ATLAS MAP SUPPLEMENT: SOUTH CENTRAL UNITED STATES

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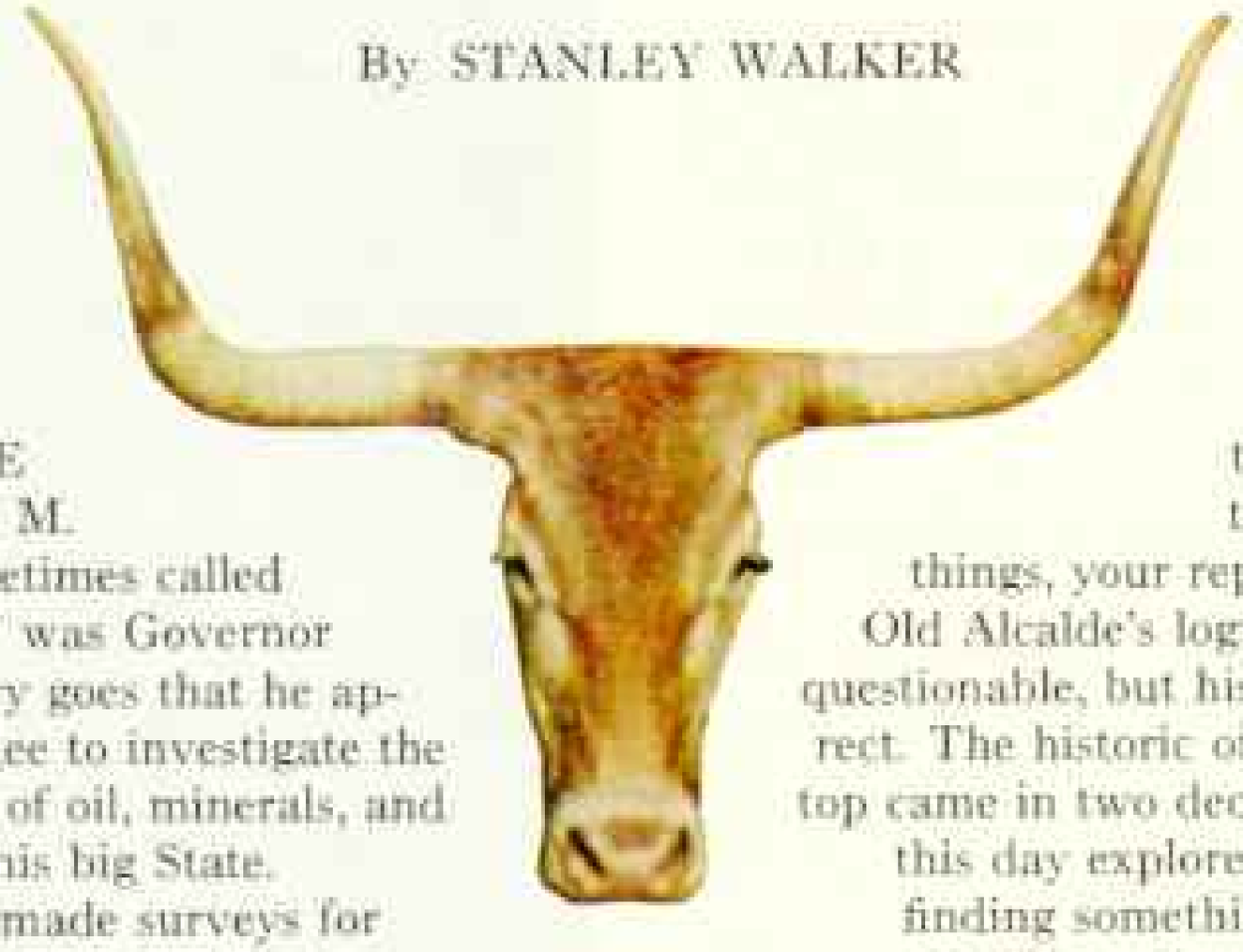
The Fabulous State of Texas

In what was once "a howling solitude," oil wells gush and factories clatter—but "Big T" still faces problems as basic as water shortages and cities that grow too fast

By STANLEY WALKER



BACK IN THE 1880's, Oran M. Roberts, sometimes called the "Old Alcalde," was Governor of Texas. The story goes that he appointed a committee to investigate the possible resources of oil, minerals, and artesian water in his big State.

The committee made surveys for six months and reported nothing doing—there were no prospects of any of these resources in all of Texas. Governor Roberts received the report, discharged the committee, and then remarked:

"But I want to say to you that every word in your report is a lie. I repeat it—a lie! Do you think God Almighty would create a great country like this and not provide a way to take care of it? In the very nature of things, your report is a lie!" The Old Alcalde's logic may have been questionable, but his verdict was correct. The historic oil well at Spindletop came in two decades later, and to this day explorers are continually finding something new and often valuable under the Texas surface.

An old poem has it that Texas grew from "hide and horn," which is hardly a historically accurate appraisal of what happened. Hide and horn, yes, but also the holes in the ground from which came oil and gas: the old Blackland Belt and the newer area around Lubbock, where cotton is grown; the enormous Plains stretches where wheat

Illustrations by National Geographic photographers B. ANTHONY STEWART and THOMAS NEBBIA

ripens in the summer; the Lower Rio Grande Valley, with its astonishing citrus groves and vegetable gardens, once almost a desert (page 191); the industries, big and little, for making boots and concrete blocks and steel and newsprint and a hundred other things.

I am a Texan. So were my parents and my grandparents. My pioneer ancestors called themselves "Texians"; they were frontier cowmen, sheepmen, peace officers, trail drivers—and, in some cases, not much of anything at all. I was born out in the hills, 14 miles from the nearest town, in the fall of 1898, so I am old enough to have sampled some of the flavor of these vanished times.

State Divides Into Four Zones

At one time or another I have visited almost all of the 254 counties that make up Texas, and when I look at a map like the one that accompanies this issue,* I tend to see the State as divided into four main sections.

First there is the Gulf Coastal Plain—hot, low country, ranging from sea level to 1,000 feet. It begins at the Louisiana border and curves south to the Rio Grande Valley, where a good part of the Nation's winter vegetables grow, along with citrus and cotton.

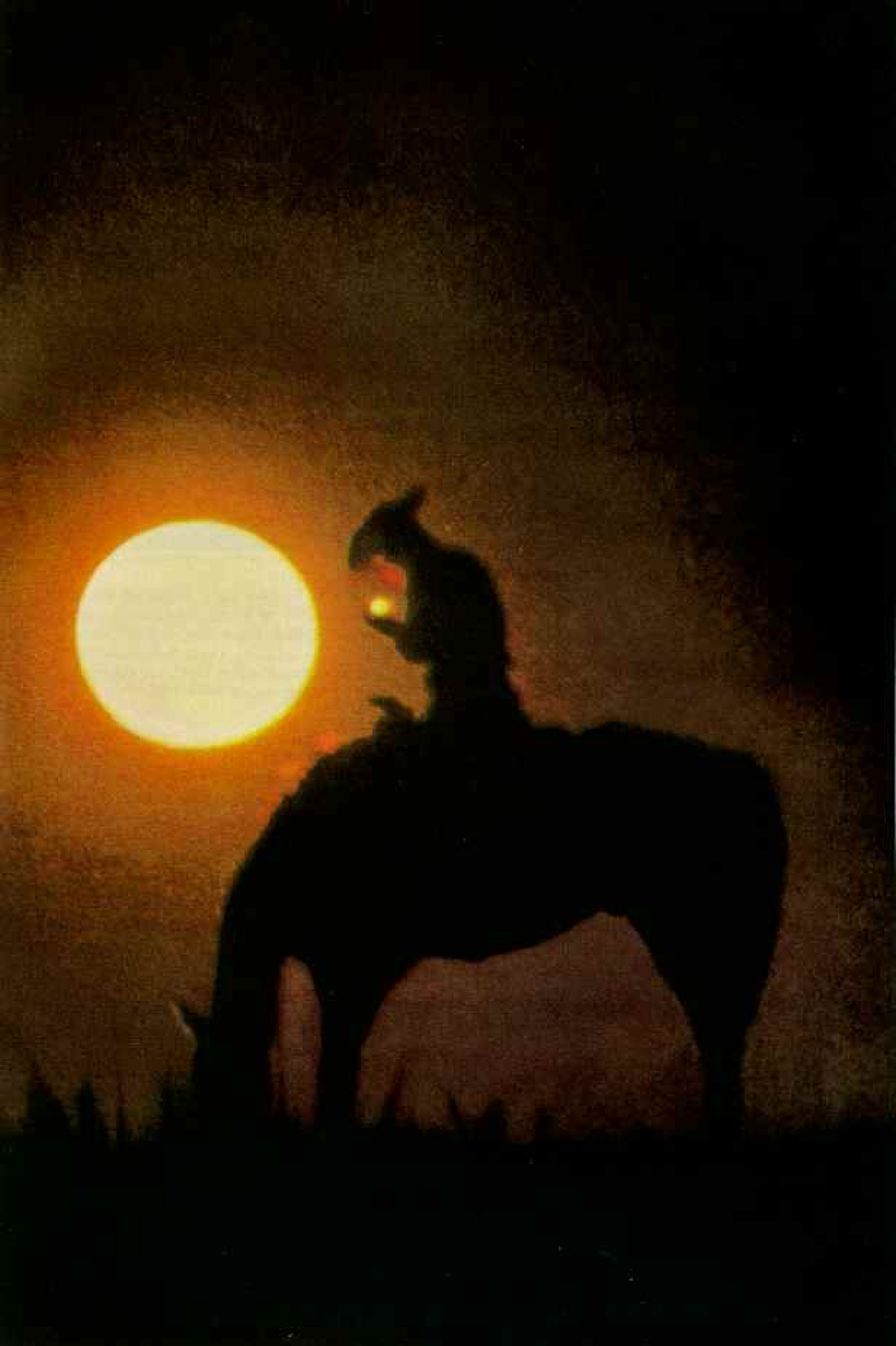
Farther inland a higher belt of land—the North Central Plains—stretches roughly southwest to northeast across the middle of the State. This is cattle, sheep, and goat country, 1,000 to 2,500 feet in altitude, and was once the southernmost range of the bison.

The other two sections are the Panhandle—part of the High Plains which run all the way into Canada—and the wild, rough country farthest west: Trans-Pecos Texas, where the Rocky Mountains drive their ramparts down from the north.

In the very broadest of terms, this is how the land lies in Texas. It is, of course, an oversimplification, for within each of these four subdivisions there is a tremendous variety of landscape, climate, vegetation, and physical features. In any case, it is not so much the lay of the land that makes the State

*See the Atlas Map, **South Central United States**, sent to Society members with this issue.

Full moon in a fiery setting silhouettes a lone cowboy striking a light on the High Plains of the Texas Panhandle. Men such as this one preserve the legendary American West in the Lone Star State, a colossus of skyscrapers, prairies, factories, and oil fields.



BACKGROUND BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

Windows of the City Club frame two Dallas landmarks: the 42-story Southland Tower (right) and the 36-story Republic National Bank Building. Club's lounge occupies the 26th floor of the Adolphus Tower.

Gleaming façades form a canyon above the intersection of Ervay Street and Pacific Avenue, Dallas. Since the end of World War II, this booming Texas metropolis has constructed more office buildings than any other U. S. city except New York.

as the people who live on it. What about the Texans themselves?

Texas is a place where the question, "Now, is that so?" is always pertinent. For example, the feeling is abroad that Texans, as a distinct race of *Homo sapiens*, are distinguished for their drive, their outward-giving personalities, their vigorous physiques, and their appetite for deeds of flamboyant derring-do. This image of *Tejano erectus* has no doubt been projected by the shenanigans of various individuals, many of them exceedingly well heeled, performed before a wondering and not always sympathetic world.

Well, is that so? A vast body of evidence, most of it from thoughtful persons who have lived in Texas all their lives, could be adduced to prove that the "typical" Texan is really a retiring, well-behaved, quiet fellow who gives the impression that he is more than a little tired—even lazy. This "real" Texan is about as bubbling a character as an old Maine or Vermont resident.

Most of the spate of so-called Texas jokes, some pretty tiresome, have actually been invented by Texans who chose this method of indicating that they did not take themselves too seriously. Some Texans, of course, do take

RUSSELL LEE

The Author: A native Texan from Lampasas County, Stanley Walker moved to New York as a young man and took over the city desk of the New York *Herald Tribune* before his thirtieth birthday. He assembled a young and brilliant staff, many of whose names have since become famous: Alva Johnston, Joseph Alsop, John Lardner, Beverly Smith, John O'Hara, and Lincoln Barnett. Mr. Walker has written half a dozen books, including *City Editor*, a classic of big-city journalism, and *Mrs. Astor's Horse*, a best seller about U. S. eccentrics in the 1930's. His latest book, *Home to Texas*, was written when, after 26 years away, he returned to live on a 300-acre "rolling chunk of God's not-always-green footstool" in Lampasas County. There he now raises white-faced cattle and black-faced sheep—and continues to write.

Apprentice stewardesses learn rules of make-up at the American Airlines Stewardess College between Fort Worth and Dallas. This year some 750 girls will take the 6½-week course covering 77 subjects, including theory of flight, first aid, passenger care, and personal grooming. Graduates receive silver wings. Texas ranks second only to New York in the number of scheduled airlines having headquarters within its borders.

Dallas model parades the latest fashion

themselves a little too seriously, but usually they do not. The classic example is the story, variously told, of the old millionaire rancher who had to make a trip to St. Louis. Before he left, his daughter begged him to buy a new suit and get a haircut.

"No," said the shaggy Texan, "I'll go as I am. If I see any of my friends, they'll recognize me. Strangers don't matter."

It is true that occasionally the more articulate boosters, carried away by the rapid growth of Texas and the manifold nature of its resources and enterprise, will let out the cry, "Texas has everything!" Such yawps are understandable, and probably pardonable, but they need not fool anyone. Texas doesn't have everything—quite.

In fact it sometimes seems, looking back over the development of Texas, that the empire has grown in large part because of the confidence (often misplaced and tragic) of hopeful, indomitable individuals like the Old Alcalde, Stephen F. Austin—the Virginia-born "Father of Texas" who planted the first important colony on the banks of the Brazos in 1821—once referred to his land as "a wild, howling, interminable solitude."

The State has known savagery and blood feuds, corruption and exploitation, droughts and depressions, ignorance and viciousness, plague and storm, but it has shaken itself and moved on—and, amid conflicts and differences of opinion which are often painful, it continues to grow. Austin would be astounded if he could see it today.

Examples of faith in Texas could be given by the score. For example, no intelligent city planner would have laid out what is now the

NE TATACHROMES BY HARRY C. BISHOP (LEFT) AND NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

in Neiman-Marcus, leaving the small boy in center wide eyed and openmouthed

great city of Dallas on the banks of the Trinity River. The site had no logical appeal. It was only a fording point in the river and not at the crossroads of anything in particular. There was no commerce, and no sign of any to come.

As recently as the 1880's Dallas was a dingy place, with wooden blocks for paving on the better streets and hogs running loose. Even in the 1920's persons traveling to the city through the worn-out, cut-over, and altogether depressing farmlands of East Texas were saying, "This land is ruined."

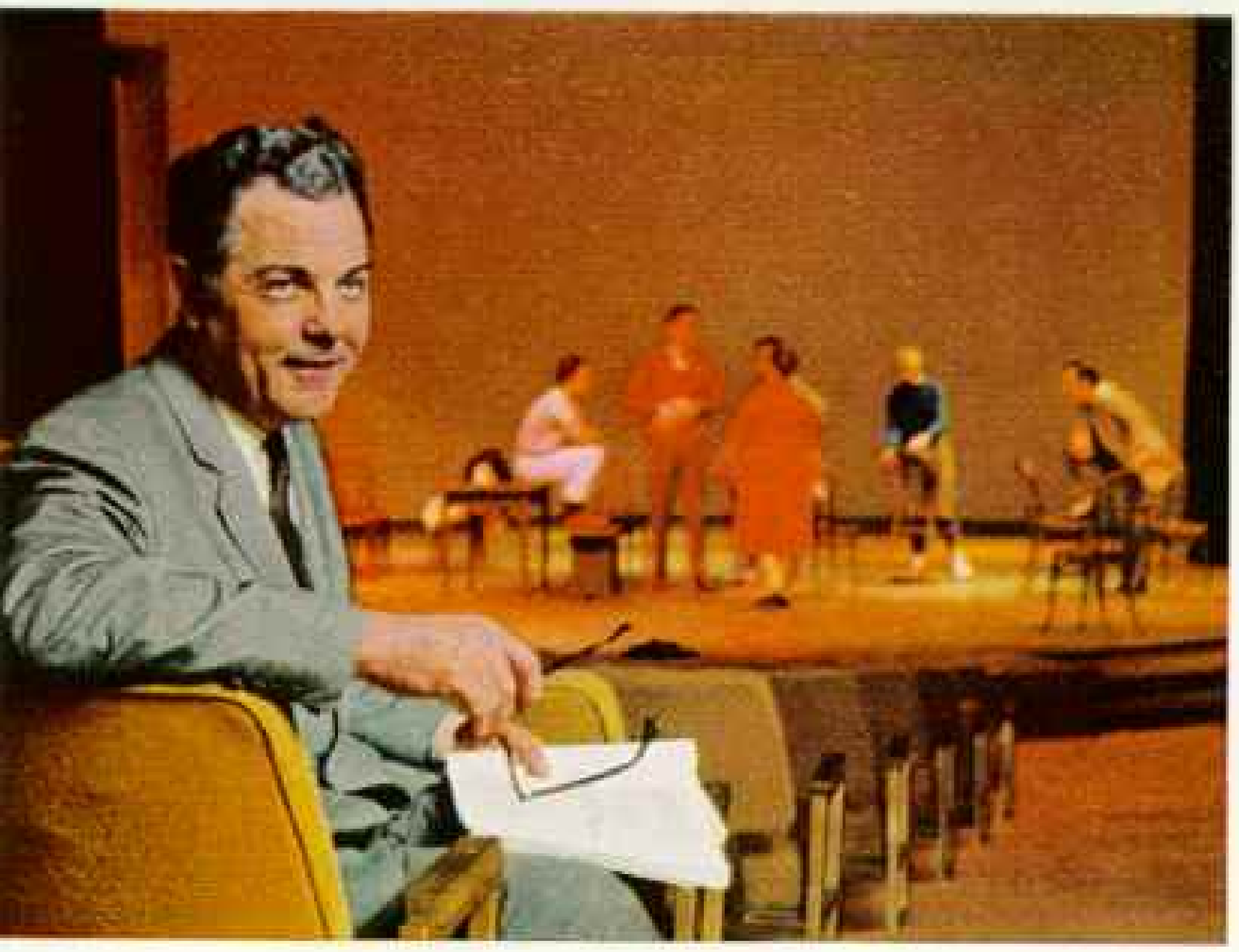
Then came the great oil discoveries under the farmland. Today Dallas has passed 670,000 and is still growing (page 153).

One of the most civilized and many-sided of the early Texas enthusiasts was George Wilkins Kendall, who a little more than 100 years ago became enchanted with the possibilities of the young State.

Kendall, born in New Hampshire, was one of the founders of the New Orleans *Picayune*. He was an epicure, and had traveled widely. To him, the promised land was the Hill Country north of San Antonio. There, near the little town of Boerne, in what is now Kendall County, he started a sheep ranch.

Meanwhile, with a stream of newspaper and magazine dispatches and personal letters, he tried to spread his dream of what his chosen part of Texas could become. He was probably the most effective of the early boosters, and he did it out of sheer enthusiasm.

Perhaps the most revealing story of this remarkable man is of the day he brought his French wife home. They drove up from San Antonio. The April sky was pouring rain, the



Script in hand, Dr. Paul Baker directs a rehearsal at the Kalita Humphreys Theater in Dallas. Designed by Frank Lloyd Wright, the playhouse holds 440. Seats crowding the rotating stage permit the actors to capture an Elizabethan intimacy with the audience.

