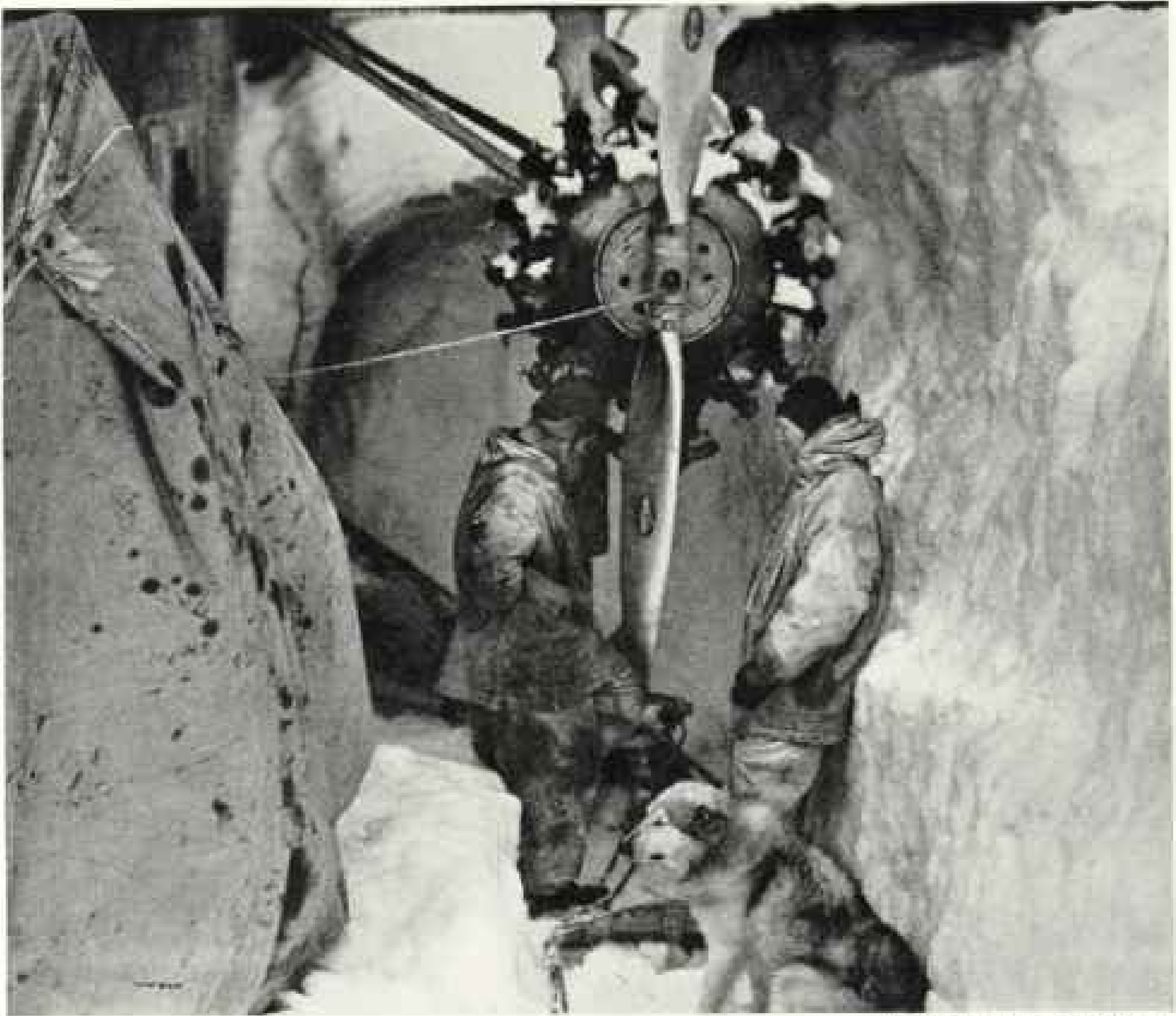
#### PLANTS FOUND IN AREA THOUGHT BARREN

When I flew back to Little America from Advance Station, October 12, I found the Marie Byrd Land party impatient to go. Encouraged by the reports of the tractor observers, they could not resist starting a day ahead of schedule, and on October 14 this first major field unit got under way.

Siple was leader and navigator. Drivers of the three teams were Alton Wade, geologist and radio operator; Stevenson Corey, our supply officer; Olin D. Stancliff, photographer and in general charge of the dogs and transportation equipment.

The first week soft surfaces and heavy loads bogged them down so that, at best, they could make only four or five miles a day. However, after a blizzard that hardened the surface and a radical cut in the weights of their loads, they were able to reach Mount Grace McKinley a day ahead of schedule, which was well, since they had far to go.

This party, with more than six weeks of continuous work in the field, had no time to spare. They studied the region's geology and possible mineralogical value. They established magnetic stations. Daily they radioed weather conditions to Little America.



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A FEW TWISTS OF THE "PROP" AND THE "BENNETT'S" MOTOR STARTED WITH A ROAR

This famous ship in which the Admiral and his men flew to the South Pole was necessarily left on the Ross Shelf Ice, buried in the snow, when the first expedition hastily sailed for home. Here Bill Bowlin and Admiral Byrd (right) examine the plane. Behind Bowlin hangs part of the tarpaulin that kept snow from filling the tunnel (see illustration, page 444).

An abundant series of snow and rock dust samples was taken aseptically for bacteriological study, while more than two dozen different species of lichens and mosses were discovered covering the exposed rock surfaces of the mountains. To their amazement the men found that in some places the plant life was so luxuriant that they actually had to scrape away lichens while following small veins to study the rock structure.

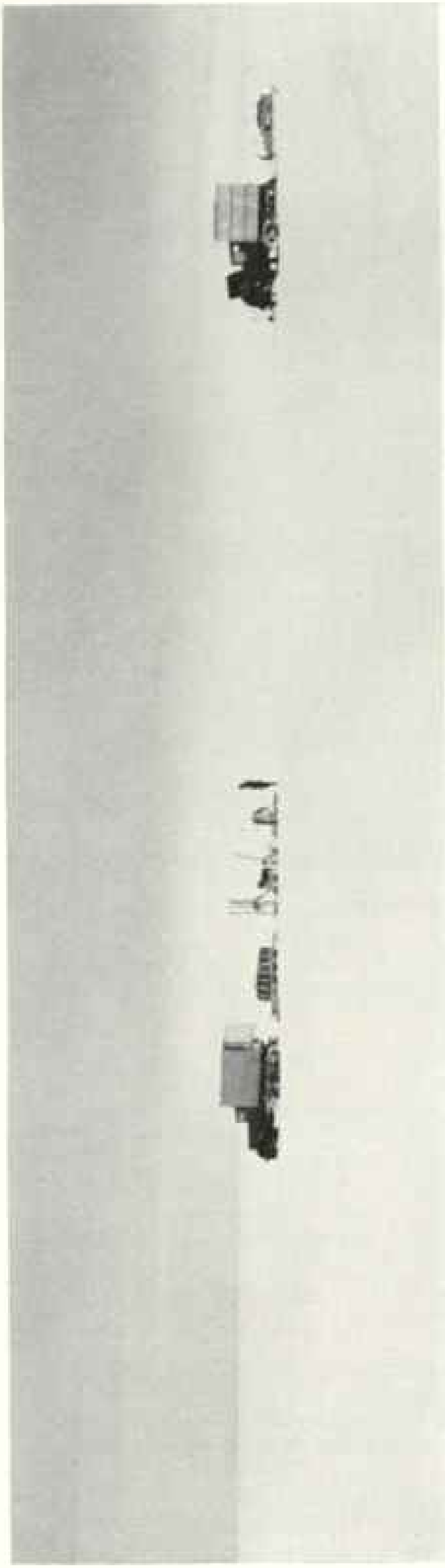
Brilliant splotches of scarlet lichens were daubed like red paint over the rocks. Patches of green, white, gray, and the dominant black conspicuously added a friendly touch to the barren scenery, and gave proof that life has this tremendous power of survival. These small plants are frozen most of the year round with temperatures that range as low as 70 or more degrees below

zero, but still in a few hours of sunlight during a week or so each year their temperature is raised above freezing. In that brief period they grow enough to maintain their hold on the rocks.

Up on the summits of three of the peaks visited were bird rookeries of both the snowy petrel and the skua gulls. This was another surprise. We had not thought rookeries would be so far south.

THE RESURRECTION OF ANTARCTIC LIFE

Occasionally the party found ponds which, though they were frozen at the time, had evidently been pools of water in the recent past, for pieces of algae were imprisoned in the ice. Some of this primitive flora was chipped out, and after it was brought back to Little America and thawed,



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Photograph by Charles G. Morgan

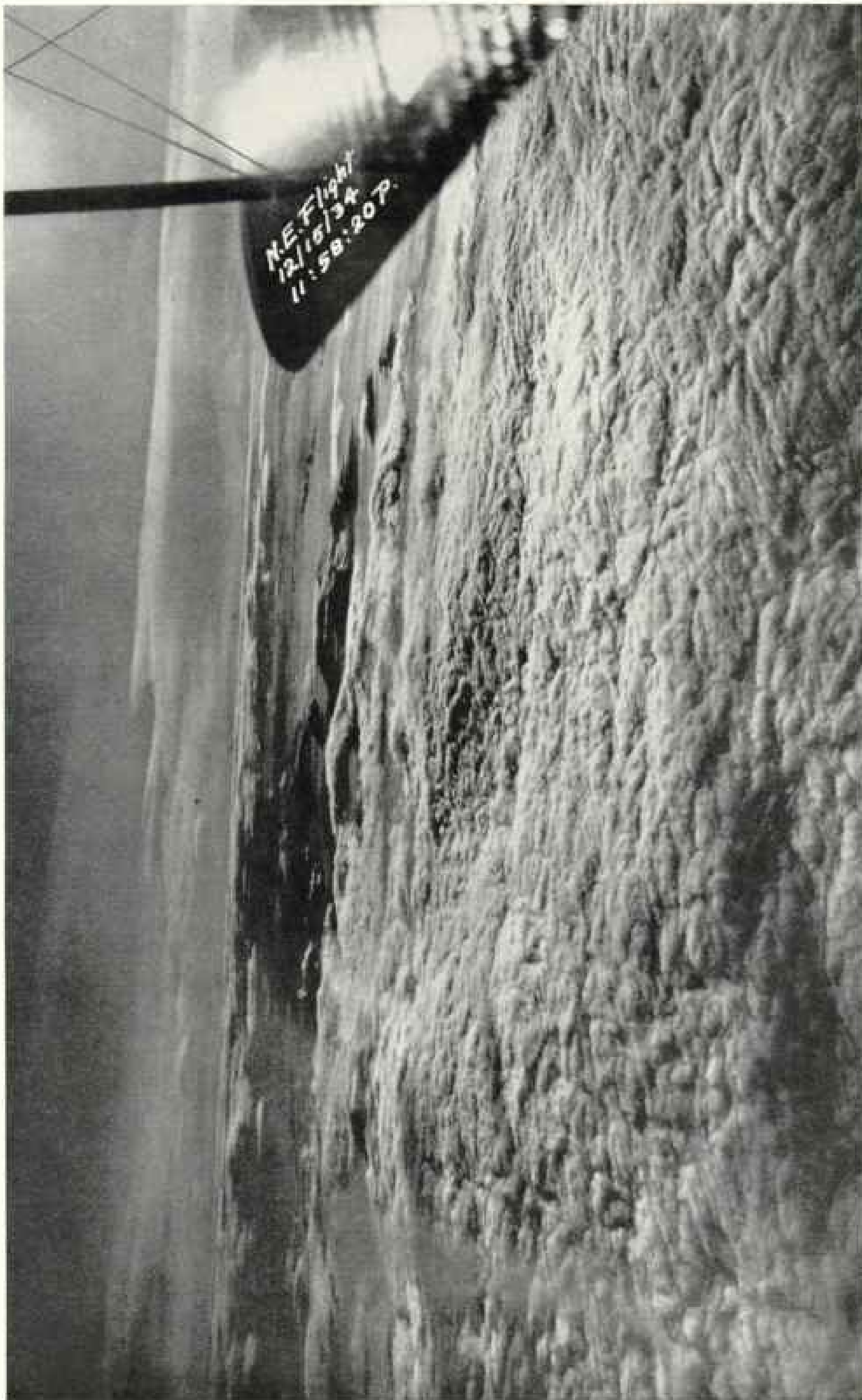
ENGINE TROUBLE HALTS THE PLATEAU PARTY ON THEIR WAY TO AN EASTERN TRAIL

The compass did not function properly aboard the leading car because of the iron motor and parts, so the magnetic needle was mounted on a sledge towed behind. Here a straight course was hard to steer in cloudy weather because snow and sky blended on the horizon and there were no landmarks.



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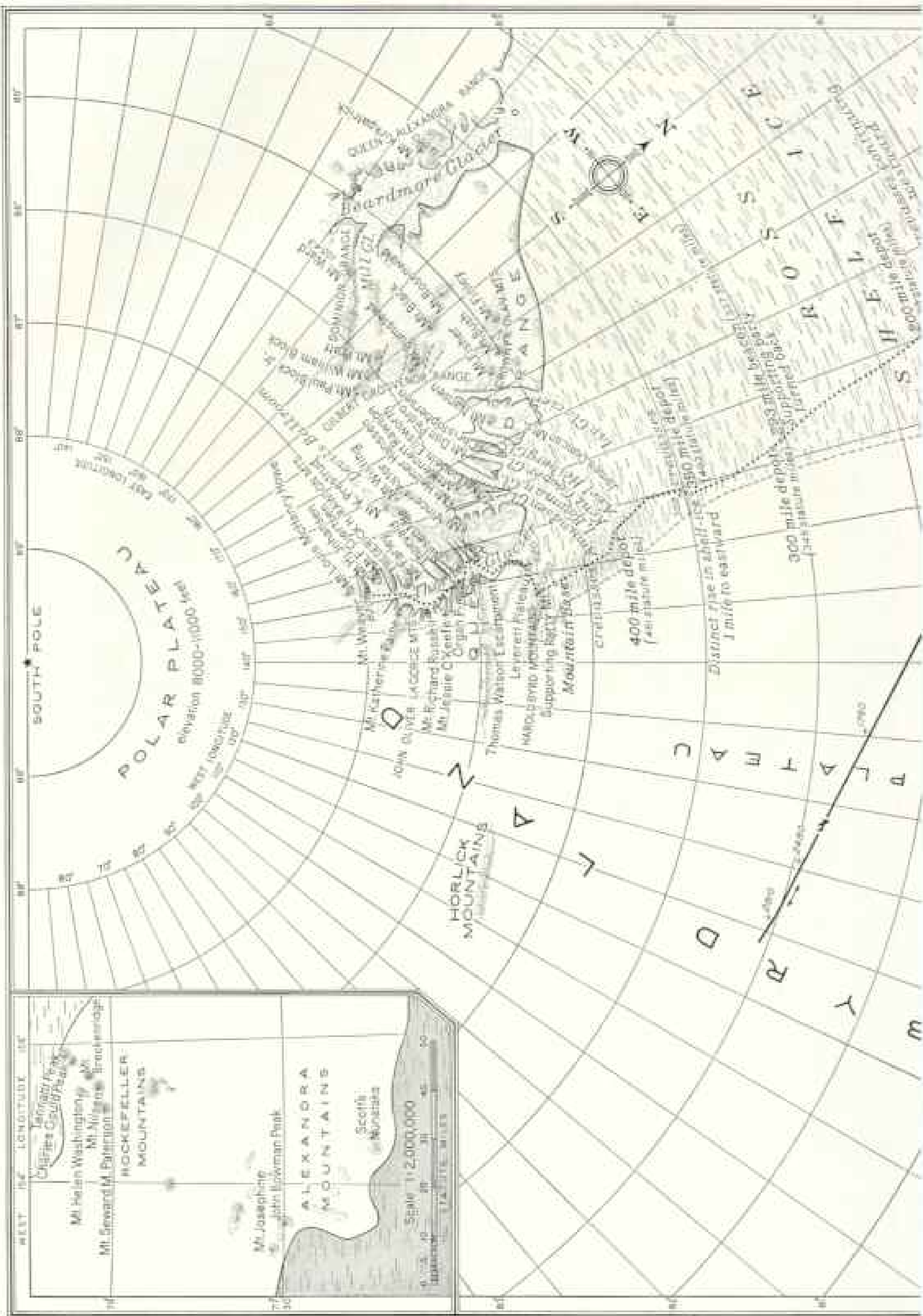
FOR TRANSPORT HOME, THE "FLOYD BENNETT'S" WINGS WERE REMOVED AND TOWED ON SLEDGES FROM CAMP TO SHIP



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BECAUSE SNOW AND SKY BLEND IN A MILKY MASS WHEN FOG ROLLS IN, ANTARCTIC FLYERS DREAD SUCH LOW-LYING CLOUDS.

Here the *William Horlick* flies homeward past the Edsel Ford Range on its longest hop to the northeast, December 15, 1934; as indicated on the wing. When about 200 miles from "home" on another flight, the southwesterly, Harold June noticed cloud formations in all directions. By radio he learned that it was still clear at Little America, so he raced for camp, and arrived just before clouds obscured the landing field.







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THE "WILLIAM HORLICK" CROSSES THE ROCKEFELLER MOUNTAINS ON ITS WAY  
TO MARIE BYRD LAND

Heavy fogs hang over this region in late summer, but by taking advantage of occasional clear days observation flights could be made. This voyage was made on New Year's Day, 1935, Antarctica's midsummer.

the microscope made an astonishing revelation. There, swimming before our eyes, were thousands of microscopic organisms.

They had endured temperatures of 60 and 70 degrees below zero in an encysted stage, only to spring to life again within an hour after they had thawed out, ready to carry on their life functions.

Perhaps some of these tiny creatures were brought to the Antarctic on the plumage and feet of birds. Others may have been blown there with the dust of the upper atmosphere; still others may have existed there for thousands of years. We will try to find out.

Throughout northern Marie Byrd Land the mountains were thrust up along the line of crustal weakness supposed to extend from the Andes of South America along

the Pacific coast of Antarctica to New Zealand. But these rocks do not appear to be of the same composition as the Andes. Apparently the Edsel Ford Range was uplifted at a very early period in the earth's history, and antedates the Andean uplift. Then glaciers eroded the region. At one time the ice sheet covered even the tops of the highest peaks. Traces of minerals were found, including galena, pyrites, and molybdenite.

At the farthest point they visited, Siple and Corey found an extinct volcano badly sculptured away by the ice, but more recent than the surrounding rock structure.

During November the party visited about eighteen different peaks or formations. Siple and Corey struck north and east among the myriads of peaks that appeared



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#### THE SCIENTISTS MEET IN THEIR HALL TO MAP OUT THE RESEARCH PROGRAM

Twenty branches of science were studied on the Second Byrd Antarctic Expedition. Here gather (left to right) John N. Dyer, chief radio engineer; Alton F. Wade, geologist; Richard B. Black, civil engineer; Quin A. Blackburn, geologist; Dr. Ervin H. Bramhall, physicist; Charles G. Morgan, geologist; Dr. Thomas C. Poulter, senior scientist and second in command of the expedition; Arthur A. Zuhn, assistant physicist; Amory H. Waite, Jr., radio engineer; Alton A. Lindsey, taxidermist; Guy Hutcheson, radio engineer; William C. Haines, senior meteorologist; David I. Paige, artist; (standing) Dr. Louis H. Potaka, medical officer; Dr. Earle B. Perkins, zoologist; James M. Sterrett, bacteriologist.

in that direction. Wade and Stancliff, exploring to the north along Saunders Mountain, lost much of their gear and dog food down a crevasse in an upset that nearly cost them their lives. Siple and Corey likewise had crevasse adventures; once it took them more than five hours to extricate all their belongings hanging precipitously in a hole after an ice bridge had broken away beneath their heavy sledge.

On the return journey, the Marie Byrd Land party visited the Rockefeller Mountains of Scott Land where they correlated their work to the east with the recurring granite structures of those mountains.

Here a rookery of snowy petrels was dis-

covered not far from the site of the plane *Virginia*, wrecked on the first expedition. While Siple and his party were in camp, a salvage party from Little America arrived by dog team to bring back the motor from this plane that had crashed there five years before. Duke Dane led the party, while Moody drove a second team, and Paul Swan, of the aviation department, accompanied them to disassemble the motor.

#### TWO FIELD PARTIES HEAD SOUTH

Seventy-seven days after the Marie Byrd Land party left Little America, they returned happy with their valuable scientific notes in this previously unstudied area.





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MC CORMICK, WHO WAS INJURED IN A "CRACK-UP," TALKS WITH HIS MOTHER  
BY RADIO FROM HIS BUNK

The pilot of the Autogiro broke his arm above the elbow when the "tired windmill" met with an accident in landing one windy day (see text, page 444). The regular weekly broadcasts usually originated in the radio shack, but when Bill wanted to talk with his mother, who lives in Lansdowne, Pennsylvania, a wire was stretched to his bed in the Science Building.

On October 16, two days after the Marie Byrd Land party had started eastward, two other major field parties headed to the south.

The Queen Maud Geological party, led by Quin A. Blackburn, a topographer of the first expedition, was to study the geology of the Queen Maud Range near the 150th meridian of longitude in Marie Byrd Land; while the Plateau party, consisting of Pete Demas, Ervin Bramhall, Charles G. Morgan, and Bud Waite, set out for the Polar Plateau with the heavy seismic outfit to measure the thickness of the polar ice cap and also to measure the earth's magnetic field from the same stations.

Dr. Bramhall, physicist, did the magnetic work; Morgan, expedition geologist, the seismic work. These two were co-leaders. Demas had command of tractors and Waite handled the radio (see illustration, page 425). Six dog teams with seven men trailed out over the Shelf Ice to the south, to be gone for nearly three months.

The dog teams were supported by two

tractors that set out on the trail a few days later. These tractors carried the heavy instruments of the Polar Plateau party as well as a great portion of the man food and dog rations. For the first 220 miles all went well, but at this point the crevassed region that caused so much trouble on the first expedition was reached. We had believed that a trail for the tractors lay to the eastward, but after several days of search both east and west, no safe path could be found.

This was a severe blow to our Plateau party, for without the aid of the tractors to a point farther south they could not hope to make the plateau before their dog food gave out.

The only alternative was to divert the Plateau party to the new Marie Byrd Land plateau, which would be nearly as good a field of study as the Polar Plateau.

Finn Ronne and Albert Eilefsen, drivers of the Plateau party's dog teams, were now assigned to support the Geological party, and this new combination pushed on rapidly to the south with heavy loads. Blackburn



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ONE DAY ADMIRAL BYRD WAS IN TOUCH BY RADIO WITH SIX FIELD PARTIES, AN EXPLORING AIRPLANE, TWO DISTANT SHIPS, AND HIS NEW YORK OFFICE

But the familiar smile and manuscript indicate that in this case the Admiral is talking to an invisible audience. The expedition broadcast studio was almost as much traveled as the explorers themselves, for it was kept in operation aboard ship and in New Zealand, transferred to the ice, and then used going home.

was geologist of the party as well as leader, and he had with him Stuart D. Paine, who served as navigator and radio operator, and Richard S. Russell, who had charge of the supplies and the laying of the trail depots.

The three teams were tied together in tandem as a precaution in crossing these hidden pitfalls. About 403 miles out a crevasse bridge, weakened by the crossing of the leading team, gave way as the second one was crossing it. For seven hours these three men struggled with the dangling load. One man was lowered on a rope, the sled was unpacked, and its cargo hoisted piece by piece. The entire load of instruments and precious food was saved, except for about fifty pounds of dog food (see page 464). Several times the party had escapes almost as narrow as this first adventure.

Is there any wonder that the leader of an expedition gets gray hair when he is constantly hearing of such things over the radio from five or six separate parties in the field?

Forty-two days after their start from Little America, the Geological party reached

their base at the foot of the Queen Maud Range, where they cached food and supplies for their return journey.

#### FACING SOME OF THE WORLD'S BITTEREST WINDS

This outward journey had been made in the face of some of the bitterest winds in the world. Because of close proximity to the later-discovered plateau, to the east, they were apparently caught in the draught of cold air flowing from higher altitudes onto the Ross Shelf Ice. Sometimes the velocity of the wind reached more than fifty miles an hour, and many of their days were torture.

They first encountered rock at Supporting Party Mountain. It was a dramatic moment for them when they found the cairn and note left on the summit by the Geological party of our first expedition. A second ascent was made the following day to complete the survey work.

I quote from Blackburn's trail diary: "A faceted pebble found on the summit



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EMERGENCY PROVISIONS GO ABOARD THE "HORLICK" FOR A FLIGHT OVER  
UNKNOWN TERRITORY

During the flying season, the plane carried sufficient supplies to last the crew two months in case of a forced landing far from Little America. The equipment consisted of rations, tents, "man-hauling" sledges, sleeping bags, clothing, skis, and navigating instruments. Every article put in the plane was carefully weighed to be sure the load was within the limit.

and other faceted and striated ones not far below indicate the entire peak was once over-ridden by the ice. Lichens were also found on the summit."

Turning westward they crossed the icy mouth of the Leverett Plateau and reached the east portal of the Thorne Glacier, a run of 23 miles, where they began its ascent.

CREVASSES WHICH COULD SWALLOW AN  
OCEAN LINER

Marching steadily southward they rose approximately a thousand feet a day, the first half of the climb being over cracked and rippled blue ice. Several times they attempted to cross to the west side of the glacier, but each time the chaotic maze of pressure ridges and crevasses which runs the entire length of the Thorne balked them.

In one spot they threaded their way along narrow ice ridges which fell away to bottomless pits on either side. These pits were crevasses on a gigantic scale, resulting from a constriction in the glacial channel. A New York office building could have been quite easily dumped into one of these

chasms with enough room for a good-sized ocean liner.

This upheaval was a singularly impressive sight, an exhibition of the ponderous forces at work everywhere in the Antarctic. The recent glacial periods in North America must have displayed something of the same grandeur and awfulness now found here at the bottom of the world.

Eight days after leaving the Ross Shelf Ice, the party halted at an elevation of 6,100 feet in 86° 58' S.—210 miles from the Pole. Close by was a mountain, which displayed on its northwesterly face horizontal beds of sedimentary rock. These sediments ran practically from the level of the camp to the summit. Here was ample reward for a geologist.

WHEN A SOUTH POLE SUBURB WAS  
SEMITROPICAL

In the moraines they passed many hours picking over the fragments tumbled from the mountainside. Invariably these finds included plant fossils, leaf and stem impressions, coal, and fossilized wood.



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PETERSEN, CAMERAMAN AND RADIO OPERATOR, SELECTS THE EVENING'S FEATURE

"Movies" were screened three times a week. After the expedition's 97 complete films had been shown once, they were run through again and again. The film storehouse was a cave dug in the ice near the new mess hall and stacked boxes of film formed its walls.

Here, at the most southern known mountain in the world (except several half-submerged ridges a few miles to the south), scarcely 200 miles from the South Pole, was found conclusive evidence that the climate in Antarctica was once temperate or even subtropical.

This party had experienced hard going for 690 miles, but when they found some fossilized tree trunks that alone repaid them for their arduous struggle.

The temperatures while the party was at this mountain rose not more than five degrees above zero, Fahrenheit, and that at the height of midsummer! What low temperatures, probably a hundred below zero or even lower, must be experienced during the middle of the winter night!

For three days they encamped there, waiting for the wind to subside. But not once did it let up. With the persistence of a trade wind it swept out of the southeast, cold and frigid, hampering the geological work and making a venture outside the tent miserable. Finally, despairing of a lull, they donned furs and their heaviest clothing and began the ascent of the mountain. Gradually, as they neared the top, the wind

decreased until on the summit, at approximately 8,200 feet above sea level, it was quite calm.

Below them they could see the drift streaming around the mountainside and around their camp. The summit was evidently above the down-draught from the interior. To the south lay several almost submerged ridges, and, beyond, nothing but flat, dreary snow stretching onward to the Pole and farther. To the east and west no mountains were visible. They were well to the north.

And far away, reflecting the golden beams of the afternoon sun, was the Devil's Ballroom, described by Amundsen on his polar journey. Needless to say, there was an urge to go on to the Pole itself, which they could have done had they prepared for it. But their work lay in the mountains which, scientifically, were more important than reaching the Pole.

On the return to camp, Blackburn made a geological cross section of the sediments, a task of great value. While retracing their way down the glacier, they made contacts with mountains at 14 different locations, giving an excellent knowledge of the geo-



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A DOG TEAM WEAVES ITS WAY THROUGH TREACHEROUS PRESSURE RIDGES AND CREVASSES ALONG THE TRAIL FROM SHIP TO CAMP

logical structure of the Thorne Glacier region. Fourteen triangulation stations were established to survey and map.

#### PLANT LIFE'S FARTHEST SOUTH

Just south of latitude 86 degrees the men came upon the most southerly recorded plant life, tiny primitive lichens growing on the northern exposure of a mountain. Farther north, near the foot of the glacier, large quantities were found. But here at 86 was the most southern permanent life in the world, so far as is known.

Growing only when the temperature rises to the melting point, it completes its life span under the most rigorous circumstances. For only a week or so in mid-summer at this latitude is the sun warm enough to melt the snow.

Life is so difficult and the environment so hostile that they grow no larger than the head of a small pin. Without a glass it is almost impossible to make out the individual plants.

#### A "GLACIER" PROVES TO BE A PLATEAU

Back at the portal of the Thorne, after 23 days on the glacier, the party climbed a mountain close by and made the interest-

ing discovery that the Leverett is not a glacier, but a vast plateau which stretches eastward to the horizon, broken only by a few ice-ridden hills and ridges, and southward to the base of the Polar Plateau escarpment. They also discerned that the escarpment swung slightly northward, decreasing in height and probably merging with this newly discovered plateau farther to the east.

Returning to the mountain base, the party picked up supplies cached there on the outward way, and with 450 pounds of precious geological specimens, notes, and scientific data they set out for Little America, 528 miles away. Without any extra effort they made the journey in 19 days, three of which were spent in camp. This makes their daily average nearly 33 miles for each traveling day, or about  $27\frac{1}{2}$  miles per day for the entire trip.

The work and plodding of the faithful husky dogs made the trip possible. Paine had a leader, a large black and white Labrador, whose performance was equivalent to that of another man. Throughout the entire trip, save for approximately a hundred miles, he led the way without a man skiing ahead.



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Photograph by Charles G. Morgan

SNOW EDDIES, WHIRLING ABOUT BRAMHALL'S TENT, KEPT DRIFTS FROM SMOTHERING IT DURING A BLIZZARD ON MARIE BYRD LAND PLATEAU

Never before has a major field party gone south with a dog breaking the trail. Jack the Giant Killer also picked the way through many crevassed areas and followed a compass course without swerving. Dogs still are the infantry of polar exploration.

The party returned in superb physical condition, after traveling more than 1,380 miles by dog team.

#### RADIO'S PART IN THE EXPEDITION

In the Antarctic there are no telegraph lines, no ship or train or air mail, no telephone system. There, in the field of communication, radio is supreme.

By taking full advantage of it, we gave safety insurance to the field parties that warranted my letting them go farther afield than I should have considered otherwise.

One day in the spring at the height of our activities I was able to supervise (though I rarely exercised this supervision) six units doing field work, an airplane in flight mapping distant mountains, my two ships, the *Bear* and *Ruppert* to the northward, and my office in New York City. The Geological unit was more than 690 miles from us by trail and the Marie Byrd Land party more than 460.

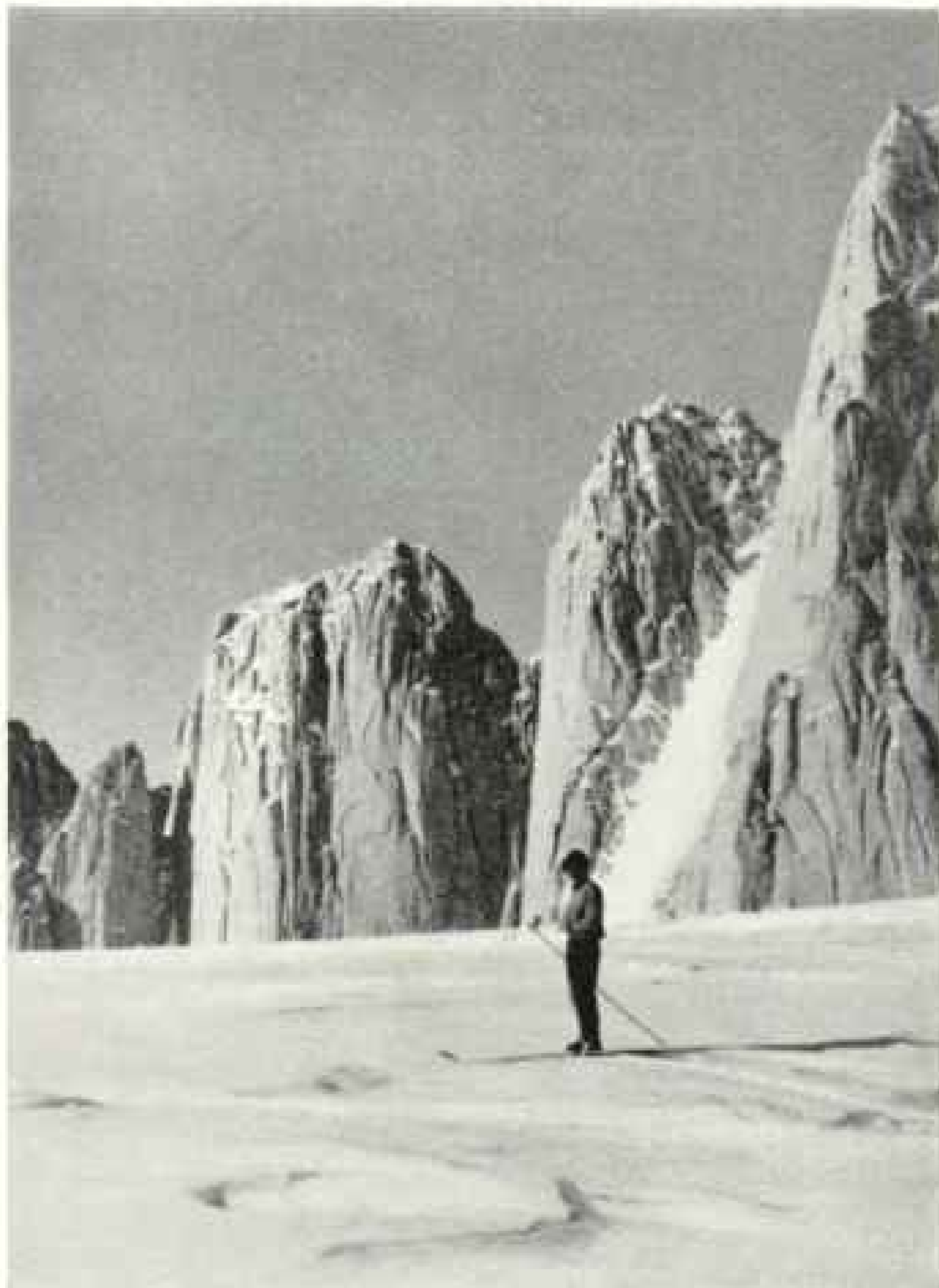
Twice while exploring from the air in the *William Horlick I* received a query from a trail party and radioed back instructions. This is an eloquent testimonial to the work done by John Dyer, chief radio engineer in charge of communications, and his assistants, Guy Hutcheson and Bud Waite, and communications operator Clay Bailey.

While Bailey handled radio communication with the States, Dyer, assisted by all the other radio personnel, was responsible for the engineering of the radio broadcasts.

Murphy, who also wrote all the expedition news dispatches, was in charge of the broadcasts and planned the programs.

Ours was a very much-traveled broadcast studio. First, on the *Jacob Ruppert* it crossed the Pacific Ocean to New Zealand. It was still on the *Ruppert* during her adventures in the unknown seas, and it came finally to rest in a small shack under the snows of Little America.

Broadcasting would have been easier had the hardy explorers been as courageous in front of the microphone as they were in the presence of danger. Knees often shook and voices stammered. There was not among



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Photograph by Richard S. Russell, Jr.

#### "ORGAN PIPES" TOWER ABOVE THE MIGHTY THORNE GLACIER

These mountains along the vast ice river were reddish, gray, and brown. Paine was navigator of this Queen Maud Geological party, which sledged up the ice to the southernmost mountain, the farthest point south reached by the expedition. The men explored new lands, for no one had previously taken this route.

us a single actor, nor did I select my men for their singing or other musical ability.

We simply tried to tell of adventure in the making, and we are grateful to the millions who listened in. Through the NATIONAL GEOGRAPHIC MAGAZINE I wish to thank each one of the listeners for their patience and interest in our undertaking.

#### ANXIOUS MOMENTS WITH THE TRACTORS

The original Plateau party had consisted of four men, each with a nine-dog team. Their plans had been frustrated, however, by the inability of the tractors supporting them to negotiate the crevassed region 184

miles south of Little America.

Men on skis, dog teams, and airplanes searched in vain for a possible gateway through the honey-combed pitfalls. Charles G. Morgan and Dr. Ervin Bramhall, co-leaders of the Plateau party, added their teams to the Geological party. They then joined Pete Demas and Joe Hill, the drivers of the tractors, who were accompanied by Bud Waite, the radio operator for the unit.

It was still hoped that the Tractor party might be able to work farther south than the crevassed region that had barred its path. The tractors turned east from the 173-mile beacon with the hope of escaping the omnipresent crevasses, but their story of the entire summer journey is a continuous nightmare of crevasse pitfalls.

The jarring vibration of the heavy machines shook open crevasses in country that appeared to be entirely free of these lurking dangers. Usually

the crevasses opened by tractors were not more than two or three feet wide, so despite these breath-taking moments the party continued toward the plateau to the east.

On November 10, suddenly the leading tractor lurched backward, sinking into the square shoulders of a crevasse until the skis and engine were higher than the cab.

Tons of snow broken from the crevasse roof resounded with a swishing roar as it rushed into the depths below. And for a minute that seemed as long as eternity the tractor quivered and shook until wedged between the yawning walls.

Bramhall had been standing on the side of the tractor, giving compass directions to Demas, the driver, and he yielded to his first impulse to jump clear; but Demas was captive in the cab, scarcely daring to breathe for fear a slight movement would send the heavy machine tumbling to the bottomless depth below. The second tractor halted so that its vibration would not add to the danger.

As soon as they were able to help Demas out of the machine, they set to work constructing a runway to haul the suspended tractor to safety by the second machine. They cut snow out beneath the front skis until the machine settled to a more even keel, and then pulled it out with tractor No. 2, which was able to get around the end of the crevasse.

Despite the constant danger, there was no neglect of their scientific investigation. The party had climbed to an elevation of 1,900 feet on the plateau to the east, and at stations averaging not more than 29 miles apart, both Morgan and Bramhall carried out their full program, which took nearly 24 hours at each station.

#### MAP MAKING WITH THE AID OF DYNAMITE

Morgan was measuring the thickness of the snow and ice beneath them. He would set off a charge of dynamite on the surface, which started a vibration that reflected from the underlying strata of rocks and was photographed by an amplifying recording device through sensitive Geophones. He will be able, when his data are worked up, to plot the contour of the land beneath, irrespective of the great depth of ice overlying it.

In the meantime, Bramhall, after establishing his position by sun observations, would run a series of magnetic observations so intricate that they required hours of continuous instrumental readings.

Several times the party was delayed for days, searching for a safe passage through a labyrinth of ice fractures.

One tractor had to be abandoned after a burst of speed across a precarious crevasse.

They came into the 150-mile depot, on the eastern trail, December 16, with a sigh of relief that they were once more on a known route, free of danger. Here, as stated, they had a happy rendezvous with Siple's party, which had been standing by

to assist them had they been unable to get past those last crevasses.

The tractor took Wade's heavy rock specimens to haul home and, after many trials, on January 2 it roared into Little America despite a heavy fog. As with the other parties, all hands were in fine physical condition.

In two months and a half they had traveled more than 920 miles.

#### THE FLYING SEASON OPENS

When all the field parties had left, we were free to concentrate our efforts on starting the exploration flights. Only from the air could we solve our most important geographical problems.

We had already made frontal attacks on the eastern coast line from the seaward side, and now we determined to supplement these by flank attacks from Little America. Overshadowing this problem in importance, however, was the so-called continental problem—whether Antarctica was one continent or two.

So little of the coast line of the Pacific Ocean and Weddell Sea, and of the interior region between them, was known that geographers for many years have been speculating on this problem. Some geologists studying the rocks from East and West Antarctica felt that they were too dissimilar for the two regions to be united. Others reached the opposite conclusion. Some tidal experts felt that the behavior of the tides in the Ross Sea indicated a sea connection. This view was supported by the great indentations of the Ross and Weddell Seas with their water-borne ice barriers extending toward each other through the unknown interior.

Until this problem was solved, geological science could form no concept of the fundamental structure of this great area, and its relationship to the neighboring land masses to the north.

Related to both these problems was the question of the Edsel Ford Range.

Did this range join the Queen Maud Range to the south? Did it die out, or did it follow the coast to Hearst Land and Graham Land? These questions we hoped to answer in some measure by a series of flights to strategic points.

Exploring from the air has always been my deepest interest. What should I do now? I was still in bad condition from my Advance Station experience and Dr. Potaka





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#### THE GEOLOGISTS RETURN TO CAMP WITH 450 POUNDS OF PRECIOUS ROCK

This Queen Maud Range group left Little America October 16, 1934, headed south, and was joined later by the Plateau party that started on the same day. About 403 miles out, a snow bridge hiding a crevasse weakened when the first sled crossed it, gave way beneath the second load. After a seven-hour struggle the men saved the dangling sled (see page 454). Russell (left), in charge of supplies, Blackburn, leader, and Paine, navigator and radio operator, made the trip without serious mishap.

had told me not to take any long flights. Besides, was it proper for me to fly when, should we have a forced landing far from Little America, I should be a drag on my companions when they would start walking back?

#### THE FIRST CHANCE FOR FLIGHT

Good flying weather in the Antarctic is very rare. Seizing our first chance, we launched the opening flight November 15. Rightly or wrongly, I went on this flight. Our course followed the sides of a triangle. One vertex of the triangle rested on Little America. The apex was approximately midway between the coast of Marie Byrd Land and the Queen Maud Range, while the third vertex lay in the southern mountains of the Edsel Ford Range (see map, pages 450-451).

The course recommended itself for these reasons: It would strike at the heart of the white space holding the fate of the supposed strait; it would determine the trend of the plateau previously discovered by the Tractor party; it would give some indication

whether Marie Byrd Land is an archipelago, a distinct continental mass, or a part of the Antarctic continent; and, finally, it would bring the base line of this flight track within the limit of vision of the pioneer eastern flight of December 5, 1929.

The flight crew comprised chief pilot June, co-pilot Bowlin, navigator Rawson, radio operator Bailey, and me. Leaving Little America, we first ran down the southeastern leg of the triangle to the apex. From this position our Queen Maud Geological party was to the southward, the Tractor party was to the westward, and Siple's party to the north.

At this point, where the belt of crevasses traversing the 81st parallel slithered off to form a curiously arrested white whirlpool at what appeared to be the foot of the plateau, we found a definite depression. We sounded the elevation with the plane's altimeter—a trick we later used to excellent advantage—and found it to be only between 400 and 500 feet above sea level, nearly 4,000 feet below the highest known elevation of the plateau.



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Photograph by Richard S. Russell, Jr.

## BREAKFAST AT AN OVERNIGHT CAMP ON THE THORNE GLACIER

During the idle hours of the long winter night members of the expedition put up the rations for the sledging and tractor parties that were to go out into the field as soon as the sun returned. Each ration contained just the right food for one man's meal and consisted principally of carefully measured portions of pemmican, oatmeal, powdered milk, butter, chocolate, tea, bacon, dehydrated spinach, and lemon powder. Paine and Blackburn here seem to enjoy their dishes of pemmican which they took, frozen, from the bag in front, and boiled with water in the cooker over the kerosene stove. They could melt snow in this outfit and bring the water to a boil in less than ten minutes.

From what we had seen, there was reason to believe that if the transcontinental strait did exist, it must lie there. I was inclined to think that it did exist. June and Rawson were of the opinion that it probably did not exist. We were getting at the heart of this matter, but we should have to do some more flying to determine the final answer.

When we turned north, the snow surface soon began to rise and we found ourselves on a gradually ascending plateau. As we continued north, we found that this was part of the plateau discovered by the Tractor party.

We hit the Edsel Ford Range a little to the east of Mount Grace McKinley. To the left was Arthur Sulzberger Bay and ahead was Mount Iphigene. Sulzberger Bay we found to be far larger than we had thought.

We were now above the Edsel Ford Range at an altitude of 11,000 feet. We were struck by the massing of peaks to the north-

east. It was as if a giant hand had strewn them there like so many pebbles. They streamed eastward as far as we could see.

## AN AMAZING MOUNTAIN DISCOVERY

I was amazed, and in that moment I realized that I might have to change my whole conception of that area. We had thought that the Edsel Ford Range ran north and south. We had seen it and photographed it from the northwest. But our eyes had betrayed us. It now looked as if the range ran east and west and possibly connected with the mountains of Graham Land, which, in turn, are thought to be a continuation of the great Andean range.

If this were correct, then what we had discovered and photographed on our first expedition was a cross section of the range. In other words, we had seen the mountain range from its end and not along its length. Now we should have to make a flight to the eastward to check this trend.



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Photograph by Charles G. Morgan

#### A SCIENTIST MEASURES THE THICKNESS OF THE SHELF ICE BY DYNAMITE

Small charges, buried several feet, were set off and the time for the sound of the explosion to descend to the bottom and echo back to the observers was recorded by this seismographic instrument. From these figures the depth of the ice was calculated. Previously the expedition had experimented and determined the speed of sound through the Shelf Ice. The depths of the water beneath the ice could also be found in this way. When the sound of the detonation reached the bottom of floating ice, a faint echo would be reflected from the water and then a second noise when it rebounded from the ocean bottom. In some places only one echo would be heard, in which case the Shelf Ice was aground on shoals or resting on islands that protruded above sea level.



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Photograph by Richard S. Russell, Jr.

#### LOOKING UP FROM 75 FEET DOWN A CREVASSE!

On the southern trail near the 350-mile depot (403 statute miles) this sledge broke through a snow "bridge" and fell down the deep fissure. Fortunately, the dogs had already crossed and were able to keep the sledge from falling. A man was lowered by a rope to salvage the equipment (see page 455).

On all my flights of exploration up to this one, I had done the navigating. On this flight I gave the job to Rawson. I found him competent and cool, and navigating a fast-moving plane is not easy where time changes quickly and the magnetic compass is not dependable. I knew I could depend on Rawson. Also June would do well as flight commander, so I decided not to make the next flight. In spite of my bad physical condition, it was not easy to stay back.

To make the next flight on November 18 I dispatched a flying crew consisting, in addition to Rawson and June, of Bowlin, copilot, Petersen, radio operator, and Pelter, mapping cameraman. They were to fly direct to Mount Grace McKinley and then due eastward to trace the Edsel Ford Range as far as gasoline supply and weather would permit. At 4:56 p. m. the *William Horlick* was over Mount Grace McKinley.

Every 15 minutes Rawson flashed back position reports to Little America, and on a big map in the radio shack we followed the track of the plane. At 7 o'clock they radioed that the plateau extended unbrokenly in all directions. It had risen to an altitude of 4,300 feet, as indicated by the altimeter while skimming the surface. They also reported that a large new mountain bearing slightly north of east had been sighted on the horizon.

But a heavy cloud bank was rolling in from the north and east and they had to turn back. They reported after their landing that east from Mount Grace McKinley the mountains back of the western face of



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#### THE SHIP'S DOCTOR MAKES FRIENDS WITH AN ADÉLIE.

When the *Bear of Oakland* arrived at Little America to take the expedition home, a flock of the little penguins waddled along the ice edge to investigate. These birds, in contrast to their larger cousins, the "emperors," who reside in Antarctica, are found here only during the summer, but they move north in winter (see illustration, page 415). Dr. Highet, petting this little fellow, wears a fur-fringed parka.

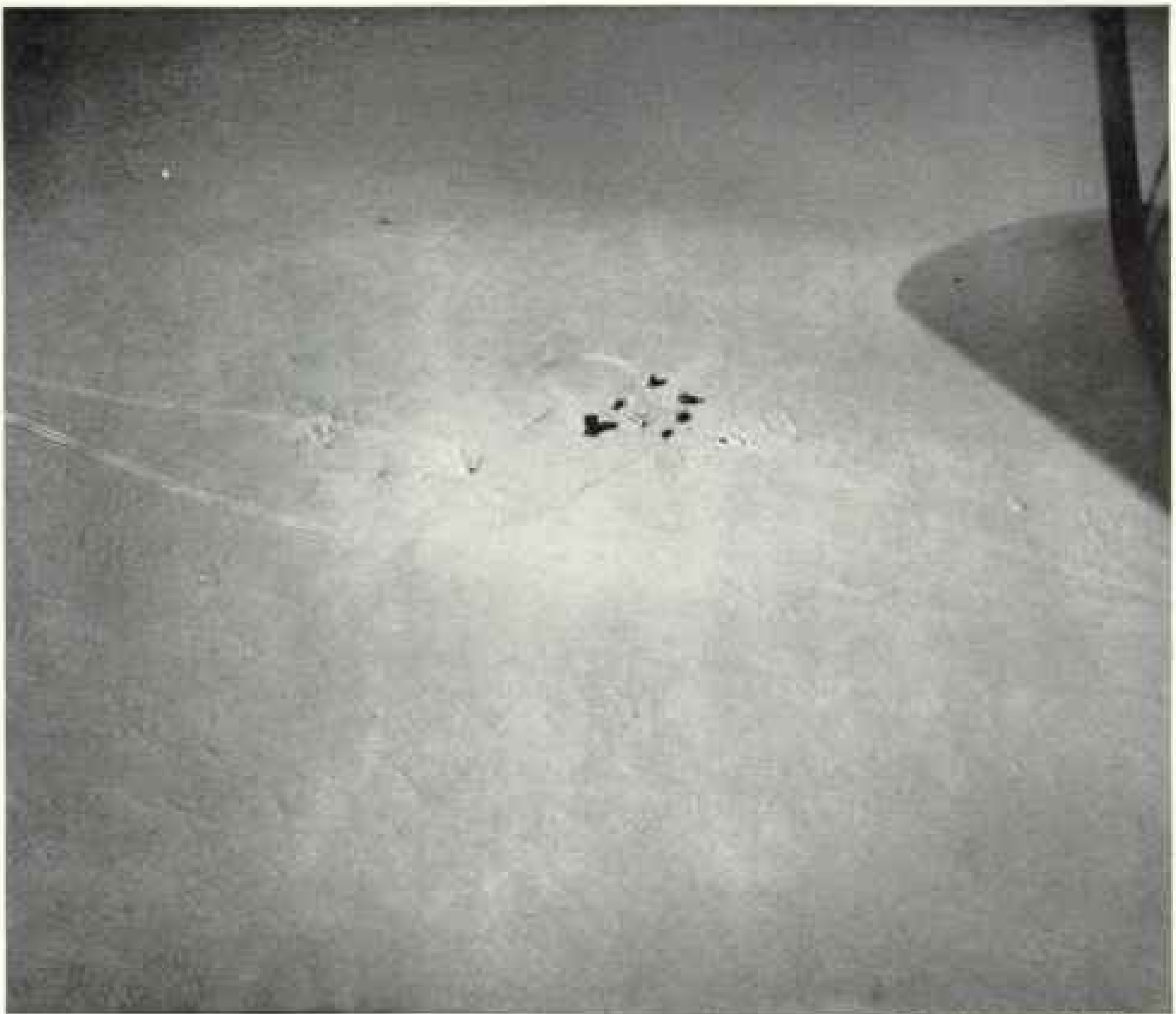
the range narrowed down into a single line heading slightly northeast at first and then gradually bending more easterly and then slightly southeastward.

Beyond this line of peaks to the north they could see dark water sky, indicating that the coast line parallels in general the axis of the mountains.

#### THE QUESTION OF THE STRAIT

But the question of that depression we discovered at the apex of the triangle still remained. Did it mean the existence of the strait?

On November 19 Blackburn's Geological party, penetrating unknown areas 432 miles



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THE TRACTOR PARTY APPEARED AS MERE CRUMBS ON A TABLECLOTH, YET THE  
"HORLICK" NEVER MISSED ITS "DATE"

Here the Morgan-Bramhall caravan is encamped on the icy wastes of the Marie Byrd Land plateau. The cruising airplane was always able to locate exploring parties by careful navigation with the Bumstead sun-compass, based on positions sent in by radio. The use of tractors was experimental on this expedition, but it was astonishing the way they stood up under the rough going of icy trails (see pages 425, 445). The *Horlick* twice went out to reconnoiter a route around crevassed areas, and on November 23 landed at the tractor camp and took up several members of the Tractor unit to get a bird's-eye view.

south-southeast of Little America, flashed us an important hint by radio—the sighting of what appeared to be high land to the east of them. This indicated a plateau where I had doubted its existence. It was a point in disproof of my theory, so I determined to hasten the flight that we contemplated to the eastward of Blackburn's party.

Weather held up flight operations for a while, but on November 22, June, Smith, pilot, Rawson, Pelter, and Bailey, with June in command, took off on a 1,110-mile journey which carried them ultimately to latitude 83.05 S., longitude 119 W.

As they turned, Smith discovered in the vicinity of latitude 85 between the 110th

and 115th meridians a cluster of ice-ridden peaks, presumably eastern prolongations of the Queen Maud Range, approximately 195 miles east of the longitude of the last known peaks of that range. June and Rawson also examined the mountains. It was indeed a lucky find, since it extended the Queen Maud Range nearly two hundred miles farther east than it had previously been observed.

The flight also afforded an excellent illustration of the perils of flying in the Antarctic. On their return trip, about 230 miles from Little America, June noticed a great mass of low-lying clouds extending as far as the eye could reach in every direction. We



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ALFALFA AND FEED FOR THE "DAIRY HERD" WERE STORED IN THIS ICY "LOFT"

Here the men dig out the left-over supply, which they took back with them when the expedition left Little America. Edgar Cox, leaning over the sack, had charge of the dairy.

advised him by radio that it was still clear at Little America, but that there appeared to be a bank of cloud on the southern horizon.

As is well known, when it becomes overcast there, snow and sky blend together, and the whole region takes on the aspect of a sea of milk. It is impossible to distinguish the surface from the sky, much less to pick out a good place to land.

June opened up the motors, and they settled down to a race with the clouds. Already long arms of vapor were reaching toward the sea on each side of Little America when the plane popped over the northern wall of the bank and came in to land. A few minutes later Little America was so enveloped in clouds that it was impossible even to make out the abrupt rise of the Barrier cliff from our valley a few hundred yards back of the camp. Again radio was used to advantage.

Now as to what this flight brought out regarding the problem of the strait to the Weddell Sea.

A few miles southwest of the depression we had observed on the flight of the 15th, the crew found a plateau rising to a considerable altitude and rolling unbrokenly to the point where the new peaks were sighted.

This proved that the only place there could be a strait to the Weddell Sea from the Ross Sea was the depression we had found on our first flight. Was this depression only a bight or bay of the Ross Shelf Ice on the western margin of the plateau? Would deeper penetration prove that these plateaus were one? At all events the fate of the transcontinental strait now lay in this forty- or fifty-mile gap between the 81st and 82d parallels east of the 147th meridian. This would mean another flight to that gap.



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Photograph by E. H. Bramhall

#### HERE, OLD-FASHIONED AND MODERN METHODS OF ANTARCTIC TRAVEL MEET

The Morgan-Bramhall Tractor party found the crevasses in the ice impassable when they were striving to reach the Queen Maud Range. They were obliged to turn east and then north, abandoning one of the cars on the way. On December 16, 1934, they met Siple's dog-sledging group at the 150-mile depot after two months in the field. The huskies and explorers returned to Little America hale and hearty after plodding 870 miles along the Edsel Ford Range to Balchen Valley (see text, page 454, and map, pages 450-1).



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#### THEY FOUND PLANTS GROWING ON THE BLEAK MOUNTAINS OF MARIE BYRD LAND

"To their amazement, the men found that in some places the plant life was so luxuriant that they actually had to scrape away lichens while following small veins to study the rock structure. Brilliant splotches of scarlet lichens were daubed like red paint over the rocks" (see text, page 447). Wade, Siple, Corey, and Stanciff (left to right) composed the eastern party that left camp October 14, 1934, to study the region's geology and mineral content. On this sledging trip rookeries of the snowy petrel and skua gulls were also found.



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#### NO LONGER IS THIS MOUNTAIN A BLANK SPOT ON THE ANTARCTIC MAP

Members of the first Byrd expedition to Little America discovered Mount Grace McKinley from 100 miles off on December 5, 1929, while aboard the *Floyd Bennett*. On the second expedition the Tractor party, consisting of June, Rawson, Von der Wall, and Petersen, first reached and climbed it, October 11, 1934. The *William Horlick* used it as a control point for the aerial surveys of Marie Byrd Land. The mountain was named for the wife of Captain Ashley McKinley (see pages 407 and 446).

On November 23, with June, Bowlin, Rawson, and Petersen, I took off in the *William Horlick* to close the gap. Again I fear I gave Dr. Potaka some concern.

Just south of the apex of the triangular course of the flight of November 15, where we had found the depression, we headed east, sounding the ice elevation by altimeter by coming down to within a few feet of the snow surface. We made a number of these soundings.

When we turned north at Long. 140 W., Lat. 81.10 S., we found that the surface under us had risen to over a thousand feet. To the south and east the plateau extended unbrokenly and rising in altitude. On the return west we sounded the northern border of the area and found that the elevation was uniformly 1,000 feet or higher. Our flight of the 15th had already proved that to the northward the plateau rose in altitude to the Edsel Ford Range.

The results were conclusive. The long-sought strait was nonexistent. Correlating our flight data with the Geological party's discovery that the Leverett is a plateau, we can now say that the plateau of Marie Byrd Land probably rolls unbrokenly from the South Pacific Ocean to that geographical point we call the South Pole. It extends at least 1,000 miles north and south and probably many hundreds of miles farther.

Antarctica, then, is one continent!

#### RENEWED ATTACK ON COAST LINE

With the transcontinental passage eliminated, we devoted our few remaining weeks of the flying season to continuing our attacks on the coast line. Unfortunately, this area seems to be one of the cloudiest in the whole of Antarctica. Every attempt we made was defeated.

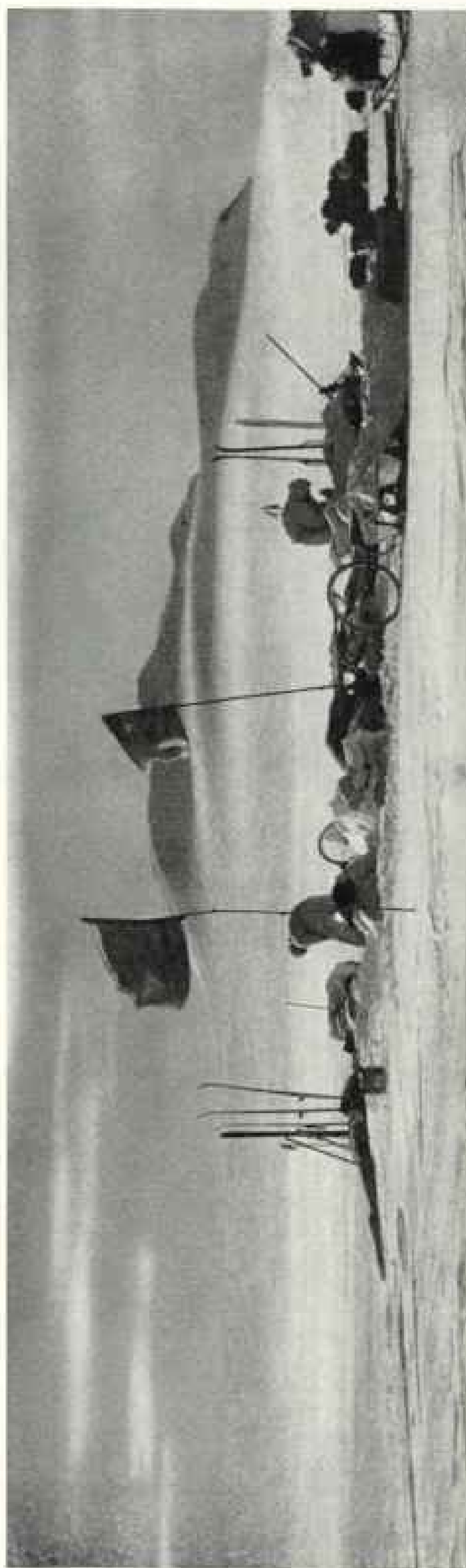
On December 15 the flight crew, consisting of June and Bowlin, pilots; Rawson,





WADE, COREY, AND SIPLI WAVE A NEW YEAR'S GREETING TO PILOT SMITH AS HE ROARS OVERHEAD

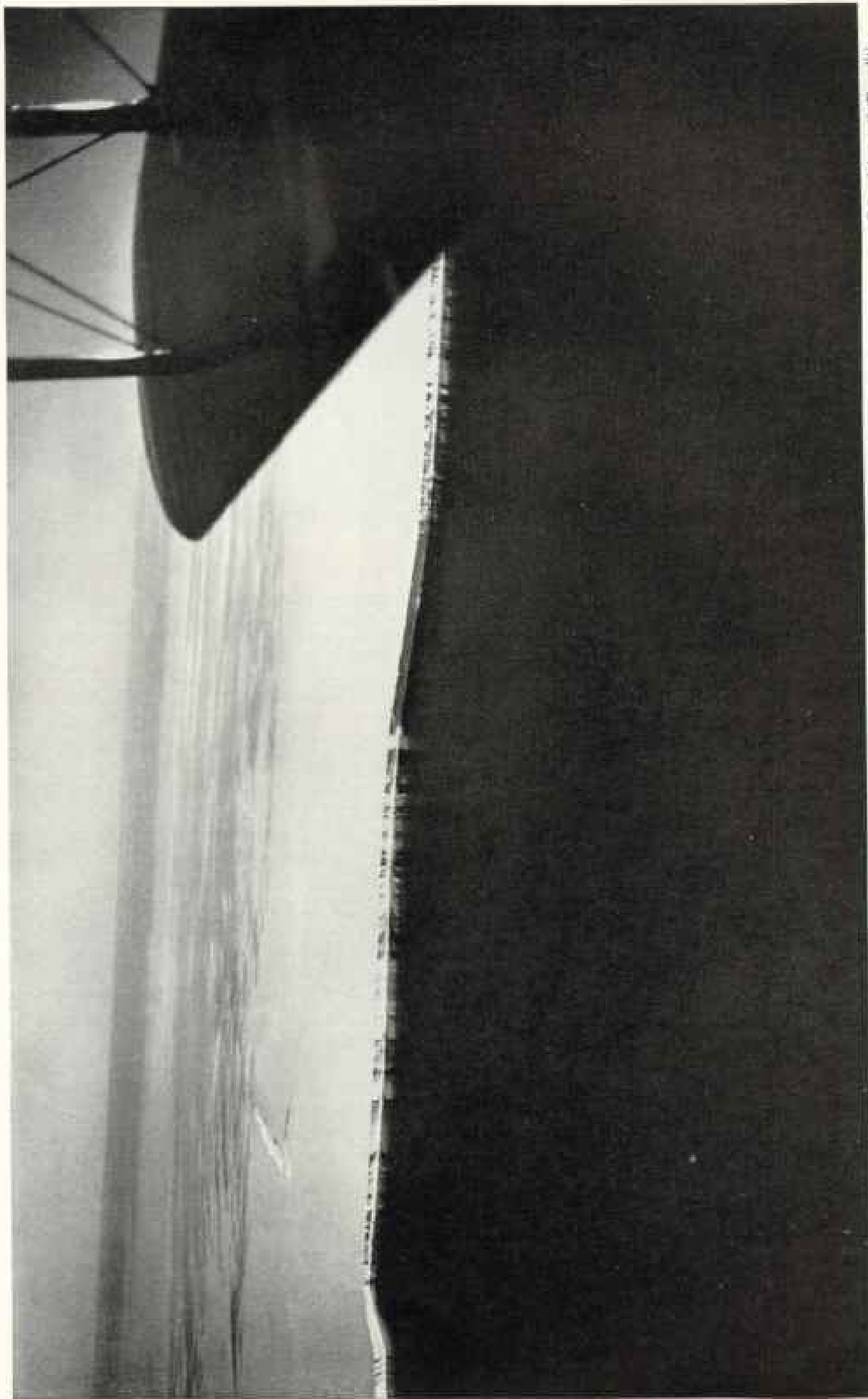
The strip of red cloth is a signal to *Miss American Airways*, meaning "All well—OK." A code was furnished all land parties for communicating with the planes.



A DOG PARTY REPLENISHES ITS SUPPLIES FROM A DEPOT ON THE SNOWY SLOPES OF MOUNT GRACE MC KINLEY

© Byrd Antarctic Expedition

Such caches were left at regular intervals along this route weeks before by a tractor party. They were always marked by flags and beacons of snow blocks. As a group advanced into new territory, they stuck flags or markers in the snow every quarter of a mile to guide them on their return. One aviator, as he flew over such a trail, remarked that it looked "like a picket fence."



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BYRD'S-EYE VIEW OF THE THICK ROSS SHELF ICE WHICH HAS ENCRUACHED ON THE SEA 12 MILES SINCE SCOTT CHARTED IT IN 1911

The *Bear of Oakland* surveyed a broad 400-mile front between Ross Island at one end and the Bay of Whales at the other, and discovered that the ice edge had moved northward considerably. From the *William Horlick* the Barrier seems like white cake frosting, but its steep face rises 50 to 150 feet above the surface of the water and extends below more than three times the distance it does above.



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AN ANXIOUS MOTHER WAITS TO LEARN, "WHAT DOES MY BABY WEIGH TODAY?"

Dane, Sterrett, and Young lift the baby seal off the ice by block and tackle attached to a tripod. The seal doubled its weight again and again during the first few months after birth, and will continue to grow, though more slowly, for several years to come. Several hundred seals were branded so their movements in the Bay of Whales might be studied (see pages 442 and 443).

navigator; Petersen, radio operator; and Felter, mapping cameraman, made our longest thrust along the coast.

Just west of the Edsel Ford Range they ran into huge masses of cloud, which forced them to climb over 13,000 feet to get over the top. They continued on well beyond the northwestern edge of the mountains, but finding no sign of the clouds' breaking they were forced to turn back.

Through holes in the clouds, however, they were able to get glimpses of the mountains and found, significantly, sea ice and patches of open water just north of the mountains. This checked with the heavy water sky that had been observed on the flight east from Mount Grace McKinley.

A few days later Bowlin took the *William Horlick* up in another attempt to photograph the Edsel Ford area, to meet with the same thick weather.

The season was now getting late and the midsummer fogs and overcast conditions had become nearly perpetual. Reluctantly, we were forced to conclude that our flying was over. With the greatest possible alertness June and Bowlin had taken advantage of flying weather. Whenever the weather broke during waking or sleeping hours, the ground and air crew were ready.

In spite of handicaps and bad conditions, there were no structural or engine or fuel troubles. The aviation crew under June was indefatigable. Sleep meant nothing to them. It consisted of Bowlin, pilot, mechanic; Smith, pilot, mechanic; McCormick, pilot, mechanic; Boyd and Dustin, mechanics; Swan, airplane constructor.

Lieutenant Commander Schlossbach, U. S. N., Retired, who had been with Wilkins on his Arctic submarine expedition, was one of my volunteers. He took charge of the Fairchild airplane after it was dug out, renovated this machine, which had been under the snow for five years, and made many successful flights with it.

When we dug out the *Floyd Bennett*, our South Pole plane, the engine started immediately after being heated. The five years under the snow seemed to make little difference (see pages 444 and 447).

#### JOURNEY'S END

With the airplane work finished, we turned our attention toward getting ready for the arrival of the *Ruppert* and *Bear*. The trail parties had not yet returned.

I must confess to great apprehension when my men were far afield among crevasses. So I was happy when all my parties



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#### SHUTTLE SERVICE WAS A HAZARD, EVEN FOR THE ICEBREAKER "BEAR"

Although the bay ice had already drifted away from Eleanor Bolling Bight, on the east side of the Bay of Whales, mountainous sections of the Shelf Ice were likely to fall off and crush the ship or cause waves strong enough to dash it against the white wall. High tides especially increased such danger. The *Bear* transferred the cargo from the snow shelf to the *Ruppert*, laying to out in the bay.

had returned, not only without casualty but in good physical condition.

Captain Verleger of the *Ruppert* had been forced to resign his command and return to the United States on account of ill health. His place was ably taken, however, by Lieutenant Commander Stephen Rose, U. S. N. R., who had been first officer of the *Bear of Oakland*.

The *Bear of Oakland* was the first to leave New Zealand in order to test out the navigability of the pack before we risked the *Ruppert*, and was also to make a survey of the Ross Barrier between McMurdo Sound and the Bay of Whales, a project last accomplished by Captain Scott in 1911.

All during our operations, Ellsworth and Balchen were at Graham Land with their ship and plane, standing by to fly to Little America. Our part was to radio them weather reports twice daily, and upon request to give reports from our field parties.

They abandoned their attempt January 1 after waiting several months in vain for flying weather. I believe that Ellsworth will make this flight next Antarctic spring and I wish him all the luck in the world.

When the *Bear* and *Ruppert* finally arrived, the ice of the Bay of Whales was impassable. We had to go alongside the

barrier of the Eleanor Bolling Bight, on the east side of the Bay of Whales, for loading. The *Bear* took most of the gear and transferred it to the *Ruppert*, but for the planes the *Ruppert* had to enter the bight. We loaded and got out as quickly as possible, for it is hazardous to tie up a metal ship to the Great Barrier, as we had previously discovered.

It was a relief when we finally headed for home. The Ross Sea was still open, and we were able to make an uneventful voyage to New Zealand.

#### THE MAJOR DISCOVERIES

Now to sum up briefly our work:

The greatest remaining geographical riddle, that of the Antarctic strait, was answered; a vast new plateau was added to the map. The northern limits of the continent in the Pacific Quadrant were indicated. Our aerial and ground surveys will necessitate an entire revision of the maps.

Hundreds of new mountains in the Edsel Ford and the Queen Maud Ranges were added to the map, and both ranges were extended several hundred miles eastward.

Seismological soundings clarified the mystery of the Great Barrier and showed in places the depth of the continental ice cap.



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#### "COLORS" AT LITTLE AMERICA FOR THE LAST TIME

Here Admiral Byrd (right) and Commander Noville lower a wind-tattered Old Glory from one of the radio towers on the day of their departure. If the flag had been taken down at each sunset, it would have been lowered only 121 times during the entire year, because of the long Antarctic winter "night" and summer "day."

Our survey of 460 miles of the Barrier front indicated that it had moved 13.8 miles to the north since 1911.

The geology of the newly discovered mountains was investigated. The adaptations of living organisms to the Ice Age were studied. It was discovered that millions more meteors strike the earth's atmosphere annually than had previously been suspected. The depth of unknown waters was recorded by thousands of soundings.

A thorough study of the earth's magnetic field was made. Two weather-recording stations were maintained, and the most nearly complete series of upper-air studies ever made in the Antarctic was carried on.

These are but a few of the scientific discoveries of the expedition, discoveries that were made possible only by the fine work of my men.

We had done what we set out to do.

Members of the scientific staff of the expedition are at this writing studying and correlating, at seven institutions throughout the country, the mass of data which, when finished, will fill ten volumes. There is much hard work ahead before the job is ended. We started work on the second expedition in 1932. We hope to complete it by 1938.