Director of unorthodox dramatic productions, Dr. Baker divides his time between Dallas and the Baylor University Drama Department in Waco. Sometimes he uses more than one actor to portray different facets of a character's personality.

Arms outflung, an actress in Studio One, an experimental theater at Baylor University, expresses herself with motion. Her gesture represents "glide," one of the basic stage movements studied at the school.

Drama students at Baylor act, write and direct plays, design scenery, and work backstage. Studio One seats playgoers in swivel chairs surrounded by six stages.

wind was chilly, and the grass still brown. They drove on through the hills, and his wife finally asked, "Where are the beautiful plains of Texas you have told me so much about?"

"My dear," said Kendall, gesturing about him at the hills and valleys, "here they are!" He knew. And, in time, Mrs. Kendall came to see the country somewhat as he did, though she was nonetheless dismayed one day to discover a rattlesnake coiled around her beautiful French clock on the mantel.

She outlived her husband many years and became a thorough Texan. In the Hill Country the names of George Wilkins Kendall and his wife are still held in respect.

The old-timers had prophetic glimpses of what was going to happen. I've heard it said that, as a young Army officer stationed in Texas before the Civil War, Robert E. Lee observed, "I hear the footsteps of coming millions." Those millions have arrived, and more are on the way.

Texans, perhaps more than the people of any other State, are fascinated by their own history—and with reason. It has been quite a history.

Six flags have flown over the land—those of Spain, France, Mexico, the Republic of Texas, the Confederate States of America, and the United States. On gala occasions all six are sometimes flown today.

The visit of the Spaniard Alonso de Pineda in 1519 was the first break in the era of the aborigine. Later explorations, and the long story of the Spanish and French claims, the mission era and the rise of Mexican influence, have produced an enormous literature. Modern history, however, may be said to begin with 1821, when Austin established his first brave and tattered little colony.

PORTACHROMES AND OF EKTACHROME (LEFT), LOWER BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

Drum Wranglers pull Big Bertha across the University of Texas campus in Austin. Pride of the Longhorn Band, the drum weighs 300 pounds and spans eight feet. Once owned by the University of Chicago, Bertha became radioactive when stored under the stadium where the first atomic reactor was built. After decontamination, the drum was bought for the Longhorns. Girl at left sunbathes before Andrews Dormitory.

It was virtually impossible for Anglo-Saxon settlers from the old States, mostly Protestant and strongly individualistic, to live happily under the domination of Mexico. Conflict was sure to come.

The year of the decisive break was 1836. The President of Mexico, Antonio Lopez de Santa Anna, with an army of thousands, crossed the Rio Grande with the idea of subduing the rebellious Texans. He headed straight toward San Antonio, where fewer than 200 Texans, against the orders of Gen. Sam Houston, had barricaded themselves.

The Alamo fell on March 6, 1836, and every man in the garrison lost his life. Their bodies were burned by the victors. Many brave men were here, and the names of some will never be known. But four are recited today as a sort of litany: William B. Travis, James B. Bonham, Jim Bowie, and Davy Crockett.

Foolish to stand there and die? Some would say so. But the stubborn, hopeless act not only gave Texans a spiritual boost which lasts to this good day; it also gave General Houston time to rally his forces, so that the next month, on April 21, he turned on Santa Anna's army at San Jacinto (near the present city of Houston), and defeated it in one of the decisive battles of the Western World.

From 1836 until the end of 1845, when

U.S. SPACECRAFT BY BARRY C. BISHOP (UPPER) AND NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS KOBBIA © N.G.S.

Flame-defying firemen at Gulf Oil Corporation's Port Arthur refinery wear suits of aluminized fabric whose shiny surface reflects heat.

Probing for oil, drillers sink a hole 60 miles west of Midland. Derrick man at left watches the huge traveling block lower the drill stem through the turntable into the hole. When the turntable rotates, the bit-tipped drill stem bores into the earth. A crew working in soft clay can drill 250 feet an hour; rock may slow progress to a foot an hour. Only one wildcat well in nine strikes oil.

ETCHING BY LAURENCE LOWRY © N. A. S.

Derricks Near Baytown Stud Galveston Bay

Texas drillers found oil in 1866 near Nacogdoches, but production remained a trickle until 1901, when the fabulous Spindletop gusher near Beaumont ushered in the oil age. Biggest boom of all began in 1930 when No. 3 Daisy Bradford blew in near Kilgore. Within a year the East Texas field had 4,000 wells, and crude oil prices dropped from a dollar a barrel to a dime. Out of the confusion came spacing of wells and regulation of flow.

Leading oil State, Texas has produced 24 billion barrels, more than a third of the Nation's total. Close to half a million wells pock its landscape, including the world's deepest, a 25,340-foot dry hole in Pecos County. Some of the State's richest reserves lie in the Gulf of Mexico.

Texas was admitted to the United States, the Republic of Texas survived—impoverished, worried, and sometimes pathetic. Mexico objected when Texas entered the Union, and thus came the Mexican War.

The Civil War brought a new set of horrors. Sam Houston, old and eloquent and far-sighted, was governor, and he took a stand against secession. He was thrown out of office, and Texas joined the Confederacy. Like other Southern States, she lost many men, and suffered her share of humiliation in the Reconstruction era.

State Could Break Up Into Five

The decades immediately following the Civil War were almost as stirring as what had gone before. Wild and half-wild cattle were rounded up along the coast and along the Nueces and the Frio, and driven to Kansas. Spreading their domains beyond this Brush Country, the cattle kings were the big shots. And then the railroads came, and Texas gave much of its public land to help them come. Finally, though few realized its significance at the time, came the symbol of the new era: the oil gusher at Spindletop in January, 1901.

One oddity of Texas politics is that it can (under the terms of annexation in 1845) divide itself into five States if it so desires. Sometimes this would seem to be a logical move because of the State's vastness. People along the Sabine River, in East Texas, have seemingly little in common with citizens who grow those wonderful cantaloupes in the Pecos Valley. And the Amarillo nabob, living in that high and windy place, is a stranger to the shrimp gatherer on the Gulf.

The trouble is that they are all Texans, united by some almost mystical bond which the outside world might call sentiment. The writer and historian J. Frank Dobie once said that Texas would never split up into five States because no one could decide who would get the Alamo.

Maybe that is the nub of the question. I go to San Antonio as frequently as I can, because I love the place. And I always visit the Alamo. I can't help it. It is a beautiful spot, restored with taste and with a painstaking effort at historical accuracy (page 195). It is impossible to be wholly accurate about the Alamo, for all the experts died there.

The stone walls around the old mission are thick and graceful. The trees are a healthy green. Hereabouts may be found the spot where (probably) the fevered and wasted knife fighter, Jim Bowie, made his last stand. And here (also probably) is the place Davy Crockett went down swinging his empty rifle like a terrible club. There (again maybe) Colonel Travis, the red-headed commander, drew his line on the floor and asked those who would stay to come across, and they came.

The pull of the Alamo, for me, is an inexplicable thing. I'm sure it is not at all because some of my very distant kinsmen died there. I never knew them; they were nothing to me. And yet, well, I do know this, and it is nothing to be ashamed of: I can't be inside the Alamo for more than ten minutes before a teardrop falls down my cheek. There's no escape.

This unplanned monster, Texas, in many ways justifies the predictions of the original dreamers and the assertions of the modern boosters. The smogless skylines of the larger cities are quite striking, when the light is right. There is more Texas money available now to finance Texas projects, which Yankee dollars formerly backed. The growth has been relatively steady. Texas has "not put all its economic eggs in one basket," as one enthusiast puts it.

Problems: People and Water

The standard of living goes up and up—up indeed, until in some instances it is an international joke. The level of education is higher. Great industrial plants, clean and symmetrical, suddenly appear on the flat prairies. Public health matters have improved. Air conditioning has lessened the terrors of the Texas summer days.

In the midst of this self-congratulation, however, the thoughtful Texan is faced with two facts of life of the most profound importance:

First, the population trends in Texas point

Miners at Grand Saline Tap an Underground Mountain of Salt

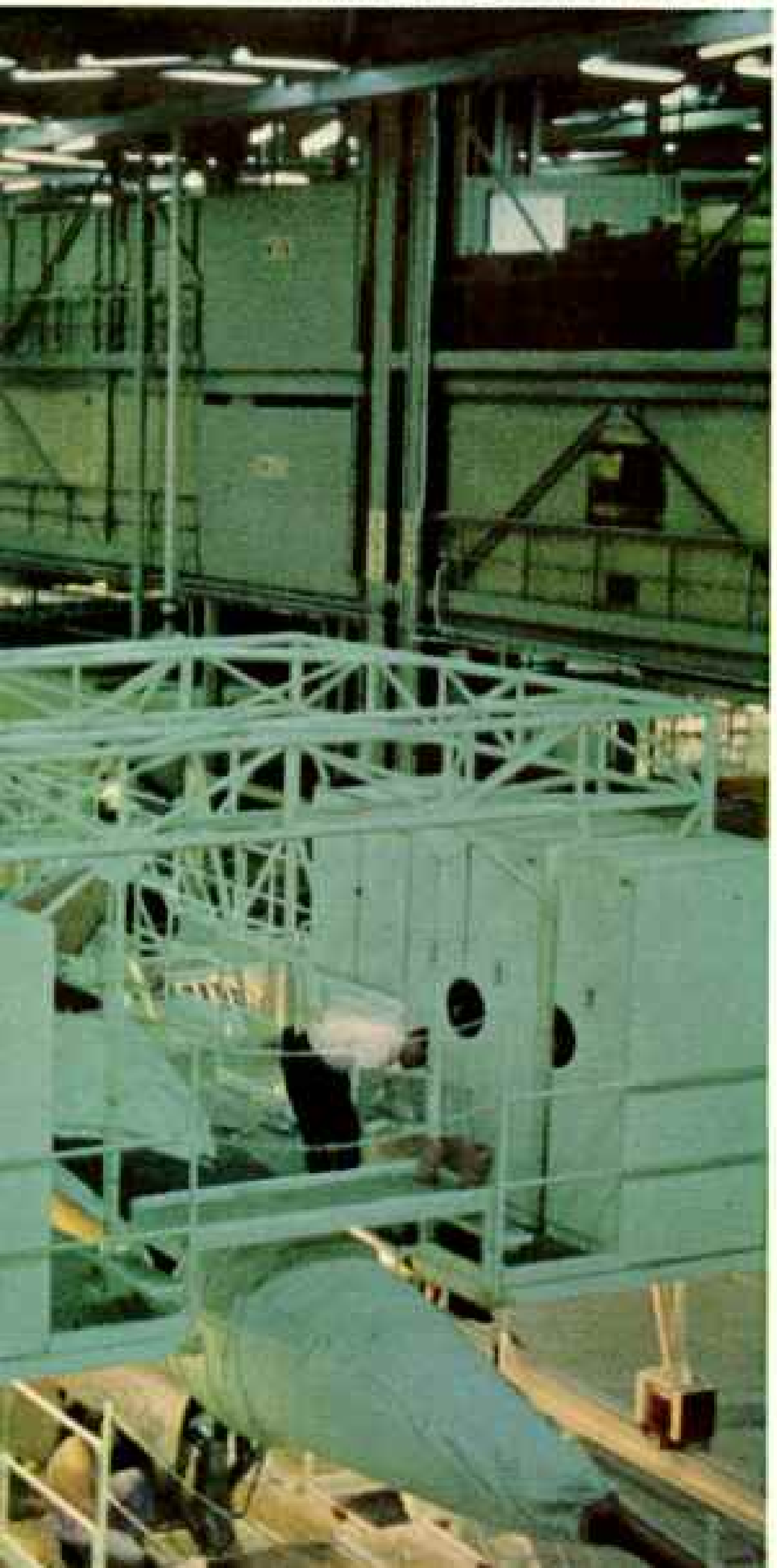
Deposited by the evaporation of prehistoric seas and squeezed upward by contractions of the earth, the salt forms a dome a mile wide at the top and an estimated three miles deep. In 1929 the Morton Salt Company sank a shaft to the 750-foot level. Here, working by floodlight, the men dynamite the face of a gallery and load rock salt for hauling to a crusher. Worker on the boom pries fragments from the wall.

Monkey astronaut tries out a space seat at the School of Aviation Medicine, Brooks Air Force Base, near San Antonio. Plastic foam cushions the shock of rocket blast-off; nylon mesh holds the animal snug. Knowledge gained from work with monkeys may help launch a man into space.

Supersonic B-58 Hustlers move down the assembly line at Convair's Fort Worth plant. Four jet engines suspended beneath the delta wings enable the bomber to fly at twice the speed of sound.

Lured by sunny days and flat spaces, aviation came early to Texas. World's first use of the airplane in a military action took place in 1911 along the Rio Grande. During World Wars I and II, thousands of flyers trained on Texas airfields.

All photographs by National Geographic photographer B. Anthony Stewart (left) and Dean C. Bishop © N. G. S.



inexorably to the rise of a few very large urban centers, while the rural areas and the small towns are either stagnating, being depopulated, or just plain dying.

Second, the water problem, a vexing and complex subject, has not been solved, but throughout the State the matter is being tackled vigorously.

Any consideration of today and tomorrow in Texas must deal with these two facts. They are basic. In a sense, they are two prongs of the same question: How to supply water to a population that is crowding together more and more in a few urban areas.

Even the most casual visitor to Texas will soon observe that the subject of water—which takes in droughts and floods, drizzles and the cold winter sleets that kill young goats—is all-pervasive. The history of Texas is in large part the story of water—too little and then too much.

The weather has supplied Texans with a constant topic of conversation and with their oldest and most durable jokes. There was the early German settler who reported that "The rain she vas all vind, and the vind she vas all sand"; the stranger who asked, "Does the wind always blow this way?" and got the reply, "No, sometimes it turns around and blows the other way"; and so on and so on.

Cloud Seeders—but No Clouds

The ranchers watch the snails, hoping that their climbing will mean rain; the farmers tie dead fish to fences and turn dead rattlesnakes on their backs, hoping to induce rain (no help); at least one governor has called on the people to pray for rain, with inconclusive results; the cloud seeders have tried, but all too often there were no clouds to seed.

As late as the 1950's (roughly the first seven years of that decade saw a most serious lack of rainfall) well-to-do ranchers in many West Texas counties went broke. One man left the country, leaving a sign on his pasture gate, "Will Be Back When It Rains."

In such times the world situation, and even the doings in Washington, seem to Texans remote and somehow unimportant. They look for omens. They listen to the radio, hoping for some encouraging word from the weather experts.

There are some bright spots. For example, Houston, long worried about its water supply, has finally worked out arrangements to tap fresh sources on the San Jacinto and Trinity Rivers. It will need them, with its population nearly one million and still galloping

FRANK MUTO

Lyndon B. Johnson Rides Silver Jay on His LBJ Ranch

A flair for politics swept Mr. Johnson from a Texas schoolteacher's desk to a seat in the House of Representatives, later to the Senate, where he became majority leader, and last fall to the Vice Presidency of the United States. Here, on his Tennessee walking horse, he inspects his ranch near Johnson City. Adolfo López Mateos, President of Mexico, presented the saddle to the Texan after a visit to the LBJ Ranch.

Grass grows shoulder high on the Flat Top Ranch near Walnut Springs.

Seven years of drought parched Texas in the 1950's. At one point folks in Dallas drank bottled water while their lawns withered. Many ranchers faced bankruptcy; farmers fled the waterless land.

One who escaped real hardship was Charles Pettit (opposite), who, by foresightedly building dams and planting grass, transformed a patchwork of scrubby woodland and worn-out farms into a profitable 17,000-acre domain.

ahead. Dallas suffered during the drought, but an imposing series of dams—begun before the dry spell and still being built—rise on the streams above the city, and the future looks bright. The situation in Dallas at one time during the drought was so serious that the Red River, far to the north, was tapped to supply—with inferior, red, and salty water—some of the city's most pressing needs. For a time many Dallas citizens had to watch their lawns and shrubs wither away while they drank bottled water.

New Plant Will Purify Sea Water

Recently revived is the old dream of purifying the water from the Gulf of Mexico and piping it inland to the more arid parts of Texas, and the Department of the Interior has actually started a demonstration plant in Freeport. When finished, it will produce a million gallons of fresh water a day. It is too early to guess how this will turn out, particularly as to cost. The general attitude is one of quiet skepticism.

Thousands of dams have been built in Texas over the past few years—big dams such as the Falcon on the Rio Grande (and another one is now projected and approved), the really impressive chain of dams on the Colorado River above Austin, some dams on tributaries of the Trinity River, which partially encircles Dallas, and fish ponds and stock tanks too numerous to count. In many places this has changed the face of a whole area.

Yet, when heavy rains come, as in the early summer and the fall of 1960, floods still rush down to the Gulf, taking valuable soil with them and threatening people in the lowlands. Some of these new dams are open to the objection that silting may in time render them useless, and there have been other objections. But Texas is proud of its man-made lakes, and there seems no doubt that they have held back an enormous amount of water that otherwise would have been wasted.

These lakes also have provided Texans with an outlet for their most consuming enthusiasm—fishing. It seems hard to believe, but even Amarillo, way up in the Panhandle on the edge of what used to be called the Dust Bowl, brags about the fishing near by. The banks of the East Texas streams and lakes have always drawn fishermen; now they are at it all over the State. Their urge to fish amounts to a mania. The other favorite pastimes, in descending order, are hunting deer and shooting doves, watching television, cheering their favorite football players, listening to weather reports, and helping chase escaped convicts.

Some of the most significant work on the problem of what to do with Texas land and

PHOTOGRAPHS BY RUSSELL LEE © NATIONAL GEOGRAPHIC SOCIETY

water has been performed not by government agencies but by individuals with the resources to do things on a large scale. The King Ranch near Corpus Christi, famous for its immense size (980,000 acres), has gained additional attention not only for its Santa Gertrudis cattle and its horses, but also for water conservation and the propagation of grasses.*

Flat Top Grows 82 Kinds of Grass

To many observers, the work done by Charles Pettit on his Flat Top Ranch near Walnut Springs, about halfway between Fort Worth and Waco, seems of the utmost significance. This place is an object lesson in what a man with a dream, with pertinacity and intelligence and a fair amount of financial resources, can do when he tries.

Mr. Pettit, a little more than 22 years ago, assembled his domain of 17,000 acres by buying up a group of worn-out farms and pastures and scrubby woodland where people for more than 100 years had been struggling to make a living. He embarked upon this adventure when he was almost 60 years old and when the doctors gave him little chance to live much longer.

*See "America's 'Meat on the Hoof,'" by William H. Nicholas, and "King Ranch, Cattle Empire in Texas," 26 illustrations in color, NATIONAL GEOGRAPHIC, January, 1952.

Mr. Pettit is still going strong at 81, and he has built something that is studied with admiration and respect by persons who come from as far away as South Africa.

When I visited Flat Top Ranch, just about the first thing Charles Pettit said to me was: "Jump in this car. I want to show you my grass."

He is almost fanatical about grass. At his invitation, one expert made a sort of grass census, and reported that Flat Top Ranch had 82 different kinds. Mr. Pettit has experimented with many grasses strange to his part of the country, but his main reliance is on sturdy native grasses such as buffalo, bluestem, grama, and switch, and the Indian grass around him in the photograph above.

He has built more than 70 dams, some across the East Bosque River and others across creeks and draws. He has eliminated gullies. In some places, long trenches conduct excess water in a controlled flow roughly parallel to the main watercourses—a simple and practical method of pasture irrigation. Thus he not only raises grass seed to sell and makes several cuttings of hay in a season, but ensures steady grazing for his stock.

His Hereford cattle are among the best anywhere. His hundreds of white Yorkshire hogs (he started raising hogs at the suggestion of the late Louis Bromfield) show a steady

Roundup!