And there is much yet to be done in the Antarctic. We hope our work will make the next explorers' job easier.

I will end by saying, as I did in my article in *THE GEOGRAPHIC* after my first Antarctic expedition, that "above all else—what means more to me than anything else—is that we left not a single man in Antarctica, and for that we give thanks to Providence."

# SUNGMAS, THE LIVING ORACLES OF THE TIBETAN CHURCH

BY JOSEPH F. ROCK

AUTHOR OF "THE GLORIES OF THE MIHYA KONKA," "KODRA KINTHOONGA, HOLY MOUNTAIN OF THE OUTLAWS," "LIFE AMONG THE LAMAS OF CHOSI," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE.

ANCIENT Greece had her oracle of Delphi; Tibet has her Sungmas,\* men believed to have similar powers. Sungmas are neither sorcerers nor incarnations, but the abodes of malignant spirits, or spirits of demonized heroes who, subdued by saintly lamas or high incarnations, have become the protectors of religion.

These roving demon spirits, obedient to the spells cast over them, are said to select either a lama or a layman as their abode during the lifetime of the person thus selected. Distinct from incarnations, they manifest themselves involuntarily as well as voluntarily in their chosen abodes.

## CONSULTING THE SUNGMAS COSTLY

Any lamasery with a claim to importance has its oracle, though some of the supposed Sungmas are impostors who work themselves into frenzy merely for pecuniary gain. Every Sungma has his fee, the amount depending on the importance of his demon spirit, and the wealth of the person who seeks the augury. Sometimes as much as 1,000 tankas (\$100 or more) will be exacted.

Whether oral or written, the replies the Sungmas give to questions have true Delphic vagueness and ambiguity. They confine themselves mainly to advice concerning the performance of meritorious deeds to counteract evil influences or ward off calamities. The questions usually are written on slips of paper and handed to the Sungma, who, without looking at them, holds them above his head and "answers" them with incredible rapidity.

Often the replies are animal-like grunts which the attendant lama, through whom the questions have been presented, professes to interpret. The groans and moans issuing from the foaming mouth of the so-called possessed lend themselves, of course, to considerable freedom of interpretation.

Although there are many Sungmas, genuine or pretending, throughout Tibet, the

\* The word phonetically is spelled *Sun-ma*, the *r* is silent, pronounced *Sung-ma*, meaning guardian, the guardian of religion, or protector of religion.

five of real importance reside in Lhasa. One of them, recognized as the State oracle, *Nā chung*,<sup>b</sup> is consulted by the Dalai Lama.

These oracles play an important role in the selection of high incarnations, or in the search for the incarnation of a deceased Dalai Lama. All five are consulted and their answers checked. Before action can be taken, the five must be found to agree on the identity of the child believed to be the incarnation, the name and appearance of its mother, the location and description of the house it resides in, and the details of its surroundings.

It was in the winter of 1928 at the lamasery of Yungning in northwestern Yunnan that I learned of the existence of these mysterious Sungmas. The abbot told me that the famous Balung chū dje, one of the Sungmas of Lhasa, was to perform in Yungning at the Feast of the Lights on the day of commemoration of the death of Tsong K'apa, founder of the Yellow lama church.

The human abode, or *chū dje*, of Sungma Balung chū dje, was the person of a Chungtien lama, a native of the Tongwa (Tibetan) tribe, the son of a Tongwa bandit chief of northwest Yunnan. This "possessed" lama, who had been residing in Lhasa for several years, had stopped at Yungning on his way to visit his birthplace in Chungtien. He is said to be the abode of the powerful demon Chechin.

There are several Sungmas who are supposed to be the chū dje of Chechin. Of these the most important is a lama called Betin Konser chū dje from the name of Chechin's house on the market square of Lhasa; and the second in rank is the one I saw perform in Yungning—Balung chū dje, named after another residence of Chechin. As their names indicate, they are considered "houses" of Chechin.

## PREPARATION FOR A TRANCE

Both Balung chū dje and Betin Konser chū dje, before going into a trance; that is, before Chechin takes possession of them, don the robes of a Sungma—elaborately decorated embroidered garments often made



Photograph by Joseph F. Rock

PEASANTS AND LAMAS CROWD CLOSE WHEN A SUNGMA GOES INTO A TRANCE

It was at this Tsong K'apa festival at the Yungning lamasery that the author first learned of the existence of the strange form of worship in which a lama, when taken with an epileptic seizure, is supposed to become the temporary abode of a god. In this case Balung chü dje, a visiting lama, became possessed of the demon Chechin. A large banner embroidered in gold and silver scintillates in the sunlight from a frame in front of the hall. The author and the Hlikhin chief viewed the ceremony from a safe vantage point behind the columns of the temple (see Color Plate VI).

of gold brocade, the gift of some devout worshiper (see Color Plates I, II, and IV). Thus arrayed, they take their seats in foreign fashion—not cross-legged—on ornate chairs, usually near the entrance within the main temple of the lamasery.

Some of the lamas in attendance begin to chant the classic of Chechin, beseeching the spirit to take possession of his chü dje; while some ring bells or blow conch shells; and others, carrying incense burners, walk around the bowed figure of the waiting Sungma, wafting the fragrant smoke of juniper twigs as offering to Chechin.

Such was the beginning of the performance in which I had the rare experience of watching Sungma Balung chü dje.

He sat motionless on the throne in the somber chanting hall, his face buried in his hands, breathing the fragrant juniper smoke, while the deep, low tones of the chanting lamas, punctuated by bell ringing and the blowing of conch shells, lent mystery to the whole scene. A tall, curiously decorated and plumed iron hat, weighing

about 50 pounds, was placed beside him.

I stood with the old Hlikhin chief behind one of the tall pillars of the temple hall close enough to the Sungma to watch him, and yet safely out of his reach. When Chechin has entered the performer's body, he often acts like a raving maniac, and is not responsible for his actions.

TRUMPETS ANNOUNCE SPIRITS' ARRIVAL

Soon the Sungma began to accompany the lamas in their mumbling prayers, while the incense went the round, and the silent audience awaited the spirit of Chechin. Suddenly sonorous blasts of large trumpets and deafening clash of cymbals burst forth, and the Sungma moved uneasily in his seat.

A deep, gargling sound escaped him, and his hands clasped his throat. The attending lama, a brother of Balung, now lifted the huge hat upon the Sungma's head and tied it firmly under the chin. By this time the performer was fully possessed by the spirit. The gargling sound is believed to be a sure sign of the presence of Chechin,

who, the classic relates, died by suffocating himself with a kattak, a silk scarf.

Balung still sat dreaming for a while; then all at once his body began to sway and his legs to shake. Frantically he threw himself backward while lamas held him and tried to balance him. He spat and groaned; blood oozed from his mouth and nostrils; his face became purple—inflated to such an extent that the leather chin strap burst.

#### SUPERHUMAN STRENGTH DISPLAYED

He took a sword handed to him, a strong Mongolian steel blade (see Color Plates V and VI). In the twinkling of an eye he twisted it with his naked hands into several loops and knots!

The lamas continued their praying; the Sungma swayed and shook, groaned and sputtered blood. The audience became frightened and surged back.

The Sungma tossed the 50-pound hat above his head; adjusted it again, meanwhile puffing like a steam engine. The perspiration running down his face mingled with the blood which oozed from his nose and mouth.

The attending lamas wiped his face, and tried to comfort him. A lama now stood in front of him with a round silver platter on which reposed an offering, a triangular pyramid of *tsamba*, or barley-flour dough. This the lama held to the Sungma's face, so that his forehead touched it. The lamas changed the tune and tempo of their chant.

Still shaking, the possessed Sungma took a handful of rice, and threw it violently into the crowd. At this point the abbot of the monastery approached, bowing and kowtowing, only to be beaten severely on the back with the flat of a sword wielded with merciless fury by the Sungma. Fear spread among the crowd; the abbot fled; the Sungma continued to shake from head to foot with uncontrollable convulsions!

#### CHECHIN'S BLESSINGS ROUGH

Now was the time for worshipers to receive Chechin's blessing. A regular fight ensued as the lamas of the monastery, each carrying a small silk scarf (kattak) as offering, thronged forward. Each lama tried to get to the Sungma to place a kattak on his shaking knees and receive the blessing of a blow, a puff of breath from his distorted mouth, or a gentle laying on of his hands.

Forward they surged, eager to reach the Sungma before the spirit of Chechin should

leave his body. A few managed to receive the blessing, while attending lamas, laying on unsparingly with birch whips, kept off the eager mob.

All at once the Sungma, puffing and blowing, threw himself backward exhausted and lay like a lifeless form for a few minutes. The spirit of Chechin had flown, none knew whither.

When Balung rose, he was weeping and whining. His garments now were adjusted, and a different headgear, the sort worn by minor Sungmas, was placed upon his head. Three of the underlings of Chechin were to manifest themselves in this Chungtien lama.

Seizure was not long in coming. Almost immediately the afflicted man leaned forward and began to shake. The lamas near him handed him bow and arrows and a flag-staff. With outstretched arms he stood erect, spat, puffed, and blew.

The lamas again rushed to receive his blessing. The more privileged, the abbot and the Living Buddha of Yungning, came first; then the mob. The latter were less fortunate, for only two had received the blessing when the shaking stopped and the Sungma again threw himself backward, groaning.

Again the *tseng-che*, the hat of a minor Sungma, was placed on his head. The poor man was in pitiful plight, bathed in perspiration. He supported his head with his hands. As he took his seat, incense was offered.

He rested thus for only a minute; then rose and with a terrific thump fell back upon his chair, shaking like an epileptic. In this state he received the homage of the throng.

This last spirit to take possession of him was supposedly Tsen-gwve chimbu, an underling of Chechin. It is a speaking spirit, the oracle or interpreter of Chechin, and inordinately fond of wine.

Once more the abbot stepped forward and putting his head under the Sungma's chin, asked him a question and received a reply. Once more the mob, eager to receive the spirit's blessing, were whipped into line by the attending lamas while the old Hikhin chief and I watched the performance from a place of safety. Had not the predecessor of this Sungma killed another lama in the Muli chanting hall?

A terrific jerk raised Balung from his seat while a lama brought in the *darma*, another *tsamba* pyramid painted red to represent



flames, with a black heart in the center and an imitation human skull as a crown. The lamas beat large flat drums, which they held on long curved staffs; others beat smaller drums; terrific blasts from the giant 15-foot long trumpets rose above the infernal din. The mob had grown, but the whipping lamas, who spared not even women and children, kept them in order.

Still shaking, the Sungma rose from his seat, and the lamas proffered him milk-colored wine. Cup after cup he gulped down; then ran forward, snatching drinks as he ran and pouring many libations on the ground. He shook like one with ague as he flung furiously down the courtyard in the wake of a group of scurrying lamas.

Suddenly he halted and dropped into a chair placed for him by a lama who had been following him. Again he rose and ran so fast that the lama with the chair had difficulty in keeping up with him. The mob straggled behind.

He sat down and rose and shook and ran again as if driven by superhuman power, his flight a series of ups and down. As he ran he shot arrows in all directions, and between shots brandished a sword.

Outside the lamasery gate he sat down before a triangular pile of burning straw. He was still shaking violently.

#### BANISHING OF THE DEMONS

A circle of lamas beat drums and blew trumpets, powder shells exploded, and a volley of rifle fire crackled. To this accompaniment the dorma was thrown into the center of the fire. This act, known as the *dordja*, is the weapon of the *Vidam* or tutelary deities of the lama church as well as of the Sungmas. Concealed in the dorma was a triangular iron pan into which all the demons supposedly had been coerced by the shaking Sungma. The *dordja* meant the banishing of the demons believed to afflict Yungning.

The Sungma shook; his upper body bent forward; he gulped cup after cup of wine. Rising, he shot off arrows in the four directions of the compass; then threw handfuls of wheat into the wide spaces to open the roads for the banished, fleeing demons. He leapt in a mad dance to the center of the burning straw pile, careless of his finery, and whirled like a demon into and around the flames.

The performance ended abruptly. In a last wild dash the Sungma was off for the

monastery, the frantic mob at his heels. He vanished into the black recesses of the gloomy old temple.

The predecessors of the present Sungma Balung chū dje were, in the order named, a lama from Muli and a Mongolian called Sumpo chū dje. It was the latter who killed a lama with his sword while possessed by Chechin.

Sumpo chū dje was a lama, but wished to give up his monastic life to marry. Chechin did not approve of the idea of his chū dje taking a wife, and while in possession of the man's body threatened to kill him if he did so. The Mongol Sungma, however, followed the dictates of his heart and married. One day while possessed by Chechin, the unfortunate man disemboweled himself, and, in his dying agony, hung his entrails on the lamaistic images on his private altar. Later Chechin appeared in the present Balung chū dje.

Before the lamas recognized the Chung-tien boy who became Balung chū dje as the abode of Chechin, he was thought a maniac by his father, who tied him up when the seizures came upon him. A living Buddha, questioned while in a trance, declared him to be Balung chū dje, or Chechin's abode.

A Sungma must lead an abstemious life and refrain from smoking. Moreover, Sungma Balung chū dje must not eat chickens, eggs, or pork, or take snuff; for Chechin, it is said, has a violent dislike for these things. Because Balung chū dje is inordinately fond of snuff, Chechin made him in one of his shaking fits smash his beautiful agate snuff bottle. The story recalls cases of double and triple personalities, and the Sungmas may well represent such clinical cases.

Steel swords twisted into knots by Sungmas are highly prized by Tibetans, who fasten them to doorways and above gates to temples and homes to ward off evil spirits. I have examined such swords made of excellent steel, a fourth to a third of an inch thick, and found it beyond my strength to bend even the tips. Yet the Sungmas have twisted them into several spirals, beginning with the thickest parts near the hilts.

That there are many fake Sungmas is evident, as is the fact that the superhuman strength and the remarkable actions of so-called genuine Sungmas are beyond the power of normal persons.



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Autochrome Lumière by Joseph F. Rock

A DEITY MAKES THIS ORACLE STICK OUT HIS TONGUE

Garbed in his silken robes, with sword and banner, stands one of the King Sungmas of Tibet—men subject to epileptic seizures and supposedly possessed by demons. With open mouth and staring eyes, he is in an early stage of the trance during which the lamas and their flocks believe he becomes the mouthpiece for the powerful spirit Dordje Dirakte. Should he collapse at this stage, he would be thought controlled by an evil influence, instead of his benign patron. Any peasant subject to such seizures may be made a lama and elevated to this queer priesthood.



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**BY HIS HAT THE TSEN SUNGMA IS KNOWN**

The higher, or King-Oracles, wear much taller and more elaborate head-dresses. This man, underling of the Sungma in the accompanying picture, interprets when his superior is in a shaking convulsion.



Authebrunus Lumiere by Joseph F. Rock

**HE WAITS FOR THE SPIRIT TO POSSESS HIM**

Arrayed in all his finery, with lance, bow and arrows, and rope, the oracle of Sungma Dordje Djalte is ready for the trance. He will tie up any "heretics" with the heavy cord suspended from his left wrist.



© National Geographic Society      Autochrome Lumière by B. Anthony Stewart

**CHE-TA-PA-LA PROTECTS THE MONASTERY OF MERCIFUL HALL**

One of the most powerful spirits, the deity pictured here riding a bear and trampling his enemy, manifests himself in the Sungma of Se-pa. In his raised hand he holds a chepper, while in the other is a bowl filled with the brains, eyes, and blood of his foes, which he devours.



Autochrome Lumière by Charles Martin

**THE SIX-ARMED LORD IS A TERRIFYING DEITY**

This banner and that on the left were presented to The National Geographic Society by Doctor Kock. The central figure is a likeness of Gombo Chartripa. On his left is the fearsome demoness, Balden Lhamo, of whom lamas declared a former Queen of England was the reincarnation.



© National Geographic Society

Autochrome Lumiere by Joseph F. Rock

THE GOD CHECHIN MAKES HIM VIOLENT

This man, son of a Tongwa bandit chief, is believed by the lamas and members of the Tibetan church to become the mouthpiece of the deity. He is known as the Sungma Balung chü dje. When he dresses in his gorgeous robes, the spirit manifests itself by causing him to go into terrific convulsions. His predecessor killed a lama with a sword while under the same influence. Balung holds a trident in his right hand and, during his fits, he runs up and down shooting off the arrows to banish demons. At some seances these so-called oracles performed seemingly superhuman feats of strength and agility.



Autochrome Lumière by Joseph F. Rook

A TEMPLE BANNER IS ADORNED WITH TWO DEITIES

The blue, many-armed figure at the left represents Gombo Chartrupa, that on the right Chechin, whose dragon-steed tramples a victim. The latter spirit is said to take possession of Balung chü dje, the oracle pictured on the opposite page.

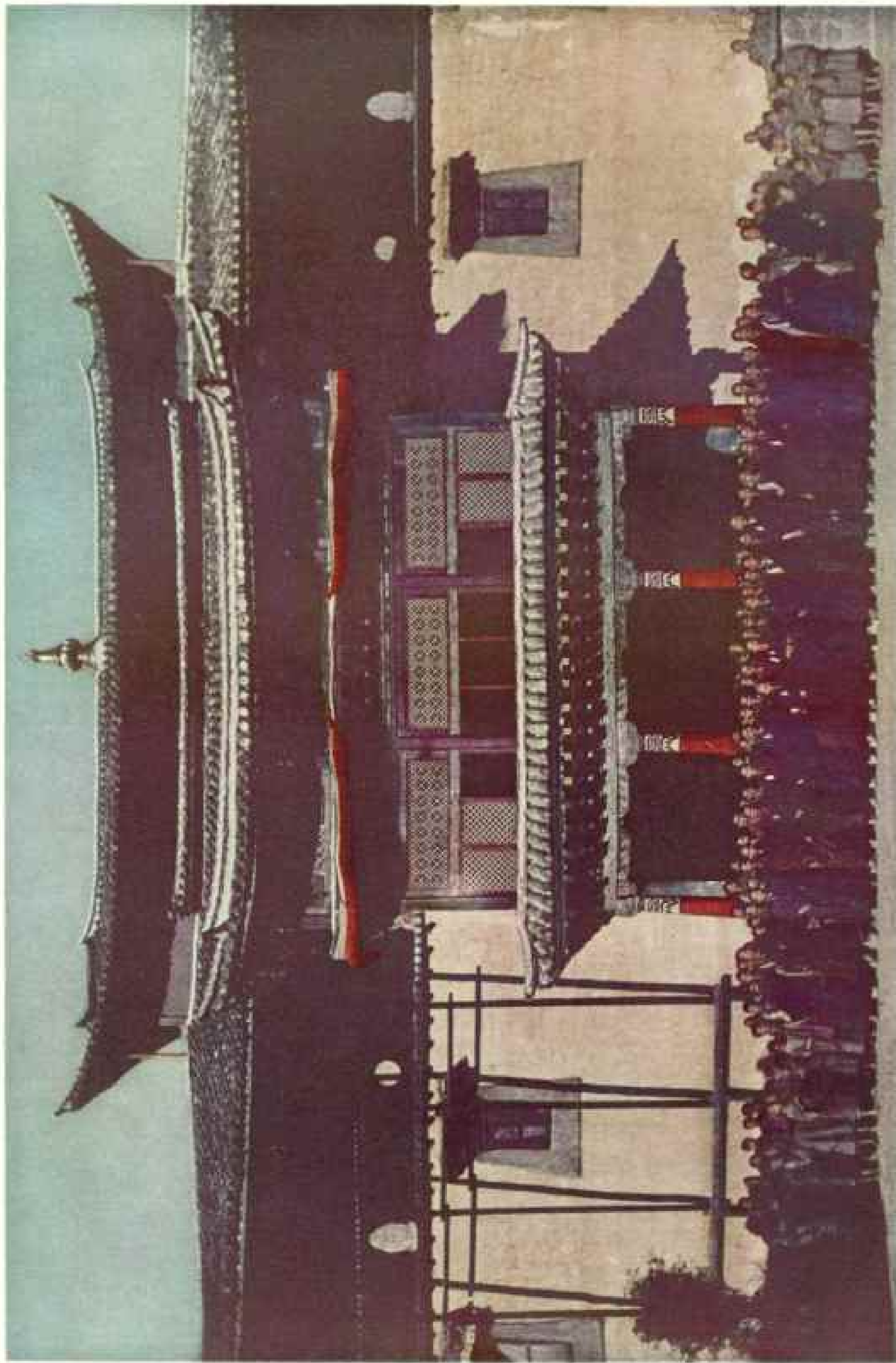


Autochrome Lumière by Charles Martin

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WITH BARE HANDS THE ORACLE TWISTED THIS SWORD OF MONGOLIAN STEEL

Sungma Balung chü dje (opposite page) seemed to have superhuman strength when possessed by Chechin. In an instant he wound into coils the weapon which a normally strong man could hardly bend. He gave it to the leader of The National Geographic Society's Yunnan Expedition.



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LAMAS ASSEMBLE AT YUNGNING LAMASERY FOR THE FESTIVAL OF TRONG KA-PA

Attechtourne Lamière by Joseph F. Rock

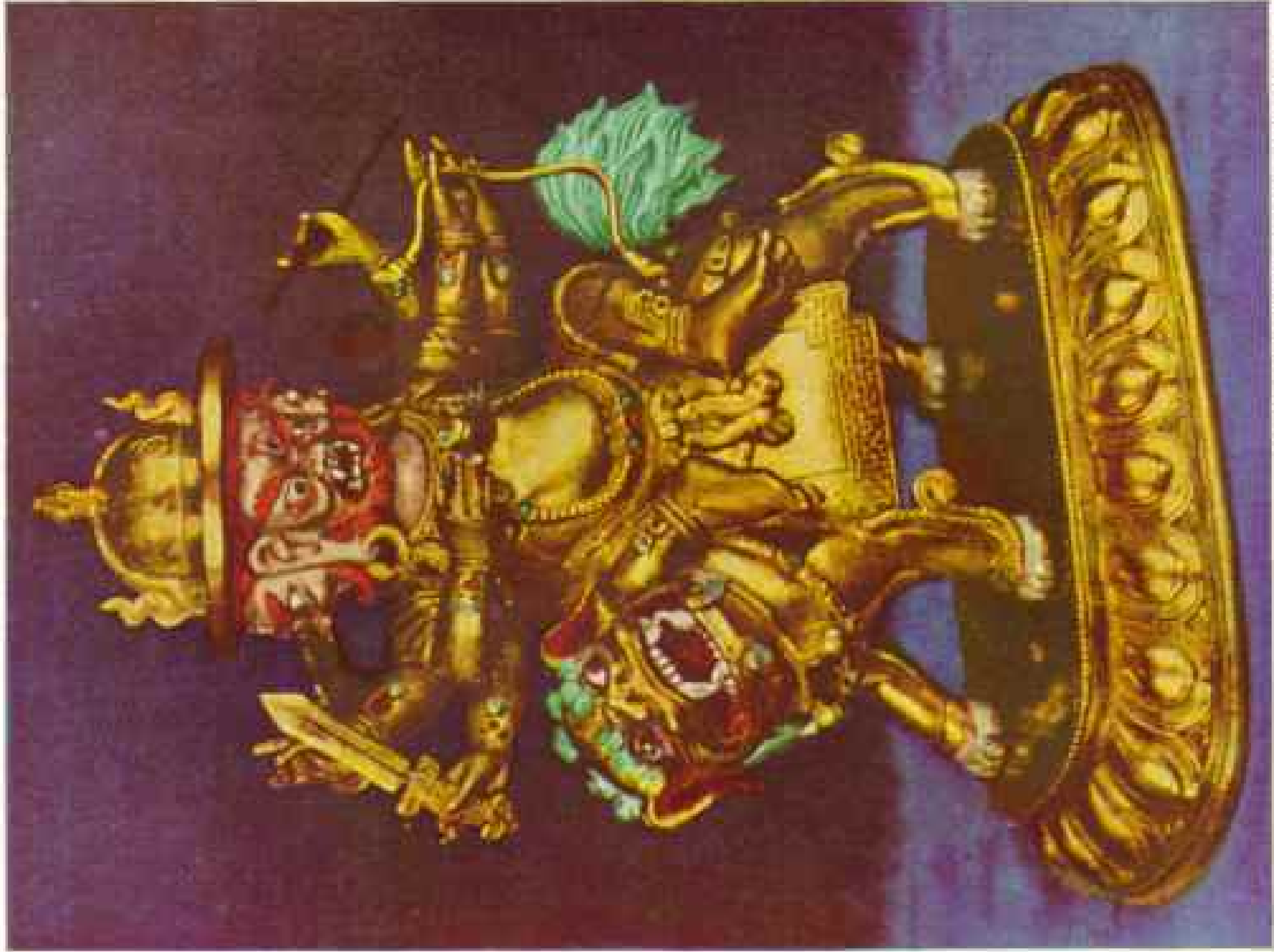
Here Doctor Rock witnessed the amazing seance at which the Simgma Balung chü dje with his bare hands twisted a sword of Mongolian steel (see Plates V and IV). The temple is still in use.



© National Geographic Society      Antiochaine Lumière by Joseph F. Rock

WITH THE MYSTIC WORD "OM." HE OPENS CEREMONIES

As Lama Orize, he leads in the chanting at Yungning Lamasery, and must, therefore, have a thorough knowledge of Tibetan writings and the canons of the church. Dressed in official robes and wearing a crown, he holds in his right hand a bell and in his left a thunderbolt of brass.

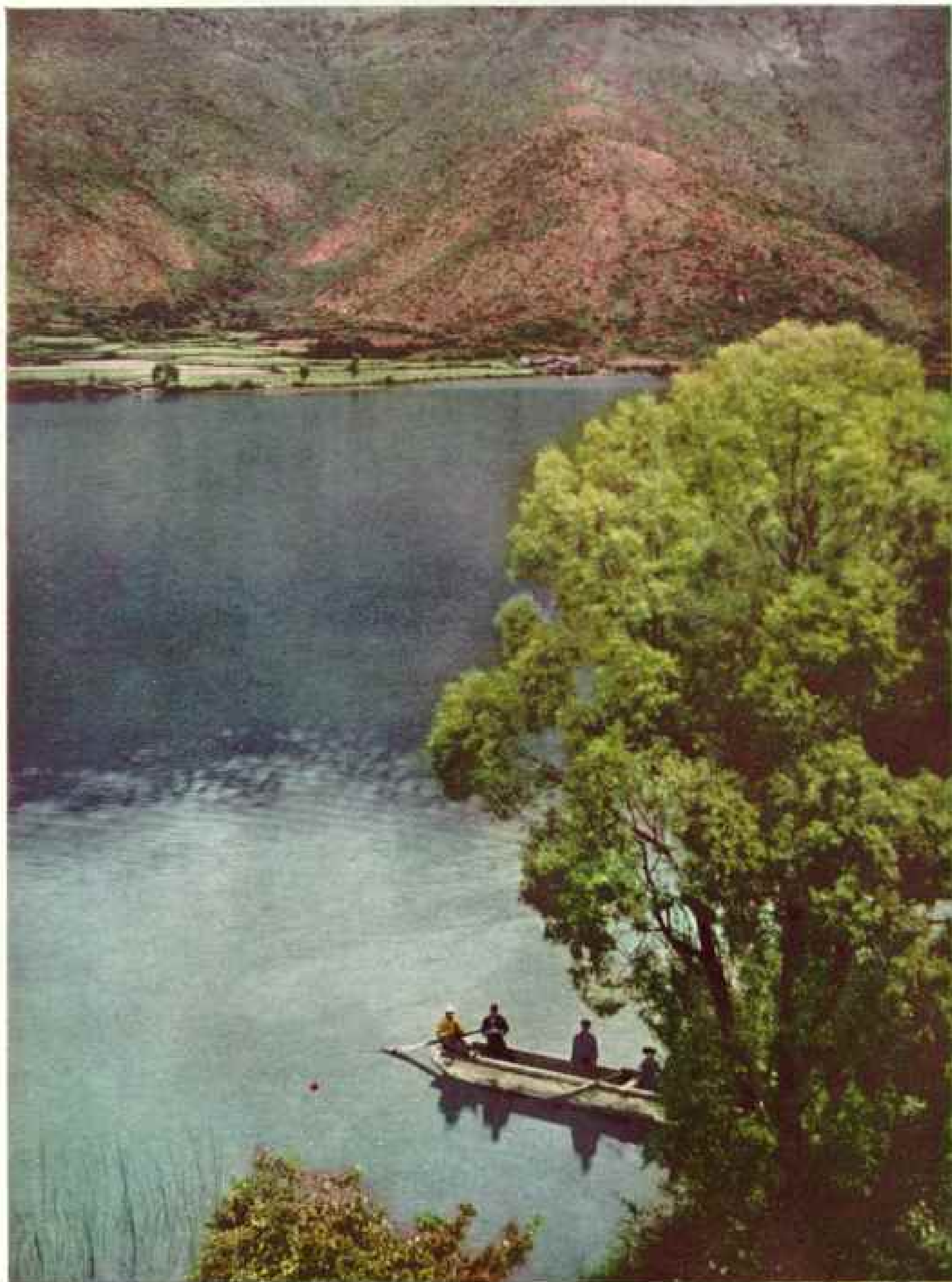


Antiochaine Lumière by Charles Martin

THIS THREE-PAVED IMAGE REPRESENTS TING-LÄ-GYALPO

The powerful deity is riding the Tibetan mythical lion. This spirit is said to take possession of the Nā-chung oracle near Lhasa. The figure, four inches tall and of exquisite workmanship, came from Labrang Lamasery. It now is at The National Geographic Society headquarters.





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Autochrome Lumière by Joseph F. Rock

A CRATER CUP SOME 270 FEET DEEP IS YUNGNING LAKE

On the island of Anawa, from which this photograph was taken, Doctor Rock gained most of his information about the Sungmas. The land is the property of the Muli king, and a hermit lama now dwells there. Though the crystal depths of the water teem with fish, the lamas, who do not approve of taking life, never angle for them. There is no boat traffic, save that in crude dugouts such as the one shown. Legend says the flat bottom of the lake, now fringed with tall willows, once was a cultivated field.

# BY MOTOR TRAIL ACROSS FRENCH INDO-CHINA

BY MAYNARD OWEN WILLIAMS

AUTHOR OF "FROM THE MEDITERRANEAN TO THE YELLOW SEA BY MOTOR," "THE COASTS OF CORSICA," "CARNIVAL  
DAYS ON THE RIVIERA," ETC., IN THE NATIONAL GEOGRAPHIC MAGAZINE

*With Illustrations from Photographs by the Author*

**B**ETWEEN the India of unrest and stormy China is an oasis of peace and beauty—French Indo-China, composed of one colony and four protectorates.

Contract rubber workers, milking the tame, orderly, and prolific descendants of jungle trees, are no longer, as during boom days, used up faster than they can be recruited.

After ten years of Occidental studies and contacts in France, His Majesty Bao-Dai, 19-year-old Emperor of Annam, returned in 1932, not to antagonize his mandarins with foreign manners or his people with forced changes, but to bow in filial piety before his father's tomb and pay his respects to the highly respected and venerable Regent who "carried on" until his return.

## THE ASPECT OF A CHINESE PAINTING

Along the north frontier of Indo-China stretches such a fairyland as is pictured by the painters of the Southern Sungs, who sent a diplomatic mission into Indo-China to bring peace between the Chams and the Annamites nearly a thousand years ago.

Outcroppings of rock, now jagged and barren except for a few adventurous pines, now rising in heavily wooded masses above a hazy valley, are marshalled in irregular ranks. All the way from the Yunnan border to the matchless Bay of Along, from whose waters rocky islets rise like a staggered wall against the open sea, one lives in the atmosphere of a Chinese painting.

The motor road along which I drove first stretches straight across alluvial plains, cut by larger dikes than those confining the Mississippi.

Soon it swings back upon itself in dizzy curves, sloping away into the soft haze the Chinese artists knew so well—impalpable mists which mimic the sea and transform inland mountains into dark islets. One slope is tangled with impassable jungle growth; the other is a naked cliff overhanging flooded paddy fields.

Primitive men followed obscure trails through this land of mystery. Brigands

sneaked back and forth from one favorite ambush site to another. Tribesmen, winning rice land from the forest, built their huts in hard-won clearings. Storm-swollen stream beds served as trails for trader and brigand alike and, from one isolated outpost to another, French troops and Thô "partisans" pushed forward the tricolor, beneath whose folds is peace.

At the end of these broken ranges are coal mines along the giant steps of whose ever-widening amphitheatres, open to the sun, Tonkinese laborers in low-coned hats mine away whole grimy sections of the countryside. Far in the south is the red-dust rubber country surrounded by untamed jungle, or flooded rice paddies which made the fortunes of Billiken-built Chinese traders of Cholon—rapidly developing regions where the population has tripled in seventy years.

Wealth has been amassed in other parts of French Indo-China, but in the green entanglement of upper Tonkin marshals of France have been made. Here the Government, slowly rearing a wall of loyalty and peace against unrest, seasoned men for a wider service.

## WHERE GALLIENI, LYAUTEY, AND JOFFRE SAW SERVICE

Surrounded by enemy forces, lost in the Tonkin jungle, and short of food, a French colonel calmly discussed the writings of d'Annunzio and John Stuart Mill with his chief of staff, Lyautey, by way of clearing his brain. The cool colonel was Gallieni, whose taxicab troops nineteen years later were to help save Paris from the German advance.

From Langson on July 30, 1895, he wrote to Lyautey, hero of modern Morocco, that he pitied "those poor devils in France who imagine that they are seeing life because they . . . attend the latest play . . . or remain tied to their wife's apron-strings, discussing the color of their trousers or the shape of their shoes."

A decade earlier, before this town was "born on naked soil," Joffre had served in



CHOP STICKS FLY WHEN A MAN-COC GIRL EATS RICE

Growing in flooded paddy fields or hillside terraces ill-adapted to the cultivation of other foods, rice rivals wheat as the world's daily bread. It is food—and in the form of arrack or saké, drink—to millions of Orientals who have never tasted wheat or corn,

Indo-China. Marshals and presidents alike remember with a strange nostalgia this far colony where they helped build an empire before returning to their beloved France.

A temporary reverse suffered by French troops at Langson brought political defeat to Jules Ferry, the empire builder who had advocated the conquest of Indo-China, and he later died from an assassin's bullet, but on the martyr's monument at Haiphong the inscription reads: "I proudly claim the title of *le Tonkinois!*"

French Indo-China was the goal toward which the Citroën-Haardt Trans-Asiatic Expedition had pressed across the breadth of Asia for nearly a year.\*

A 1,500-mile triumph, stretching from Haiphong to the Siamese frontier, was about to begin.

But the time for honors had passed.

Our brave and resourceful chief, Georges-Marie Haardt, hero of three pioneer motor journeys—those across the Sahara, across Africa, and across Asia—had just died in Hong Kong.

The plans of years were set at naught.

#### THE END OF A LONG TRAIL ACROSS ASIA

The expedition artist, Alexandre Iacovleff, and I, urged by Governor-General Pasquier to make as complete a survey as possible, started work among the picturesque Thai, Man, Lolo, and Meo tribesmen who inhabit and defend the north frontier, beyond which live their tribal brothers, taking with us the painter Louis Rollet, winner of the *Prix d'Indochine*.

On a rainy morning, with a local cinema operator as my guest, I set out for Caobang,

and beyond. Iacovleff and Rollet were just ahead with Jean Yves Claeys, distinguished young archeologist whom the Governor-General had designated as our guide throughout Indo-China.

An hour beyond the mile-long Doumer Bridge, whose construction marked the victory of the engineer over the river demon to whom the priests had prayed, we came to a village whose main street was lined with gaily colored but sodden flags.

"What is the fête?" I asked, hoping for some colorful ceremony.

\* See "First Over the Roof of the World by Motor," by Maynard Owen Williams, in the NATIONAL GEOGRAPHIC MAGAZINE, March, 1932.

"The Citroën Central-Asia Expedition is due to pass here any minute," replied the smart young officer of the native police.

Jacovleff's car had gone by, unnoticed. How explain that my car represented all that was left of the Expedition? I sent a message to the Mayor, and, driving on through the rain, joined my friends in that Residency which has housed at least three marshals of France.

#### A MOCK FUNERAL IS THE FEATURE OF A FESTIVAL

Through the rainy streets, between long lines of spectators, many of whom carried umbrellas little larger than their hats, there moved a native funeral procession, complete in every detail except the body.

Rare old silks and the gaudiest tissue-paper decorations were combined in this mock funeral.

Sparsely bearded priests, surrounded by gong-ringers, rode in rickshaws. In front of the gaudy catafalque, paradoxically decorated with the Chinese character for longevity, there walked the white-clad figures of special mourners.

One of these, representing the nearest of kin, leaned on a rude staff, and a veil of coarse homespun hid his head as he slowly backed along the funeral route, his face always turned toward the coffin which followed him to the grave.

The priests, wearing colorful prints or greasy old brocades over their ordinary clothes, maintained, as did the onlookers, the same solemnity that would have marked a genuine funeral.



TO EXPERTS THE WOMEN'S FASHIONS SERVE AS TRIBAL GUIDES AND ALTIMETERS

In the Tonkin hills tribes live at varying levels. Down in the valleys are the Thais, who took the best lands. Between one and three thousand feet live the several Man tribes and above them the Meos, whose women (left) wear "sailor collars," though far from the sea. For a male to see a Man-Tien girl (center) wax her hair is considered a shame. Brightest of tribal dress is that of the Man-Coc women at the right (see Color Plates II, XIV, and XVI).

Strangely enough, the only persons who did not take the spectacle seriously were the score or more of straining porters, their shoulders burdened with the heavy bamboo platform on which the empty funeral canopy was carried.

#### THE HILL TRIBES COME TO TOWN

A heavy shower turned us toward a small pavilion in the local park, to which had come from their distant homes representatives of the hill tribes—Nungs, Thais, and Mans. One tribesman bore such a matchlock as



THIS TONKIN WOMAN IS THE MOLD OF FASHION FROM ANKLETS TO PANCAKE HAT

Her wide palm-leaf head-covering makes a fine parasol. Her footwear is durable and easily cleaned. The new plow—still lacking a steel prong—is light and portable. The knapsack rolls into a neat bundle and the hand-woven fiber basket is adaptable either to a suckling pig or vegetables.

served in the defense of the frontier. It had no butt-stock and its mechanism was exposed to rain and dirt, but in his hands it was a formidable weapon.

Some of the women, on whose shaven heads folded pieces of cloth were held in place by strings of brightly colored beads, wore homespun robes decorated with star, arrowhead, swastika, and diamond needle-work designs and heavy silver ornaments.

Neither here nor elsewhere did the French officers force the tribesfolk to pose. The whole occasion was a popular festival, enjoyed by the natives of Langson.

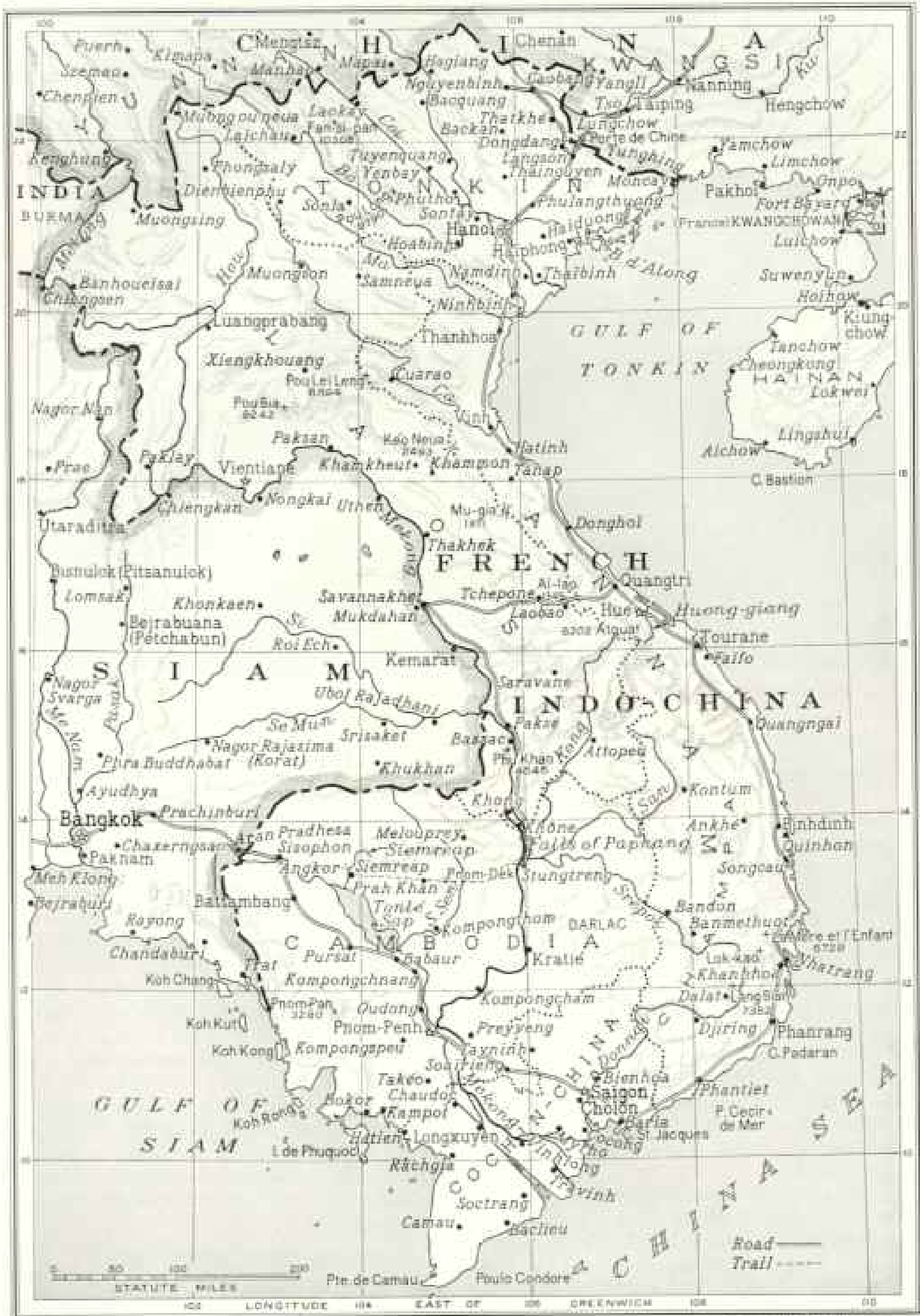
Men and girls, standing at opposite ends of a long field, hurled stringed projectiles—like slings into which the stones have been tied—at a paper target forty feet or so above the ground. Each player deftly caught the projectile thrown by his or her partner and keen rivalry resulted. Nor did

the game stop until the lofty target, no bigger than a large dinner plate, had been completely demolished.

Early in the morning we took the road for Dongdang, just inside the Porte de Chine. Tonkinese troops, some in khaki, others in blue and white, lined the street, across which strings of tricolor banners had the frontier hill-crests as a background. Then came fierce dragons, their heads tossed wildly about on the most active of many pairs of legs.

#### A SORCERER GIRDLS FOR BATTLE WITH EVIL SPIRITS

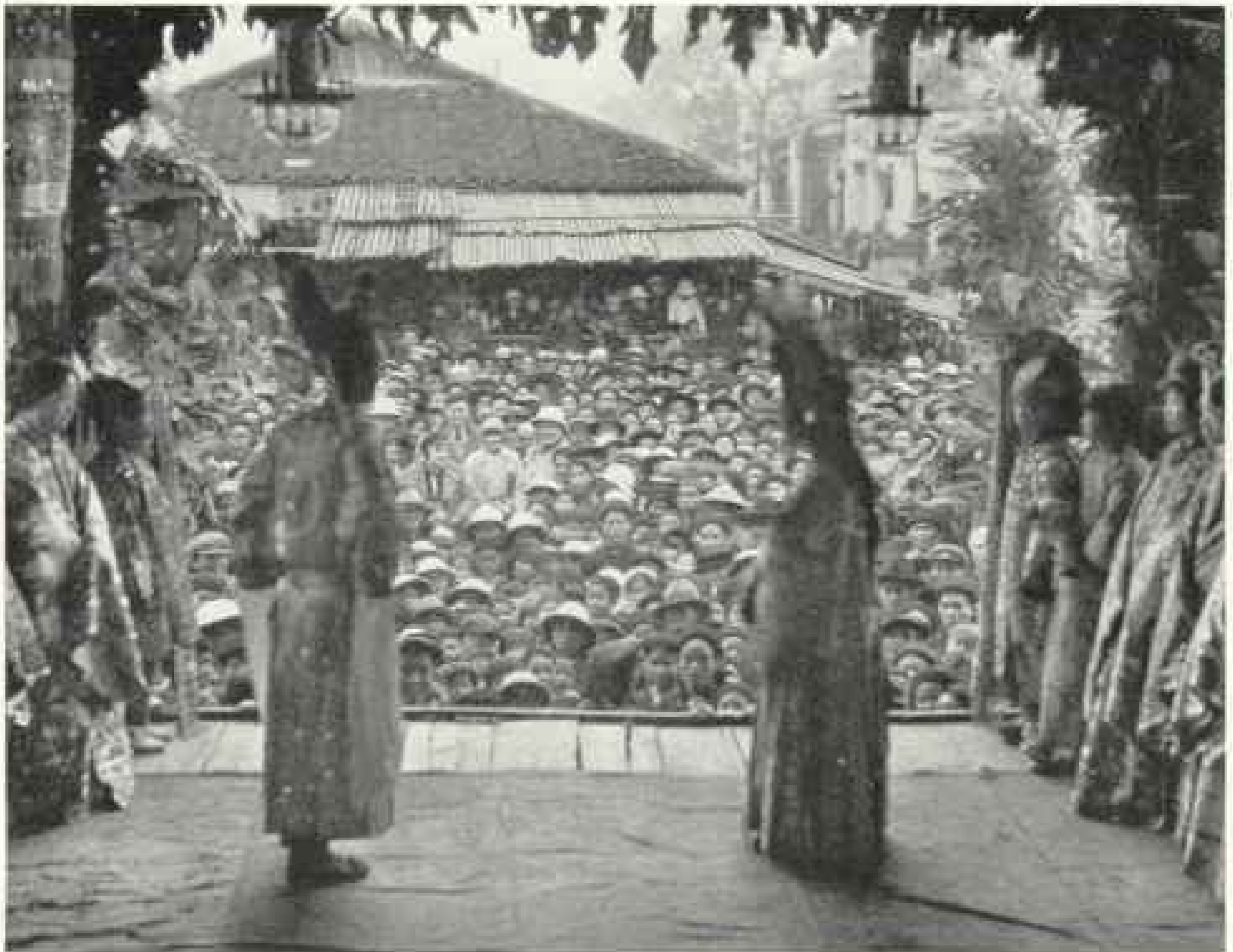
A Chinese theatrical company paraded its heavily embroidered umbrellas in our honor, while a sorcerer brought forth a long-handled *don tam* and such a cluster of intertwined steel rings as marks time for the sorcerer's lone fight against swarms of



Drawn by Arthur Haas

FRENCH INDO-CHINA CONSISTS OF THE COLONY OF COCHIN-CHINA AND THE PROTECTORATES OF CAMBODIA, ANNAM, TONKIN, AND LAOS

Somewhat smaller in area than our coast States from Maine to Florida, Indo-China has nearly twice the population of New York State and stretches from the latitude of Habana, Cuba, to that of the Orinoco River.



STANDING ROOM ONLY—AT AN OUTDOOR CHINESE THEATER IN UPPER TONKIN

Open to all, with no admission charge, al-fresco theaters draw farmers or gamblers to town. Trade guilds and voluntary collections supply the necessary funds. Among the varied tribesmen in the audience at Thatkhé, the wife of the local French Administrator stands between her white-helmeted husband and the artist, Louis Rollet.

malevolent spirits, or for their flattery and propitiation.

The almond-eyed leading lady, her tight black turban bright with gewgaws, wore a rich robe upon whose flowing sleeves some mythical bird was outlined in gold.

These theatrical troops carry their wardrobes and scenery from one part of the country to another and set up their open-air stages in the heart of the market place.

The first army food supply house in Thatkhé was built with impromptu taxes on such humble but popular gambling houses as make of each frontier town an amusement center for a vast tangle of countryside.

*Baquan*, the favorite gambling game, is a complicated form of "heads and tails," played with four coins, painted white on one side. Once within sound of the rattling cups, both Chinese and Annamite villagers are sure victims.

When we drove up to Thatkhé I wished I

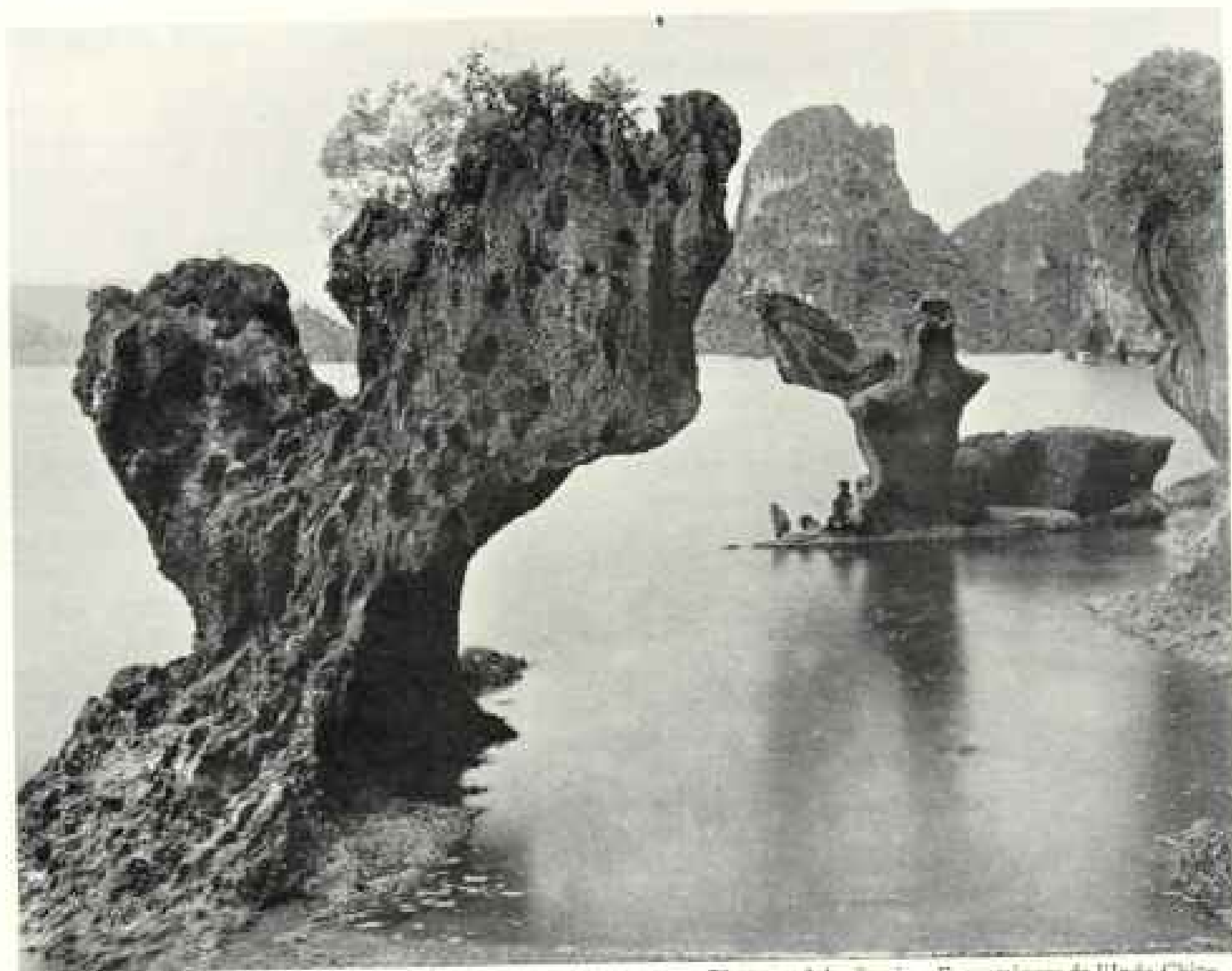
had been born to some heel-clicking regiment, for civilian gestures seemed an inadequate response to the fervor with which we were greeted.

Illustrated programs had been mimeographed and a native lad, speaking impeccable French, delivered a stirring address of welcome dedicated to an absent Expedition. Athletic exercises were carried out with snap and precision, and a variety of tribesmen and tribeswomen had been assembled.

How desirable it would have been to follow these hill dwellers back across the paddy fields, by narrow trails along the heavily wooded slopes where—if one believes their legends—the nine-tailed fox snaps up humans at a gulp and there lives a virgin whose glance is death!

#### CHECKERS WITH LIVING "MEN"

At Caobang, Iacovleff and Rollet set up their easels on the porch of the Residence and immediately began work. I pushed on



Photograph by Services Economiques de l'Indo-Chine

LIKE INKY ICEBERGS IN A TROPIC SEA, ROCK FORMATIONS DOT THE BAY OF ALONG

Men have given fanciful appellations to many of the weathered and worn islands of this poetic bay. To the natives the suggestive rock sculpture is the work, not of Mother Nature, but of a fabulous monster, from which the region takes its name—Bay of "The Dragon Came Down."

to Nguyenbinh, promising to choose the best of models and rush them back in my car while I took color pictures of tribespeople, sorcerers, weavers, and a local variety of chess or checkers with living "men" who really were Man-Coc and Man-Tien girls in gala array (see illustration, page 521).

A long line of them greeted my car as I arrived—enough color and primitive beauty to make a photographer marvel. Weeks of horseback riding and negotiation could result in no such quarry as this, for in the mountain villages the women are hid from the view of strangers except during the *Tet*, or month-long New Year, and during that popular festival each eager participant is too distracted to pose. Yet here they were, three score or so of them, brightening the cloudy market place.

I hastily picked out a couple of models (one was a chieftain's daughter, which was a bit of luck) for Iacovleff and Rollet, chose young men companions for them, added

such numerous chaperons as the occasion and local proprieties demanded, and, my own car being too small, hurried them off to Caobang in a sturdy autobus.

When it comes to living checker men, the slave girls of the Moguls captured my imagination long before these tribal daughters took their places on a "board" consisting of a rice terrace marked into squares by strips of bamboo (see Color Plates XIV).

#### GOWNS WORN ONLY FOR A DAY

For all its 16th-century magnificence, Akbar's abandoned capital in far-away India left me no memory more potent than the small squares scratched in the red sandstone pavement—the game board across which tawny slave girls of the long ago, selected for imperial favor and wearing silks so soft and fragile that they were discarded after one day's wearing, moved from square to square in response to the orders of sleek-bearded nobles.



I doubt whether anyone but these exotic women of the Tonkin hills, so colorful yet so shrinking in their modesty, could have acted out a checker game without doing offense to that East Indian wraith of vanished reality. Their moves, duplicating those made by players on a conventional checkerboard, showed the same lavish dramatizing of a contest, somewhat as two football coaches use star athletes for displaying formations and runs worked out on a blackboard.

At Nguyenbinh the priests and sorcerers were a problem, for they listen not to the voice of living authority, but to the mysterious mandates of the gods.

Some of them had gone into their trance-like seance before our approach and interference would have been profanation. How any army officer, in full physical control of the sorcerers, but a noninitiate in sorcery, was able to induce them into the light and before the lens I do not know, but palms were crossed with silver—potent sorcery the world around.

There in the market place at Nguyenbinh the magic of sorcery was skillfully shaped by the magic of the French colonial administrator. The spirit of Lyautey, colonial genius, still lives in upper Tonkin.

It was market day in Thatkhe when we returned, and a Chinese and an Annamite theatrical troupe were rivals for the approval of the crowd. Oriental audiences have a positive genius for concentrating on the main show and ignoring the extraneous. Wearing a black cloak to signify his invisibility, a property man can cross the stage, stumble or sneeze without affecting even the youngsters, who, seeing a gaily gowned actor do no more than stride his whip, know at once that he has mounted his horse.

In the Occident every serious artist fears the chance event which brings a laugh or a titter where a titter is tragedy.

#### TO THE JAIL YARD FOR PHOTOGRAPHS

When I mounted the shaky platform on which the Chinese troupe performs and, standing high on the wardrobe trunks at the back of the stage, had my tripod held by a wrinkled granny who, incidentally, knows volumes of Chinese theatrical classics by memory, there was scarcely a smile, though I was in full view. But when it developed that this was no regular performance, but a camera rehearsal, the crowd became so big and the platform so

jostled about that we retired to the jail yard for our photographs.

The Annamite artists, still in street clothes, looked so nondescript and slovenly that it seemed hardly worth the trouble to ask them to put on their costumes and make-up. A long road and a busy day lay ahead. But it is worth while to see a theatrical "bird in the hand" in his fine feathers.

When they appeared, my persistence was rewarded. An erstwhile spiritless wench had become a veritable princess, and eyes so recently devoid of light now flashed forth a smile from beneath a regal head-dress of glass and tinsel topped by two graceful pheasant plumes—"fine feathers" playing their traditional rôle.

The costumes of the men were fresh and colorful. A prince wore silks under a circular shieldlike decorative plaque, edged in spotless white fur. Was this exquisite idol of the market place the slovenly nondescript of a moment ago?

#### THE HOUSE OF THE SORCERESSES

That afternoon we climbed a shaky ladder, crossed a quaky bamboo porch, entered "The House of the Sorceresses," and held vicarious communion with the malevolent powers of darkness.

Sorcery and religion are strangely combined, and both retain a dignity with which the French administrators are careful not to interfere. We had been told in advance that we must not disturb the ceremony or even expect overt recognition of our presence. None of the four sorceresses gave any sign of knowing we were there.

Dressed in silk gowns, soft in texture and tone, they sat, tailor-fashion, on the clean matting with the flexible toes of their bare feet occasionally moving to a strange, unearthly rhythm.

The three younger women wore a white fillet about their topless black turbans and played long-handled *don tams*, three-stringed guitars covered with python skin from the near-by jungle. The fourth sat near the red lacquer shrine, its porcelain bowls bristling with incense sticks, and set the measure by raising and lowering a clinking cluster of shiny rings above a small square pad covered with lacquer-red silk.

Now and then she stopped the uncanny beat of the bright ring-web, spat a maroon stream of betel juice into a highly polished



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Finlay Photograph by Maynard Owen Williams

CAMBODIAN DANCERS GESTICULATE RATHER THAN RECITE THEIR  
COUNTRY'S LEGENDARY HISTORY

Standing on the steps leading to the Royal Throne Room at Pnom-Penh, capital of Cambodia, one court dancer wears a bird-faced mask representing a solar deity, Garuda. The other young woman wears the triple-headed mask of a Demon King bearing a thunderbolt in his hand.



POMPONS AND SILVER MAKE THE MAN-COO'S TONKIN'S BEST DRESSED WOMEN

Nowhere in this province are seen tribal costumes richer in barbaric beauty than these at Nguyenbinh. The Yunnan border cuts across language barriers and tribal divisions.



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Final Photographs by Maynard Owen Williams.

TONKIN SORCERERS CEASE SERVING EVIL SPIRITS TO FACE A CAMERA

Many tribes near the Yunnan frontier practice witchcraft with the aid of sounding brass and tinkling cymbals. For comfort amid the powers of darkness, flood, and disease the people turn to magic.

THE TRICOLOR RULES: THE RAINBOW IN FRENCH INDO-CHINA



GIRLS PRESENT SPRIGS OF JASMINE AS TOKENS OF WELCOME TO LAOS

When the author arrived at the home of the French Commissioner in Savannakhet, gaily dressed women crowded the garden, bearing blossoms which were presented by each in turn.



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Friday Photographs by Maynard Owen Williams

IN LAOS, THE *BOUN*, ANY KIND OF FESTIVAL, ATTRACTS INFORMAL AUDIENCES

This joyous ceremony was one at which cotton cords became good luck charms. After being blessed by the native priests they were tied to the wrists of honored guests (see Plate VI).



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Finlay Photograph by Maynard Owen Williams

**BUDDHISTS IN YELLOW GOWNS, AND CHECKERBOARD ADELYTES SWEEP A HAVEN OF THE DEAD**

Near the River of Perfume, away from the crowded streets and canals of Huế, Annam's teeming capital, the Royal Tombs are set in quiet enclosures carved from the jungle. Here a procession of priests files between a monumental gateway and a placid pool.



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**A FRESH FLOWER ADDS THE FINAL TOUCH TO LAOTIAN COQUETRY.**

In the hills west of Annam modern civilization has been held at bay, although shapeless blouses often hide the satin brown of the skin (see Plates III and VI). Jewelry is rare, but blossoms figure in most festivals.



Fairley Photographs by Margaret Owen Williams

**SILK HAS WON A PLACE DESPITE THE TEACHINGS OF BUDDHA.**

Although the taking of life, even of a silkworm, is against Buddhist doctrine, silken robes are now worn by priests, gentle seekers of that emancipation from worldly cares known as Nirvana.



BOTH FAMILY MAN AND MANDARIN IS THIS OFFICIAL OF THE HUÉ COURT. Local critics of the drawings of Alexandre Jacovleff, artist-explorer, are the wife and children of M. Vo Chuan, a member of the Department of Education in the Annam Government.



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CHILDREN BEARING FLORAL TRIBUTE ADD INTEREST TO A BASK CEREMONY

Around a visitor's wrist, Laotian chieftains tied five cotton cords with wishes for a safe journey from Saigon to Paris by air. The steamer in which he would otherwise have traveled burned and sank in the Arabian Sea off Socotra with the loss of scores of lives in 1932 (see Plate III). The plane completed its 8,000-mile flight without mishap.

THE TRICOLOR RULES THE RAINBOW IN FRENCH INDO-CHINA



CAMBODIA'S NINETY-SEVENTH RULER HAS A NEW PALACE AT PNOM-PENH. The telescopic roofs, carved pinnacles, and lustrous roofs of King Sisowathmonivong's new home link it with the architecture of Siam rather than the diverse styles of Indo-China.



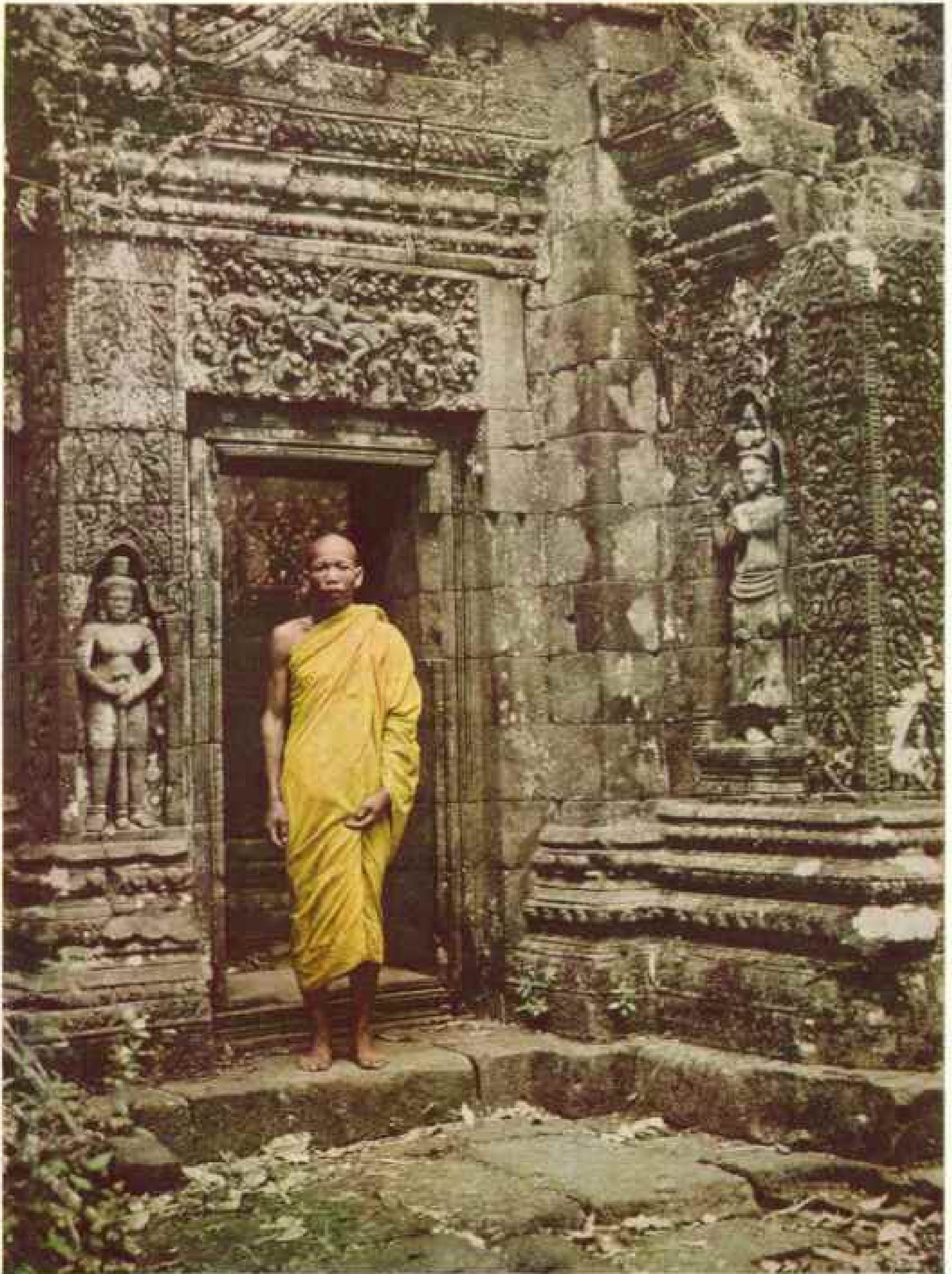
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Finlay Photographs by Maynard Owen Williams

LIKE STONE NYMPHS SPRUNG FROM ANGKOR CARVINGS CAMBODIAN DANCERS POSE

With whitened faces setting them apart from the toilers, the dancing girls arrive by jungle paths at the Temple of the Sacred Sword. Adjusting their rich costumes and striking conventional attitudes, they turn into living duplicates of carved Apsaras pictured in temple murals since the days of the Khmer kings.





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Finlay Photograph by Maynard Owen Williams

YELLOW ROBED BUDDHISTS ADOPTED THIS TEMPLE OF A RIVAL SECT

Pleasant mannered and peace-loving, the Laos like few laws, light taxes, and much comfort. At Wat Phu—The Monastery of the Mountain—they found the abandoned temple of Linga Parvata just the place to set up a far different religion. Even a sacred spring of the Brahmans, which bubbles from the holy hill beside the Mekong River, is used in Buddhist ablutions.

little cupidor, and rinsed with tea her cavernous mouth, its darkened teeth almost invisible.

Had it not been for the solemnity of the sorceresses, their complete indifference to our presence and the perfect air of conducting a secret seance with unseen spirits more tangible than ourselves, the betel-chewing would have seemed incongruous. Instead it heightened the impression that we were observing the whole esoteric ceremony through a peep-hole, or a crystal ball.

The *don tams* plink-planked on and on, the tangle of woven rings sent forth their weird musical clatter with vivid monotony, and slender, long-fingered hands swept up and down the lean necks of the soup-ladle guitars. Shut out from the central mystery, we stole softly away.

One might tour the East for years and never enter the "House of the Sorceresses." At night, in the chiaroscuro of candle light and incense smoke, it must be an even more impressive experience. But we were to have tea in Langson with the Resident and Mme. Klein and night must find our headlights sweeping the low plain about Hanoi.

#### HANOÏ, A CAPITAL OF CONTRASTS

Like other Eastern combinations of Oriental city and European outpost, Hanoi, the capital of French Indo-China, has its sharp contrasts. The obvious one is that of native streets, where the goldsmith and the potter, the ivory carver and the silk merchant, the medicine mixer and the lacquer maker give the names of their professions to the highway enclosed between their workshops, while beyond the midcity lake a tea dance moves to American jazz. But what Oriental city from Harbin to Bombay lacks this contrast of cultures?

Hanoi has its bright bouquet of wide-hatted flower "girls" squatting under a hanian at a corner of the lake, such a happy idea of art-loving Governor-General Pasquier that they are called "Pasquierettes," but my most vivid memory is of something trivial. It was raw and cold in Hanoi—with what longing we remembered its coolness when we reached the steamy Huong-giang (River of Perfume) two days later!—and I had entered one of the capital's splendidly stocked bookstores.

I wanted a pack of envelopes and noted that there was no glue on their flaps. Careless! I chose another package. Still no

glue. Hanoi has such long months of humid heat that the administrators must seal their letters with the aid of a glue pot, lest the envelopes seal themselves shut.

We attended the opening of the new museum of the *École Française d'Extrême Orient*, whose savants have rescued, protected, and interpreted the mysteries of this link-land between Hindu, Malay, and Chinese races, religions, and civilizations.

Another GEOGRAPHIC staff member has described and pictured the Mandarin Road over which we motored to Hué and his "heavy loads, bouncing on shoulder poles" and "screeching wheelbarrows, pushed by industrious Tonkinese," is a vivid picture of that toil-crowded highway.\* In Hué, his friends became mine.

One night we were guests of a royal dowager while young dancing girls performed and supple Annamite princesses swept the 16-stringed *don trank* with their graceful hands as they squatted in waves of delicately colored native silks and neatly pleated trousers of creamy white.

Betel chewing and the habit of putting black lacquer on their teeth adds an incongruous note to the beauty of the sinuous Annamite girls, but some of them are already cultivating pearly teeth, and then the enigmatic Annamite smile, shorn of the stains left by areca nuts wrapped in betel leaves and spread with paste of lime, takes on new charm to Occidental eyes.

Prince Buu Liém, wearing many medals and the official's ivory plaque or *ba-ngai*, welcomed us to his home life, livened by the beauty of the young Princess Kieu Nghieu, his daughter. Vo Chuan, a Mandarin in the Department of Education, put on his purple robes and winged bonnet of office while Iacovleff painted his portrait, and his youngsters, like silk-clad dolls, looked on or watched the goldfish dart between the lotus pads of a tiny pool (see Color Plate VI).

#### BOAT LIFE ON THE RIVER OF PERFUME

One afternoon, when light and heat had lost their edge, I drove beside a shadowy canal and waited at a bend until a gondola-like sampan, propelled by two oarsmen in coolie hats, added the necessary touch of leisurely life and movement to this peaceful backwater.

\* See "Along the Old Mandarin Road of Indo-China," by W. Robert Moore, in the NATIONAL GEOGRAPHIC MAGAZINE, August, 1931.



BEADS AND BAUBLES BRIGHTEN THE SMILE OF AN ANNAMITE ACTRESS

Two long pheasant plumes complete this elaborate headdress worn by a member of a theatrical troupe at Thatkhé. Only within recent years have female parts been played by women. Inconspicuous in her street clothes, this young artist, when ready for the stage, exemplified the proverb, "Fine feathers make fine birds."

Aquatic plants floated in sluggish currents, a thatched shed was reflected in the stream and feathery bamboos rose against the radiant sky. Only the soft plash of oars accented the silence. The roar and bustle of the city streets still die away when I recall that idyllic picture of boat life near the River of Perfume.

Hué, like Peiping, has its forbidden city and a fine museum, housed in a pavilion of the palace. The Khai-dinh Museum, like many another, is overcrowded with riches. But they fit these high-beamed palace halls and are provided with that proper setting,

which, to the French connoisseur, makes or destroys a gown, a wine, a phrase, or a thought. Thus housed, an Annamite museum piece is not a meaningless bauble, but a distillation of the indigenous art outside its very walls.

It was to this provincial capital on the River of Perfume that Bao-Dai returned from the Occident. Judiciary reform, creation of a Ministry of National Education, recognition of a House of Representatives, and inclusion of the President in the Council of Ministers—all were promised by this youthful Son of Heaven.