IN THE DECADES following the Civil War, when Texans drove millions of cattle to Kansas railheads, Dan and Tom Waggoner carved out a half-million-acre ranching domain near Vernon.

Many facets of ranch life remain unchanged from the ways that the pioneer Waggoners knew. Here, at roundup, their successors lasso and throw steers in the old-time manner. But the downed critter is a Hereford, not a longhorn, and the branders use a butane burner (lower right), not a wood fire, to heat the iron. The Bell helicopter flushing Waggoner cattle from the brush would have amazed old Dan and Tom no end.

KODACHROME (ABOVE) BY HARRY C. BISHOP; ON EKTACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER O. ANTHONY STEWART © N.G.S.

RODALHORNE LODGE AND ITS PATACHHORNE OF BATTLE

profit. He raises bobwhite quail by the thousands. No one knows how many deer are on the place. He has brought back the wild turkey and hopes to do the same for the prairie chicken. He even has a herd of antelope, thriving hundreds of miles east of their normal present range. Ducks and other wild fowl cover his lakes.

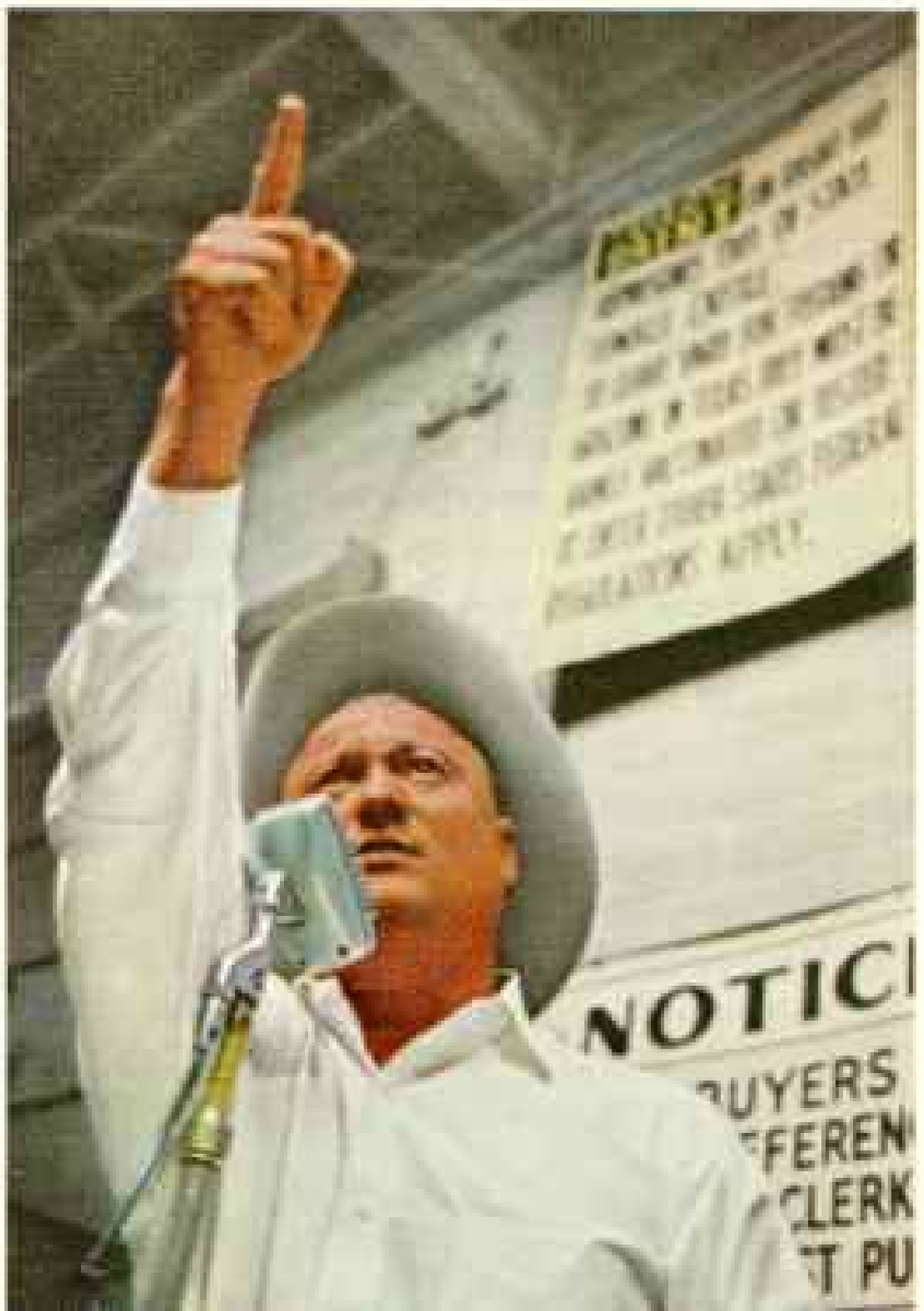
In the Pettit adventure there are several things to think about—and people go away from his place thinking. For one thing, his chain of dams has not only given him plenty of water, but has actually improved the water supply of the farmers and ranchers who live downstream—persons who at first viewed his dam building with much alarm. ("That rich fellow is holding back all our water.") And it is here, for all to see, that he has taken a place of poverty and despair and turned it into something profitable and beautiful.

Mr. Pettit contends that many well-to-do, or even moderately well-off men, if they

GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA © N.G.S.

As many as 25,000 cattle fatten on grain sorghum in the Lewter Feed Lots at Lubbock. Mostly Hereford and Black Angus, they gain 300 to 400 pounds in 120 days. About half go to a packing plant on the premises.

Texas leads the Nation with 9¾ million head of cattle.



"**Nineteen** . . . bid a quarter, quarter, quarter," chants the auctioneer at the Amarillo Livestock Auction Company, the world's largest seller of cattle by open bidding. Averaging about $19 a hundredweight, 1,000 head an hour may change hands here.

Bustling El Paso, westernmost Texas city, glitters under a full moon. Spurred by expanding industries and defense activities, the population more than doubled in 10 years to 273,000 in 1960. This view looks into Ciudad Juárez and the mountains of Mexico.

really set their minds to it, could do the same thing. He is constantly urging his oilmen friends to "do something for the land."

"The land gave you what you have," he tells them. "It is your duty to give back something to the land."

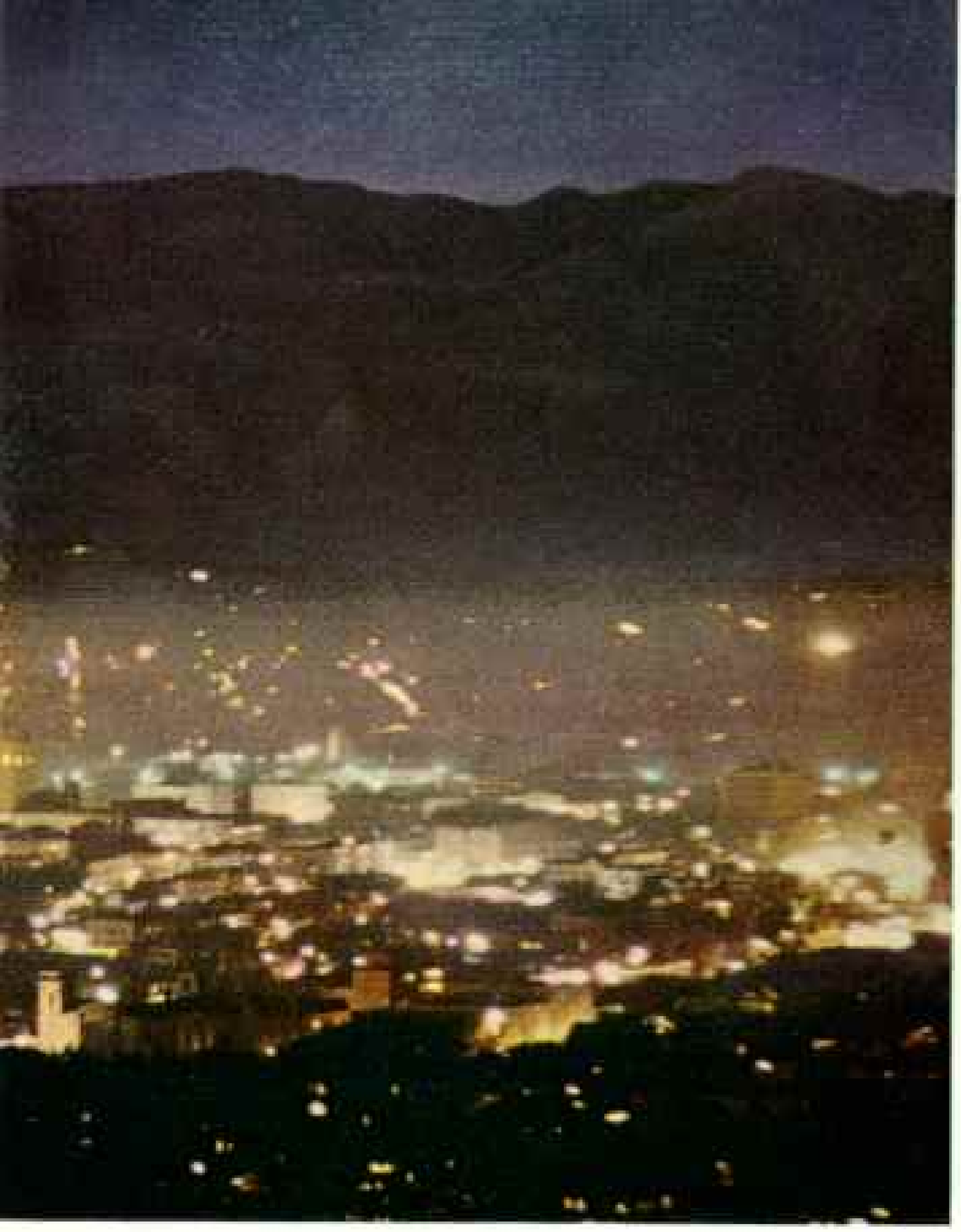
A few of them have tried it, in one way or another. The expenditures made by these men have improved much of Texas.

Look, for example, at the doings of R. E. (Bob) Smith, an independent oil operator from Houston, a plain-spoken, direct, white-haired gentleman who got his start the hard way in the West Texas oil fields. A friend of his said ten years ago that Mr. Smith was worth $700,000,000. Whatever he is worth, he began buying up land along the Gulf Coast and improving it.

The cost has been tremendous. Much of the land required a great deal of work before it was useful, and, in common with other Gulf Coast ranchers, Mr. Smith found that he had to learn a lot about cattle diseases, pests, minerals, parasites, balanced rations, grasses, and all the rest. (It is a known fact that the more sparsely grassed lands of West Texas provide richer, more balanced feed substances than the lush coastal prairies. It's what's in the grass that makes the cow—and the beef.) Anyway, today Mr. Smith can point to a magnificent layout, to the usual blue ribbons, and to solutions to some of the problems of Gulf Coast farming.

Other Texans have set up foundations to improve agriculture: the Texas Research Foundation at Dallas, for instance, has improved Texas cotton, wheat, corn, grasses, grain sorghum, and many other crops. And the Luling Foundation teaches better farming methods on its demonstration fields southeast of Austin.

Although the most solid, spectacular, and numerous improvements in the whole picture of Texas living have come about in recent years, notable Texans down through the decades have done their part. Take the case of



Handmade western boots from El Paso's Tony Lama Co., Inc., carry spurs across the Southwest. The firm files foot measurements for repeat orders, many of them from servicemen overseas.

Schoolgirls of Mexican descent board an international streetcar to Ciudad Juárez.

the portly, moon-faced James Stephen Hogg, who was governor for two terms in the 1890's and is held by many students of history to have been Texas' greatest governor.

Mr. Hogg is remembered as a man of uncommon ability who fought for the people of Texas against Jay Gould's railroad interests, as a founder of the Texas Company, and as the friend of higher education. It is also a fact that when he was traveling he was always on the watch for little ideas that would help Texas.

For example, when he encountered an unusual type of melon in the dining room of a New York hotel, he would inquire about it, obtain the seeds, and then try them out in his garden in Austin. Later he was almost obsessed with raising things on his Varner Plantation, a splendid place which may be reached in an easy drive from Houston, and which is now, as the gift of his daughter, Miss Ima Hogg, the property of the State.

Goats Stir Up an Argument

Varner Plantation was a brushy place, and Mr. Hogg did exactly what thousands of Texans are doing in similar circumstances today—that is, he brought in goats to "clean up the place." Just about anything Mr. Hogg did was popular, and this fact may have something to do with the steady rise in the popularity of the goat, once confined mostly to Mexico and the extremely rough and arid parts of Texas.

The goat has replaced the sheep of another era as the center of acrimonious debate. The pro-goat and anti-goat people have not yet made peace, though there is a middle-of-the-road school which holds that a few goats are good in brushy country, but too many are terrible.

The goat is hardly a laughing matter in Texas. It has become an important source of income. Mohair, which at last seems to have found its place in the manufacture of many articles, brings about a third more per pound than wool. Many persons who swear they do not like lamb or mutton will eat barbecued goat whenever they have a chance.

Goats may be observed grazing, or tearing

Wind and sun etch the face of a King Ranch foreman, Alejos Gutierrez, like many other employees, has spent a lifetime on the estate. His father, an expert horseman, came from Mexico. Nearly a million acres make the 107-year-old ranch the Nation's largest.

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA © N.G.S.

Sheep are counted as they run into a corral on the Fred Forster, Jr., ranch, first stop on their way to San Angelo's market.

Like cattle, sheep came to Texas with the mission-building padres of Spanish times. In number of sheep, Texas leads the Nation.

Calf, horse, and roper churn whirlwinds of dust in a rodeo at Alpine. Lariat tied to saddle horn, the wrangler charges the struggling calf to throw and tie it. Each spring Alpine holds an intercollegiate rodeo that draws student performers from all parts of the country.

down brush, as far north as the Red River, and east to the Louisiana line. The pro-goat people say that goats are not only good in brush country, and to keep sprouts from coming back in pastures from which brush has been removed by machinery, but that they "might as well be grazed on land that is not good for anything else."

The anti-goat faction argues that the goat craze is getting out of hand, that avarice is spreading them to pastures which should support cattle, that goats are death on better grasses, and that the goat, historically speaking, is the great signpost on the road to desert conditions; poverty, and eventual ruin.

Considering the State's variety, it is little

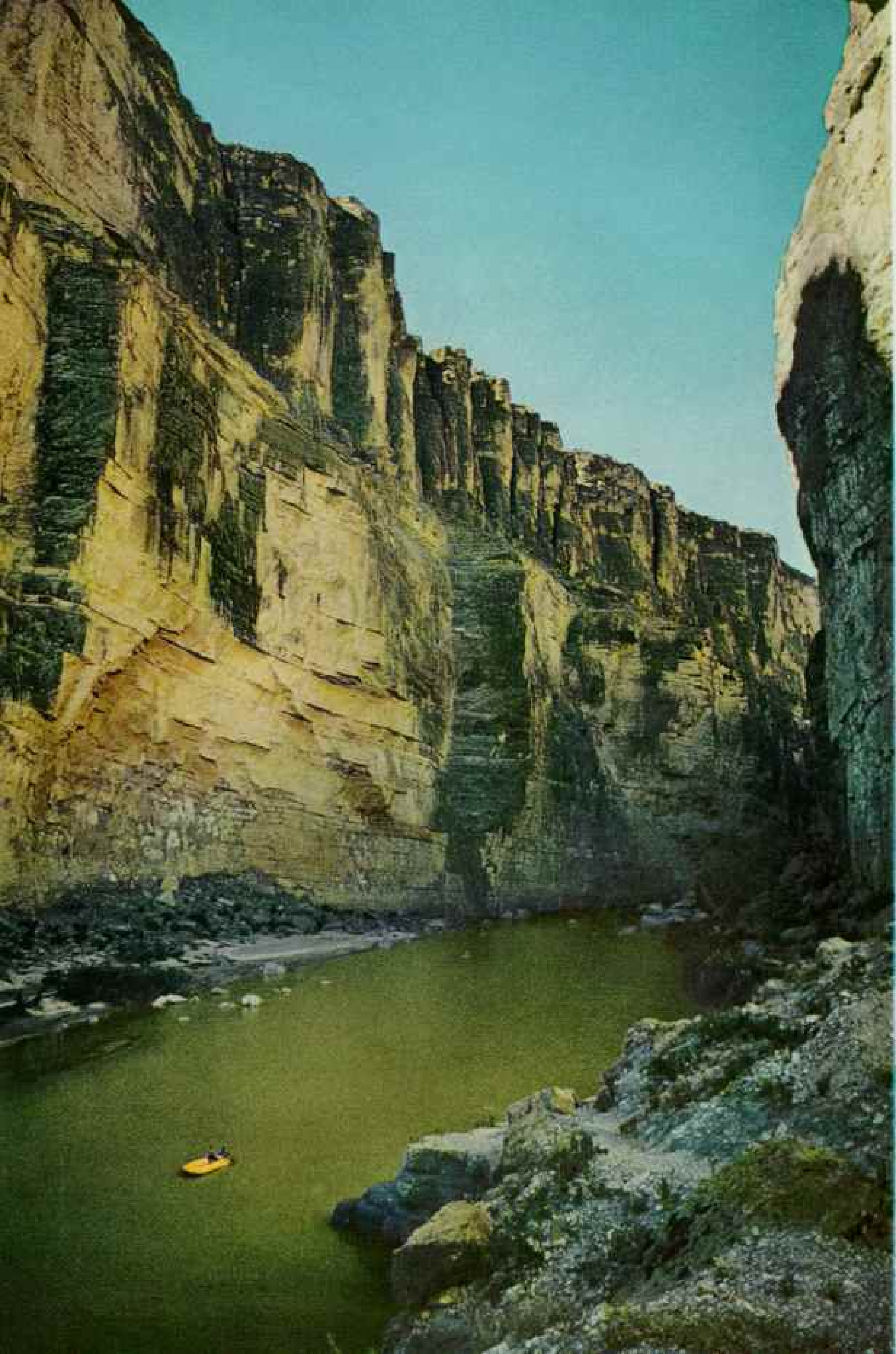
KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA © N. G. S.

Visitors to Big Bend National Park Scan the Chisos Mountains, Roof of Texas

This view from the South Rim climaxes a 12-mile horseback ride from the camp area in The Basin. Sawtooth ridges, rising above the writhing valley of Smoky Creek, hide the Rio Grande where it makes the big bend that gives the park its name. Mexico lies beyond. Early settlers shunned these 7,500-foot peaks; Comanches and Apaches found them a haven.

wonder that Texas through the decades has impressed travelers as being beautiful in spots —and, in other places, depressingly ugly. It all depends on where you are, and sometimes who you are.

Forty years ago the traveler through Texas on one of the main railroad lines might have observed, from the train window, many fasci-



PHOTOGRAPHED BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA ©

White-tailed deer eat acorns in a glade near Fredericksburg in the Hill Country. Game officials have restocked wide areas; the State now counts 1½ million deer.

Thousand-foot battlements of Santa Elena Canyon in Big Bend National Park seem to meet beyond park rangers patrolling the Rio Grande. Mexico lies at the left.

nating sights, but few of these, except for an occasional glimpse of a startlingly delightful Texas landscape, would have struck him as beautiful.

Now it is wholly different. Most of the travel is by automobile, and one may penetrate with no difficulty at all into virtually every corner of the State—800 miles across, almost any way you go—from the vastnesses of the Big Thicket in deep East Texas, to the almost terrifying and primitive harshness of the Big Bend country on the southwest border (opposite and page 174).

NATIONAL GEOGRAPHIC photographer Tom Nebbia, after traveling thousands of miles by auto, came up with this observation: "I was afraid Texas would be monotonous. It changes every few miles." True. And sometimes these changes—in soil, vegetation, hills, and so on—are surprisingly abrupt.