Though clothed in a robe of gold, Bao-Dai's only possible rôle is that of servant to his barefoot subjects. Among his first acts were the inspection of a trade school and a school for girls—this in a capital long distinguished for its "Camp of the Scholars," providing purely literary education for males only. His example was noteworthy, for although Annamites don't wear starched collars, many still prefer white-collar jobs.

Indo-China spends a surprisingly large proportion of its budget for education. Oriental religion and philosophy, expressed in Chinese, Sanskrit, and Pali, are combined with western science, but every effort is made not to uproot the people from their time-tested habits of life and thought.

#### OVERLAND TO AMAZING ANGKOR

From Hué we started overland for Angkor by way of the highlands of Laos, across the mighty Mekong and through the Cambodian jungle.

The first night found me at Savannakhet, a guest in the home of Commissioner and Mme. Detrie, who not only overwhelmed me with kindness, but abetted several hundred Laotians in doing the same.

The Laotians refuse to do coolie work and Annamite laborers are brought up from the plains. Since Laotians retreat before the Annamite settlements, this proud, primitive race is gradually losing its ancestral lands before the advance of modernity. I found the natives of Laos unusually attractive, both in looks and in actions.

Near an isolated pagoda, far from the town, an avenue of cut banana fronds led to a gaily decorated shelter which was the focus for costumes brighter than an oleograph rainbow. Hundreds of women, squatting along the line of approach, held tiny sprigs of flowers between their flattened palms.

Commissioner Detrie helped, but it took us a long time to garner all these floral tributes, and no pictures could be taken or other ceremony proceed until that had been done. In presenting the jasmine blossoms or other flowers, the women looked straight ahead, or touched their foreheads to their joined thumbs until after the gift had been accepted, then broke into normal conversation among themselves.

When I landed at New York, two months later, I still had five cotton cords around my wrist, and in spite of the amiable persecutions of my friends, to whom a cotton cord seems a hollow honor, wore them till they fell off. For they were tied on my wrist at a *basi* ceremony by five Laotian chiefs from whom they were tangible testimonials



FACING THE COFFIN, HE BACKS TOWARD THE GRAVE

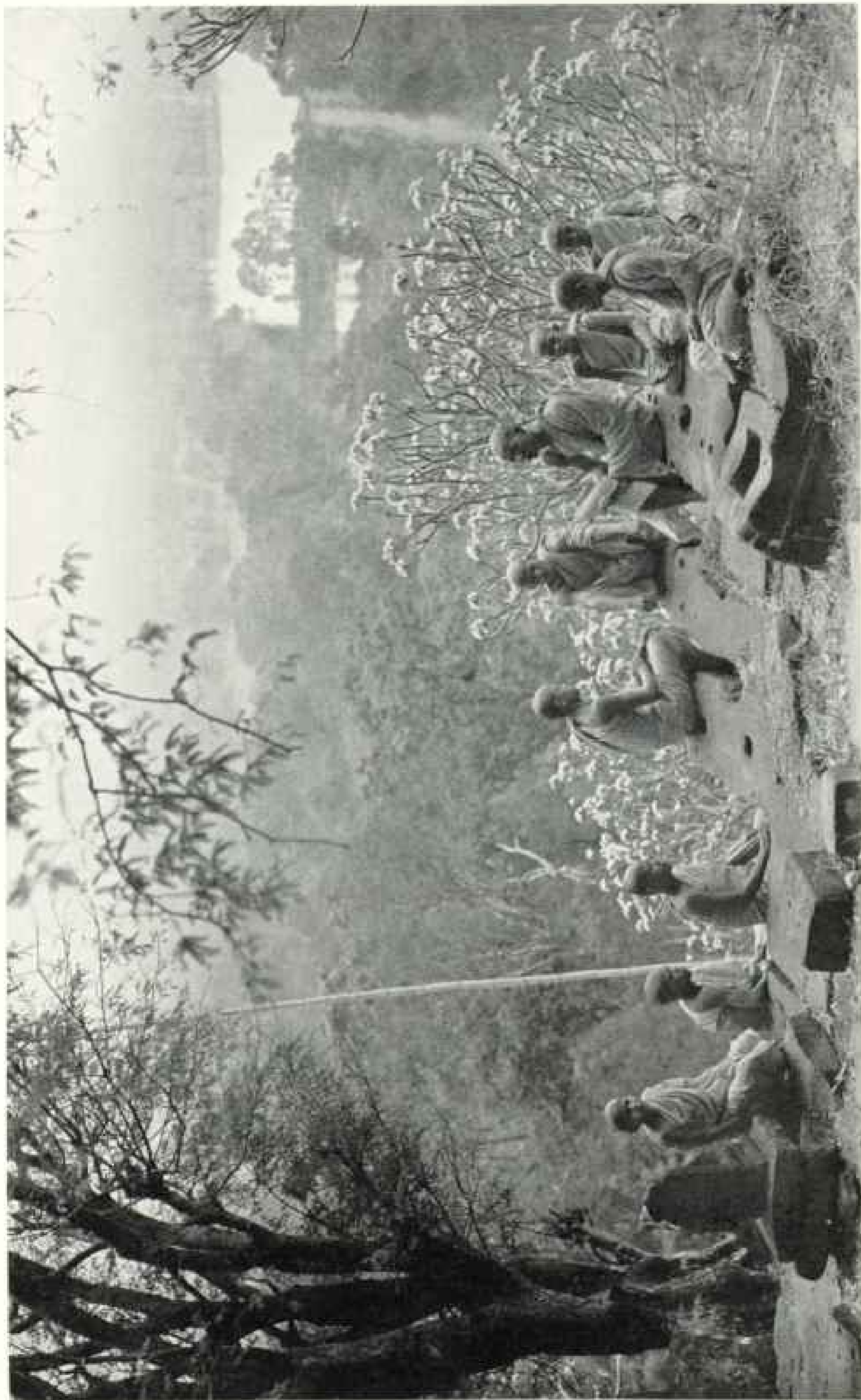
In this Tonkin funeral at Langson, one white-clad mourner, the nearest relative, leans on a cane and precedes the catafalque. Slowly and reluctantly he gives way to the corpse on its way to burial. This specially rehearsed funeral, accurate to the last detail, lacked a body (page 489).

of good wishes for a safe voyage and a happy return. A shred from a hangman's rope could have not been a better talisman.

French officials wear the *basi* cords as evidence of friendly relations with the hill tribes and take them seriously. No weapon would prove so effective a protection.

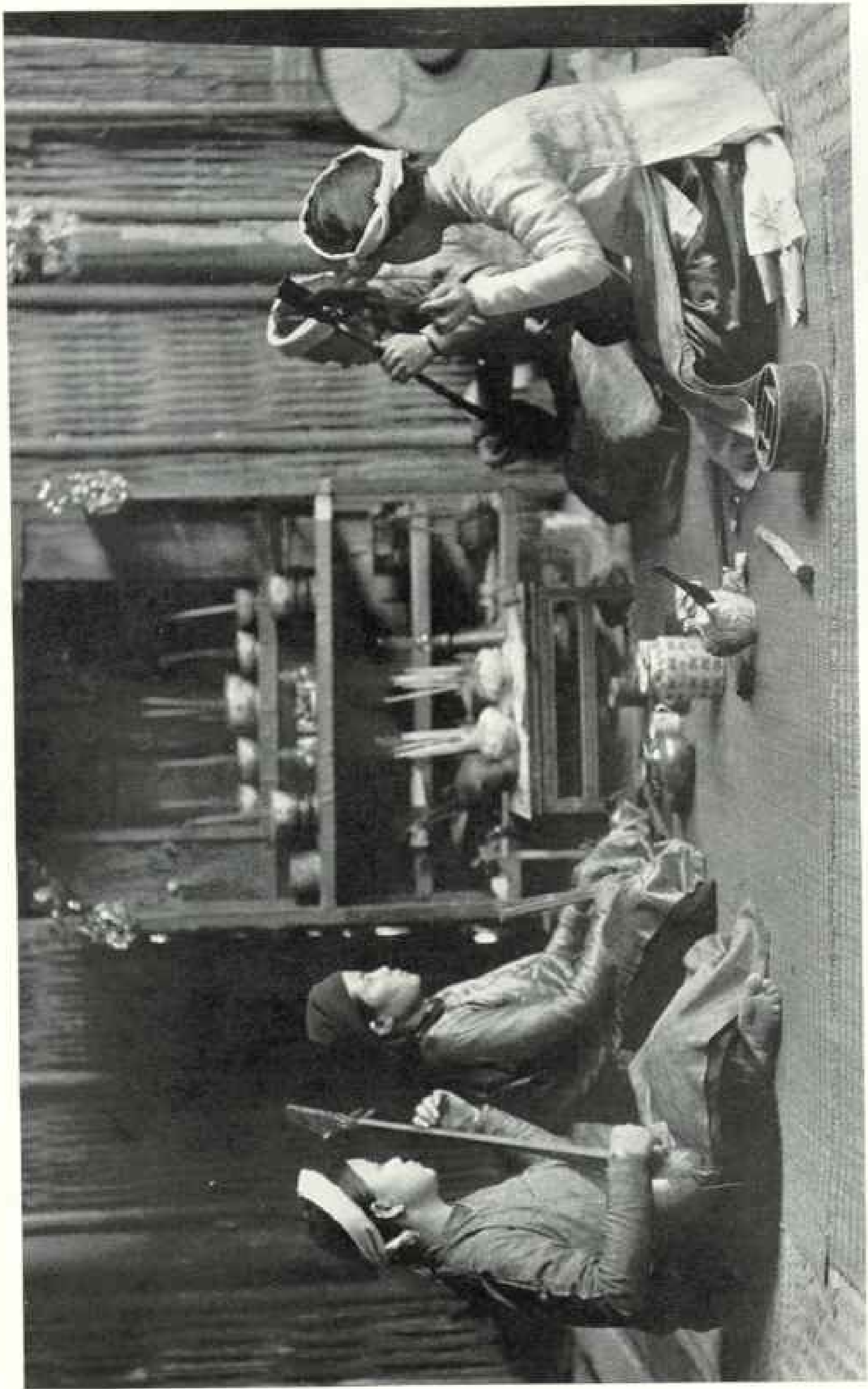
During the festival two well-muscled youths put on a foot-boxing match, a procession of half-naked men and bright-skirted women circled the pagoda, and a group of thirty bonzes prayed at the base of the conical temple.

The costume of the Laotian women consisted, until recently, of a bright *sinh* and a loose-folded scarf. An ugly cotton blouse



A RARE SPOT FOR MEDITATION OR TEACHING IS WAT PHU—THE MONASTERY OF THE MOUNTAIN

Away from the busy plain and the mighty Mekong River, this small group of yellow-robed Buddhist novices meets in a setting revered for centuries. An ethereal haze clothes the valley, and water from a sacred spring trickles near by. Buddha taught that life is suffering, and few attain such escape from its problems as do the wearers of the yellow robe.



HOVERING SPIRITS WERE MORE REAL TO THESE SORCERESSES THAN A FOREIGN LENS

No offense was taken at the making of this rare photograph, for to the women neither the photographer nor his camera was present. Around a crude shrine at Thatkhe, furnished with incense bowls, the women wove a web of sound which excluded the material world and conjured up the spirits to whose flattery or propitiation they give their lives. Python skins cover the long-handled *don-tam* twanged by the priestesses of necromancy.



A CLOWN'S VERSION OF "THE GOBLINS'LL GET YOU" IN THE UPPER TONKIN

Each Chinese theatrical troupe, however classic the drama, has its clown whose pantomime, often skillful, offers the comedy relief from a surfeit of nobles, generals, and legendary deities.



IN LAOS FOOT-BOXING RESEMBLES FENCING WITH THE FEET

A favorite amusement on a festival program is such a contest, fast as a cockfight and distinguished by craft rather than force. The idea is to catch one's opponent off balance, when a slight push or twist of the foot will upset him. There is no count of ten to give him another chance.

has been added and it took diplomacy and patience to induce the daughters of Savannakhet's best families to be photographed without the offending garment.

Near Savannakhet, just before we passed, a herd of wild elephants had done considerable damage, and pythons are so common that the skins, later to be transformed into shapely slippers for modern daughters of Eve, sell for a dollar or so apiece. But during our weeks in the jungle we saw not a single tiger, leopard, gaur, wild elephant, or python. Although Indo-China is a paradise for Nimrods, so that signs reading "Domesticated Elephants" are sometimes necessary, in most parts of the domain patience is as essential as marksmanship.

#### ADVENTURES ON FLIMSY BRIDGES

Adventure, for us, came from a succession of flimsy bridges bound together with lianas which had later dried and loosed their hold. From Paksé we crossed the Mekong and set out for Wat Phu, a famous Brahmin-Buddhist site with a sacred spring.

We were told that the trail was new, but we were not informed that no motor car had ever crossed the succession of jackstraw structures which bridge the chasms plunging toward the Mekong.

Once, when we were in the middle of such a rustic bridge, the whole structure swayed ominously, and in trying to push us up the steep bank at the far end the back wheels kicked the small cross pieces out of their bound joints and the whole rear axle sat through the bridge (see page 529).



BEHIND HIS FALSE WHISKERS, TWINKLING EYES BETRAY THE MAN

Amused by the camera, this member of a Chinese theatrical company awaits his cue near the Porte de Chine at Dongdang. Wandering bands of players move from town to town repeating traditional rôles familiar to the youngest spectator.

Ordinary tools would offer scant aid but where one finds primitive men he's in luck. One brown lad deftly opened a couple of coconuts to refresh us, went to cutting fresh green lianas, impressed his fellows into service, used a young tree as a lever, and pried the heavy car up till the new cross pieces he had cut could be laid beneath the wheels.

It was fatiguing work under the hot sun, but in an hour we were free. In another five minutes we were sitting through the next bridge of the series—and no primitive folk at hand.

Clays sent his lighter car back over the fearsome bridges we had already crossed



and, leaving my chauffeur on guard, Claeys and I tramped on through the heat.

The friendly Mayor of Bassac offered sorely needed succor to two weary wayfarers. One look at his bed platform and we lay right down, without stirring until someone brought coconuts which we emptied down our throats.

Claeys had the good sense to ask for sarongs and, stepping inside the polychrome circle of intricately patterned silk, we dropped our sweat-soaked clothing to the floor and then lay back again until the pressure lamp spewed blazing oil on the floor and the Mayor's daughter left off tending a naked baby long enough to beat out the flames with a soaked rag.

I still have a sarong woven by the Mayor's daughter—a beautiful fabric of purple and yellow silk. The thread was dyed before it was woven, and when one unravels it various lengths of yellow and purple on the single thread give no hint that they formed such a regular and beautiful pattern when put through the loom.

By what mathematical formula or ancient tradition the color-spacing is done I cannot say. It is one of those wonders of primitive handicraft before which the citizen of a machine age stands in ignorance and awe. I wouldn't have missed Bassac—unless a rickety bridge had swayed too far. And I wouldn't have liked to miss it, even then.

For miles up and down the Mekong one can see the steep peak of Phu Khao, a sacred mountain to which, in the 6th century, the Chen-la kings offered human sacrifices. Later it was honored by the Brahmins as a giant linga, and it is now the site of a Buddhist Monastery.

#### PEAK A SHRINE OF THREE RELIGIONS

So have three overlapping religions based their worship on the most prominent geological feature of the jungle-covered countryside, and around the sacred spring Brahmin and Buddhist lived together in peace for centuries.

In the side of the mountain this sacred spring perpetually bathed a linga, the central object of worship in the Khmer temple of Linga Parvata. The elaborately carved structure is now mostly roofless and Buddhist idols with Mona Lisa smiles occupy one of the bays (see Color Plate VIII).

The yellow-gowned monks and novices live in small thatched structures on this elevated platform 250 feet or so above the

plain and possibly 400 feet above the low-water level of the Mekong. From their retreat, at the head of a long series of stone steps leading up from a square pond, they have a splendid view of the dense jungle below.

We descended to the steamy plain and entered our motors. A gang of workers had rescued mine and that of Claeys was back from Paksé, whose Commissioner was eager for news of us.

On our return to Paksé, the town seemed metropolitan. As we danced on the outdoor platform at the club, those two half-naked foreigners, lying in bright sarongs on a bed platform in the Mayor's house at Bassac, seemed utter strangers.

We rolled merrily south to the Falls of Paphang near the Khône barrier which interrupts navigation on the mighty Mekong and continued after lunch to Stungtreng, our taking-off place for a drive through the jungle to Angkor.

#### BLAZING A JUNGLE TRAIL

The hot season was upon us, and as we sat on the flower-shaded porch with M. Filleau de St. Hilaire, after our cars had been ferried across the wide river, we heard such tales of old colonial days as made our plans seem commonplace. Yet we were told that no civilians had preceded us over these newly opened jungle trails.

As the Resident at Kompongthom guided us through his jungle kingdom he carried a large stock of medicines, and his arrival in each tiny cluster of huts was a signal for the villagers to assemble for a much-needed course of dosing, washing, and bandaging—a small proportion of the 3,000,000 medical consultations that are held every year among the 21,000,000 inhabitants of French Indo-China.

Civil and military hospitals and Pasteur Institutes in Saigon, Nhatrang, and Hanoi are features of an efficient Public Health Service, and serums against pest, cholera, dysentery, and hydrophobia are delivered across wide jungles by airplane.

Just before nightfall we arrived at the temple of Prah Khan, long since swallowed up by the jungle.

Coming upon these disordered stones, once neatly aligned but now separated by writhing roots and overwhelmed by tropical vegetation, one appreciates, as he cannot along the smooth avenues at Angkor, the victory the Khmers won over the jungle.

THE TRICOLOR RULES THE RAINBOW IN FRENCH INDO-CHINA



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Vinlay Photograph by Maynard Owen Williams

ARISTOCRATIC PALMS AND THIRSTY PADDY FIELDS ARE NOURISHED  
BY CRUDE WATER WHEELS

Slowly turning, night and day, the groan of their axles testifying to endless toil, these *norons* beside the sluggish Siemreap River lift trickling bamboo tubes of water from the stream and empty them into troughs leading to the gardens. Within sound of this rustic scene, richly carved ruins bear witness to the vanished civilization which reared the stone tapestries of Angkor's temples.



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UPON HIS BREAST HE WEARS THE CARVED IVORY BADGE OF A MANDARIN

Dressed in the pleated silk trousers favored by the women of Annam, a princess poses with her husband in their tropical garden at Huế.



Finlay Photographs by Maynard Owen Williams

A SEVEN-HEADED SERPENT AND LAUGHING LION INSPECT THE NEW YEAR VISITORS AT PNO-MPENG

A high official of the Cambodian court, wearing gala dress, stands near a grinning *serpêk*, guardian lion of the Throne Room.



Fisher Photograph by Maynard Owen Williams

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MADAME PENH'S HILL GAVE A NAME TO CAMBODIA'S CAPITAL: PHNOM-PENH

A century after Marco Polo started across Asia, a native woman, Madame Penh, saved four sacred images of Buddha from the flooded waters of the Mekong. Enceased in a shrine on this hill, or Phnom, they immortalize the name of their rescuer. Caged in the zoo are tigers, revered animals of Annam,



"ALL THE WORLD'S A STAGE" IN A MARKET TOWN OF UPPER TONKIN

This gay assembly is no ballyhoo for a side show but is a colorful drama of Clown and Emperor freely played in the open market place. Thus buyers and farmers with vegetables are attracted to town and wooers of Lady Luck are lured to games of chance.



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Finlay Photographs by Maynard Owen Williams

TONKIN'S CHINESE THEATER APPEALS TO THE EYE RATHER THAN TO THE MIND

These poor wandering players assume dignity when they don their richly embroidered silks. Musty plots, handed down for generations, come to life when the youths play traditional parts, each with a costume badge indicating its character.

THE TRICOLOR RULES THE RAINBOW IN FRENCH INDO-CHINA



TEMPLE VISITORS LIVE IN A HOUSE ON STILTS BY THE SIDE OF THE ROAD

When pilgrims flock to this shrine the guest house, reached by ladders, in the compound becomes a veritable "tourist camp"! Travelers sleep on clean matting in this shelter open to the breeze and shaded by palms and bougainvillea blossoms.



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Finlay Photographs by Maynard Owen Williams

LADIES OF LAOS TOWNS ADD A COTTON BLOUSE TO THE NATIVE SCARF

Country dress usually consists of a gay skirt and scarf; the latter is laid aside during strenuous field work, weaving, or grinding grain. In the larger villages a shapeless cotton garment is replacing these old styles.



© National Geographic Society

**THESE MAN-CDC GIRLS WERE LIVING CHECKER "MIEN"**

Sometimes visitors to Nguyenbinh are treated to a game of checkers with human pieces arranged in their honor on a broad field marked by bamboo squares. This six-foot Juno standing beneath banana plants was "captured" early in the game (see color Plate XVI).



Friday Photographs by Maynard Owen Williams

**ANCIENT STONE COBRAS FLANK A MODERN HIGHWAY**

Paved roads are the French weapons against jealous tropical jungles. Where obscure trails were marked by the lifted heads of sacred serpents automobiles now dash through green tunnels, carrying visitors to the mighty temple of Angkor Wat.



Finlay Photographs by Maynard Owen Williams

**AFFECTION, NOT ART, FIXED THE POSE OF THESE ANNAMITES**

The right hand of the sister remains a formal stiffness, but the left protects little brother from a ducking in the goldfish pool. They are children of a Mandarin in King Hoa-Dai's court, at Hué (see Color Plate VI).



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**SPEECH RIDES THE CLOUDS ON HUÉ'S MORTUARY FILLARS**

Two Buddhist leaders, standing in the quiet of Annam's Tombs of the Kings, cling to their prayer chains but neglect the sky-blue pictographs on the columns which sing the triumphs of man or the peace of the eternal.





BELLES AND BEAUX OF THREE TONKIN TRIBES ASSEMBLE FOR A CHECKER GAME.

Crimson pompons and checkerboard trousers distinguish the Man-Coc women who acted as the white "men" (see Color Plate XIV). In chic but somber clothes, the Man-Tiens (second row) with high head-dresses suggesting graduation caps, were the black pieces. Bearing umbrellas, the Meo-Blancs (left) wear wheel hats built up of narrow webbing like rolls of adhesive paper.



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Finlay Photographs by Maynard Owen Williams

WILLING WALL FLOWERS WATCH A MEANINGLESS COURTING SCENE.

During a daytime rehearsal of the love court, for the camera, these girls seem content to look on from a balcony. But when the moon ushers in the actual festival each will welcome an admirer.

against which any victories, if vigilance relaxes, are but temporary.

JUNGLE PLANTS WAGE CONSTANT WAR  
AGAINST HUMAN INVASION

With what jealous subtlety the banyan extends its insidious embrace! With what inhuman patience the vegetable world strives to reassert its sway!

When the early explorers discovered the Khmer temples, they not only found a rich and highly developed art—a skill and patience which transported man-made mountains from quarries twenty-five miles away, veiled them in mantles of megalithic lace, and covered acres of walls with the drama of history and mythology—but they found evidences of a civilization which once conquered the jungle and reared vast cities on the sites of swamps.

When the Khmers disappeared so mysteriously—and in spite of his far-ranging feet and intelligence, Marco Polo missed the headline story of his day by failing to visit the Khmer temples from near-by Champa—the jungle immediately reasserted itself. "The people walked out and the jungle walked in."

Chou Ta-kuan, who may have known Marco Polo at the court of Kublai Khan, visited Angkor the same year the Polos returned to Venice, and although accustomed to Oriental splendor gave a vivid description of the Khmers.

"When the King goes out, covered with iron, so that knives and arrows, striking his body, can do him no harm, cavalry head the escort; then come the standards, the pennants, and the band. Maidens of the Palace, to the number of three to five hundred, dressed in flowery gowns, with blossoms in their hair and holding big candles in their hands, form a troop; even by daylight their tapers are lighted.

"The ministers and nobles ride in front on elephants and look far ahead; their red parasols are without number. After them come the King's wives and concubines, in palanquins, in carriages, or on elephants. They certainly carry more than a hundred parasols adorned with gold. Behind them is the King, standing upright on an elephant and holding in his hand the precious sword (Prah Khan, the Gift of Indra)."

Several temples bear the name Prah Khan. East of Angkor, deep in the jungle, this one, whose walls, towers, and chambers are strangled by the octopus-tentacled jun-

gle, gives a vivid impression of what ruined Angkor was like before it was tidied up and restored.

Tree roots writhe like serpents through the medieval courtyards and, having split huge stones asunder, now hold them suspended as a proof of their power. Tiny tendrils, first tickling the bulging breasts of smiling *devatas*, then reaching behind their narrow waists, tore the celestial show-girls from niches where the Khmers had enshrined them and won them for the unrelenting jungle.

Dead stones, vivified by the nameless artists of a vanished civilization, still echo the sculptured tramp of marching elephants.

Smiling faces on tall towers have a sphinxlike liveliness which resists the ravages of time. Crude stone gave immortal fame to a king already leprous when the sculptor began his portrait. Giants, holding the thick body of the cobra-headed Naga through which the aboriginal cult of serpent worship has lived on through Hindu and Buddhist rites, have persisted from the remote age of credulity to that of skepticism.

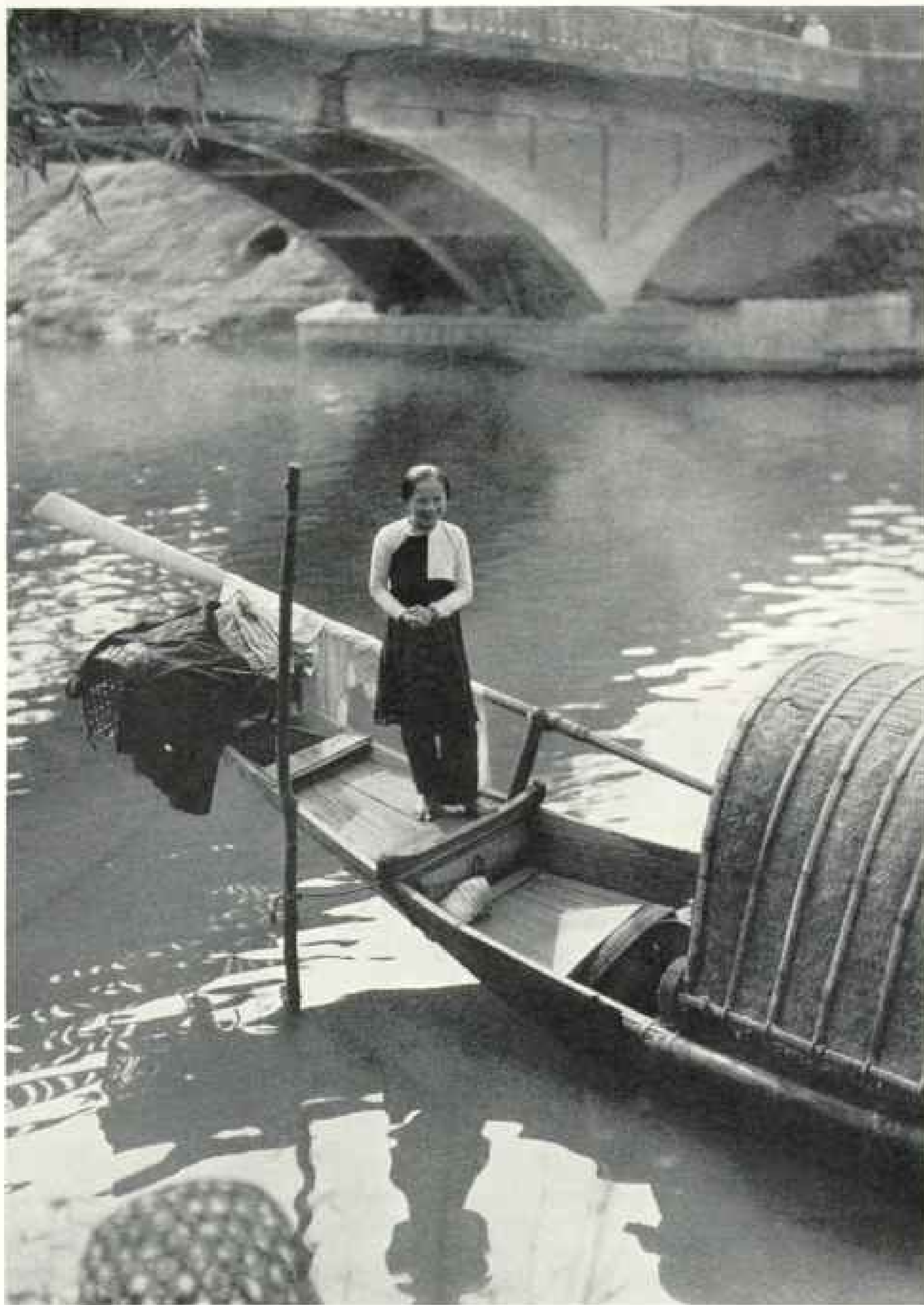
TO PREVENT OVERCROWDING IN HEAVEN!

And Apsarases! Perfect in beauty and potent in lure they are sent to earth to rob saintly ascetics of the spiritual perfection toward which they have striven through denials and penances and so prevent overcrowding in heaven. The Rig-veda and the Brahmanas contain many legends of these demi-mondaines who traffic their charms between heaven and earth. Hundreds of them enliven the Khmer sculptures, which are often gay but never obscene.

These Apsarases—a pony ballet—carved in stone centuries ago, are as supple and spirited as are their breathing sisters in cloth-of-gold. Balanced under the high headdress, or *makot*, like an Ouled Nail with her body swaying beneath a bottle on her head, they are as irresistible as Puck.

The more regal figures of *devatas*, bowered in leaves and flowers carved from rock, have more vitality than the ephemeral humans of the market place. The Cambodian temples hold their breath, as if in awe at the sudden downfall of their masters. But their hearts still beat.

Around these disordered temples, where so many stones still speak, because their decorations deal, not with the geometry of Byzantine, Saracen, or Copt, but with



MODERNITY BRIDGES AN UNSPOILED CANAL AT HUÉ

Life in Annam is speeding up. Across the River of Perfume from the concentric confines of the Capital City, the Royal City and the Forbidden Purple City, the European suburbs move to the rhythm of motor car and radio. Dividing them is this canal on whose backwaters life seems to stand still—content with its own reflections. As in Canton, there is a population—water-born and water-borne—whose life currents are those of river and canal, of sculling oar and tying pole.



ANIMATED CHECKER "MEN" AWAIT THE PLAYERS' NEXT MOVE

Acting as living pieces in a local version of a checker game, these Man-Coe girls, their playing names exposed on small plaques, do not sit within the bamboo-marked squares but at their intersections. The photographer, busy with his lenses, admits that he did not master the game, in which plays made on a small board were duplicated on this checkerboard, large as two tennis courts.



THEIR ANCESTORS FORGED THE CLAMPS WHICH BOUND KHMER TEMPLES TOGETHER

For untold generations the Kulis of Pnom-Dek, or the Iron Mountain, have worked the mines and forged the metal. Each process has mystical and religious significance, and tenans their forefathers fashioned a thousand years ago still resist the strain of the jungle roots, as they insinuate their fibers and slowly pry to bits the shrines of half-forgotten gods.



A. CATAPALQUE WITHOUT A COFFIN MOVES IN A PROCESSION LEADING TO NO GRAVE

Tawdry tinsel and old soft silks figured in this mock funeral at Langson. Priests in rich old gowns solemnly rode in a funeral procession whose central feature was a platform which bore no body (see text, page 489, and illustration, page 505).

sprightly living models, the true but transient life of the jungle is imposing its power. By some prolific chemistry of soil and sun and vapor this many-tentacled monster, so vital in fact, conveys a sense of death and destruction.

In the aisleless tangle of vegetation at Prah Khan even a Joyce Kilmer would have cringed from the tyranny of trees.

#### RUNNING THROUGH A JUNGLE FIRE

As night settled down and our headlight pierced bright tunnels in the blackness there was a macabre quality in the majesty of the jungle, where the eternal transmigration from man and beast to plant includes all nature in its pantheism.

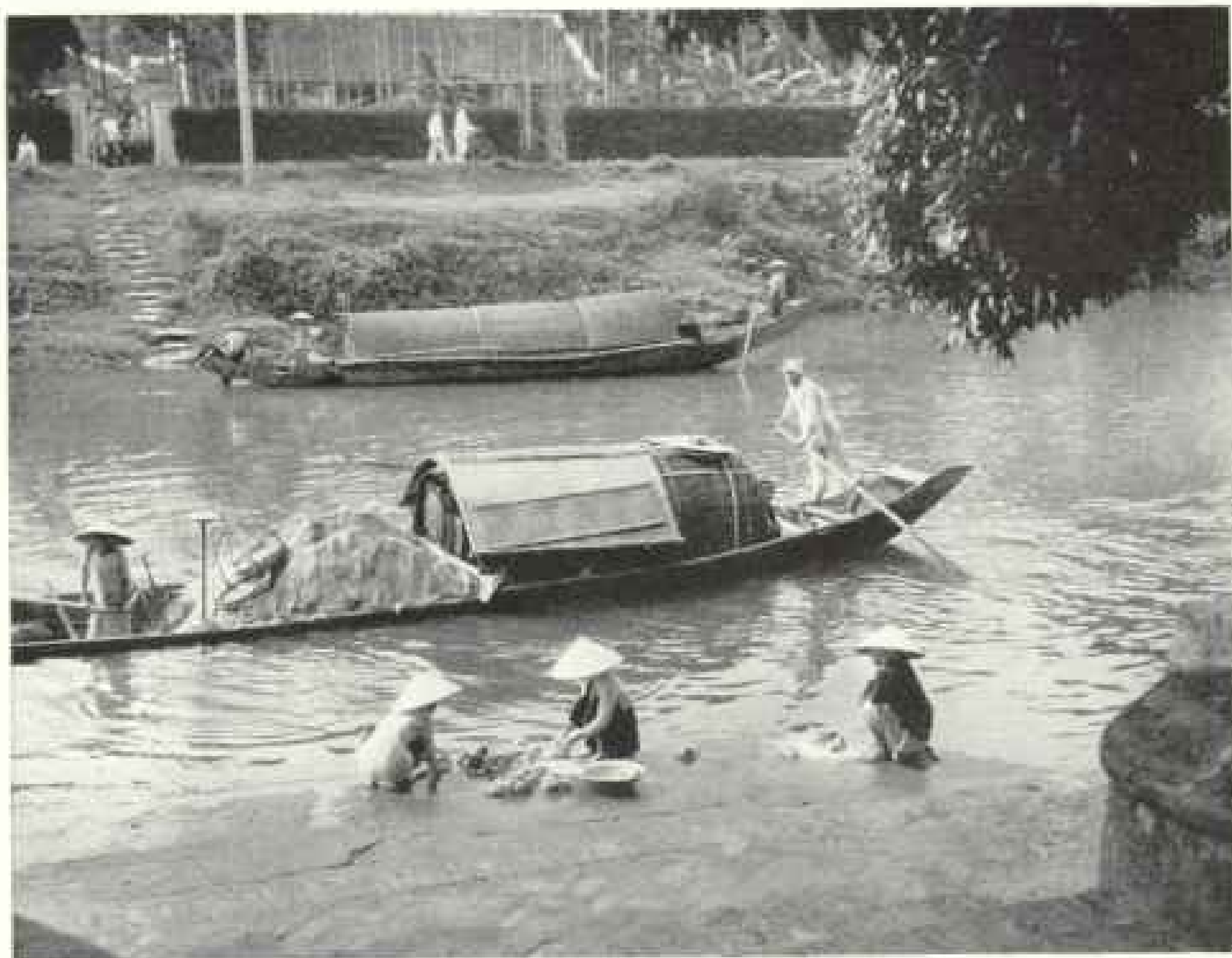
A fire in the tropical forest! Where in my childhood did I first glimpse that picture of a Noah's Ark collection of beasts fleeing for their lives before a serpent-tongued conflagration which feeds and grows and strikes fear into creatures whose courage and craftiness have enabled them

to make a home of the deadly jungle?

Between Prah Khan and Angkor, during several hours of motoring along the one possible trail, in which we sometimes stopped to hack the tangle of a fallen tree from our path, we were seldom out of sight or smell of a jungle fire. Two wooden culverts had burned just before our arrival, forcing us to slippery morasses at the side.

There *was* a real thrill in driving ahead through the tunnel of darkness, real beauty in the score of flames which added ruddy patches to the velvet dark. One bridge collapsed, sending up a shower of sparks, only a few rods ahead of us. But there was no sense of being trapped by a circle of fire or of impending doom.

An hour or two before midnight our headlights revealed a giant of a man, nude to the waist and carrying a gun. Someone had phoned ahead—yes, there are telephones in this jungle—and a forest ranger, whose skin must have been proof against insects, had come out to help us on our way.



WASHING ONE'S DIRTY LINEN IN PUBLIC IS NO SHAME IN HUÉ

Beside the busy waterway which divides the commercial section of the capital of Annam, women in wide candle-snuffer hats squat on the stone quays and gossip and wash, gossip and wash. A load of building sand is being rowed to its destination on this canal, which is the cargo highway of a city well supplied with rickshaws and automobiles.

Not far from the splendid boulevard which connects the Angkor ruins we passed a shadowy village livened by a few points of light. Beside me, my barefoot chauffeur snored, his head against me like that of a child. No ready-made drama, yet that night ride to Angkor is a vivid, welcome memory.

One rainy March day a year before, the Paris copy of Angkor Wat at the Colonial Exhibition carried me half around the world. The real thing carried me back from the tropics to the metropolis. The stupendous original, worthy of the greatest temple builders, is not impressive at long range. Well-read visitors, looking at it from the bungalow, find the reality disappointing.

No wonder! Manhattan's incomparable skyline as seen from Jersey City, across the Hudson River moat, is not much farther away, and man-made structures must compete with those composing New York's

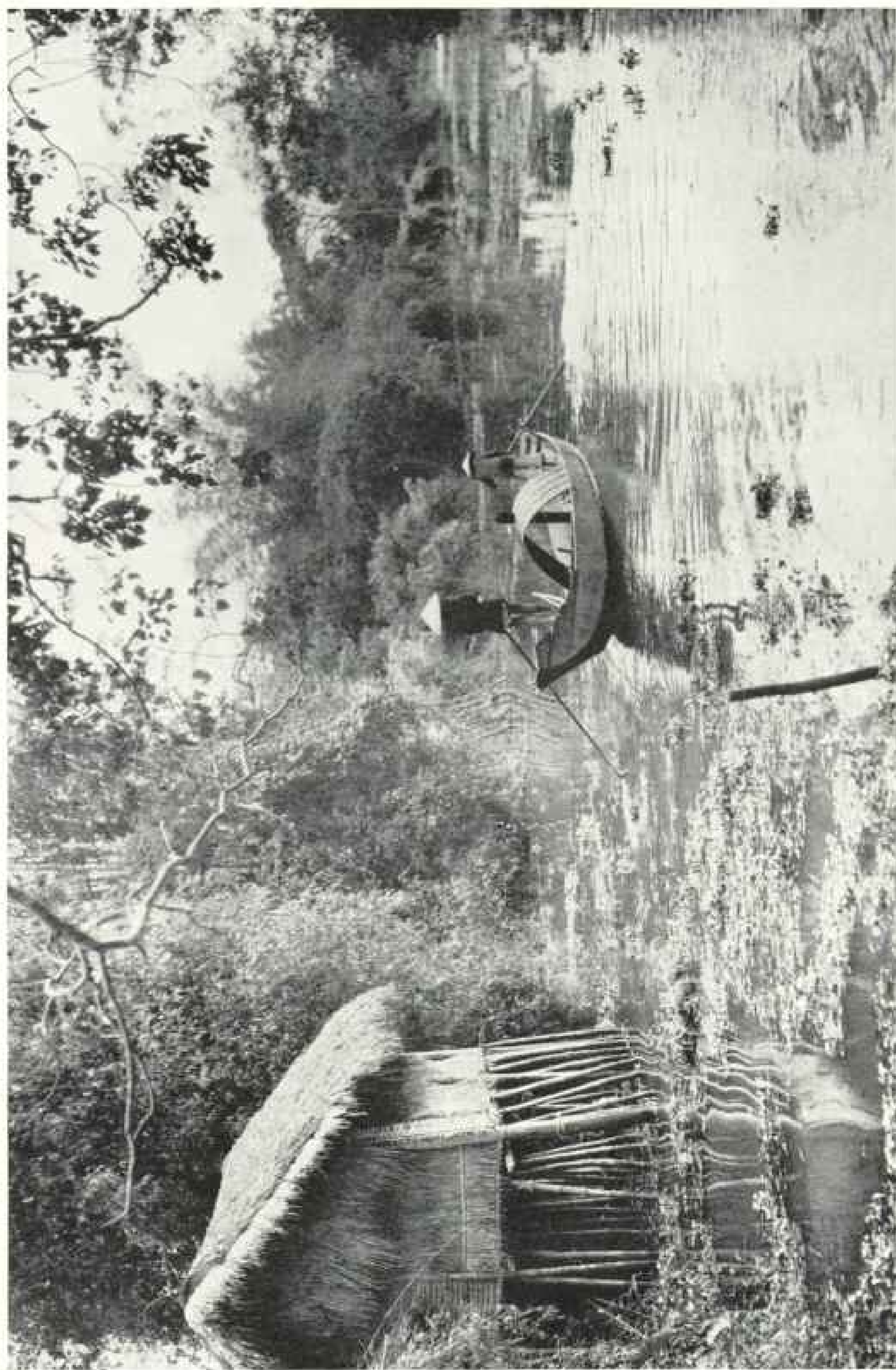
glittering palisade of stone and steel—the modern Angkor Wats — “temples of the city.”

Set a 180-foot tower in the middle of a square mile of courtyards, corridors, and moat and it is flattened out. But the inner steps to the Bakan rise before one like a wall, and hot-weather visitors are tired out before they reach the topmost shrine. The mind must travel a longer road than the feet to appreciate this strange religious edifice, shared by Brahmin and Buddhist during 200 years.

#### MONSTERS, SERPENTS, GODDESSES

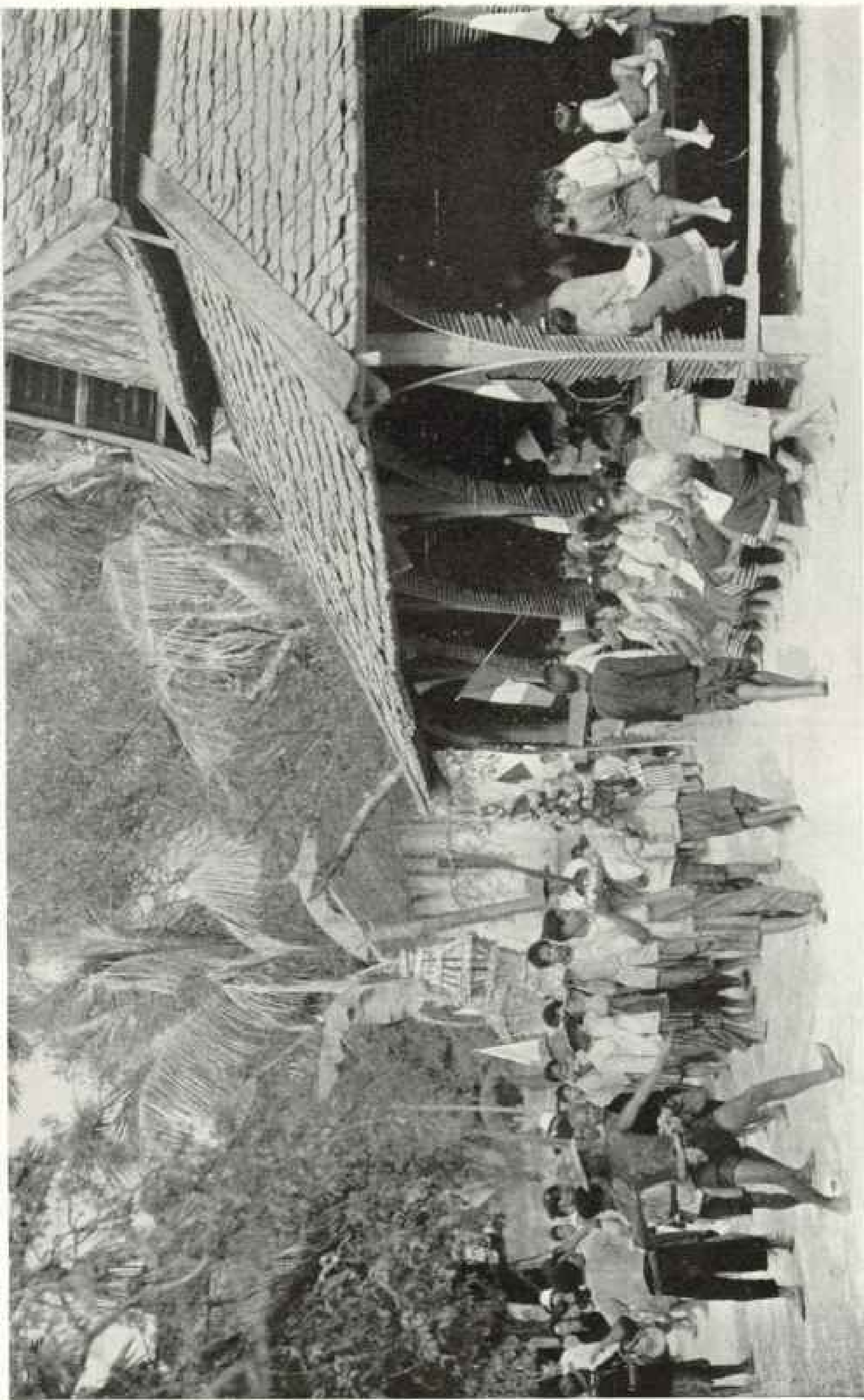
Pierre Loti, as always, adds the romantic touch to this vast expanse of the unfamiliar, this architectural story-book of a complex mythology!

“Everywhere monsters at death grips. Everywhere the sacred serpent dragging its coils along the ramps and lifting its seven venomous heads like a scarecrow.



IN SUCH A SETTING NEAR THE RIVER OF PERFUME A MEER SAMPAN BECOMES A DREAM SHIP

Close to the teeming city of Huế, two Annamite oarsmen go about their workaday task with a silence and a grace which make memorable this bamboo-fringed backwater of a tropical river. No smoke; no noise. Only the dry crackle of the swiftly growing bamboo and the swish of oars in the sluggish stream.



LAOTIAN LADS AND MAIDS STAGE A DAYLIGHT REHEARSAL OF A LOVE COURT

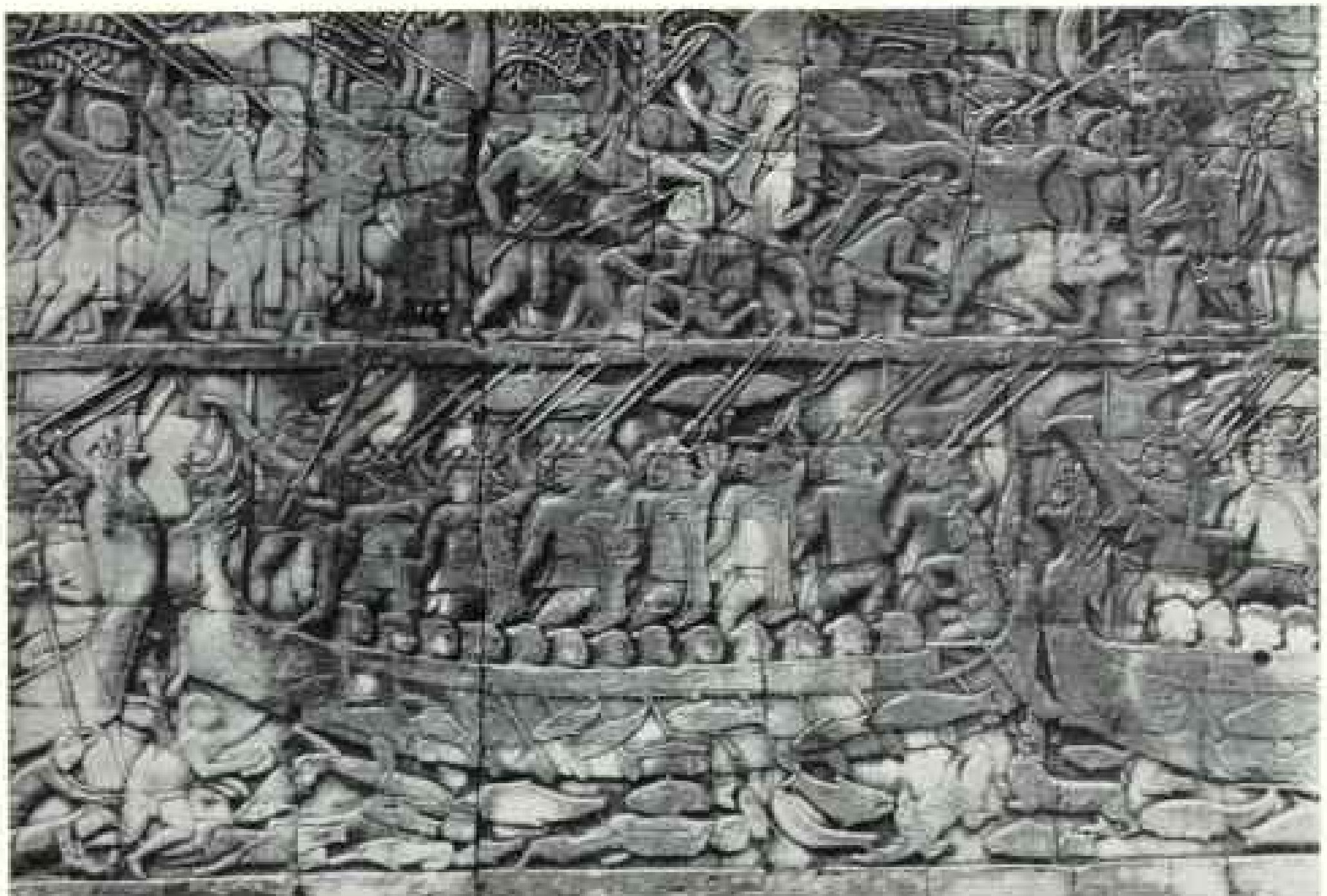
Carrying a showy structure of silver paper and preceded by dancers and flower-bearers, the young men parade about the women's shelter, decorated with flags and fronds. Soon they will kneel before a row of supposedly bashful maidens wearing embroidered skirts and chant gallant songs. Such is the rehearsal. The real ceremony, held by moonlight, is the subject for a poem, not a photograph (see Color Plate XVI).





FRENCH ARCHEOLOGISTS RESTORED THESE STONE CARVINGS AFTER MANY CENTURIES

Of the blocks which form this newly excavated carving from the 10th-century temple of Banteai-Srei only the top one has been damaged by weathering. The lower corners are many-headed serpents such as form the angles, balustrades, and roof ridges of Angkor temples. Within this ornate frame two men with peculiar top-knots and armed with clubs fight for a fair lady.



THESE ARMY AND NAVY BATTLES HAVE LASTED FOR CENTURIES

Chams with top-knots and close-cropped Cambodians here struggle on land and water with war elephants and battle junks. Above the close-ranged heads of the oarsmen, warriors brandish their javelins while fish and crocodiles, men and dragons swarm the stream. Above, infantry forces fight.



LAOTIAN HOMES WEST OF THE MEKONG ARE LITTLE MORE THAN SLEEPING PORCHES

Raised on piles, with the space underneath devoted to a loom or livestock, such light huts are crude affairs, since most household activities are carried on in the open. Resisting rain and sun without holding heat, these thatched shelters, admirably adapted to the tropical climate, are copied in more pretentious buildings.

"But the Apsarases! How charming and smiling they are under their head-dresses of goddesses—always with that disconcertingly enigmatic air of naughty collusion.

"All those figures which centuries of pilgrims could reach have been so frequently caressed that their lovely nude bosoms shine like lacquer. Women, passionately desiring motherhood, have done this.

"In niches framed by stone embroidery they are still adorable. What a pity that their feet, ungainly as those of an Egyptian bas-relief and carved in profile below legs that face front, betray them. These maladroit feet show that the lovely Apsarases were the creation of primitive artists still struggling with perspective, still ignorant of foreshortening."

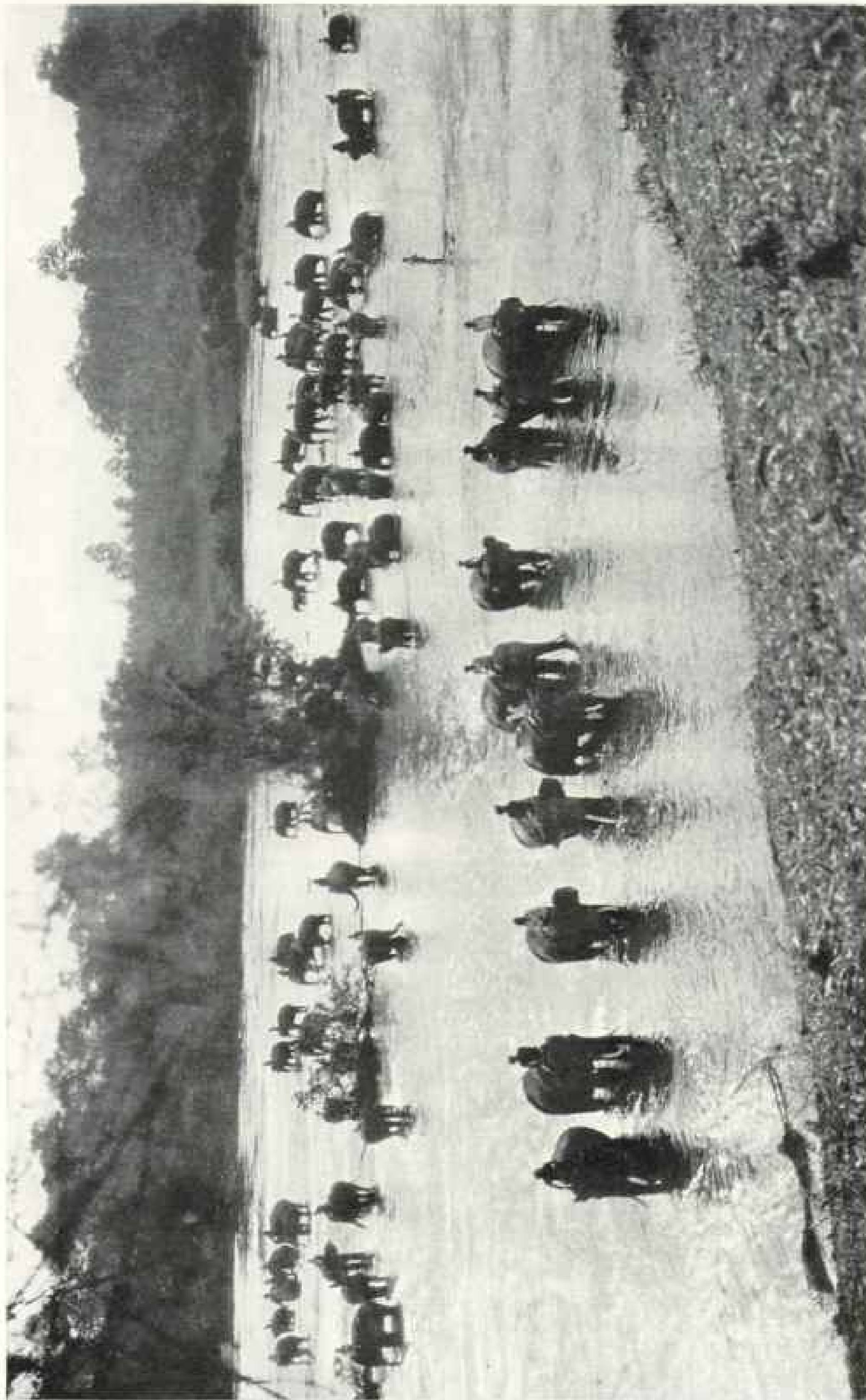
The bas-reliefs of Angkor merit—and demand—careful study. The tug-of-war between gods and demons churning the elixir of immortality, with a mountain for

a dasher and the Milky Way for buttermilk, is fifty yards long. Vishnu's victory over the demons is a mass of intricate detail. Scenes from the Mahabharata and the Ramayana give scant clues to those collections of "wildest legends and deepest philosophy."

#### DANTE'S INFERNO OUIDONE

Pictures of Khmer court life convey little to the casual observer. Even the chamber of horrors pictured in the thirty-two Hells fails to divert all visitors from the heat above their own heads. When it comes to Hell, the Angkor stone masons make Dante and Dore seem mild, yet folks who love murder stories turn their backs on the Khmer tortures and return to the bungalow for cocktails!

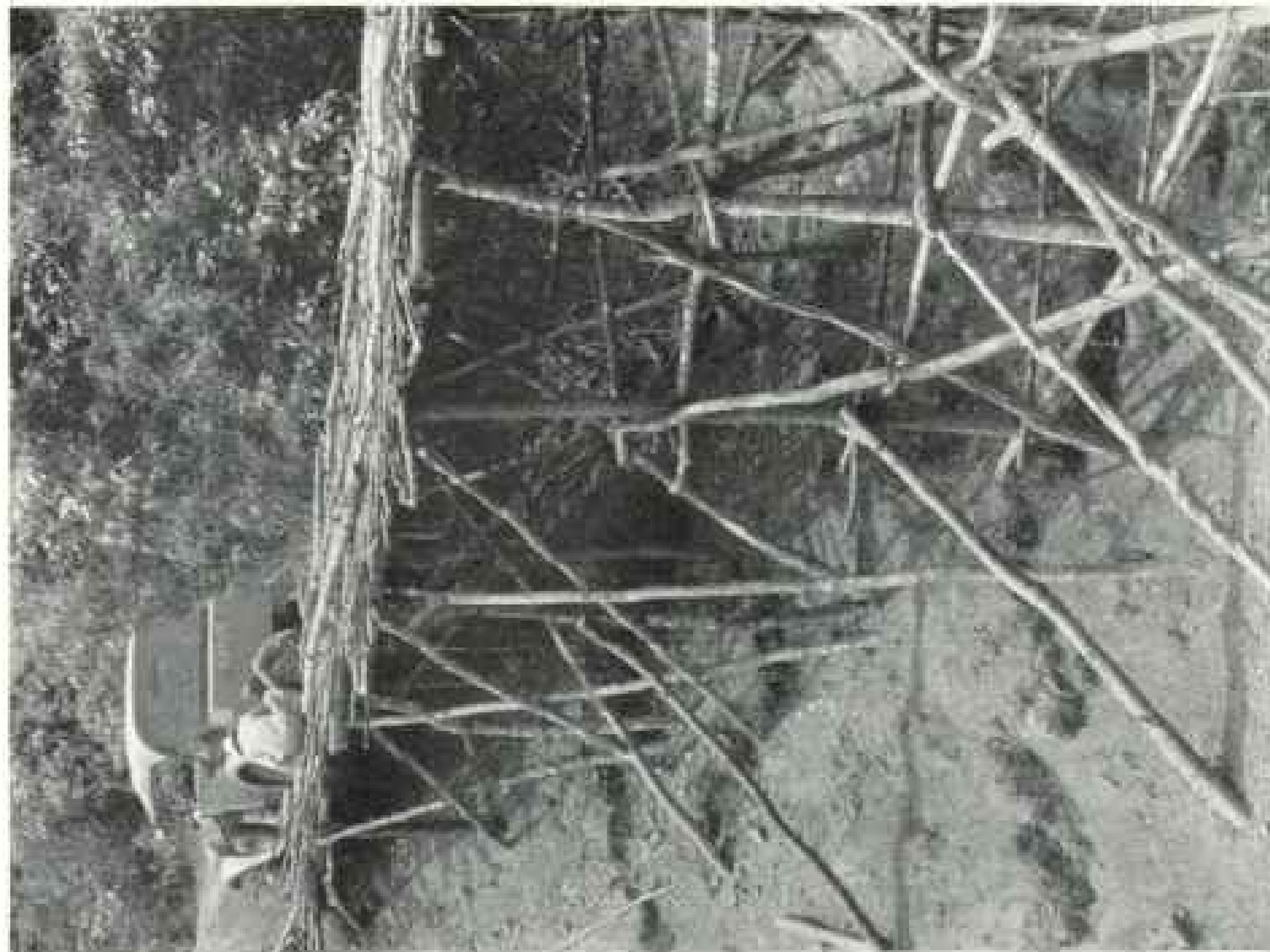
The Cambodian dancing girls at Angkor seem unusually authentic, especially when performing in front of the carvings from which their poses are a copy.



Photograph by Crocodon-Huon Expedition

**ELEPHANTINE "ENTRÉE," DIRECTED BY MAIGOUTS, MASS FOR A MOUVIE RECORD**

To make a "talkie" of the Moïs and their elephants on the upper reaches of the Srepok River, scores of the beasts were called together at Bandon by the local Resident. The tribesmen are experts at capturing and domesticating the wild elephants which find rich pasture on the Darlac (plateau).



LIKE A FAT MAN SITTING THROUGH A CANE-SEATED CHAIR,  
THIS CAR CRASHED THROUGH THE CROSS PIECES

Though the bridge near the Mekong River swayed on its fiber-bound props, it stood up well under the heavy load. As the automobile approached the steep incline, the sapling ties came apart and the wheels dropped through.



WITH EAR LOBES DISTENDED BY GOLDEN RINGS, THIS FIGURE  
TELLS A STORY FEW CAN READ

Not yet has this sculptural detail at Banteai-Srei been fully explained. But in ways familiar to the expert it reveals the geographic and racial background of 10th-century artists. This niche is in the small, ornate temple of Isvarapura.



A GOOD SALESWOMAN CRISPS HER DAILY BREAD ON A CHARCOAL BRAZIER

In the humid air of Annam the native rice wafer soon loses the crispness which is its chief attraction. Once arrived at the market place, the careful vendor toasts her soggy loaves to bring back their original freshness.

More impressive than the Geisha dances of Kyoto are the torchlight performances on the terrace at Angkor Wat.

Behind the young dancers, with their paste-white faces and sparkling crowns, loom the shadowy towers of the mighty temple. Darkness, like a scenery dome, focuses the attention on the central action. Smoky torches point the circle of flame, inside which the company of dancers fall into awkward but accurate poses petrified by stone masons nearly a thousand years ago.

The Cambodian dance is as jerky as an animated cartoon. And for the same reason. Although the movements must occupy an exact number of beats and unite gracefully, it is not primarily a flow of rhythm, but a series of postures.

An Occidental dancer conveys a sense of flight by a swift leap through a cloud of

chiffon. The Khmer actress stands stock still in a conventional pose, *symbolic* of flight.

But an able observer has written of the mystery of Angkor for GEOGRAPHIC readers,\* so I pressed on to my third New Year celebration of the year.

#### THREE "NEW YEARS" IN FOUR MONTHS

On January 1, 1932, my French companions passed New Year Eve with German Catholic missionaries near Liangchow in Kansu Province. Five weeks later, Petro-Pavlovsky and I were Chinese New Year visitors of a Mongol prince whose chief guest was the Panchen Lama. Now, in April, came the Cambodian New Year reception given by King Sisowathmonivong

\* See "Four Faces of Siva," by Robert J. Casey, in the NATIONAL GEOGRAPHIC MAGAZINE, September, 1928.



TESTED AND APPROVED BY MILLIONS IS THE ORIENTAL CARRYING POLE

Never was the wooden yoke of the dairy farmer or maple syrup collector as jaunty as the flexible carrying pole. It breaks the force of the carrier's stride, equalizes the pull of unequal burdens, and can be switched behind the neck from shoulder to shoulder without the loss of a step. Much favored by the Annamites, the human yokes are here seen in the Laotian village of Savannakhet.

in the resplendent throne room at Pnom-Penh.

In Hué architecture, costume, and personality reveal close relationships with China. In Pnom-Penh one might well fancy oneself in Siam, of which Cambodia was formerly a part. Pagoda and palace are built on Siamese models, and although no traveler could mistake a Cambodian for an Annamite, only the expert can differentiate between the Cambodians and the Siamese.

At Pnom-Penh I was given the run of the palace and not only introduced my workaday attire amid the spectacular court dress outside the throne room but somewhat innocently created a scandal which everyone involved had the graciousness to overlook.

I wanted the young dancing girl who rep-

resents a princess to sit on a white balustrade beside the ceremonial lion. In her tight-seamed garments and jeweled mules she could not climb, so I helped her into place. She was already suspended in the air when I sensed that such a thing simply isn't done. But there was nothing to do but go through with it.

The Cambodian dancing girls are sewed into their gold-embroidered doublets—which practice suggests the Imperial Guardsmen of the Tsar, close around whose shapely thighs the white buckskin trousers were sewed when wet. But the facts are not as romantic. The sewing is done because the costumes would not otherwise fit, since they are worn relics of the days of other dancers and greater glory.

Georges Groslier, who took hundreds of photographs to save the classic dance



THE HEAD BONZE AT THE PNOM-PENH SHRINE ACCEPTS A NEW YEAR'S OFFERING

Atop the Pnom, or hillock of Penh, which gives its name to the Cambodian capital, worshipers present the season's gifts to a spectacled priest, while the youngsters are diverted by more mundane matters. The 563-year-old shrine was built to house four images of Buddha rescued from the Mekong River by Madame Penh (see Color Plate XI).



THIS CAMBODIAN PILGRIM FULFILLS A VOW WITH A NEW YEAR'S SHAVE

Outside a shrine at Pnom-Penh the camera caught this peculiar tidying-up for the annual festival. Watching every stroke of the razor in the hand of a friend, a tot leaning over the mother's shoulder is absorbed by the cutting of the hair, which is carefully preserved in a bit of paper on the ground.

from extinction, wrote:

"If some catastrophe were to wipe out five ballet mistresses and the ten young actresses on our list, the classic Cambodian theater would be finished forever, simply because no one could pass on its tradition."

As it was, a sixty-eight-year-old woman danced better than any of her pupils, and a former favorite of the King came out of her retirement to help breathe life into vanishing art.

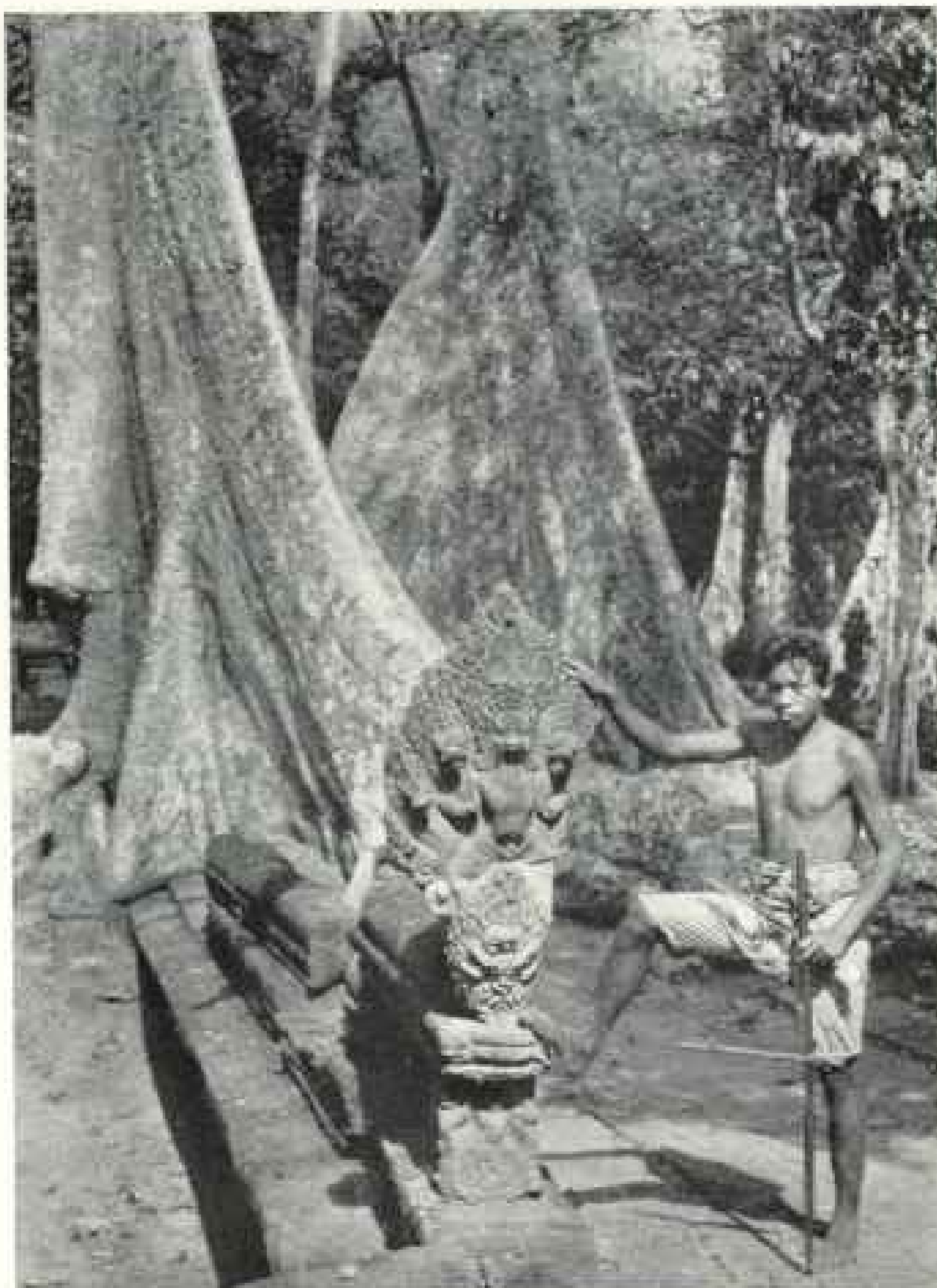
The late Gervais Courtellemont owed much to the cooperation of Mlle. Karpeles, a French woman who acts as a living link between widely diverse cultures.\*

When the GEOGRAPHIC containing his autochromes arrived in Pnom-Penh, the "Brothers of the Saffron Robe" welcomed it with as much delight as a virtuous Buddhist allows himself. Probably no copies of your Magazine are more treasured than those in the Royal Library of Cambodia, where a woman, foreign in birth but not in spirit, renders signal service to those followers of Gautama the Buddha who are obeying his last wish: "Work out, therefore, your emancipation with diligence!"

From the court and religious life at Pnom-Penh to the seaport of Saigon one comes rushing back through the ages—from the capital of an Oriental poet-king to the haunts of the international money changers.

Rice, in giving Cholon its wealth, has also

\* See "The Enigma of Cambodia," illustrations in color from autochromes by Gervais Courtellemont, NATIONAL GEOGRAPHIC MAGAZINE, September, 1928.



SERPENTINE ROOTS SLOWLY TRIUMPH OVER A SERPENT'S PROTECTION

Ever since the downfall of the Khmers, nearly 600 years ago, the Naga, or snake god, has lived on in legend and in stone. But creeping beside it, the sinuous roots of growing trees are strangling their stony adversary, breaking its back and tossing the proud cobra heads in the earth. A Cambodian temple guard, armed with a cross bow, suggests the size of this carving at Ta Prohm.

benefited Saigon. But to Americans it is more interesting as a rubber market.

#### A WORLD RUBBER CAPITAL

Because the sap from the hevea tree would erase pencil marks, the product, for which hundreds of varieties of plant life might furnish the latex, was called "rubber."

The possible uses for rubber are almost unlimited, but cheap labor is still essential. The cow submits to milking machines, but the rubber tree does not, and, like the cow, it must be milked regularly or it will go dry.





BUCOLIC PEACE BESIDE THE RIVER OF PERFUME

On the way from Hué to the seven-storied Tower of the Source of Happiness, the road passes between urban houses and the silent river, echoing to the distant splash of oars. Under the bamboo a small boy, riding the broad back of a lumbering water buffalo, adds the rustic touch.