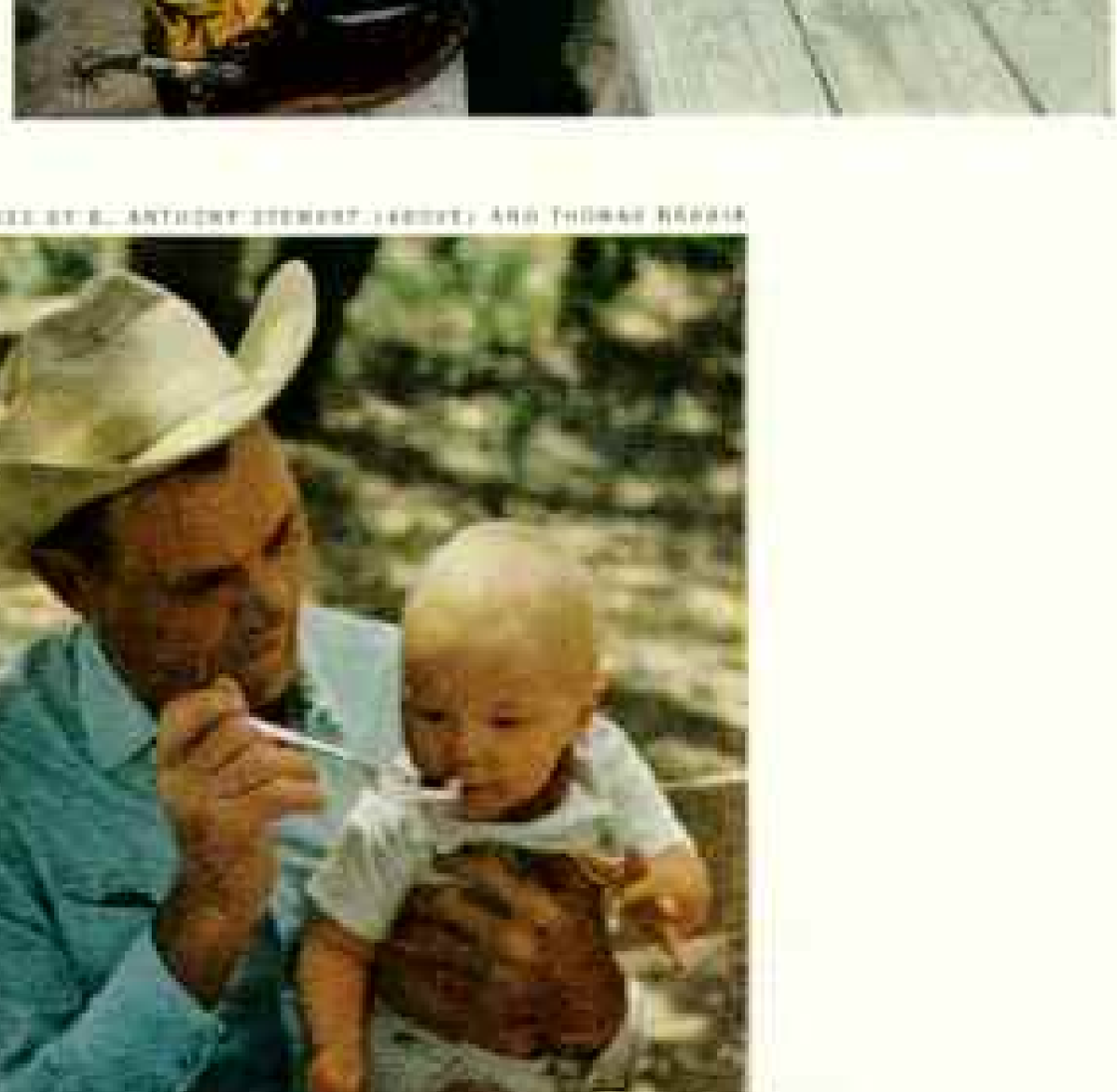
One of the most common remarks from visitors who are seeing Texas for the first time is: "I never dreamed it would be anything like this. I begin to see now why you folks like to live here."

Meanwhile, many Texans have discovered their own State. Appreciation of its distinctive beauties is hardly a new thing, but the past generation has seen what amounts to a renaissance in both city and country.

Forty years ago, for example, it seemed that many Texas cities were almost unaware that any tree except the hackberry (that weed among trees) would flourish. There were occasional oaks, pecans, sycamores, and cottonwoods, but the predominant impression was of the hackberry. The change made by judicious tree planting by individuals and municipalities has amounted to a scenic revolution.

The 1960 census disclosed what everyone had suspected all along—that the principal Texas urban centers had been having a

ANACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

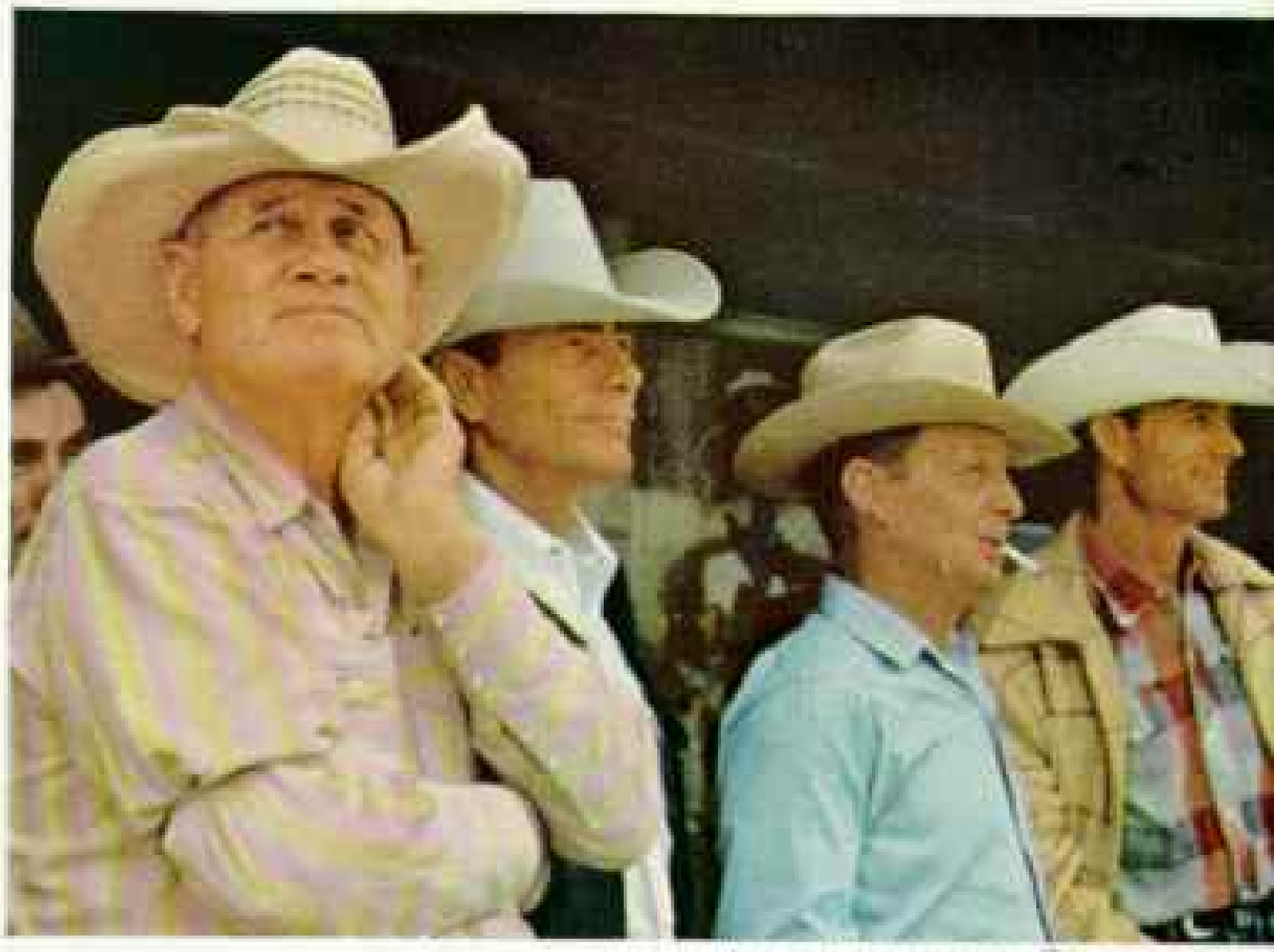


ANACHROMES BY B. ANTHONY STEWART (ABOVE) AND THOMAS NEBBIA

Country Style

PIONEER TEXANS, who lived far apart, welcomed a chance to get together, and the tradition lives on. Crowds attend some 500 festive events a year, including Nocona's All-Girl Rodeo, Raymondville's Onion Festival, and Luling's Watermelon Thump.

Dance-hall girls on the page opposite wave from a stagecoach in Bandera's annual Stampede. Ranchers at right watch the procession, which draws many participants from the Hill Country.



ANSCOCHROME BY B. ANTHONY STEWART © N.G.S.

Quarter horses round a turn at the Kendall County Fair, near Boerne, before a somnbreroed gallery. Small fry (opposite) ponder the wondrous goings-on; to one boy the world seems all boots and spurs; to baby, it offers chocolate cake.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA

KODACHROME (ABOVE) AND ANSCOCHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © NATIONAL GEOGRAPHIC SOCIETY

Teen-agers Play Volleyball on a Churchtop Amid Houston's Towers

Cramped for space, the First Baptist Church transformed the roof of its eight-story education building into a recreation area. Steel mesh encloses the court. Imposing Melrose Building (left), Petroleum Building, and Medical Arts Building spike the skyline.

phenomenal growth. Houston, which has spread out over an enormous territory (page 182), jumped from fourteenth place among United States cities in 1950 to sixth place in 1960, with a population of 933,000—ahead of Baltimore, Cleveland, Washington, St. Louis, Milwaukee, San Francisco, and Boston. Dallas, with 672,000, moved from twenty-second place to fourteenth.

The early growth of Houston was in large part because it was an agricultural and railroad center. Then came the ship channel linking it to the Gulf of Mexico, which made it a deepwater port (page 185). The big oil companies made their headquarters there. In their wake came the refineries, the research centers, the plastic makers, and no end of big and little business. The city is second only to New York among United States ports in tonnage handled.

Each Texas city has a distinctive flavor. Dallas has been referred to as a "Yankee" city, largely because of its briskness, its large proportion of newcomers from the north, and its pervasive cultural activity on a dozen different fronts (page 156). But this is not quite accurate. The city has its own feel. A banker, 80-year-old Robert L. Thornton, Sr., has been mayor of Dallas since 1953, and these years have now become known as the "Thornton era." The pride Dallas has in him is only a little more than the pride with which it views many of its other citizens.

Dallas was a fascinating but somewhat unattractive city of 150,000 when I did newspaper work there in 1918 and 1919. Today,

the drive along Turtle Creek, to me, is one of the finest in America. White Rock Lake (an area where we used to go camping when I was young) has many fine mansions and extensive gardens.

On my latest visit to Dallas a friend drove me around all day, explaining what had happened, and I tried to tell him where old Johnson-grass fields used to be. And finally, somewhere around what is called Preston Hollow, all built up magnificently now, I had to say: "No, I'm sorry. I'm lost."

But such visits are sad, too. Many good things, many excellent old houses, many whole neighborhoods are gone. Now a different generation tries to impress me with the skyline, the fancy gardens, the really excellent restaurants which seem just a little high-priced to an old cowhand, and all the other appurtenances of a proud and (no offense meant) culture-crazed metropolis.

Fort Worth Keeps Western Flavor

The old cowtown of Fort Worth, "Where the West Begins," is only a short drive west of Dallas, but the difference is astonishing. Fort Worth retains something of the flavor of the storied Southwest. Men wearing boots and big white hats are not an uncommon sight there. The stockyards flourish.

In the public mind (and the public is probably right) the late Amon G. Carter, publisher, oilman, and pre-eminent Fort Worth booster, did more than any other one person to build the city into its present image.

Mr. Carter was a stem-winder. In the years when he was ribbing the pretensions of Dallas, he declined to eat local fare when visiting the effete metropolis to the east. When he had to go to Dallas, he carried his own lunch. Be that as it may, relations between the two cities are as amicable today as could be expected. Indeed, Fort Worth and Dallas are gradually becoming one great urban entity.

Until fairly recently, long-range thinkers were doubtful that the cities in the western part of Texas could ever amount to much. Industry was limited, rainfall inadequate, and so forth. That very old and sun-kissed city,

Battleship *Texas*, veteran of two world wars, rests at permanent anchorage beside the San Jacinto Battleground near Houston. Decommissioned and presented to the State in 1948, she serves as flagship of the "Texas navy." Visitors in broad-brimmed hats inspect the dreadnought's antiaircraft guns. A spare propeller lies on deck. Staff at the bow flies the Texas jack.

Towering San Jacinto Monument marks the spot where Texas won her independence. Led by Sam Houston, 910 Texans pounced on a Mexican army of some 1,600 on April 21, 1836. Within 20 minutes half the Mexicans were dead or wounded and the rest prisoners. Texas lost only nine men.

Skyscrapers Sprout and Suburbs Spread From the Heart of Booming Houston

From the muddy, mosquito-infested town of a century ago, oil-rich Houston has blossomed into the South's largest city, with a population approaching a million. Boosters brag that Houston

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

counts more millionaires to the square mile than any other city. Hundreds of drilling and petroleum companies make their headquarters here, and oil flows from more than 500 wells within the city limits. Wreckers often tear down a relatively new building to make room for an even newer and bigger one. Gulf Freeway (foreground) offers a nonstop route south to Galveston and the Gulf.

Glistening ingots of magnesium, 30 percent lighter than aluminum, await shipment from the Dow Chemical Company's plant in Freeport. Dow mixes sea water from the Gulf of Mexico with lime to release magnesium hydroxide—milk of magnesia. Acid and electrolysis convert the hydroxide into magnesium.

Hidden in murky liquid, arms extending from the slowly revolving mechanism at the end of the catwalk concentrate the crude magnesium. Worker takes an "ore" sample.

Linked to the sea by a 57-mile ship channel, Houston ranks as one of the Nation's busiest ports. Developed at a cost of 50 million dollars, the waterway serves docks, grain elevators, oil refineries, chemical plants, and steel mills.

El Paso, situated out at the "extreme end of nowhere," remained about the same for decades. But in the past ten years it has been growing fast (page 170).

The same is true of the other western centers—Midland, Odessa, Abilene, Amarillo, and Lubbock (page 168). The opening of the vast oil and gas reservoir of the Permian Basin has had something to do with it; irrigation has helped in spots; new factories have come in; educational institutions have sprung up; airfields are everywhere; and the old backbone of life there, the cattle industry, remains stronger than ever.

For many years San Antonio was the largest Texas city; it has long since been passed, but it has been growing of recent years with vigor on all fronts. Long known as the "mother-in-law of the Army," it increases its defense activities every year (page 162). And every other type of business is gaining. Moreover, the city has a charm that sets it apart from anything else in Texas. Its old missions, its quaint houses, its restoration of a Spanish village known as La Villita, and its startlingly beautiful residential sections are all worth looking at time and again.

One element in the flavor of San Antonio

The Gulf Coast

SUN, SEA, AND SAND stamp the Texas Gulf Coast as a vacation paradise. Mineral riches and teeming waterways breed an industrial complex. Fast-growing Corpus Christi (above) now has a population of 166,000, almost triple its 1940 size. Shrimp boats and bargeloads of cotton, cattle, oil, and petrochemicals clog its deepwater port. Sailboats spread snowy wings on the yacht basin, where a girl on shore tosses tidbits to hovering gulls. Tiled spires of Corpus Christi Cathedral share the skyline with the Wilson Tower at center and the Robert Driscoll Hotel at right.

Fishermen, hunters, and sailing enthusiasts delight in the coastal marshes, bayous, and beaches. Padre Island (right), a 113-mile strip of sand stretching from Corpus Christi nearly to the mouth of the Rio Grande, proves a mecca for beachcombers. Linked with legends of buried treasure, the island takes its name from Padre Nicolas Balli, who vainly sought to found a ranching colony there more than a century ago.

Pigtailed misses of Mexican descent share a secret in Laredo. The Rio Grande and neighboring Mexico lie beyond the palm-fringed slope.

ACCLAIMADORES OF NATIONAL GEOGRAPHIC PHOTOGRAPHERS THOMAS NEBBIA (RIGHT, ABOVE) AND B. ANTHONY STEWART © N.G.S.

PHOTOGRAPH BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N. G. S.

Plump Emperata carrots spill into a crate near Weslaco in the Lower Rio Grande Valley, where harvesters work in February sunshine. Summer will find the same field white with cotton. Irrigation does the work of rainfall in the semiarid valley, whose sluices serve half a million acres. Some plots yield three crops a year.

is the influence of Latin-American culture—the long and definite shadow of Spain.* But this background does more than lend color to the city. Latin-American names may be found in the rolls of high city and county officials in increasing numbers. Here the descendants of two great peoples have found a workable way of living together. On one side of the entrance to the main library in San Antonio is a bust of Shakespeare; on the other, a bust of Cervantes.

As for Austin, the State capital: It has, as always, the State university, eight State institutions for the ill and handicapped, the seat of the State government, and the service industries necessary to support these. But it, too, is growing; new businesses have moved in, and the residential areas, particularly in the hills above the city on the Colorado River, have blossomed—usually, though not always, in a way to delight the observer.

In this business of building houses—indeed, of architecture generally—Texans are not without a certain inventiveness and originality. Many of the newer buildings in Texas—and this includes bank buildings, mansions, ranch houses, and even the more modest dwellings—show the hand of skilled, practical, thoughtful, and sometimes bold architects. A slow drive through the more attractive sections of any of the larger cities will show how a few of the better points of the old have been combined with newer concepts of living.

*See "Carnival in San Antonio," by Mason Sutherland, NATIONAL GEOGRAPHIC, December, 1947.

Despite all the stories you hear, not all Texans have money. However, a lot of them do, which brings up a subject I suppose has to be a part of any story about Texas.

The jokes concerning the Big Rich of Texas are a blend of Paul Bunyan, Pecos Bill, and Alice in Wonderland. The fictional versions are spread world-wide; the truth is almost as strange.

The stories are many, and of great variety. It is true, for example, that one man, admiring the magnificent display windows at the Neiman-Marcus store in Dallas, bought the entire contents of two of them to set up on his lawn as a Yuletide surprise for his wife. This fabulous store, incidentally, offered to customers in its 1960 Christmas catalogue such gift suggestions as $7,950 chinchilla housecoats and "his" and "hers" airplanes—at $176,000 for the pair.

It is also true that the late Sid Richardson telephoned his friend and financial partner, Clint Murchison, and asked, "What was the name of the railroad we bought yesterday?" It was the New York Central.

One Texan bought an ocean-going yacht and transported it, piece by piece, to a lake 200 miles inland, where it was reassembled. Other men collect small herds of the almost extinct longhorn cattle, and admire them extravagantly. One man, in Houston, passed his spare time following the police on their raids and handing out silver dollars to those he thought deserving.

Artificial Icicles Defy the Heat

There is a story about a rich Texan who bought his dog a boy. I question this. On the other hand, one Houston millionaire does, in fact, pay a private maid to take care of his French poodle. Another whimsical fellow, as a gesture of contempt for the heat, rigged up an elaborate scheme by which he could produce icicles when he chose and display them hanging from the roof of his house.

The more common desires of the Texas rich seem to be for big automobiles—recently for foreign sports cars—fine houses, enormous patios, barbecue pits of the most astounding ingenuity and capacity, and sunken baths. The Roman idea seems to have an irresistible appeal to a man who, in his youth on the dry prairie, had to bathe, if at all, in a washtub.

A few years ago, a wealthy woman in South Texas, shopping with a friend, paused to look long and lovingly at a bright-red automobile—a Ford convertible. "Isn't it beautiful?" she said. "I must get one."