Indo-China not only has the proper equatorial rain-belt climate, but also the workers, each of whom collects the sap from 200 to 400 trees a day and receives 40 cents for his labor. The best rubber gatherers come from Tonkin, for whose industrious laborers French islands in the Pacific also bid.

#### AKRON IS MAJOR RUBBER CUSTOMER

American interests control only three per cent of the rubber plantations, but a third of the world supply of raw rubber finds its way to the single city of Akron.

Streets have already been paved with a rubber compound, and rubber is one of the tropical commodities which are swinging many modern trade routes parallel with the magnetic compass instead of across it.

Saigon has a beautiful botanical garden, an excellent museum in which is housed the incomparable library of the Société des Études Indochinoises, and a worthy war memorial to the Annamites who died in the World War. Outside the city are newly opened sylvan restaurants with swimming pools and dance terraces. The late Governor-General Pasquier drove the first ball on a new golf course and aviation flourishes

in Saigon. In this city, where even the chauffeurs go barefoot, a Czech shoemaker, who learned his trade in America, was opening a branch store.

Although my five-weeks' dash had been fruitful, I had not even climbed to see the roses of Dalat—Indo-China's highland Baguio or Simla. Nor had there been time to visit the Mois, whom the Greeks would have styled "barbarians," in the elephant country farther north.

After crawling across Asia at a rate of 23 miles a day, I was to average nearly 800 miles a day on the return, a brusque change of tempo and scene.

Eager for America, I was homesick, too, for the sophisticated old continent I was about to leave behind. The mist-draped Tonkin hills, like a Sung painting; the hushed "House of the Sorceresses" slashed by a mesmeric rhythm of clattering chain; bamboo-fringed backwaters near Hué; dawn touching the four faces of Siva on the Bayon towers; Laotian chiefs tying on simple cotton cords with prayers for a safe return; how rich in vivid sensations old Asia is! Across the years and miles she makes her influence felt.

## A REPORT OF THE SECOND STRATOSPHERE EXPEDITION

**A**N UNFORESEEN accident, hitherto unknown in the history of ballooning, caused the collapse of the 3,700,000 cubic-foot balloon *Explorer II* on the early morning of July 12, thus stopping the expedition into the stratosphere planned during the past year by the National Geographic Society and the U. S. Army Air Corps. The balloon had received all of the gas which was to lift it into the stratosphere, and it remained only to attach the gondola when the upper portion of the bag suddenly opened, the helium rushed skyward, and the three tons of fabric fell to the earth.

Prompt steps were taken to rescue several men who were trapped under the fallen fabric, with the result that no person suffered any appreciable injury, a most providential result. Thereafter a guard was thrown around the pile of fabric so that it would not be interfered with until it could be examined by the officers in charge and balloon experts.

On the following day the fabric, almost three acres in area, was carefully spread out on the balloon field with its 44 "orange peel" gores folded one upon the other. Each one was examined, then folded over for the examination of the gore beneath. The extent and position of the tears were noted and the balloon was then put into the box in which it had been packed during the preparations for the flight. The box, sealed, was then sent to the factory of the Goodyear Zeppelin Corporation at Akron, Ohio, where the balloon was built.

### TECHNICAL COMMITTEE EXAMINES BAG

On reaching Akron, the bag was carefully unpacked and laid out on the floor of the work room, where it was examined in detail by a technical committee, including Brigadier General Oscar Westover, Captain Albert W. Stevens, Captain Orvil A. Anderson and Captain Randolph P. Williams of the Army Air Corps; Dr. W. F. G. Swann of the Bartol Research Foundation; Dr. Lyman J. Briggs, Director, Dr. L. B. Tuckerman and Dr. H. L. Dryden of the National Bureau of Standards; and Mr. Thomas W. McKnew of the National Geographic Society. Officers and engineers present from the Goodyear Zeppelin Corporation included Mr. Clifton Slusser, Vice-President, Dr. Karl Arnstein, designer, and Mr. J. Frank Cooper, balloon builder.

The examination showed conclusively that the tear in the fabric of the balloon originated at or near the top of the rip-panel, after which the tear spread rapidly in both directions. The evidence also showed that the rope used for opening the rip-panel had not been pulled.

A rip-panel is an area near the top of a balloon that is designed to be opened by pulling on a long rope extending from the panel to the gondola. When the balloon, on its downward journey, is very near the ground and ready for its landing, the rip-panel is "peeled" open to permit the instant escape of gas, thus preventing the gondola from being dragged or bounced along the ground by the wind. Such a rip-panel is absolutely necessary for the proper landing of all passenger-carrying balloons.

The panel is V-shaped in design with the apex of the V upward. The point of attachment of the rip-cord is at this apex. When the top of the balloon has been constructed, two long slits that make the V are cut in the balloon top. In the case of *Explorer II*, the slits were each nearly 30 feet long and about 15 feet apart at the base.

The point of the rip-panel was about 10 feet from the top of the balloon. These slits were bridged by a strip of cloth of the same weight as the top fabric, this cloth being so laid that when needed a rip first started at the apex of the V would proceed with certainty along the lines of the slits. The lines of ripping and the stoppage of ripping at the top and base, under normal use of the rip-panel, were assured by tapes cemented as reinforcements outlining the shape of the panel.

This design of rip-panel has been used for many years with no previous failure. It was used in the *Century of Progress* balloon, which had two successful flights, and also in the *Explorer I*. Consequently no trouble from this source had been anticipated after careful examination of the entire balloon fabric had been completed.

From the point of failure near the top of the rip-panel in *Explorer II* the rents spread in both directions up and down; and when the upper rent reached the top of the balloon it divided into two fissures extending from the top down the other side of the balloon to the upper catenary band. The balloon top was thus opened up with three great tears which let the helium out prob-

ably in about a second. The fall of the balloon to the ground then occupied six or seven seconds.

#### IMPRISONED, BUT UNINJURED, BY FALLING FABRIC

A cage of light iron pipe extending upward five feet had been installed temporarily on the top of the gondola to speed up the attachment of the gondola to the balloon. This iron cage was still in place and served to protect the three riggers on top of the gondola from the weight of hundreds of pounds of falling fabric. Although temporarily imprisoned, they were soon released by the ground crew which lifted the fabric enough to permit them to slide down the shell of the gondola to the ground.

The unexpected collapse of the balloon only an hour before it was scheduled to rise into the stratosphere came after thirteen hours of preparation, during which the team work and organization of the ground crew and scientists caused the work to progress with clocklike precision. Because of the absence of difficulty and delay of any kind during the hours of inflation during which the balloon rose steadily and smoothly, the collapse came as a stunning blow.

Although the temporary stopping of the project has been a bitter disappointment to the sponsors and scientists, and to members of the Society who followed the plans throughout the past year, the one heartening feature of the disaster is that no one was injured.

It must be kept in mind, of course, that balloons of the stratosphere type, involving huge volumes of gas and the use of large areas of single-ply fabric, may still be considered to be in the experimental stage. To offset the somewhat smaller factors of safety in very large balloons, greater care is used in handling and launching them than has been found necessary for the smaller balloons.

#### THE FACTOR OF SAFETY

If it is assumed that the fabric of the balloon is tailored to a perfectly spherical form (and this is closely approximated in the actual construction), the maximum stress in the fabric may be computed with assurance that the result will be well within 10 per cent of the true value. The most severe condition occurs during the take-off when the buoyant gas is little more than a large bubble in the top of the great balloon.

As the balloon rises and the gas expands, the upward thrust of the gas is distributed over larger areas of the fabric and the tension in the upper fabric is correspondingly reduced.

In the case of the *Explorer II* the computations show that even during take-off the stress in the fabric was only one-eighth that of the actual breaking strength of the fabric as measured by laboratory tests. In the language of the engineer, the balloon had a factor of safety of 8—an ample margin for covering increased stresses resulting from slight irregularities in the tailoring.

For handling the balloon it is necessary to place in the top of the balloon one or more valves and a rip-panel with sleeves and other attachments to carry the operating ropes and tubes down to the gondola. All these require special reinforcements of the fabric designed to offset the unavoidable local concentrations of stress. The type of reinforcements used in the *Explorer II* were based upon long years of experience, and no previous failure of any of them has occurred.

As the NATIONAL GEOGRAPHIC MAGAZINE goes to press laboratory experiments have been completed with full-sized rip panels which definitely determine the local stresses in this fabric area. Consequently, the decision has been reached, after careful consideration, to again attempt a jointly sponsored flight from the Stratobowl with the same personnel during October contingent upon meeting with entirely satisfactory flying weather conditions.

The various examinations of the balloon bag have shown that the tear in the fabric was above the upper or handling catenary band. This is the top or crown of the balloon, and constitutes only about one-twelfth of the bag's area.

While experiments are being made with rip-panels, the Goodyear Zeppelin Corporation, in a fine spirit of cooperation, is also building a new top into the *Explorer II* without cost to the expedition, in order that another flight may be undertaken when it is considered advisable.

The many pieces of delicate scientific apparatus that had been installed in the gondola had been repeatedly tested during the weeks preceding inflation and were in perfect operating condition at the time of the proposed take-off. The special instruments have been carefully stored pending the decision regarding their future use.

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President Riggs National Bank

GEORGE SHIRAS, Jr.

Formerly Member U. S. Congress, Faunal Naturalist and Wild-Game Photographer

## ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

TO carry out the purposes for which it was founded forty-seven years ago the National Geographic Society publishes this Magazine monthly. All receipts are invested in the Magazine itself or expended directly to promote geographic knowledge.

ARTICLES and photographs are desired. For material which the Magazine can use, generous remuneration is made. Contributions should be accompanied by addressed return envelope and postage.

IMMEDIATELY after the terrific eruption of the world's largest crater, Mt. Katmai, in Alaska, a National Geographic Society expedition was sent to make observations of this remarkable phenomenon. Four expeditions have followed and the extraordinary scientific data resulting given to the world. In this vicinity an eighth wonder of the world was discovered and explored—"The Valley of Ten Thousand Smokes," a vast area of steaming, spouting fissures. As a result of The Society's discoveries this area has been created a National Monument by proclamation of the President of the United States.

AT an expense of over \$50,000 The Society sent a notable series of expeditions into Peru to investigate the traces of the Inca race. Their discoveries form a large share of our knowledge of a civilization waiting when Pizarro first set foot in Peru.

THE Society also had the honor of subscribing a substantial sum to the expedition of Admiral Peary, who discovered the North Pole, and contributed \$55,000 to Admiral Byrd's Antarctic Expedition.

NOT long ago The Society granted \$25,000, and in addition \$75,000 was given by individual members to the Government when the congressional appropriation for the purpose was insufficient, and the finest of the giant sequoia trees of California were thereby saved for the American people.

THE Society's notable expeditions to New Mexico have pushed back the historic horizons of the Southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region The Society's researches have solved secrets that have puzzled historians for three hundred years. The Society is sponsoring an ornithological survey of Venezuela.

TO further the study of solar radiation in relation to long range weather forecastings, The Society has appropriated \$65,000 to enable the Smithsonian Institution to establish a station for six years on Mt. Brukkaros, in South West Africa.



THE GREATEST WATCH VALUE IN HISTORY

... a Hamilton for \$37<sup>50</sup>

(Above) The DIXON. 17 jewels. 10K filled gold, white or natural yellow. \$37.50. (With applied gold numeral dial, \$40.)

LET US SEE what Hamilton offers in a watch at \$37.50 . . . Above all, you know that here is a watch you can TRUST. Hamilton's reputation will never be risked to meet a price. Moreover, Hamilton enjoys the latest precision methods in the watch industry—such as the Time-Microscope\*, an invention used exclusively in timing and protecting the accuracy of Hamiltons.

No Hamilton has less than 17 fine jewels. No Hamilton

is cased in anything less than the highest quality platinum, solid gold, or filled gold. See our new watches at \$37.50 as well as the others at higher prices at your jeweler's. Illustrated folder sent upon request.

\* Reg. U. S. Pat. Off.

**FREE TO WOMEN:** How necessary to a woman is an accurate watch? Emily Post, leading authority on etiquette, answers this question in a new little book, "Time Etiquette." You may have a FREE copy upon request. Write Hamilton Watch Company, 302 Columbia Ave., Lancaster, Penna.

*The Watch of Railroad Accuracy*



(Left to right) BEATRICE. 17 jewels. 10K filled gold, white or natural yellow. \$37.50. FAIRMONT. 17 jewels. 14K filled gold, white or natural yellow. Case (shown). \$52.50. With filled gold

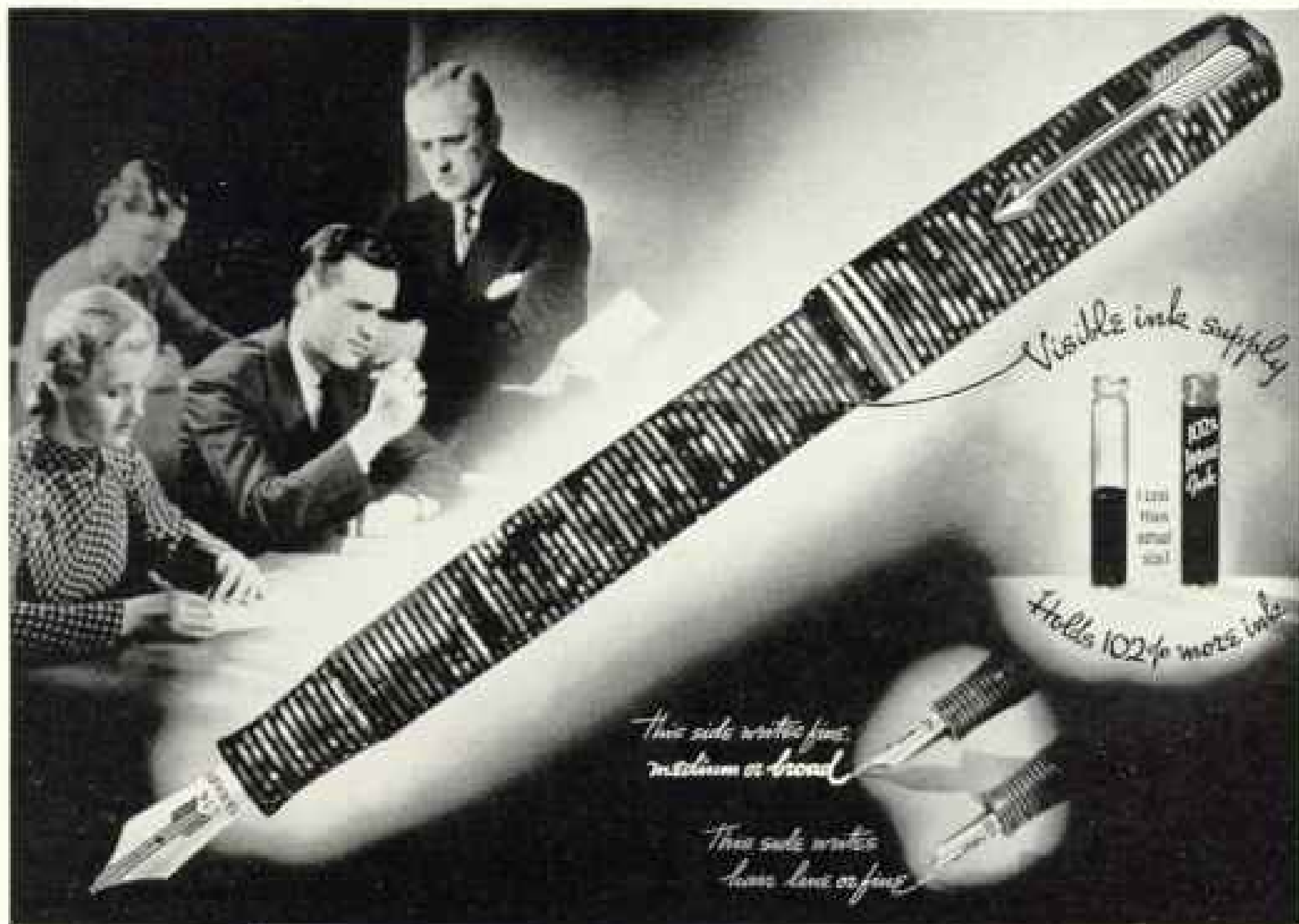
chain, \$55. DEVON. 17 jewels. 14K filled natural yellow gold only. With leather strap, \$45. NELSON. 17 jewels. 14K filled natural yellow gold only. Case curved to fit the wrist. With inside

black enamel dial, \$50. With applied gold numeral dial, \$52.50. PRESCOTT. 17 jewels. 14K filled natural yellow gold only. Applied gold marker dial, \$45. Other Hamiltons, \$37.50 to \$1000.

# A COLLEGE PROFESSOR DISCOVERED

**That Often It Isn't Their Brains, but their Pens that Run Dry  
—Cause Failure—in Classes and Exams**

*So he invented this sacless Vacuumatic, and Parker engineered it to perfection—gave it 102% more Ink Capacity—made its Ink Level VISIBLE, so it suddenly can't go empty!*



*A lovely, utterly new Style—rings of luminous Pearl laminated with transparent "Jet"—wholly exclusive because design patented*

YES, a scientist at the University of Wisconsin was amazed to find how pens that suddenly run out of ink slow down classes, demoralize thinking, and bring marks that no student wants to write home about.

This led to the birth of the revolutionary Parker Vacuumatic—the miracle pen that writes 12,000 words from a single filling—shows when it's running low—tells when to refill! As in college, so in business, too—if you can't see how much ink is in your pen, how can you tell that it won't fail you *just at the wrong time!*

Don't expose yourself to such calamities. Go to any good store selling pens, and hold this shimmering laminated Pearl and Jet Beauty to the light—see how the "Jet" rings become transparent—mysterious windows, that show the column of ink within.

Because it eliminates 14 old-time parts, including the lever filler and rubber ink sac found in sac-type pens, the Parker Vacuumatic holds 102% more ink than old style, *without increase in size.*

But don't think that sacless pens containing squirt-gun pumps are like Parker's patented sacless Vacuumatic. This new creation contains none of those. That's why it's GUARANTEED MECHANICALLY PERFECT!

Its Reversible Point—solid Gold combined with precious Platinum—is skilfully fashioned to write on both sides—slightly turned up at the tip so it cannot scratch or drag, *even under pressure!* Go and try it. The Parker Pen Company, Janesville, Wisconsin.

No Charge for this New  
**PLASKON UTILITY CASE**  
(for Cigarettes or Boudoir Trifles)

with the purchase of the Parker Laminated Vacuumatic Pen and Pencil Set. A gift Case of exquisite charm and lasting utility. Choice of Brown or Black with Ivory Lid.

**NOTE:** A remarkable Parker discovery now gives the world an ink—called Parker Quink—that cleanses a pen as it writes—a Parker Pen or any other. Ask for Quink instead of ink, and your pen will work like a charm.



## Parker

**VACUMATIC**  
GUARANTEED MECHANICALLY PERFECT

Junior, \$5  
Over-Size, \$10



Pencils, \$2.50,  
\$3.50 and \$5

# RCA's "MAGIC BRAIN" now has the sensational New "MAGIC EYE"!

*brand new thrills... unequalled tone... dazzling performance!*

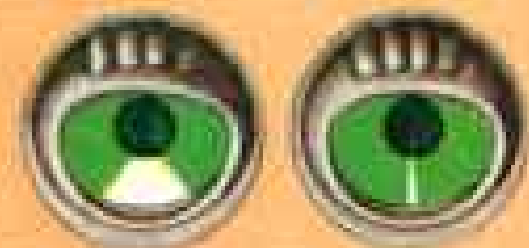
Meet the world's latest, more scientific radio! Today RCA Victor brings you the 1936 "Magic Brain" . . . with an eye—a "Magic Eye".

These newer sets offer you everything—tone, tuning, world radio, tubes and cabinet design and beauty. First, the "Magic Brain"—that uncanny achievement which is astonishing the radio world—finds the station you want, easily—quickly. Its alert "armoured watchman" tube guards against unwanted interferences. Each set delivers to you a fidelity that's practically "studio tone" as you hear it in the broadcast studio.

Next, the "Magic Eye". Here is a new RCA research development that affords super-focus. You tune with your eyes—and hence you get finer accuracy of tuning. Added

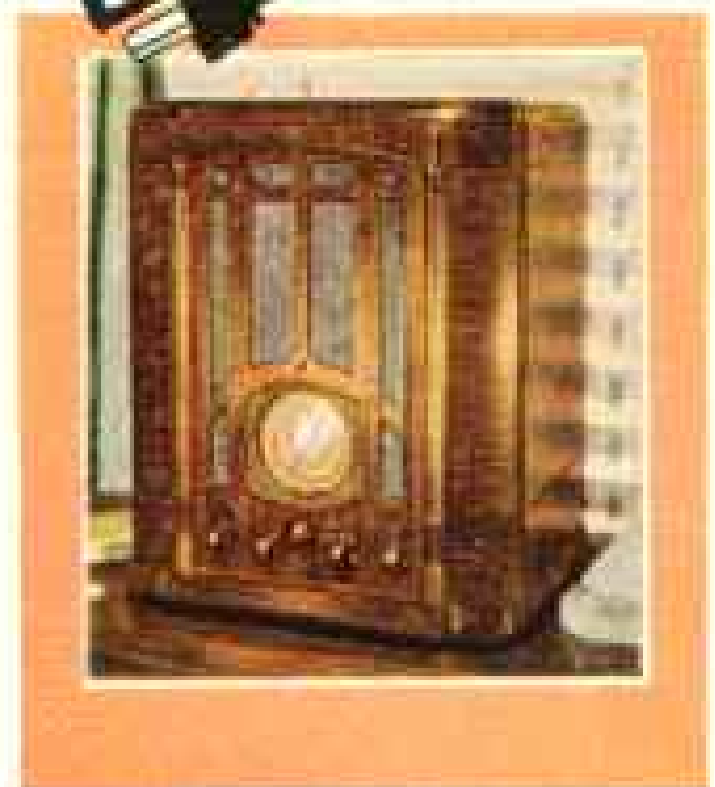
to these are the new RCA Metal Tubes—radio tube manufacturing's biggest forward step! And the "Selector" range dial. Twist a knob, the domestic band appears. Another twist, the world radio band comes into bold view. And so on, for every band—airplane, amateur, police calls. New cabinet design skilfully further enhances the fidelity of "Magic Brain" tone. Cabinets, too, are lovelier in looks; in better taste than ever.

Meet these new 1936 RCA Victor "Magic Brain" radios face to face... eye to "eye". Drop in at your RCA Victor dealer's today. RCA Manufacturing Co., Inc., Camden, N. J. A subsidiary of the Radio Corporation of America... *Put new life in your present radio, install RCA Radio Tubes.*



## OUT OF TUNE IN TUNE THE "MAGIC EYE"

*How it brings you perfect tuning!*  
The "Magic Eye", an electronic "beam" . . . which looks much like a human eye . . . tells when you are precisely in tune. Turn the set on, a dark colored shadow appears. Dial, and it gets larger or smaller as if focusing on an object. When the station is tuned in for its most perfect reception, the shadow is smaller. You have tuned in with your eyes!



You can now buy RCA Victor Radios on C. L. T. Corp. easy payment plan



PRICES FROM  
\$19.95 to \$550  
(subject to change  
without notice)

f. o. b. Camden, New Jersey, including home, automobile and farm radios and radio-photographs.

RCA VICTOR CONSOLE MODEL C-11-1 (Left). An 11-tube "Magic Brain" radio with new "Magic Eye" 3-band tuning range, long and short wave. New "Selector" airplane dial. \$50

RCA VICTOR DE LUXE TABLE MODEL T-10-1 (Right). A 10-tube "Magic Brain" radio with 3 band long and short wave tuning range, oversize speaker. \$39.95



# RCA VICTOR

*The world's greatest artists are on Victor Records*

# ON \$100 A MONTH



## Your later years could be *VERY HAPPY* in Beautiful Connecticut

When you're ready to give up active work, it would be delightful to settle down in some elm-shaded village in this beautiful old state and spend the rest of your life in comfort — following whatever hobby, sport or recreation pleases you most.

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When that time comes, you may prefer some other part of the country — or your own home town — but by owning NORTHWESTERN MUTUAL RETIREMENT INSURANCE you can count on an income of \$100 a month, or more, when you are 55 or older.

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# Hawaii

*Photographed in Hawaii.*

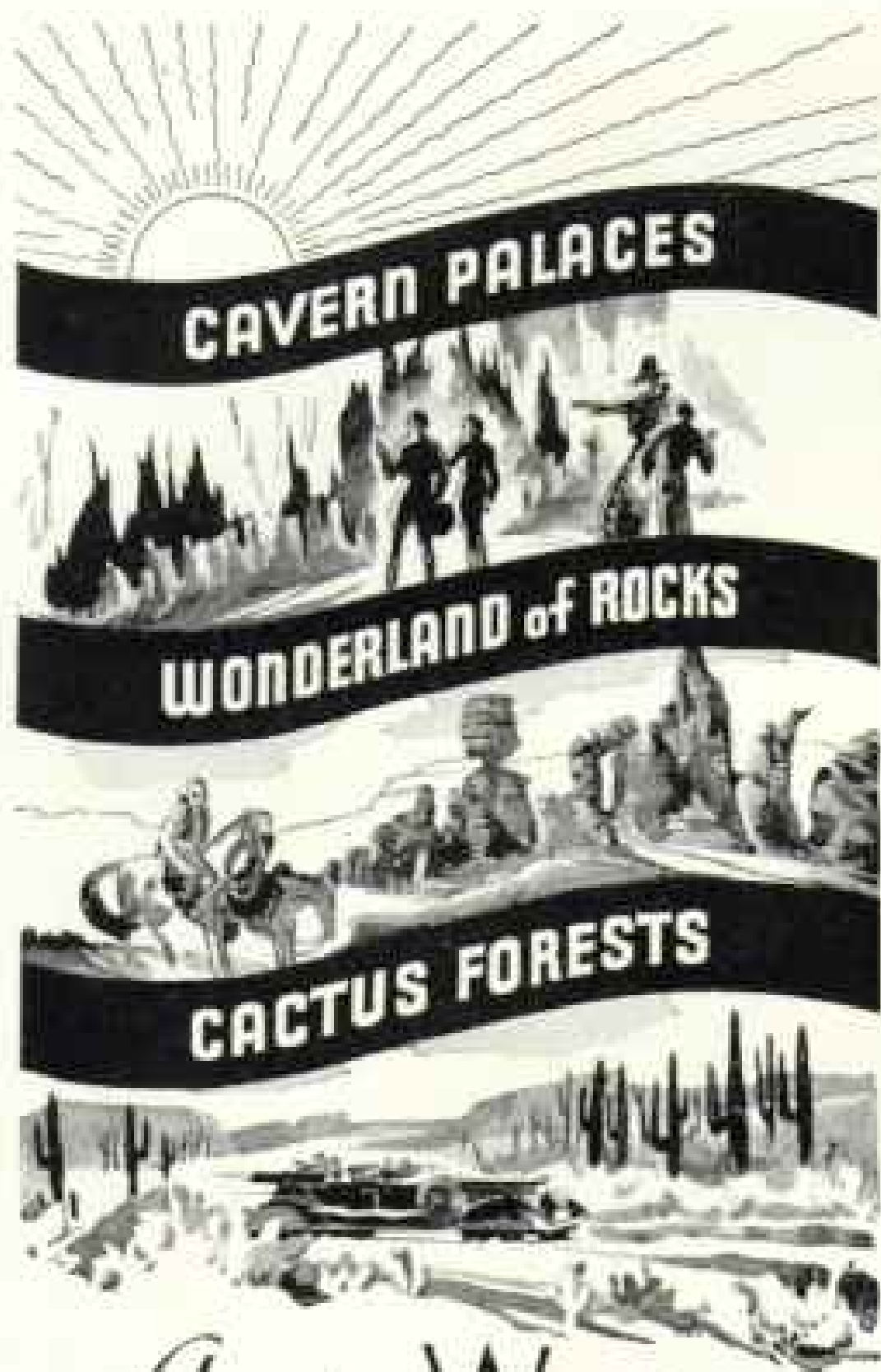
*Everyone who has been to Hawaii has succumbed to her spell.*

At the first opportunity, talk with your Travel Agent, or our offices. (Ask for literature about all-inclusive cost tours to Hawaii, and Personally Escorted South Pacific Cruises to New Zealand and Australia via Hawaii, Samoa and Fiji.) ❖ ❖ Matson Line-Oceanic Line: New York, Chicago, San Francisco, Los Angeles, Seattle, Portland.

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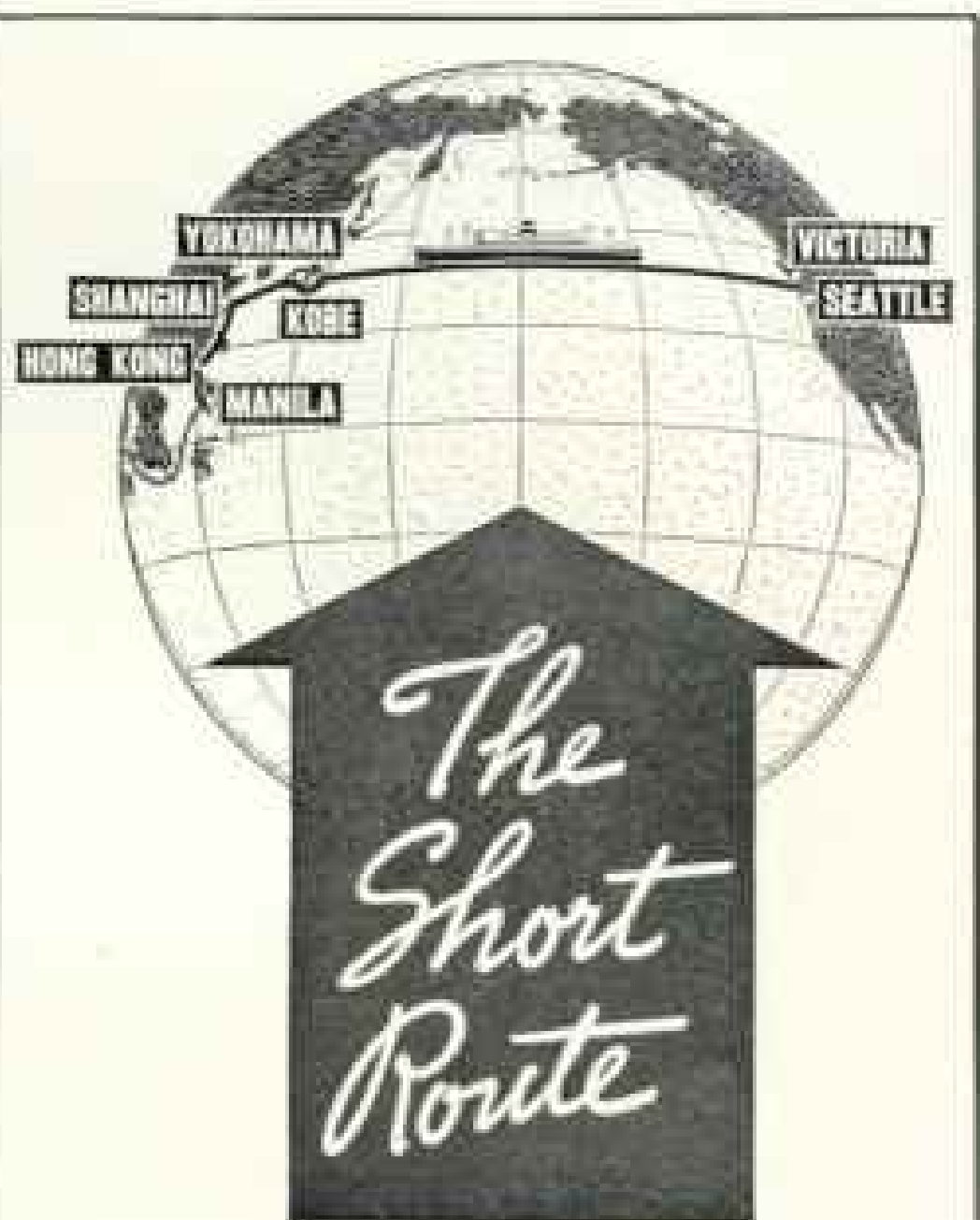
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*We Smile Correspondence*



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**OLD SOL**  
and  
**JACK FROST**  
*Discuss House Paint!*



**LISTEN IN:** *you'll learn how to beat their game and the N.H.A. will help you do it!*

"I'M making short work of the paint on this house," boasts Old Sol. "After I've scorched it there won't be much for you to do."

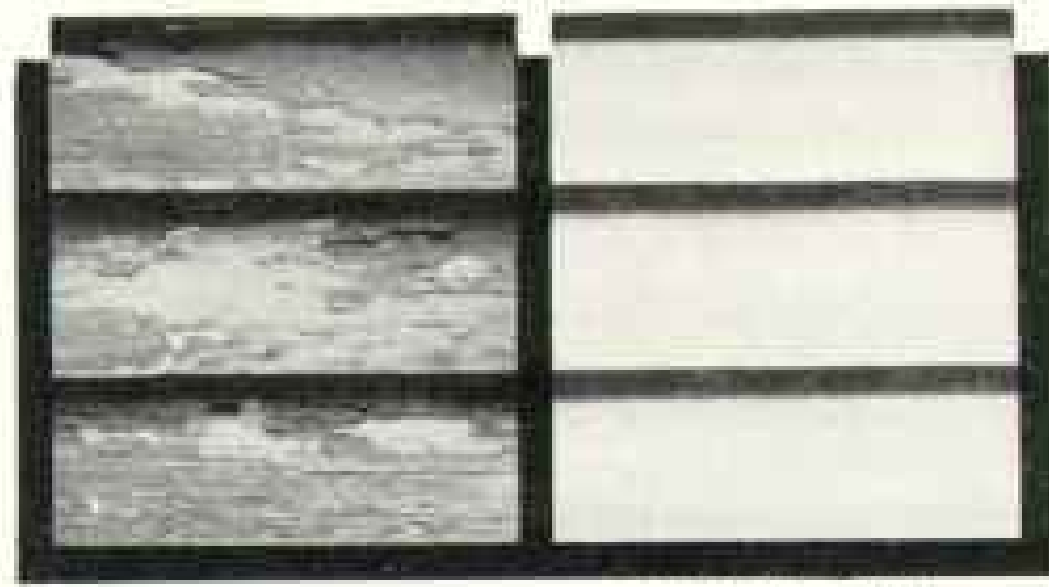
"It's only 'cheap' paint," laughs Jack, "lucky for us it isn't Dutch Boy!"

"You said it, Jack. It burns me up to work on *that* paint and then have so little to show for our pains."

Dutch Boy does not crack and scale, but wears down stubbornly by gradual chalking which leaves a smooth, unbroken surface. You can see the difference between Dutch Boy and "cheap" paint in the photographs on this page. "Cheap" paint, because it cracks and scales, must be burned and scraped off down to the wood. Then a new priming coat is needed—a further expense.

The experienced painter knows that Dutch Boy White-Lead saves you money. He mixes it to meet the requirements of your job and tints it to the exact color you specify. No one knows paint like a painter.

*Paint Now... Aided by the N. H. A.* Under the National Housing Act, you can arrange to paint on an easy-to-pay monthly basis. But whether you use the Government plan or not, send for our free illustrated booklet which tells you what you want to know about



**"CHEAP" PAINT**  
*after 13 years*

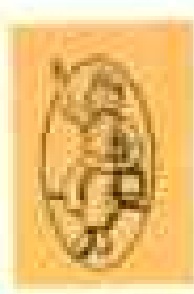
**DUTCH BOY**  
*after 4 years*

Cost \$10. Now the paint must be burned and scraped off at \$40 more. Total, \$50 or \$12.50 per year. And on top of all that there's another extra to pay for, the additional cost of a new priming coat.

Exposed, like the "cheap" paint job, to every northern New York winter. Cost \$20, or \$50 per year to date, and still less in time plus on. No burning off, no new priming coat will be needed at repair time.