"What do you want with that?" her friend asked. "You already have three Cadillacs."

"I know," the lady sighed, "but I've never had a Ford."

Wildlife Returns to the Country

As noted, in the past few decades hordes of Texas farm and ranch boys—hunters and fishermen, almost all—have decided for one reason or another that life is more profitable in the city than in the country.

In my opinion this exodus has played a big part in the astonishing resurgence of wild animal life all over the State. Even the long and severe drought of the 1950's only checked for a while the steady proliferation of just about everything that crawls, swims, flies, or runs. This is true of almost every section of Texas, and is sometimes viewed as an amazing phenomenon.

Squirrels have come back to the pecan groves in such numbers that much of the crop is often stolen. Ranchers go out at night in pickup trucks, armed with shotguns and powerful flashlights, trying to keep the rabbit population in bounds. Coyotes, long extinct in most parts of Texas, are reported on the increase in some areas.

The nine-banded armadillo, that foolish immigrant from Mexico and a relative stranger in most of Texas 50 years ago, roams everywhere, hurting nothing much except gardens, for which it has a clumsy genius. Raccoons have made it impossible in some sections to raise sweet corn.

Persons driving along the highways and country roads at dawn are shocked to see the small animals and deer that have been struck and killed during the night. Even that traditional enemy of the Texan, the great western diamondback rattlesnake *(Crotalus atrox)* is often a victim of the automobile, although many more succumb to organized rattlesnake hunts.

To the delight of almost everyone, human predators and nature lovers alike, the bob-white and other members of the quail family, along with the mourning dove, the wild turkey, and the white-tailed deer, have proliferated in an astonishing manner.

Perhaps some of this wildlife resurgence would have come about anyhow, but much credit must go to the efforts of the members of the Texas Game and Fish Commission, who,

KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER THOMAS NEBBIA © N. G. S.

Self-propelled combines reap rice near Bay City, furrowing the harvested area with wheel tracks and windrows of straw. Curving dikes hold water in the fields during the growing season. In the past decade Texas has produced more rice than any other State.

White sulphur, sprayed from a plane that almost clips the trees, dusts an orange grove on the lower Rio Grande. The Valley also grows lemons, but its pink- and ruby-red-pulped grapefruit comprise the bulk of the citrus crop. New trees produce in nine years or less. The area has recovered from the disastrous freeze of 1949-50.

HY ERTSCHBERGER BY HARRY C. BISHOP © N.G.S.

Fetching smile catches the spirit of pre-Lenten Charro Days, Brownsville's annual salute to the past. Charro means a wealthy don; and sombrero, bolero, mantilla, and filigreed jewelry deck participants in parades and dances.

with great good sense, have devoted quite as much energy to the preservation of wildlife (especially the deer and wild turkey) as to providing something for hunters to shoot.

This proconservation attitude has made friends for the commission and friends for the wildlife. For example, many ranchers now go to great pains to provide extra feed, sufficient water, and adequate cover for the game birds. Even a short generation ago such solicitude would have been exceedingly rare.

The Texan today views his wildlife refuges with enormous pride. One of the finest is the 47,261-acre Aransas National Wildlife Refuge, established more than 20 years ago by the U. S. Fish and Wildlife Service in Aransas, Calhoun, and Refugio counties on the lower Gulf Coast. Once the hunting ground for cannibalistic Indians, this area is now supervised by the Federal authorities working in association with the Game and Fish Commission. Among other things, the refuge is the last haven of the whooping crane.*

There are other Federally supervised refuges—at Muleshoe, in the Texas Panhandle; the Hagerman Refuge near Denison, North Texas; and the Santa Ana and Laguna Atascosa refuges near San Benito. State authorities also maintain nine refuges in various parts of the State. Many individual landowners have caught the idea and have established excellent private sanctuaries. The trend is gaining momentum; it is one of the brightest spots in the Texas story of today.

Birds Make State a Major Flyway

In one area Texas can boast without equivocation or hedging that it is ahead of the other States. That is in variety of bird life. In his excellent *A Field Guide to the Birds of Texas*, Roger Tory Peterson, the dean of U. S. bird observers, who did his study for the Game and Fish Commission, gives the number of species found in Texas as 542.

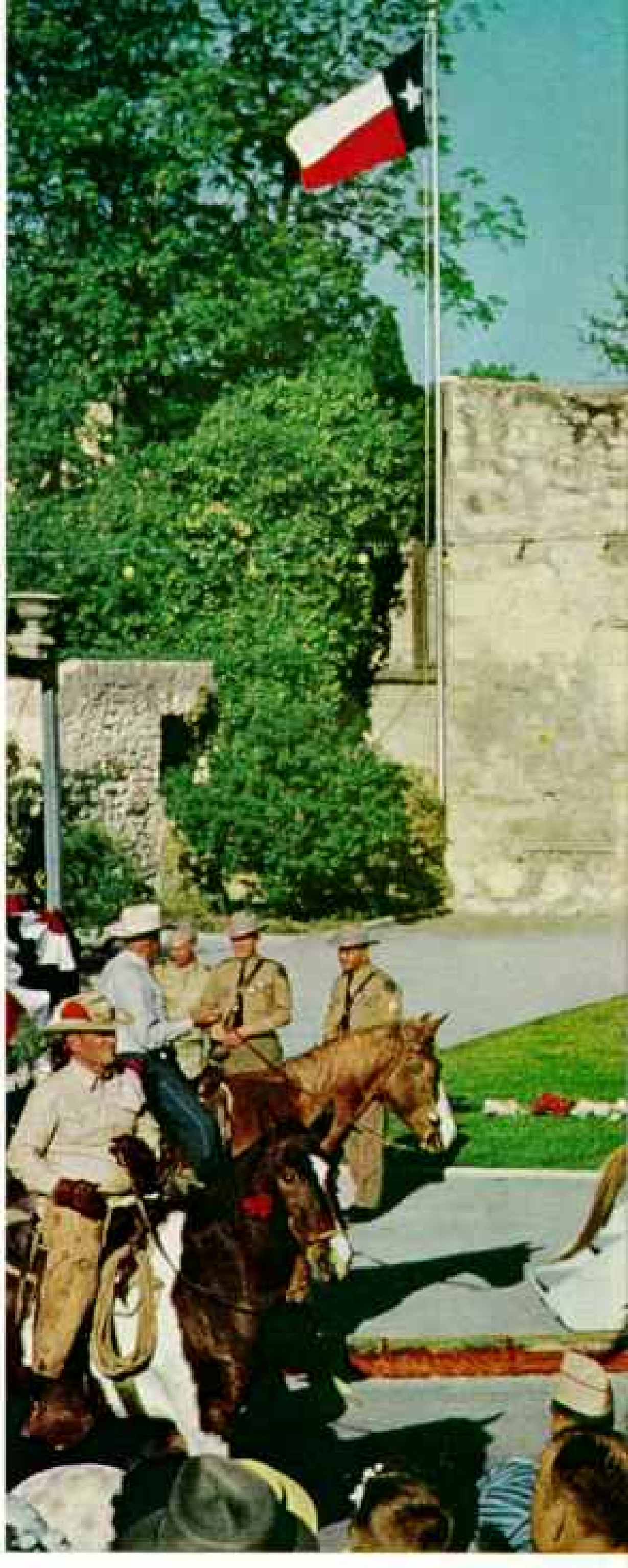
The late Roy Bedichek of Austin—author, amateur naturalist, and conversationalist (he was described by his friend J. Frank Dobie, probably accurately, as having "the most richly stored mind in Texas")—called Texas "one great, magnificent flyway." Bedichek was a bird watcher of the first rank. For many decades, while traveling by automobile over the State in connection with his work for the Texas Interscholastic League, he made a practice of camping out at night.

He enjoyed himself immensely, and by his quiet propaganda did perhaps more than any other one man to give Texans some appreciation of the glories of their bird life. It was a pleasure for me to lie in the grass beside this remarkable man while, looking through his field glasses, he would reel off the names of his friends among an enormous gathering of birds. His comments were always

*See "Whooping Cranes Fight for Survival," by Robert Porter Allen, NATIONAL GEOGRAPHIC, November, 1959.

Matamoros, Mexico, Sends a Queen to Ride in Brownsville's Pageant

Texas' southernmost city, lying in the same latitude as Miami, Florida, enjoys shirtsleeve winters, and bananas grow in its city park. Charro Days attracts some 400,000 people, many from Matamoros, Brownsville's sister city across the Rio Grande.



Old Trail Drivers Jog Past the Alamo; Lone Star Flag Flies in Mid-town San Antonio

Taking its name from *alamo*, Spanish for cottonwood, the mission drowsed in the sun for a century before the fury of Texas' War of Independence exploded. Here, on March 6, 1836, Lt. Col. William B. Travis, Davy Crockett, Jim Bowie, and some 180 others died before the onslaught of thousands of Mexican troops led by General Santa Anna. Their example fired Sam Houston's revolutionary army to victory a month and a half later at San Jacinto (page 181). From 1836 until it joined the Union in 1845, Texas remained an independent republic.

Each April San Antonio stages the week-long Fiesta San Jacinto, whose Battle of Flowers parade passes the Alamo. Veterans of cattle drives to Kansas founded the Old Trail Drivers Association, and their descendants carry it on.

informative and philosophical, and sometimes funny.

Texans are often asked: If I visit Texas, what should I see? Where should I go? What time of year is best? How long should I plan to stay there?

There are no pat answers. It depends on the person, and what he is after. If he is a statesman, let him go straight to Austin, the State capital, get a room at the old Driskill Hotel (the Texas equivalent of the famous Shepheard's in Cairo), and tell the leaders of the State government how to run their machinery without raising taxes. If he wants to go in business, there are many people in Dallas and Houston who can show him the way. If he wants to break into the oil business — well, that's harder.

How to Become a Texan

If, however, he is merely an intelligent, curious, alert, fairly friendly human being who wants to expand his horizons and enrich his life, let him take six months or a year off from whatever he is doing and be off to Texas. Then let him get an automobile, which need not be a Cadillac, study a road map, and start out. He may tackle Texas from the north, from the Gulf, from El Paso, or from the Panhandle. He can hardly go wrong if he is looking for something interesting. But he must take his time.

Nor is there any need for this hypothetical visitor to make any brain-fagging study of the State before he sets out on his pilgrimage. Let him learn more or less as he goes along. His equipment in books will be quite sufficient if, at the start, it includes Peterson's bird guide, the *Texas Almanac*, Dr. Rupert N. Richardson's competent one-volume history of Texas, and Dr. Walter Prescott Webb's *The Great Plains*. He might also pocket a pamphlet put out by the Game and Fish Commission, *The Poisonous Snakes of Texas*. He's sure to run onto one.

KODACHROME BY NATIONAL GEOGRAPHIC PHOTOGRAPHER B. ANTHONY STEWART © N.G.S.

With this to begin with, all the other riches shall be added unto him as he moseys along. And remember, he must not hurry. That would be out of character in Texas.

He will have a glimpse, in time, of the awesome wonders of the Big Bend, the quaint folkways of the Big Rich, the secretive inhabitants of the Big Thicket, the charming life of Fredericksburg, the free expanse of the big ranches, the traffic-choked cities in their swelling pride, the dying little towns, the outdoor barbecue parties, the crowded and vigorous and worried college campuses, the vast military setups, and all the rest.

After he has seen all this, of course, he will be a Texan, and nothing could make him leave.

New Water for Thirsty Texas Will Wash History Away

ABSORBED IN THE PAST, the archeologist on the opposite page stands on Texas land that has a wet future. Where he works to record Indian rock art, the Rio Grande will rise to drown these bluffs.

Twelve miles upstream from Del Rio, Texas, the United States and Mexico plan a dam named Amistad, or "friendship." Promising both countries more irrigation water, power, and flood protection, the dam will bring vast changes to a thirsty land.

Many such changes appear on your Society's newest map, Atlas Plate 10, **South Central United States,** distributed with this issue to 2,700,000 member-families.*

Water—its control, conservation, and use—plays a key role in the region's outlook for the future. By 1965 east-central Oklahoma will gain a new 100,000-acre lake with a 600-mile shoreline, Eufaula on the Canadian River. Dashed lines on the map outline the lake-to-be. Already spangling the State are such huge man-made reservoirs as Lake Texoma on the Texas border, Tenkiller Ferry on the Illinois River, and Fort Gibson and Lake O' The Cherokees on the Neosho River.

Arkansas' two largest lakes have come into being in the past 10 years: Ouachita, northwest of Hot Springs, and Bull Shoals on the Missouri border, amid the ancient Ozarks.

Within the boundaries of this new map, the Deep South meets the Far West. Here may be heard both the soft syllables of Mississippi and pueblo drums of New Mexico.

Dominated by Texas—the "Big T" of far spaces and lusty energies described by native son Stanley Walker in this issue—the new map also includes all of Arkansas, Louisiana, Mississippi, and Oklahoma. It covers most of New Mexico, shows border areas of seven more States, and reaches deep into Mexico.

Between Ciudad Juárez, Mexico, and El Paso, Texas, tourists and townsmen can cross the Rio Grande by streetcar—the only trolley between the United States and a foreign country. Farther upstream, the 1,885-mile river flows across all New Mexico from headstreams in the Colorado Rockies.

It swings close to Los Alamos, a town of 13,000 that did not exist two decades ago. Birthplace of the atomic bomb, this "secret city" lived until four years ago behind steel fences and guarded gates. Then, except for scientific laboratories, it was opened to public access.

Names all across the map echo the land's Indian heritage. "Oklahoma" means "red people," from the Choctaw. Towns show such names as Tecumseh, Shawnee, Comanche, Broken Bow. "Mississippi," meaning "great river," or "almost endless river spread out," is from an Ojibway word. Pascagoula, Mississippi, carries the name of an Indian tribe, the "bread people."

Will Rogers, part Cherokee, was born near Oologah, Oklahoma. He lived to see much of this region gain a grimmer name, the Dust Bowl, as lashing winds stripped topsoil from lands once held down by buffalo grass. But since the 1930's, better farming techniques and the new big dams have cut wind erosion and preserved precious water.

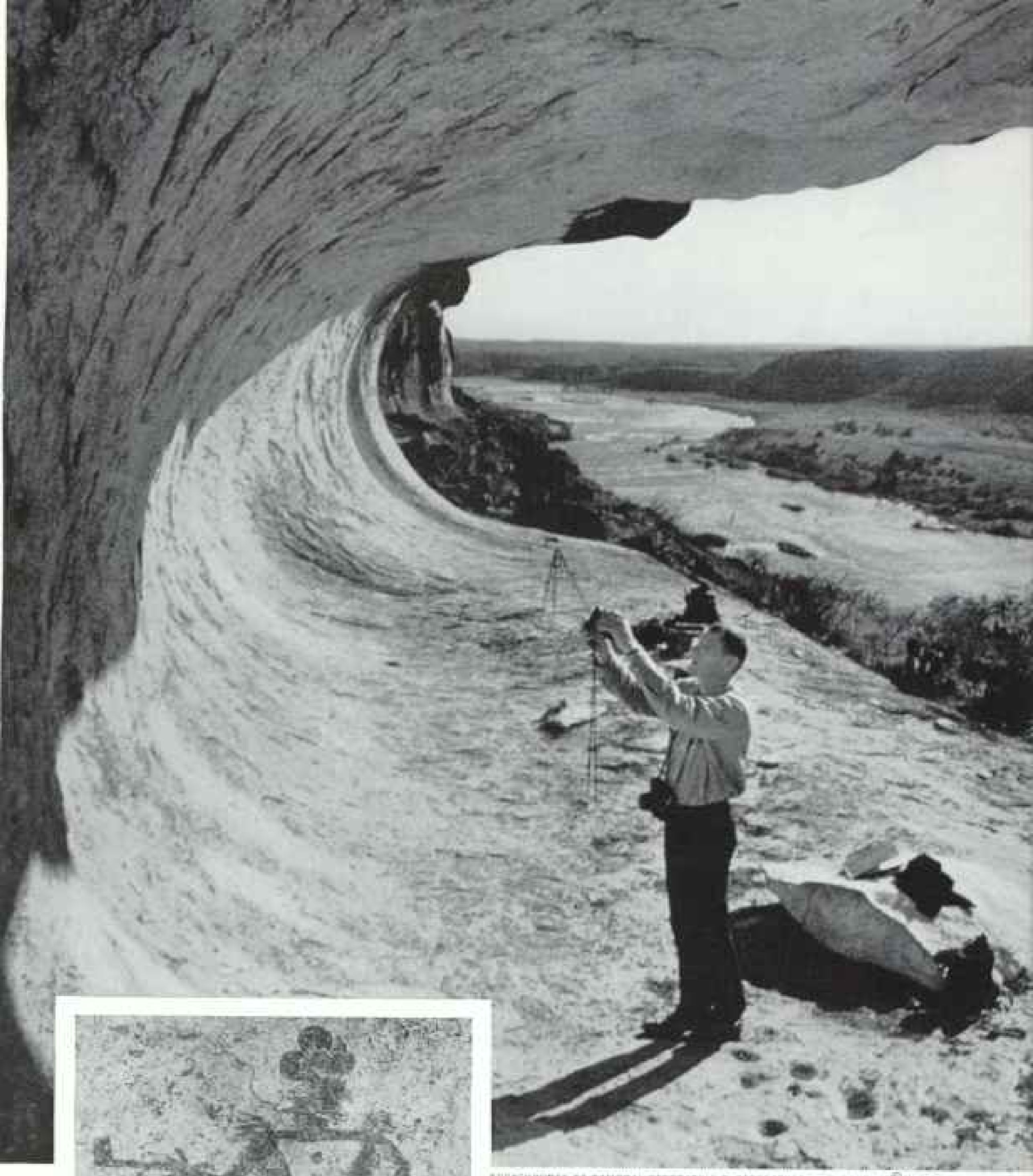
Pioneer Paths Become Scenic Parkways

Red streaks of modern highways criss-crossing the map recall historic pioneer paths. The Santa Fe Trail slanted out of Missouri and Kansas into New Mexico. Cater-corner across Mississippi ran the Natchez Trace, a wilderness trail bedeviled by Indians and bandits. Today the National Park Service is re-creating the Trace as a scenic parkway; the map indicates sections completed and under construction.

An inset on the map shows the deep delta country of the Lower Mississippi and another new tradeway being cut by man—the Mississippi River-Gulf Outlet, a 77-mile deepwater ship channel from New Orleans to the open sea. It crosses a lonely realm of bayous, marshes, and mudbanks, where the King of Rivers daily outdoes all man's changes by extending with silt the very borders of the United States.

*Twenty-second in the series of uniform-sized maps issued free as supplements in the past three years, **South Central United States** is the eighth sectional sheet covering the 50 United States.

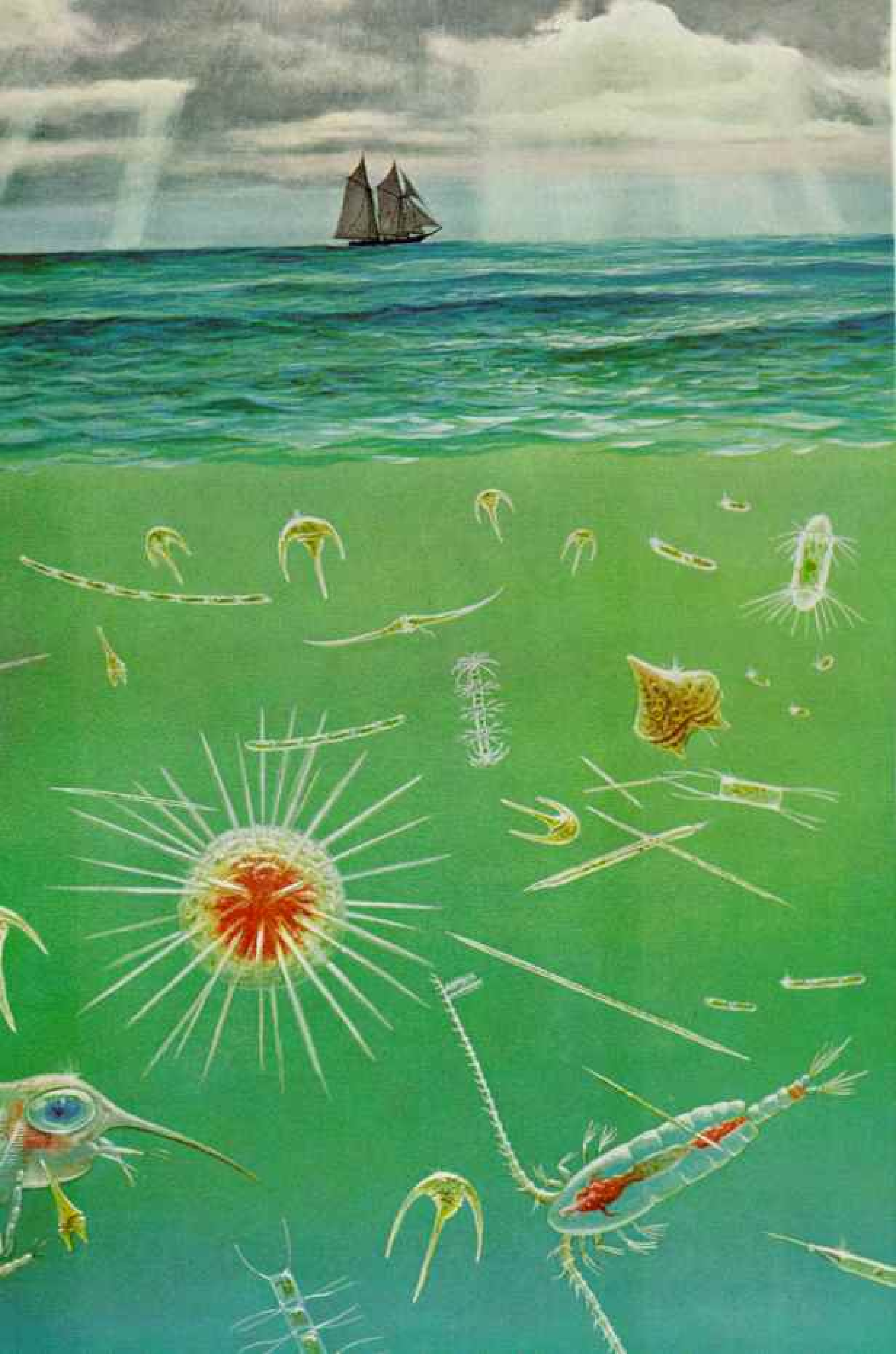
To bind their maps, a quarter-million members have ordered the convenient Atlas Folio, at $4.85. Single maps of the series, at 50 cents each, or a packet of the 21 maps issued in 1958-60 at $8.25, may be ordered from the National Geographic Society, Dept. 58, Washington 6, D. C. A combination of folio and 21 maps folded flat is available at $12.50.



KODACHROMES BY NATIONAL GEOGRAPHIC PHOTOGRAPHER W. D. VAUGHN © N.G.S.

Light meter in hand, an archeologist prepares to photograph Indian art work on a cliff near Del Rio, Texas. Scientists seek to record paintings and pictographs, most of which date from prehistoric times, before Amistad Dam drowns this section of the Rio Grande Valley.

Epauleted officer, in a comparatively recent painting, depicts arrival of the white man. Indian artist gave him a long-stemmed pipe, three-cornered hat, and buttoned coat.



How the Sun Gives Life to the Sea

ARTICLE AND PHOTOGRAPHS BY PAUL A. ZAHL, Ph.D.
NATIONAL GEOGRAPHIC Senior Staff

THROUGH RIFTS IN THE CLOUDS, shafts of sunlight speared into the crystal-clear Bahamian waters. We could see the bottom sand sparkle as our cruiser nosed along the channel of the bay at North Bimini. But out beyond the harbor's protecting land fringe, the breeze was kicking up whitecaps, spreading a dull frosting on the sea's transparency.

We were heading out to "fly kites" in that water, to collect in gossamer nets the green treasure created by the sun's rays: the tiny creatures—shown in magnified form on this page—on which a major part of life on earth depends.

Our 30-foot cabin cruiser, the *Research*, was a floating workshop for the Lerner Marine Laboratory on North Bimini, 55 miles east of Miami Beach, Florida. At the helm stood Frank Marshall of the laboratory staff, and beside me sat Dr. John McLaughlin, a research associate from New York.

The creatures we sought were the microscopic one-celled organisms that take chemicals from the sea and energy from the sun, and with them forge the sugars and starches that are the basic breadstuff of life. This production miracle is the process of photosynthesis—without which man could not exist.

"Grass" Gives Life on Land and Sea

Every schoolboy is familiar with the role of green plants on land. They liberate oxygen and produce carbohydrates—basic link in the food chain of grasses-to-animals-to-man.

That the same process goes on in the sunlit surface layers of the ocean is less widely known. Yet, of all the photosynthesis occurring on earth, perhaps two-thirds takes place in the sea. Land's vegetation produces some 40 billion tons of carbohydrates a year, that of the sea between 80 and 160 billion tons.

Floating freely in the sea are countless billions of these tiny food factories. Inside each is the same chemical, chlorophyll, found in the leaves and stems of plants on land. This miraculous substance plays the key role in enabling plants to combine sunlight and chemicals into nourishment for themselves and into food for other living things. Just as land animals graze on earth-bound plants, and in turn become meals for the flesh eaters, so marine life pyramids on the one-celled "grasses" of the sea.

The ocean's chlorophyll plants are eaten by animals a pinhead in size, or smaller. These in turn are prey for slightly larger creatures. And so on up the size ladder in the sea's rapacious cycle of eat and be eaten.

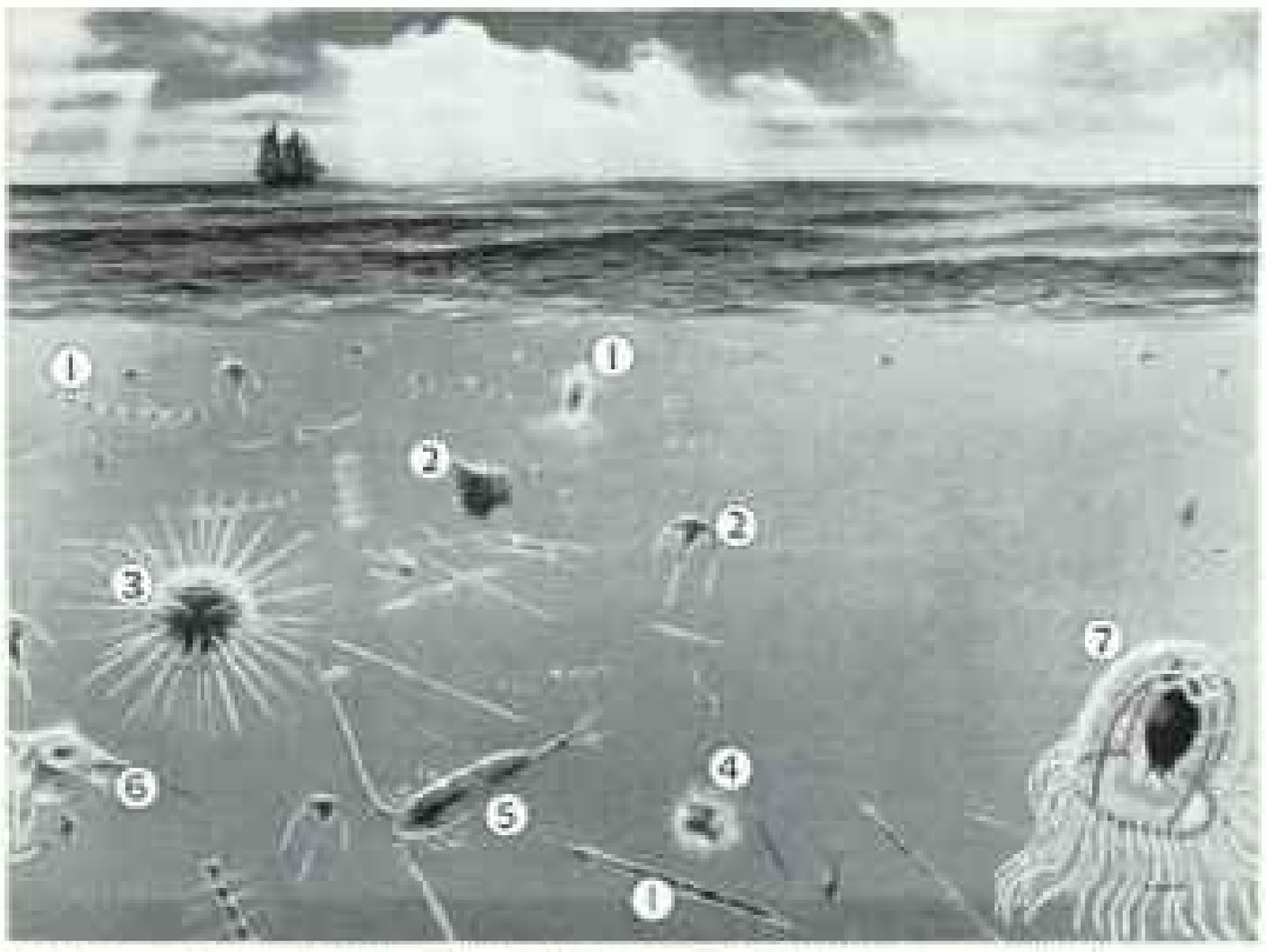
Remains of plants and creatures sink to the bottom, blending to become detritus ooze on the ocean floor. It is swallowed by detritus feeders—sea cucumbers, clams, and tube worms. Or it is broken down by bacteria to become chemicals again in the great nutrient reservoir of the sea. Diffusion and upwelling waters carry this dissolved fertilizer to the sunlit layers above, where it is used once more by microscopic plants in the endless food chain of the sea (page 206).

So sensitive are the processes these organ-

Tiny sun machines afloat in a watery vastness form the basic breadstuff of life in the sea. Like leaves on trees, they harness chemicals and the sun's streaming energy for the creation of sugars and starches, a process called photosynthesis.

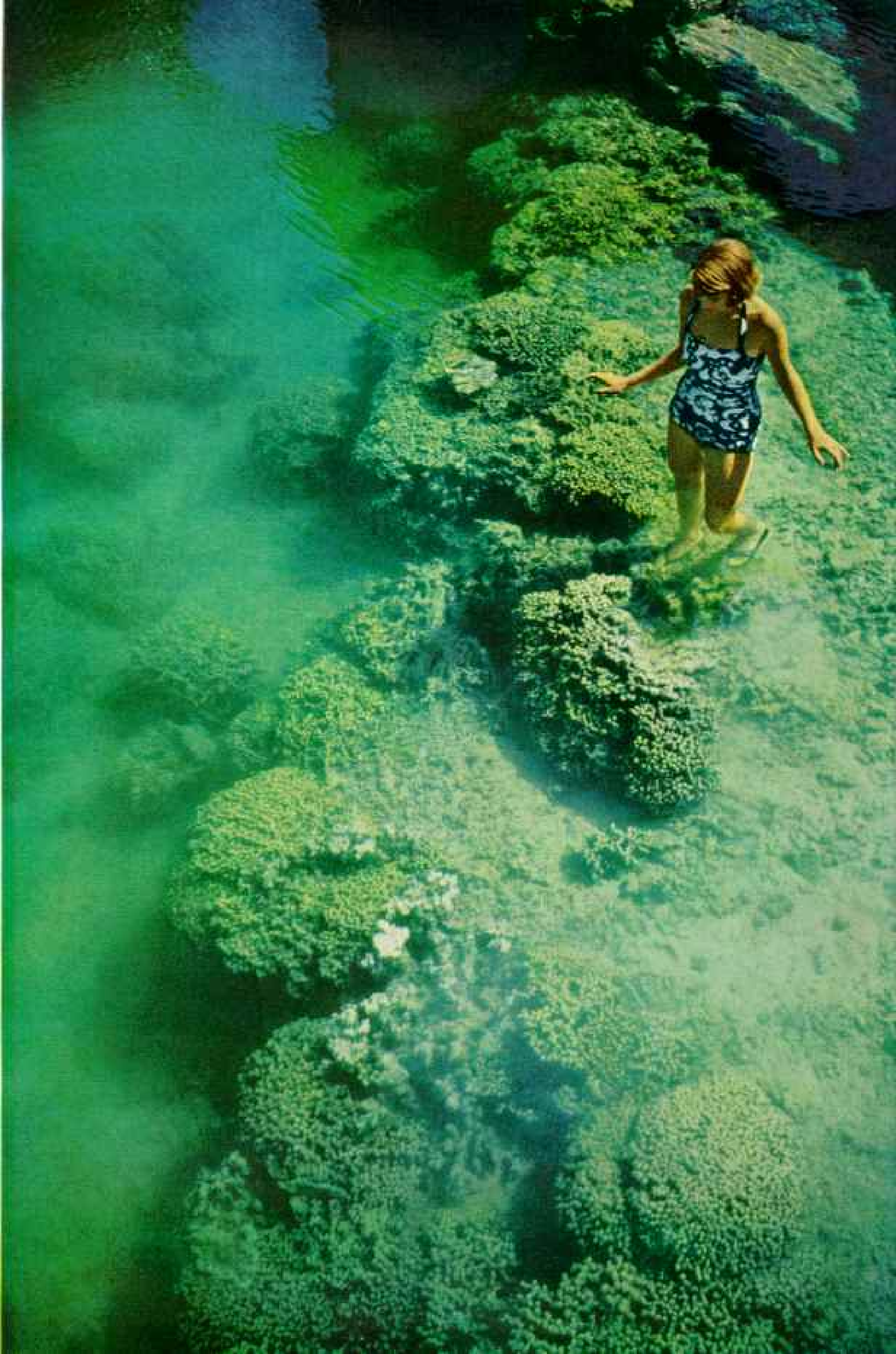
So numerous are the sea's microscopic trappers of sunlight that they achieve perhaps two-thirds the photosynthesis taking place on earth. At the heart of this miracle of nature is the emerald substance chlorophyll. Last year chemists synthesized chlorophyll in the laboratory—an achievement of far-reaching importance—but remained unable to duplicate the photosynthesis that the simplest plants perform so effortlessly (pages 214 and 219).

In the opening painting, reproduced here, the artist depicts some of the diatoms (1) and dinoflagellates (2) that make up the sea's green pastures. Larger organisms feed on them and on one another. They include radiolarians (3), foraminifera (4), copepods (5), crab larvae (6), and jellyfish (7).



KODACHROME BY PAUL A. ZAHL, NATIONAL GEOGRAPHIC STAFF; PAINTING BY M. RAMUS © N.G.S.

Green coral reefs get their color because the living polyps that create them harbor within their bodies countless one-celled chlorophyll bearers. These polyps, basking by the millions in Hawaiian shallows, prey on minute organisms. Their limestone skeletons build atop those of their ancestors.



isms achieve in the creation of lifestuff from the ocean's raw materials that they put man's attainments as a chemist to shame. They use elements in such tiny traces that man, until recently, could not detect their existence.

By now, the *Research* was out among the slapping whitecaps. We were cruising in the warm waters of the Gulf Stream, with the white beaches and coconut palms of North Bimini a blur behind us.

On the afterdeck McLaughlin and I made ready our equipment to gather in the treasure we sought—the sea's chlorophyll bearers and the tiny predators that feed upon them. Collectively, these creatures are called plankton, from the Greek *planktos*—wandering—because they drift aimlessly with the currents.

Two plankton nets were draped on the deck boards of the *Research*. The larger was a piece of nylon curtain material from a New York department store, sewn into a tapering 10-foot cone by the wife of the *Research*'s skipper. At its big end, a metal hoop three feet in diameter gave the cone a gaping maw. I fastened a towline to the three-legged bridle of this net, while McLaughlin lashed a collecting bottle into the other end. The cords had to be wound just so or the bottle wouldn't track right in the water.

"Whenever you're ready, you can put the nets over," Skipper Marshall said. And he throttled the *Research* down to a crawl.

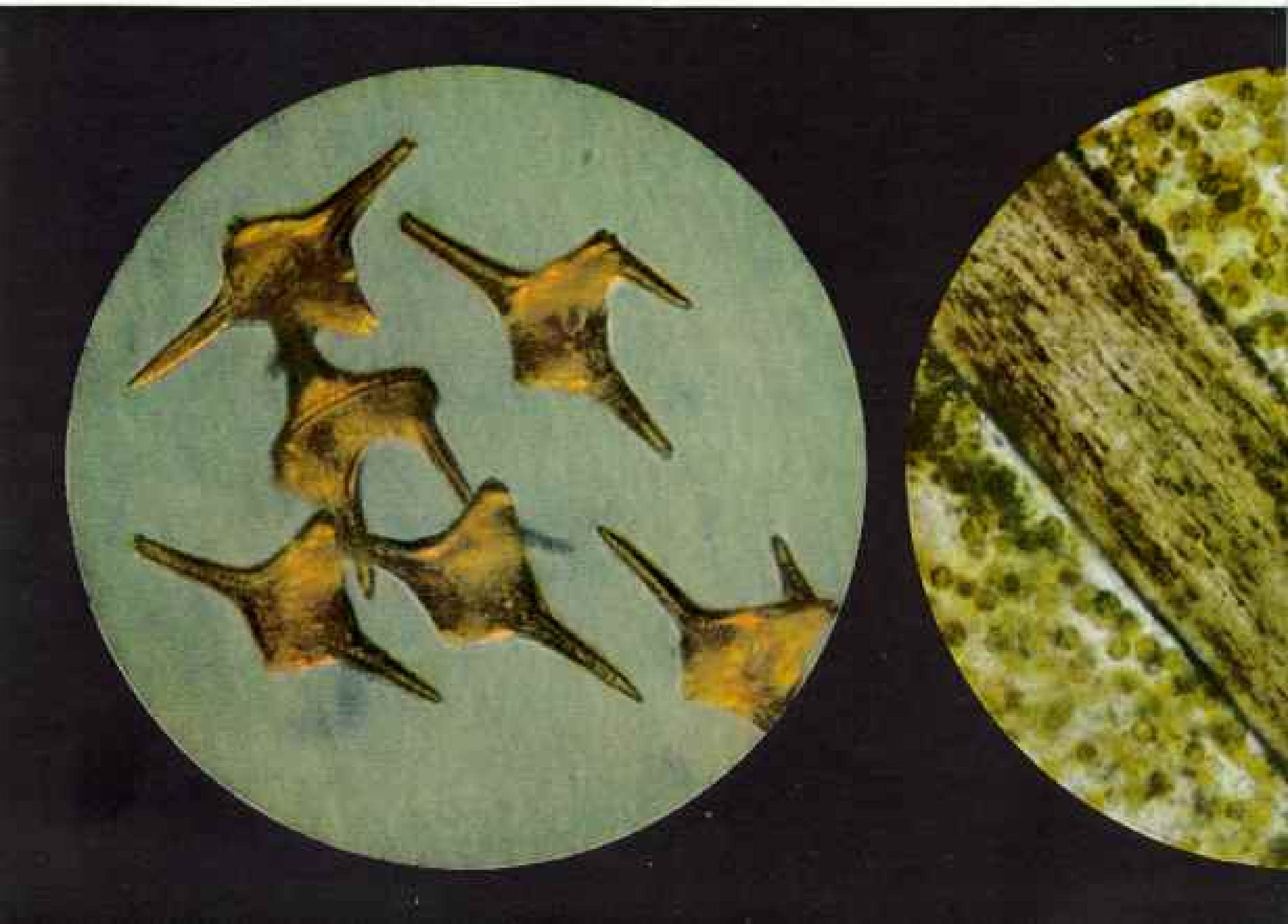
Mouths of Cloth Eat Through the Waves

As I swung the big net across the rail, the cone billowed for a moment in the breeze. It looked like a grotesque dragon kite of the Orient, or a streaming wind sock on an airfield. Then it hit the water, and the quarter-inch line that ended in the hoop's bridle was almost torn from my grasp.