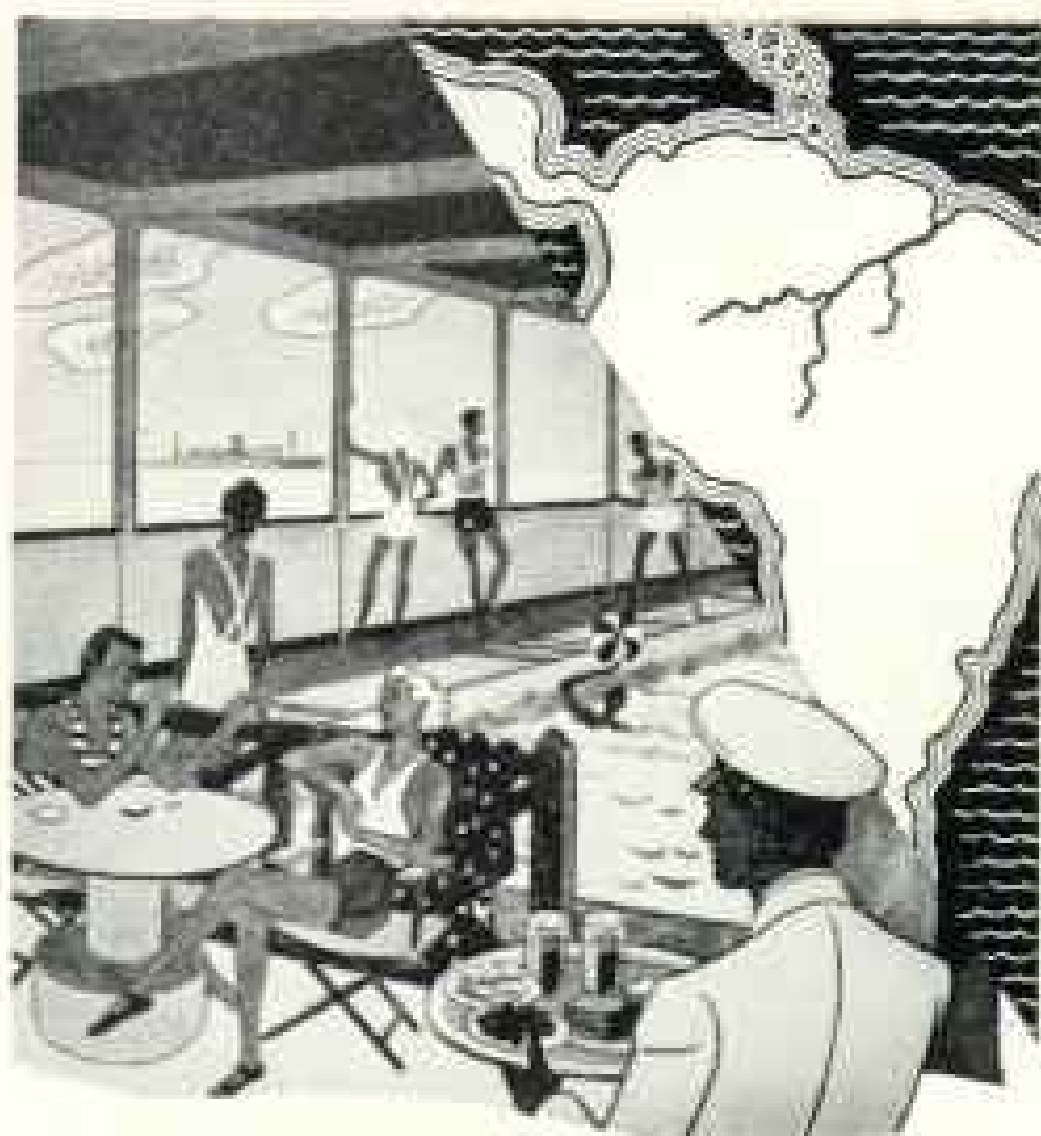
painting. Shows what to look for when buying a paint job. Included are clear directions for arranging a painting loan. Write today for "The House We Live In." Address, Dept. 193, nearest branch.

NATIONAL LEAD COMPANY, 111 Broadway, New York; 116 Oak St., Buffalo; 900 West 11th St., Chicago; 628 Freeman Ave., Cincinnati; 820 West Superior Ave., Cleveland; 722 Chestnut Street, St. Louis; 2240 24th St., San Francisco; National-Boston Lead Co., 800 Albany St., Boston; National Lead & Oil Co. of Penna., 316 Fourth Ave., Pittsburgh; John T. Lewis & Bros. Co., Widener Bldg., Philadelphia.



**DUTCH BOY WHITE-LEAD**  
*Good Paint's Other Name*





When you'll really appreciate  
**FURNESS**

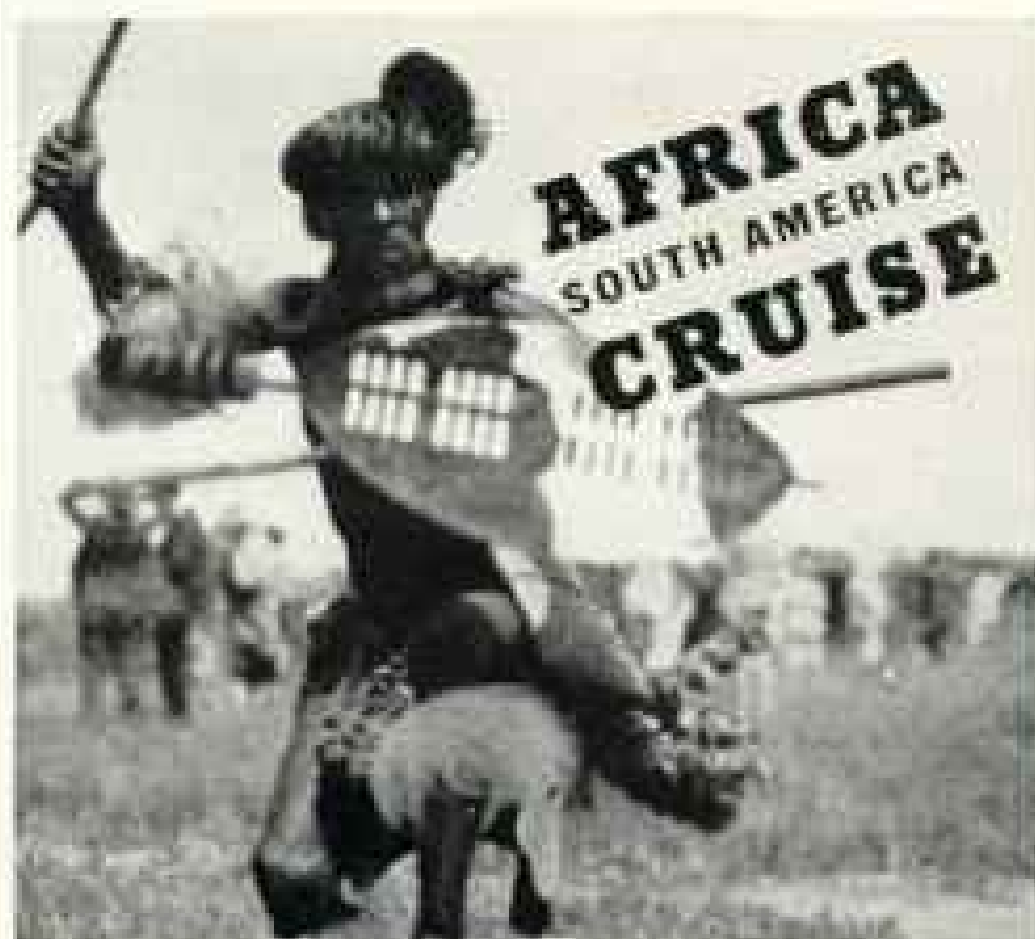
WHEN you're aboard a ship *two weeks* or more—then you really appreciate service, food, atmosphere! That's why on a long voyage you'll be glad you're traveling Furness. Every day you'll be glad to go down to meals, glad of the British way of running a ship, particularly glad that your cabin steward has had long English training.

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*Canadian Pacific*



The Bushmen lived in bush-bidden caves, their only weapons the bow and arrow.

The Bushmen—or "Quakuak," as an Arabic geographer called them—and the Hottentot, both fast disappearing races, are interesting subjects of study for the visitor to South Africa.

There are also the mysterious Zimbabwe Ruins—a world riddle, and the scene of some of Rider Haggard's fascinating novels. Rich historical associations also abound in the beautiful cities of Capetown, Pretoria, Bloemfontein, Durban, and elsewhere in the "Sunny Sub-Continent."

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Waterman's is "the pen of the day" in beauty of appearance as well as in perfected mechanical construction...and the only pen offering patented "Tip-Fill"—the cleanest and easiest way of filling. No ink on the barrel—no ink on the hands!

Waterman's now presents "INK-VUE"—in addition to its regular line—for those who like ink-visibility. See the beautiful new models—"Silver-Ray" and "Emerald-Ray"!

Pens \$2.75 to \$10

Pencils \$1 to \$5

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BY  
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No ink wasted—your pen gets every drop. When ink is low, tip bottle—it stands securely on any of its flat sides.



Waterman's Ink is the perfect flowing ink for fountain pens and the most satisfactory ink for dip pens.

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ON THE  
WEST COAST OF MEXICO



Memories of Mazatlan: The day you went deep-sea fishing and surprised a great sea turtle sunning himself on the transparent water; the day you jogged through twisting streets in an *arafia*; good-natured *marisachis* tooting in the market place and strumming under balconies.

Mazatlan is one of the most delightful towns in Mexico. Situated on our West Coast Route, halfway between the United States and Mexico City, it is a popular stopover point, and one of the many reasons for including the West Coast Route in your roundtrip to Mexico City. Very low fares permit this, and through *air-conditioned* Pullmans operate between Los Angeles and Mexico City via Tucson, Nogales, Guaymas, Mazatlan and Guadalajara. Tucson is reached from the East by our Golden State and Sunset Limiteds from Chicago and New Orleans.

**HOTEL PLAYA DE CORTÉS**

We are now building a modern resort hotel on the beach at Guaymas on the West Coast of Mexico, to be completed early this winter. It will be a comfortable base for fishing trips into the Gulf of Lower California, an angler's paradise, or for hunting trips. Or a place to just relax and rest under a friendly foreign sun.

For booklets and information about the West Coast of Mexico, write O. P. Bartlett, Dept. C-10, 310 So. Michigan Blvd., Chicago. For de luxe booklet with large map in full colors, enclose 25 cents in stamps or coin.

**SOUTHERN PACIFIC**

"Mention the Geographic—It identifies you."

# "WE'RE DRIVING SOUTH FOR THE WINTER"



AT LAST the turning leaves begin to fall; the breeze from the lake grows chilly; and then one morning a white frost on the cottage roof confirms the rumor that summer has gone south.

Now to pack up and follow! To start a carefree pilgrimage into the southland, escaping winter's bleakness and making life a perpetual holiday under bright skies of summery blue!

That is the privilege today of thousands of men holding policies in America's first chartered mutual life insurance company. And you, too, can banish from the future the wintry bleakness of financial worry.

You can provide yourself and your wife with a regular cash income that will continue indefinitely, month after month, as long as you live. It may be \$50, it may be

\$500. In this way you will be enabled to come and go as you please. You will transform your years of retirement into a long vacation. In short, you will give yourself and your wife utter freedom during the most enjoyable part of your lives—that part "for which the first was made."

To win such freedom, consult any agent of the New England Mutual Life Insurance Company. The world offers you no finer way of protecting your future than through insurance with this Company which has eliminated financial worry from countless lives; this Company which has emerged from every economic storm with increased strength and prestige; this Company whose very name today—in this year which marks the Hundredth Anniversary of its Charter—is accepted as a synonym for safety.

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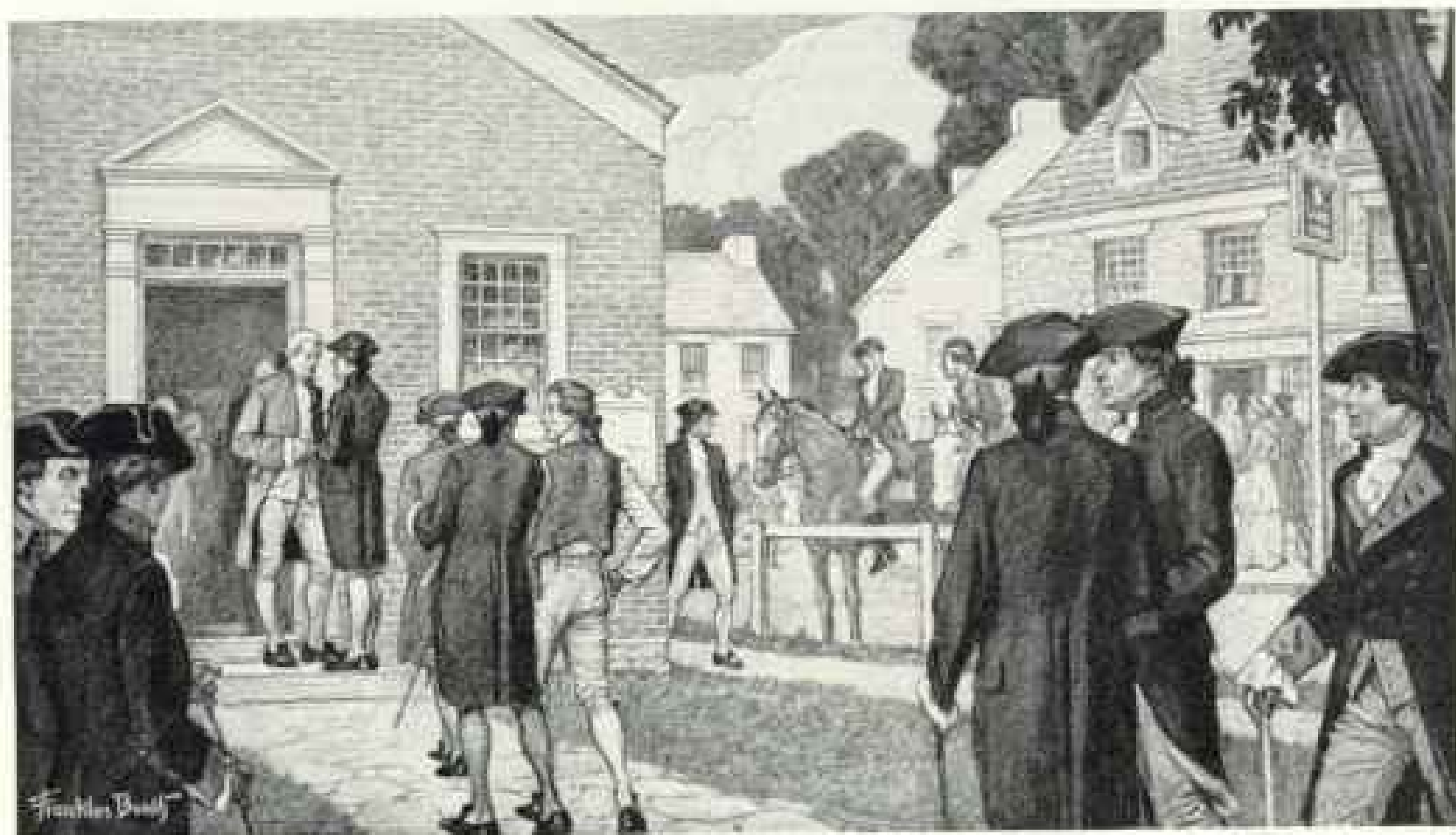
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## Town Meetings and Better Health

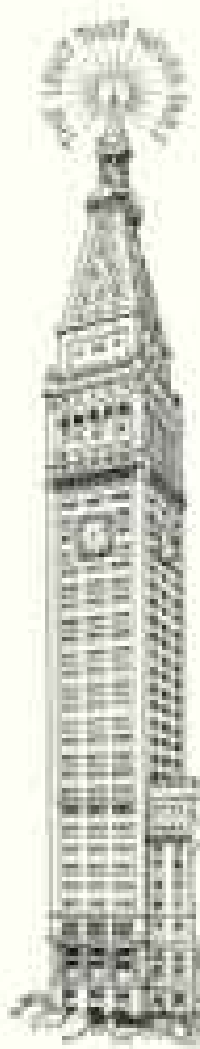
**F**OLLOWING the old Colonial custom of calling a town meeting when the safety and welfare of the citizens were at stake, the National Health Council will sponsor local town meetings throughout the country during October. You and other citizens will have an opportunity at these meetings to take stock of the activities which are being carried on to make your community a better and healthier place in which to live.

There is a direct relationship between the community and family health. Effective measures for improving sanitation and controlling disease depend upon enlightened public opinion. At these meetings you will learn the extent to which your community is giving you and your family a full measure of protection.

Your family should not be exposed need-

lessly to disease. Local health officials and voluntary organizations are striving continually to improve health conditions, and they know what vital gaps there may be in the health activities of your community. Just what, if anything, should be done is a matter for you and your neighbors to decide.

Numerous communities can bear witness to the benefits—measured in terms of better health and happiness—which have been achieved through surveys of the local situation and education of the public. In some cases the water supply has been improved, in others adequate stress has been placed upon the diphtheria immunization of children, and in still others the public has supported whole-heartedly the preparation of proper health ordinances and their enforcement. Attend your town meeting—it may lead to better health for your community.



**METROPOLITAN LIFE INSURANCE COMPANY**  
 FREDERICK H. ECKER, PRESIDENT      ONE MADISON AVE., NEW YORK, N. Y.

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**"I'LL NEVER JOKE ABOUT A BLOW-OUT AGAIN"** says **BUD FISHER**  
Famous Creator of *Mutt and Jeff*



## PLAY SAFE WITH SILVERTOWNS!

"MANY a time I've joked about a blow-out," says **BUD FISHER**, "but never again! On the way to Saratoga for the races, my car was completely overturned due to a blow-out. I was compelled to spend several months in the hospital, during which I had plenty of time to think of how important a part tires play in the safety of motoring. I'm not taking any more chances. I've equipped my car with Goodrich Silvertowns."

At today's high speeds, the *inside* of the tire gets as hot as boiling water. Sooner or later, this internal heat must escape. And it does. A tiny blister forms on the inside of the tire—between the rubber and


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To protect motorists, **GOODRICH** engineers invented the amazing Life-Saver Golden Ply—which resists internal tire heat and protects against these treacherous, *high-speed blow-outs*.

And examine the busky-cleated tread on these big Silvertowns. Then you'll see why they keep your car "straight-in-line" on wet slippery roads and give you months of extra "trouble-free" mileage! Equip your car with **GOODRICH Silvertowns**. They cost not a penny more than other standard tires... and they may be the means of saving your life!



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**L**IBERTY MUTUAL'S money-saving plan for careful motor car owners is summed up in these nine words: "Careful drivers are entitled to lower automobile insurance cost."

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*No car can be safer than the man at the wheel. And no driver can feel 100% safe without adequate insurance on his car. If you are a consistently careful driver, we believe you are entitled to car insurance at lower cost. With us, you do not have to pay the same price for automobile insurance as dangerous, reckless drivers. Here is the way our plan works: Selected drivers, hence fewer accidents and fewer losses — savings returned to you.*

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- 1 You are identified with reputable, careful drivers. Liberty Mutual's clients are selected, not merely solicited. They are the most careful automobile drivers in the country. You profit by that association in dollars and cents.
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My present policy expires \_\_\_\_\_  
Make of Car \_\_\_\_\_ No. of Cyls. \_\_\_\_\_  
Body Type \_\_\_\_\_ Model No. \_\_\_\_\_ Year \_\_\_\_\_

Getting ready for Winter?

# This man is preventing family colds!



Filling attic spaces with Rock Wool Home-Insulation keeps precious heat from leaking out of your home. If snow melts on your roof (as in picture at left), it's because heat's leaking out; your house should be insulated with J-M Rock Wool, most effective of all insulation methods.

**Johns-Manville Home Insulation**  
will give you a warmer house, save up to 30% on fuel  
... make your home comfortable all year round

**D**O YOU have cold, drafty rooms ... big fuel bills ... "family colds"?

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● **COLD**, drafty rooms in winter mean excessive fuel bills, because heat is pouring out; cold in sleeping in!



● **SWEATING** in summer — your house is practically certain to be that way if it is difficult to heat in winter!

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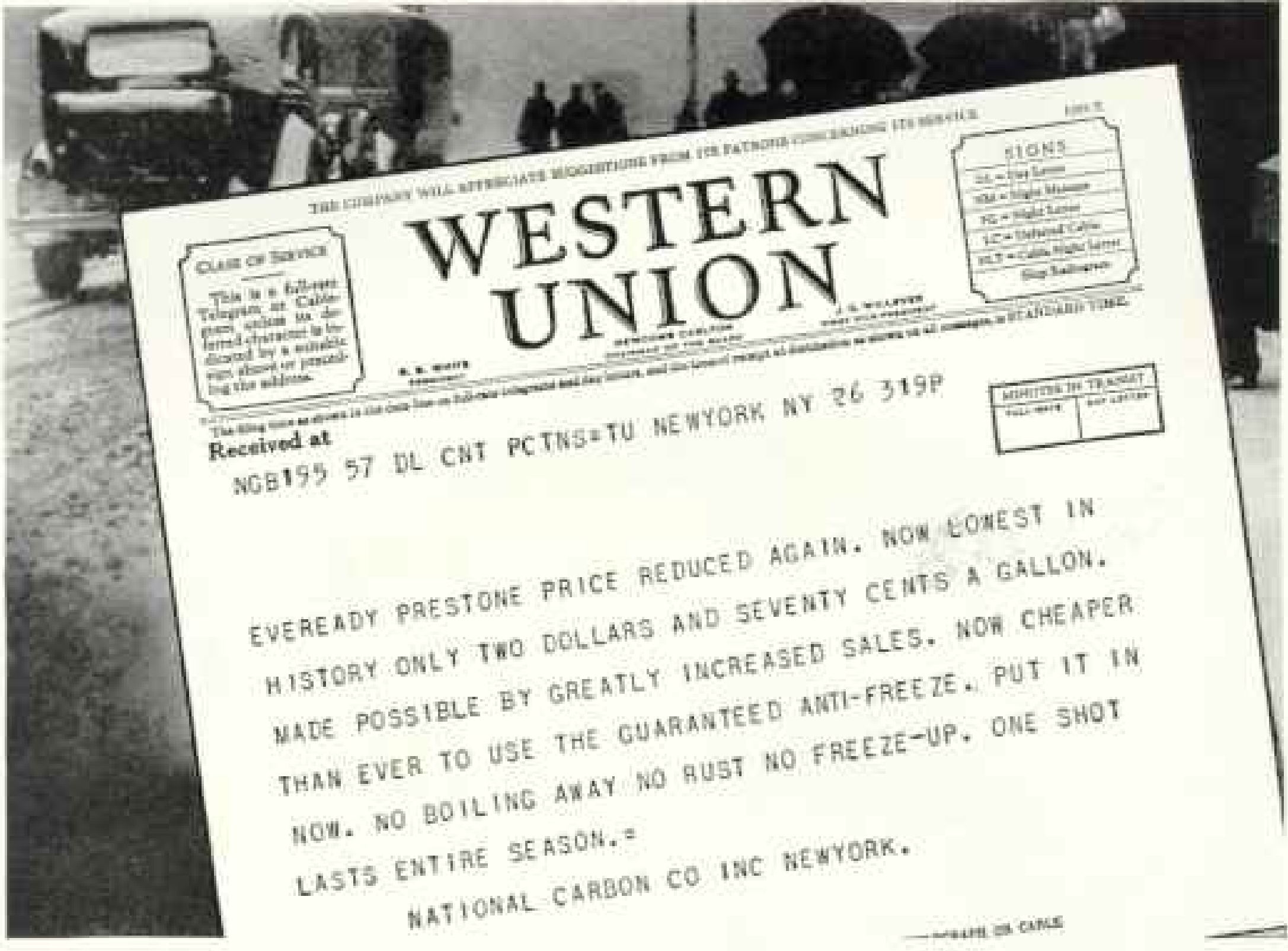
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THE COMPANY WILL APPRECIATE SUGGESTIONS FROM ITS PATRONS CONCERNING ITS SERVICE

# WESTERN UNION

**CLASS OF SERVICE**  
This is a follow-up Telegram or Cablegram unless its deferred character is indicated by a suitable sign above or preceding the address.

FIG. 2

SIGNS	
DL	Day Letter
NM	Night Message
ND	Night Letter
LC	Deferred Cable
DLT	Cable Night Letter
Day Letter	

Received at

NGB195 57 DL CNT PCTNS= TU NEWYORK NY 26 319P

MINUTES TO TRANSMIT	
FULL RATE	DAY LETTER

EVEREADY PRESTONE PRICE REDUCED AGAIN. NOW LOWEST IN HISTORY ONLY TWO DOLLARS AND SEVENTY CENTS A GALLON. MADE POSSIBLE BY GREATLY INCREASED SALES. NOW CHEAPER THAN EVER TO USE THE GUARANTEED ANTI-FREEZE. PUT IT IN NOW. NO BOILING AWAY NO RUST NO FREEZE-UP. ONE SHOT LASTS ENTIRE SEASON. = NATIONAL CARBON CO INC NEWYORK.

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Send my copy of "Answering An Important Question"

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Street and No. ....

City ..... State .....

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NATIONAL GEOGRAPHIC  
MAGAZINE  
WASHINGTON, D. C.

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. . .

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For

Reading

Months

Ahead!



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\_\_\_\_\_ 1935

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*Insulate with Fireproof Wallboard*



**INSULATING Sheetrock**

*THE FIREPROOF WALLBOARD*

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The wide use of wood in building is testimony of its economy and efficiency. But wood is inflammable. Fire destroys life and property.

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SEND 10 CENTS FOR MINIATURE TEST HOUSE



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Please send test house showing how Insulating Sheetrock actually insulates. Enclose 10c to cover mailing.

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Rappee do.  
Stralburgh do.  
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Scented rappee do. of different kinds,  
Scotch do.

The above Tobacco and Snuff will be sold reasonable, and warranted as good as any on the continent. If not found to prove good, any part of it may be returned, if not damaged.

N. B. Proper allowance will be made to those that purchase a quantity.  
May 27—1789.

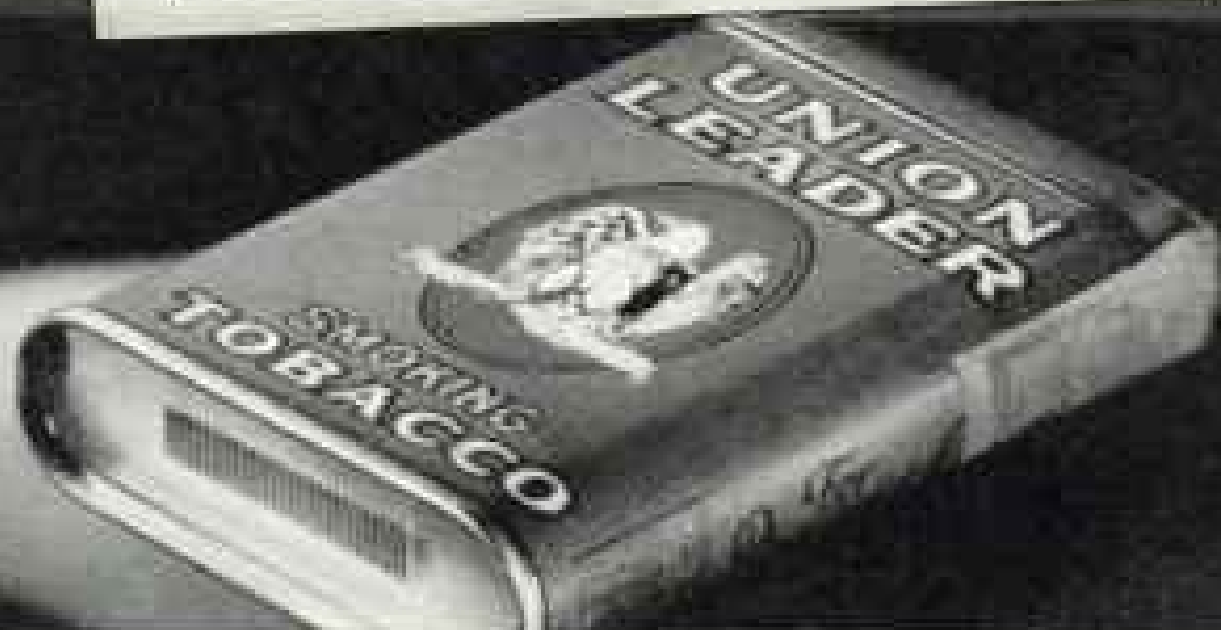
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*"Best quality & flavor . . . warranted as good as any on the continent . . . will be sold reasonable!"* Those are the promises that Peter Lorillard made to tobacco buyers in 1789. And, today, they still hold good for another fine Lorillard tobacco . . . Union Leader Smoking Tobacco.

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*O. Lorillard Company* (Established 1760)



NEW ZEALAND

# AUSTRALIA

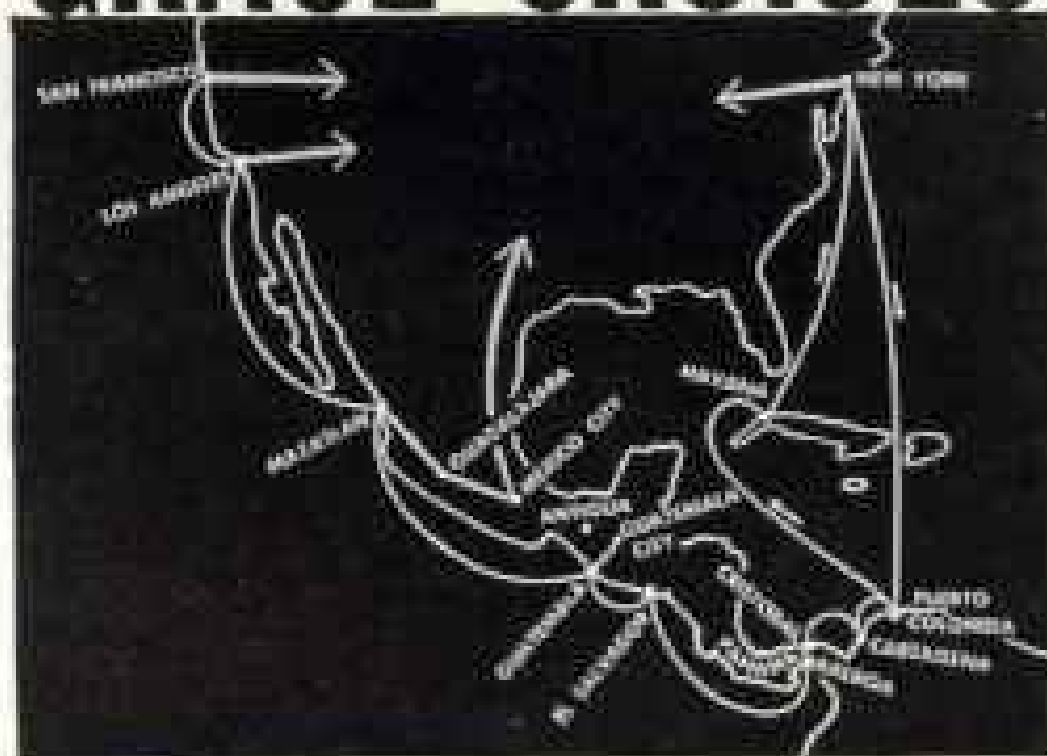
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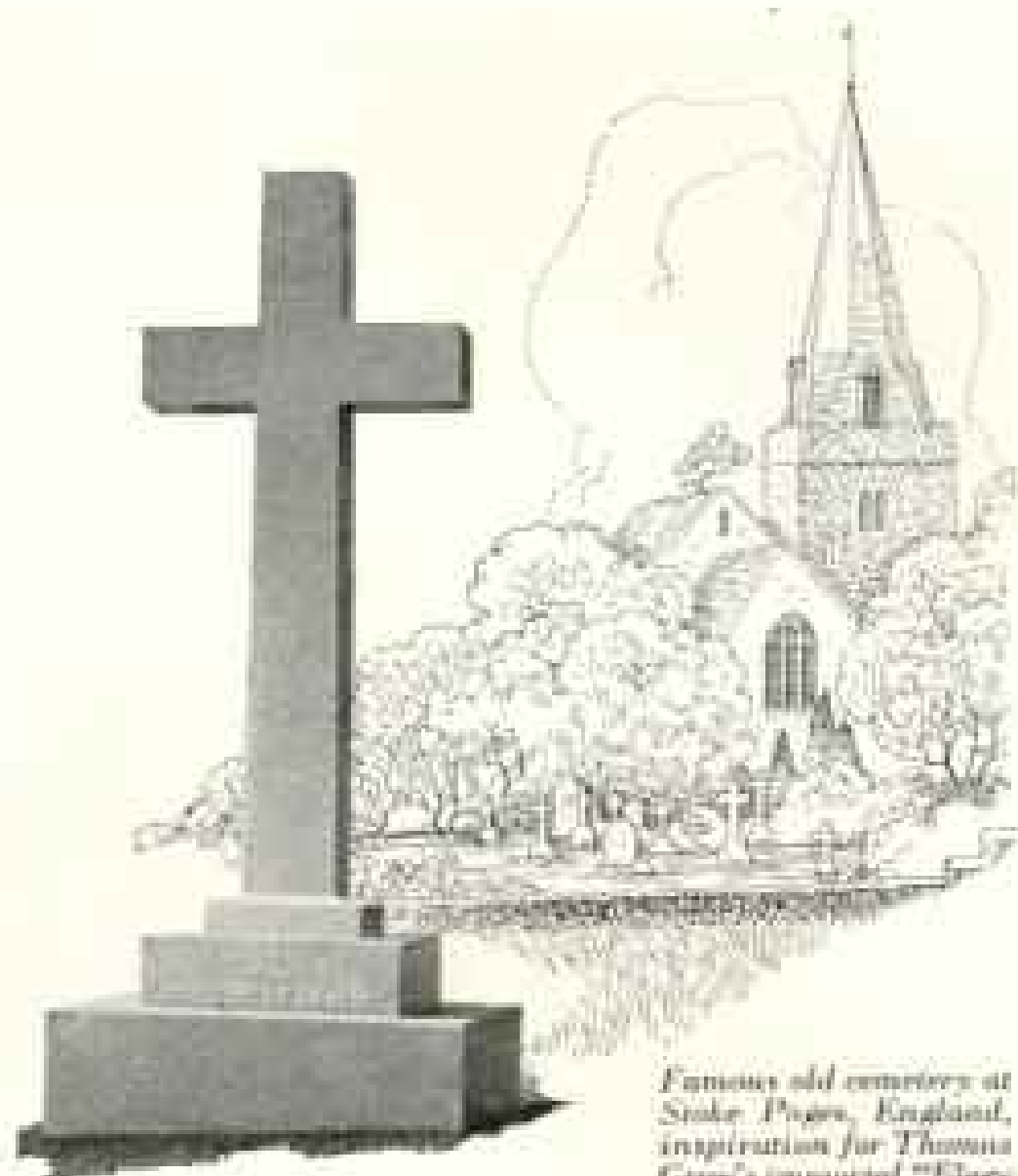
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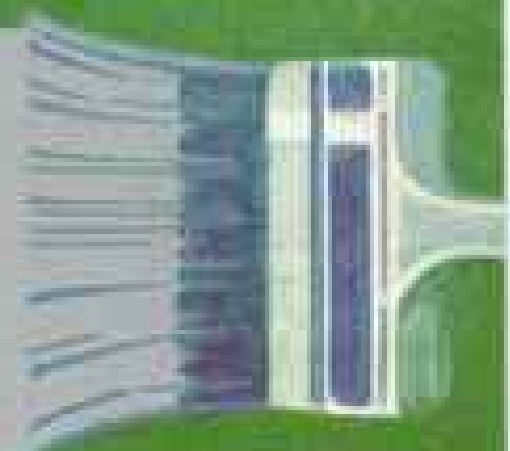
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