The net filled. When I paid out the line, the white dragon sank beneath the surface, its cavernous mouth taking in water hungrily as the *Research* towed it through the sea.

The fabric of this net was woven in a mesh of about 50 threads to the inch—somewhat finer than mosquito netting, a little coarser than a woman's stocking. When pulled along

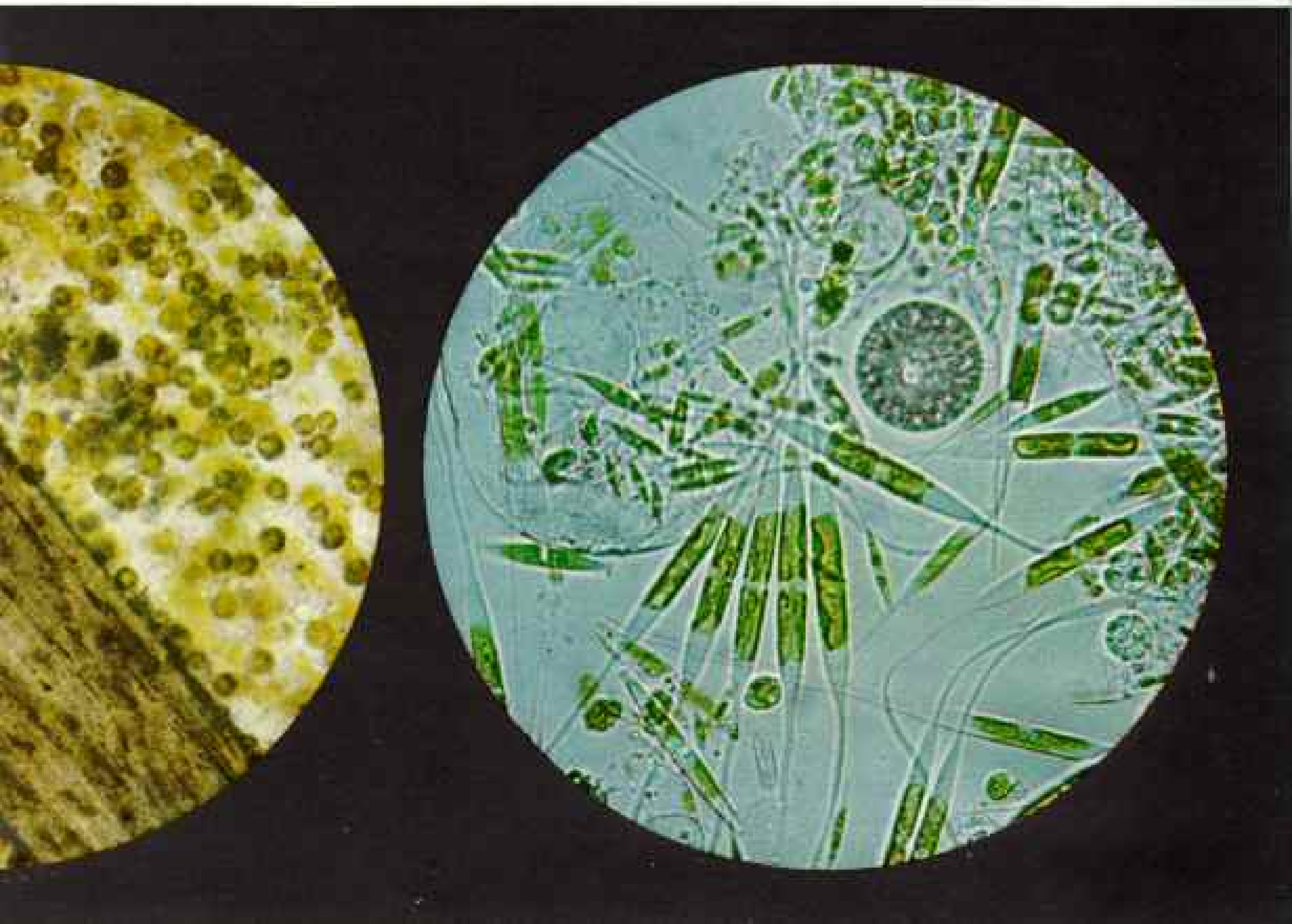
The Author: Senior staff member Paul A. Zahl brings to his many GEOGRAPHIC projects an unusual combination of scientific background and journalistic talent. His word-and-camera studies of natural history have ranged from parlor aquariums to African jungles. He holds a doctorate in biology from Harvard, and serves as a research associate of New York City's Haskins Laboratories and American Museum of Natural History.



KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

The author at his microscope examines ocean's living jewels in the American Museum of Natural History's Lerner Marine Laboratory on North Bimini Island, the Bahamas. Most of the sea's minute organisms are extremely delicate; after death they turn to a milky translucency. Dr. Zahl's remarkable photographs enable Society members to see them in living color.

Triple-pronged dinoflagellates (below, left) represent a primordial cell stock from which most higher forms of life may have arisen. Green-brown blobs within the dinoflagellates at center and the boat-shaped diatoms at right are sunlight trappers, their chlorophyll screened by a brown pigment. Enlarged human hair aslant in center gives scale. Magnification: 300 to 500 diameters.



KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Shimmering vertebrae can break apart at will; each "bone" is a dinoflagellate, 200 times life size. Other kinds turn tides red, fish nets white, and oceans phosphorescent.

beneath the surface, the cloth funnel engulfed the floating plankton, trapping all organisms larger than a single mesh. Some were caught in the fabric; others slipped and somersaulted down the sides of the net and ended up in the collecting bottle. Water currents created by the tow kept them there.

The second net, with 200 threads to the inch, was designed for even smaller plankton. Its mouth was only 10 inches across, with a screen of coarser netting over it to prevent larger organisms from entering and fouling the fine mesh. Fine as it was, the smaller net still couldn't trap the sea's tiniest inhabitants. It seems impossible to weave a fabric close enough to capture the most minute organisms and still allow water to pass through. Researchers use elaborate filters or put water samples into a centrifuge—a high-speed whirling device similar to a dairyman's cream separator—to concentrate these minute denizens of the sea.

Fertilizer From the Deep

I tossed the smaller cone overboard and tied its towline to a bitt on the deck. Then Marshall eased off some more on the throttle.

Too slow a speed would allow the nets to sink deeper than we wanted. Too fast a speed would force the nets to ride to the surface, and there be buffeted and torn by ocean swells. Marshall held the *Research* to a knot or so, which kept the big net about five feet under. The smaller one, on its shorter line, stayed just beneath the surface.

McLaughlin watched the tugging cones. "I wonder how many gallons of water are passing through those nets?" he mused.

I had a pole net in my hands, and my eyes were alert for floating patches of sargassum weed to be shunted away from the paths of the plankton cones.

"I don't know," I said. "There must be thousands. But I'll settle for a couple of collecting bottles full of live plankton."

We were netting in waters where the wanderers of the sea are not plentiful, relatively speaking. This marine life grows more prolifically where cold waters, rich in dissolved nutrients, flow from rivers and polar seas, or well upward from the ocean's deeps. Such waters support incredible populations of chlorophyll bearers—as many as a dozen million per cubic foot. There, too, congregate the tiny plant eaters and the fish that prey upon them.

Man has found the world's best fisheries where these cold-water "pastures" occur—

the Grand Banks of Newfoundland, the North Sea, and off the northwest coast of Africa, for example. Near the Peruvian coast a rain of sea birds comes down to feed on the fish life that exists there in tremendous abundance. The island cliffs and coastal crags where the birds roost are whitened with their guano. These sun-parched accumulations supply man with rich fertilizer from the sea.*

Tropical waters, on the other hand, have sparser plankton populations. One reason for the glassy clarity of these waters is that the microscopic wanderers don't exist there in such clogging numbers. But tiny organisms are present nevertheless, even plentiful. Moreover, due to the differences in chemical and physical qualities of warm compared to frigid seas, tropical plankton displays a diversity of species and colors which its colder counterpart cannot match.

We aboard the *Research* weren't after quantity. We were seeking data on the distribution and relative numbers of various subtropical plankton types.

Microscope Reveals a Miniature World

Skipper Marshall cut the ignition, and the *Research*'s engine coughed to a halt. McLaughlin and I dragged the two nets in.

The bottle attached to the larger cone was alive with bits of matter, so tiny and transparent that a shimmering iridescence was the only clue to the furious jostling and whirling within. The fabric of the net itself was thinly coated on the inside with a grayish

(Continued on page 210)

*See "Peru Profits From Sea Fowl," by Robert Cushman Murphy, NATIONAL GEOGRAPHIC, March, 1959.

Tapered net, a wind sock of the sea, sweeps through an underwater world of mote-sized creatures. Its nylon mesh, and a collecting bottle tied at the small end, capture plankton—a living chowder of diatoms, dinoflagellates, fish eggs, shellfish and crustacean larvae, and other Lilliputians of the deep. Dr. John McLaughlin of New York's Haskins Laboratories pulls in the haul from the Gulf Stream off the Biminis.

Blue whale, world's largest animal, feeds on zooplankton.

1. Sea's cycle of life begins with phytoplankton (algae and plant-animals), here highly magnified. Using the sun's life-giving power, these minute organisms combine water, carbon dioxide, and minerals into carbohydrates, proteins, and fats. They serve as the ocean's basic foodstuff.

6. Chemicals from decomposition well up to the sunlight zone and replenish the life cycle.

5. Plant and animal debris rains down on the ocean floor there to nourish bottom dwellers and to decay.

Portuguese man-of-war entangles fish in its tentacles.

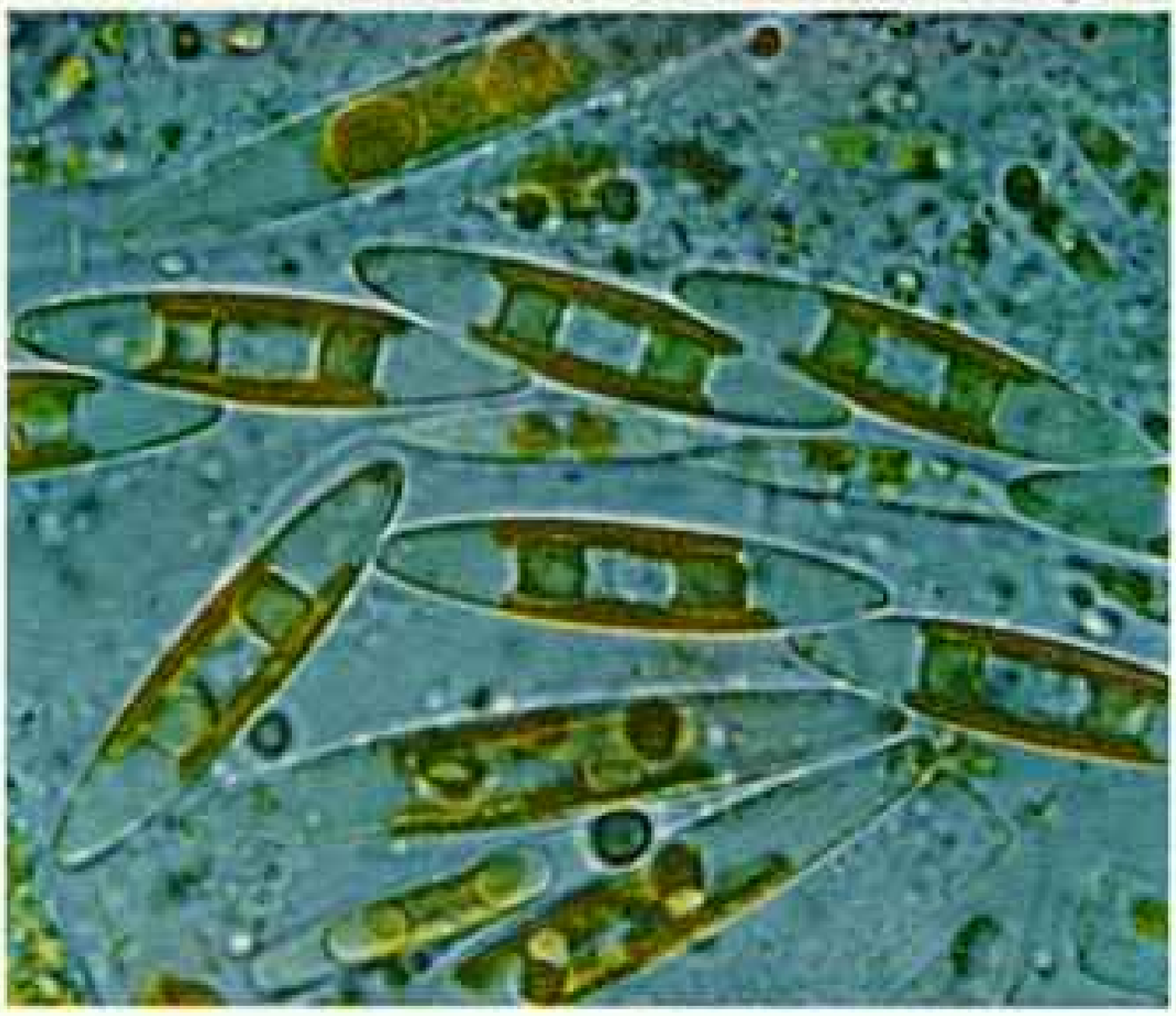
2. Zooplankton (microscopic animals) feed on phytoplankton.

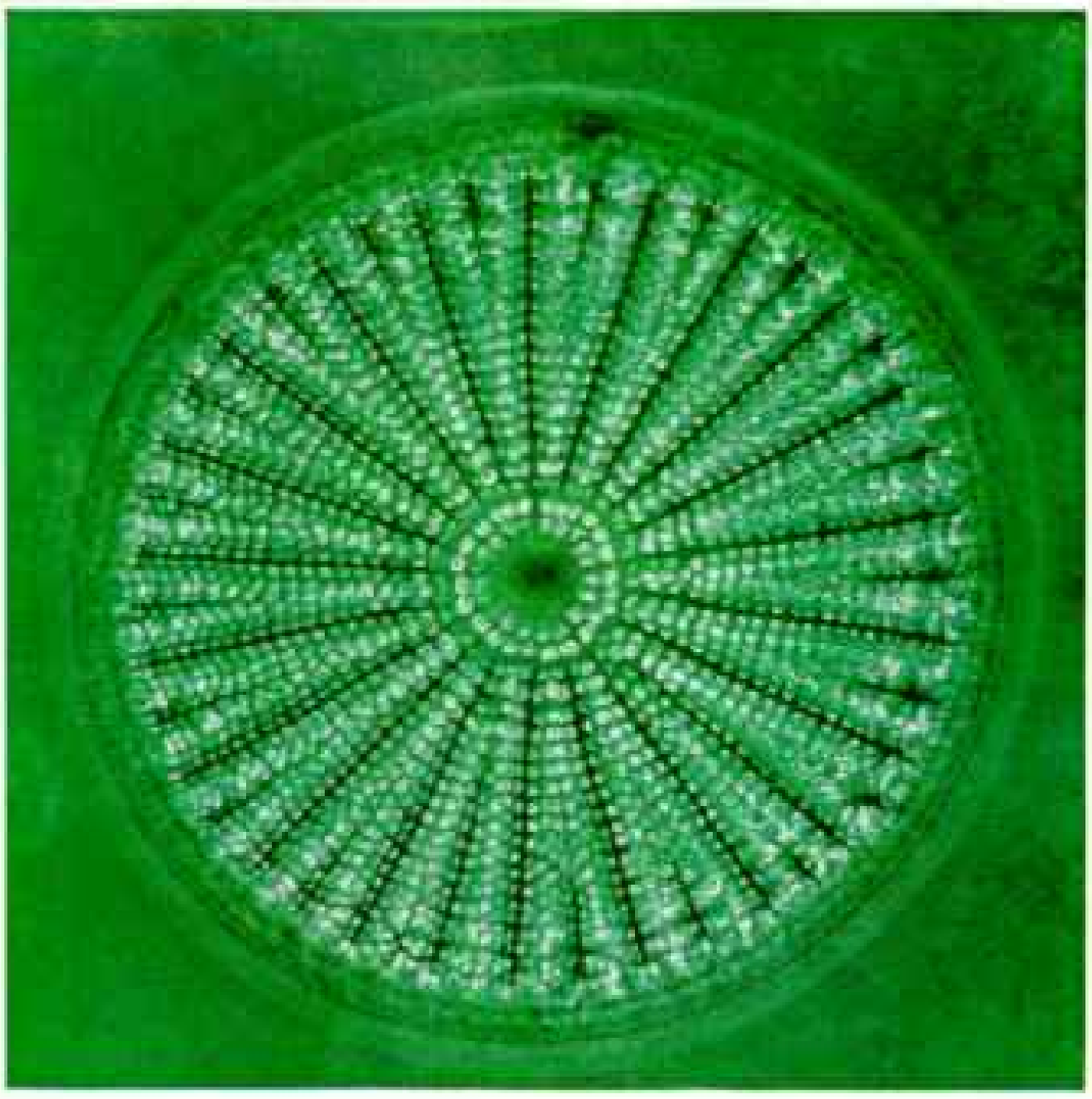
3. Herring and other fish, by the hundreds of millions, feed on minute zooplankton, here highly magnified.

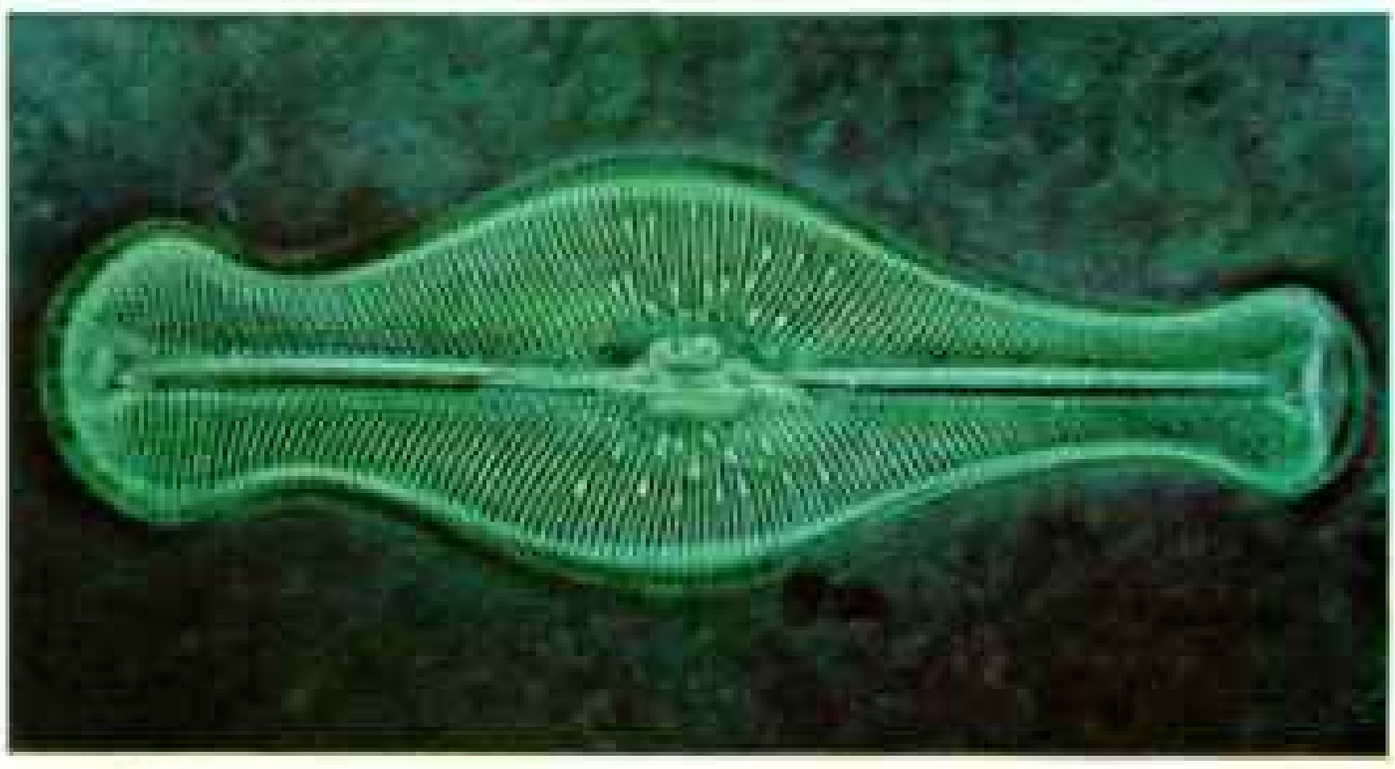
4. Tuna and other predators eat smaller fish and in turn fall prey to sharks and killer whales.

Life Cycle OF THE SEA

ROBERT C. MAGIS STAFF ARTIST







Lacy skeletons of diatoms, enlarged 600 times at center and lower left, reveal the intricate pits and perforations of their silica shell cases. In life this tracery gives the walls greater surface area, helping the organisms to float. In death it makes the cases excellent material for filters and polishes. Living diatoms (top), mag-

A. F. BAXTER, EAST AFRICAN PHOTOGRAPHIC SERVICE

Open-pit mines turn long-dead diatoms to new usefulness. Deposited in beds of ancient seas, as many as 50 million diatoms to the cubic inch, diatomaceous earth goes into paints, polishes, insecticides, and insulation. It whitens sugar, clarifies beer, and purifies antibiotics. U. S. industry uses some 400,000 tons a year. World's largest deposit, in California, covers hundreds of acres to depths of 1,400 feet. These miners, near Gilgil, Kenya, shovel down earth, bench by bench.

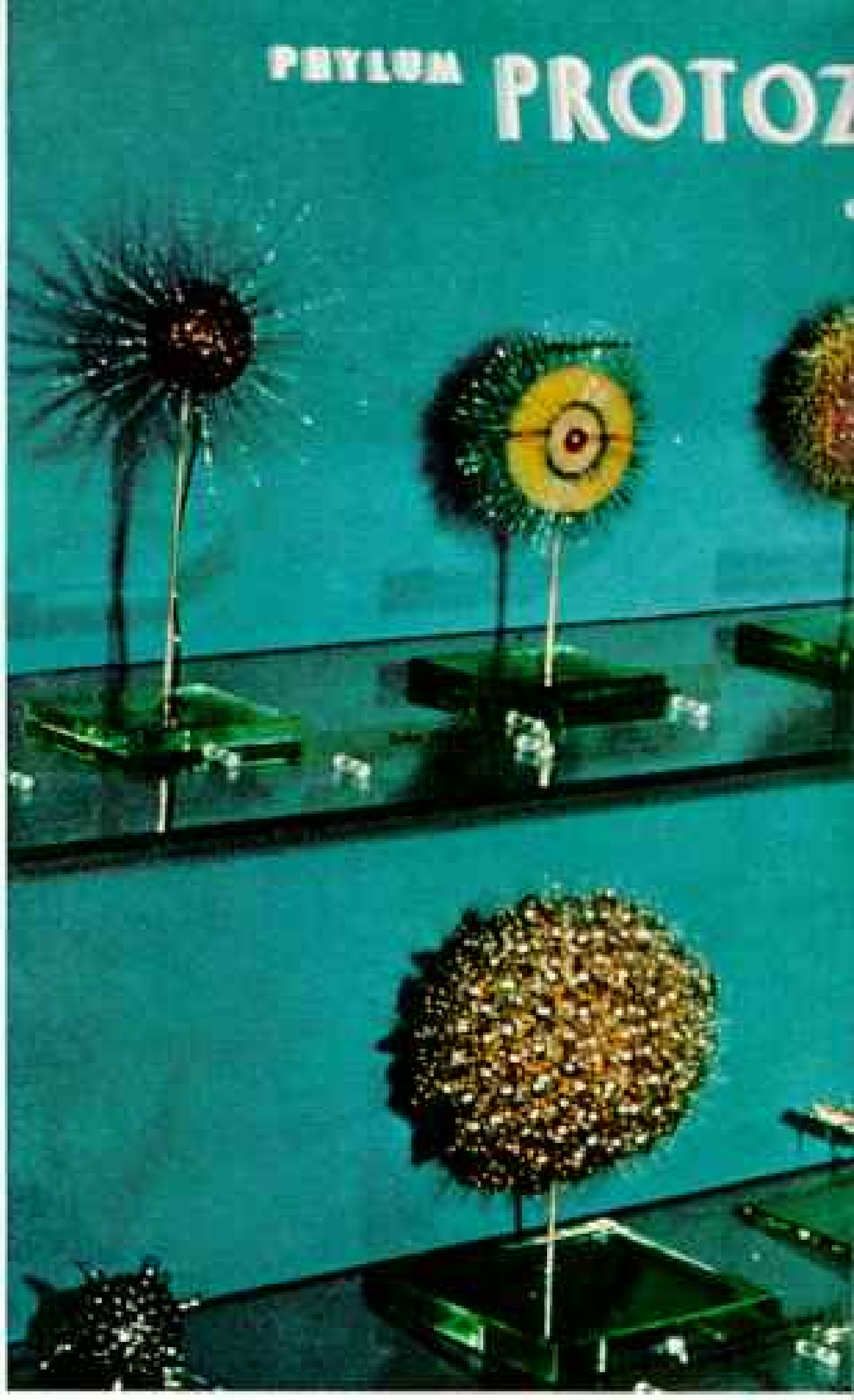
nified 300 times, contain proteins and fats similar to those in meadow hay. Round oil droplets found in them contribute to the vitamins in fish livers and may account for part of the world's petroleum deposits.

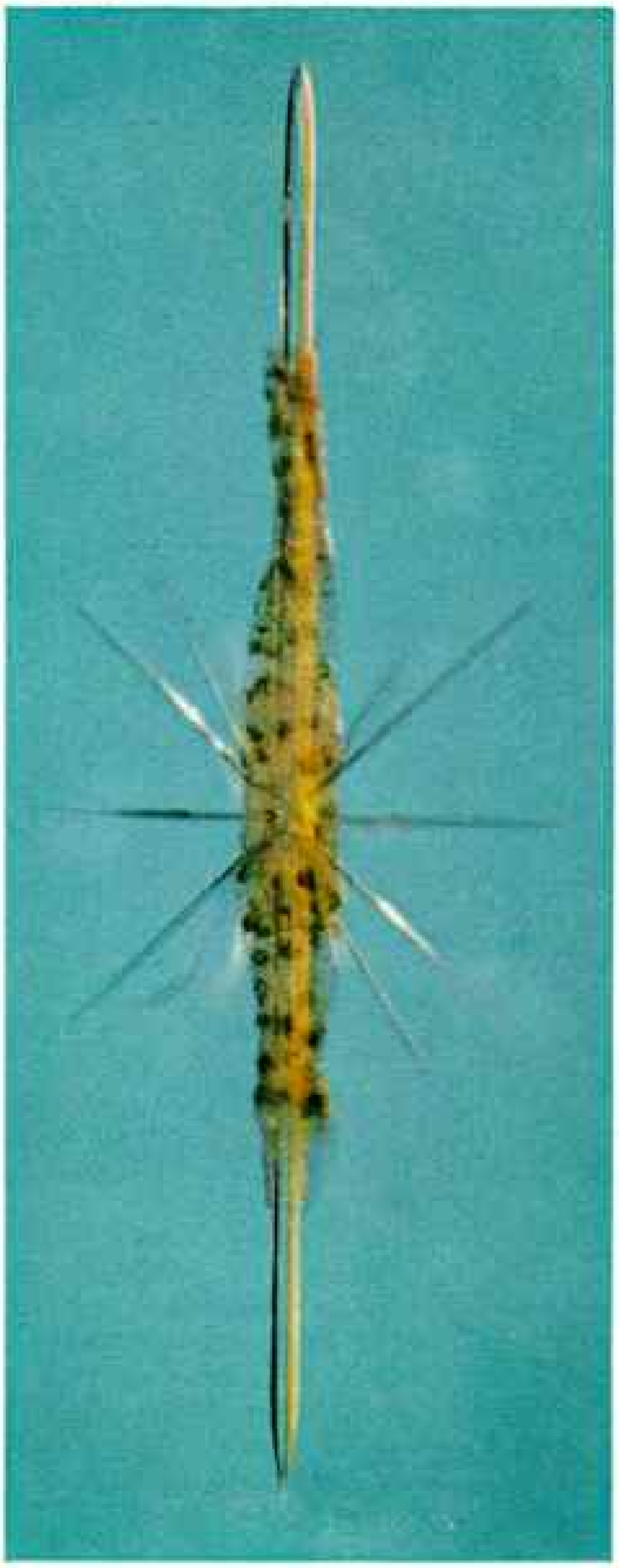
Diatoms, which assume many shapes, multiply as rapidly as ten thousandfold in a fortnight.

Glass Models Reveal Bizarre Shapes of Infinitesimal Creatures of the Sea

Devoting six months or more to each creation, a master glass blower fashioned these spiny, shining orbs for display in the American Museum of Natural History, New York. Faithfully reproducing the original's structure, he enlarged it hundreds of times.

Skeletal needles pierce a radiolarian, one of the most beautiful animals in the sea. Radiating spicules increase the buoyancy of this living specimen and other pinpoint-sized protozoa. Dark spots in the frothy protoplasm—enlarged 200 times—are one-celled plants that appear to live with the host in symbiosis, a relationship in which each may benefit the other.





paste—tens of thousands of bodies like those in the bottle.

As for the jar at the end of the smaller net, experience told me it would be full of specks too small to be seen by the naked eye.

A few hours later, at a workbench in the laboratory on North Bimini, I glued my eyes to the binoculars of a compound microscope (page 203). Through the lenses of that powerful instrument a world of hidden wonders was revealed—a world alive, restless, and almost terrifying.

Tiny crustacean monsters, vaguely shrimp-like in form, were the dominant animals of this haul. They sped about as if their lives were in jeopardy—as they were. Plankton organisms removed from the ocean usually survive only a short time.

Many were iridescent, presenting different colors at every turn of their bodies. In addition, some displayed patches of orange or red or blue pigment. All were sufficiently transparent for me to see masses of ingested greenish-brown material within many a digestive system—evidence that these tiny "cattle"

PHOTOGRAPHS BY E. ANTHONY STEWART (ABOVE) AND PAUL A. ZAHL, NATIONAL GEOGRAPHIC STAFF © N.G.S.

had been grazing in the sea's pastures.

These crustaceans were copepods (page 223), which pushed themselves through the water with feathery vanes. In size they ranged up to a giant as big as a grain of rice.

Others in the water sample were blue-eyed crab larvae, somewhat larger than a pinhead (page 215), and equally small baby shrimps with bodies like color-splotched Lucite.

There were arrowworms that looked like slivers of clear glass; pulsating jellyfish with tasseled fringes; fish eggs resembling transparent balloons; and newly hatched finny fry with big silvery eyes. And there were others, the spawn tossed into the sea in clouds by protozoa and predators—to become the vast confusion of wandering pygmies we call plankton.*

Geometry Goes Mad in a Microcosm

I pipetted some water from the bottle that had been attached to the finer meshed net, then shifted the microscope's lens system to increase its magnifying power a hundred times. Here was still another microcosm, many of its inhabitants ten thousand times smaller than a copepod. I saw living spheres, disks, wedges, anchors, and pillboxes; cones, sunbursts, spirals, quarter moons, cubes, rods, triangles, and whorls—geometry gone mad.

Some of these creatures moved and jerked. Others floated or pulsated gently. Some were single, others grouped in clusters or in ribbons. There were shelled foraminifera—crystal caskets filled with jewel spots of color. There were radiolarians—minute globes of protoplasm pinned through with radiating spicules of glass. And there were the creatures I was most eager to find in that fantastic world at the base of my microscope tube—diatoms and dinoflagellates.

The diatoms, and some of the dinoflagellates—as well as other kinds of even smaller protoplasmic blobs—are the grass of the sea. They are the minute sun machines whose existence in infinite numbers is the key to life for all the sea's teeming multitudes. They

*These marine miniatures were described in "Strange Babies of the Sea," by Hilary B. Moore, NATIONAL GEOGRAPHIC, July, 1952.

KODACHROME BY PAUL A. ZAHL; ON SATACHROME (OPPOSITE) BY W. EUGENE SMITH, NATIONAL GEOGRAPHIC STAFF © N.G.S.

White cliffs of southern England take their substance from the bodies of minute sea organisms, half a million to a teaspoonful. Moonlight outlines Beachy Head, 500-foot headland beside the English Channel. Beachy Head Light, in the distance, casts its benevolent gleam 16 miles.

Translucent shells of single-celled foraminifera easily pass through the coppered eye of a needle. Their ancestors laid down England's white cliffs millions of years ago. Calcium-built structures of these animals, magnified about 70 times, resemble the large, complex shells of mollusks.

are the trappers of solar energy, the creators of the basic bread of the oceans.

Each diatom, a tiny one-celled plant, has a shell of silica—the main ingredient of sand and glass. The shell consists of transparent halves, one fitting inside the other just as the bottom of a pillbox fits inside the top. Indeed, some species are box shaped; others are like spindles or wedges of pie.

Diatoms reproduce by dividing. The overlapping halves separate, each with a new shell secreted to fit inside the old. Thus the offspring developing from the "box bottom" is always smaller than its parent, and the size keeps dwindling through successive generations. Finally, one sends out a reproductive mass within which new cases form to the species' original measurement, and the whole process starts again.

The diatoms multiply prodigiously. One diatom may have 100 million descendants in 30 days. And it is well that they are so prolific, for a single copepod may consume more than 120,000 diatoms in a day. And the number of copepods in the sea may exceed the total of all the other multicellular animals of the earth.

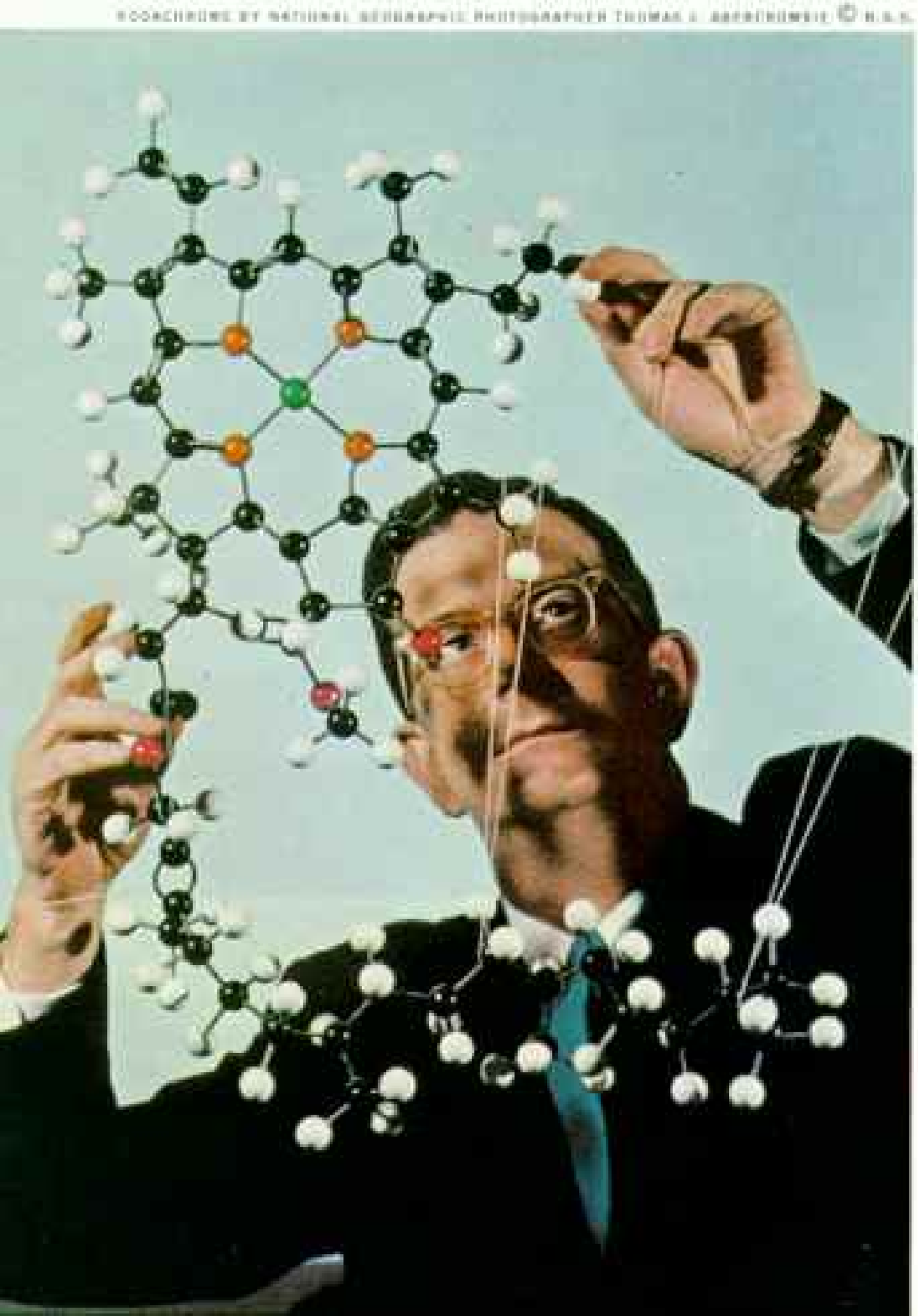
Undigested silica shells of diatoms, and cases of those that die, sink to the bottom and form layers of siliceous ooze. Upheavals of ancient sea bottoms have exposed deposits of such diatomaceous earth as much as 1,400 feet thick. Each cubic inch of these deposits contains the shells of perhaps 50 million diatoms! Man mines this earth in huge quantities for a wide variety of uses (page 209).

Scientists have found that the protein and fat content of diatoms is about the same as that of average meadow hay. They have discovered also that the oil droplets frequently locked in the diatoms' silica cases are rich in vitamins. The stores of vitamins A and D we extract from the livers of fish had their origin in diatoms and other lowly marine plants the fish fed upon.

In my microscope I could see an occasional speck of oil within the glassy shells. But most conspicuous in the diatoms' insides were irregularly shaped masses of chlorophyll—at times a bright green, more often made earth color by the masking effect of a brown pigment (page 208). Hues of diatoms range from browns through olive green to canary. The sulphur-bottom whale gets its name from yellow diatoms that grow in profusion on its belly.

Each diatom is a simple single-celled organism. Yet in its primitive protoplasm a process takes place that man, the great chemist and engineer, has not yet managed to duplicate. That process is photosynthesis.

We know what happens in photo-



Model of a complex molecule shows how nature binds 137 atoms to create chlorophyll. At the core of the model, 380 million times actual size, lies a single magnesium atom (green). Fifty-five carbon atoms (black), 72 hydrogen (white), 5 oxygen (red), and 4 nitrogen (orange) cluster around it. Some balls hide others in this view. Prof. Robert Burns Woodward, shown in his Harvard laboratory, recently synthesized chlorophyll. His achievement proves chemists' theories about the compound's structure and gives them new tools to unlock secrets of other complex molecules.

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

Blue-eyed baby crabs, 10 times life size, stare into the microscope. Many kinds of larvae teem in the sea's plankton layer, whose up-and-down movement seems keyed to the sun's intensity.

Golden headlights, a reflection from the camera's illumination, shine in the multifaceted eye stalks of a crustacean. Its almost transparent body appears 30 times life size.

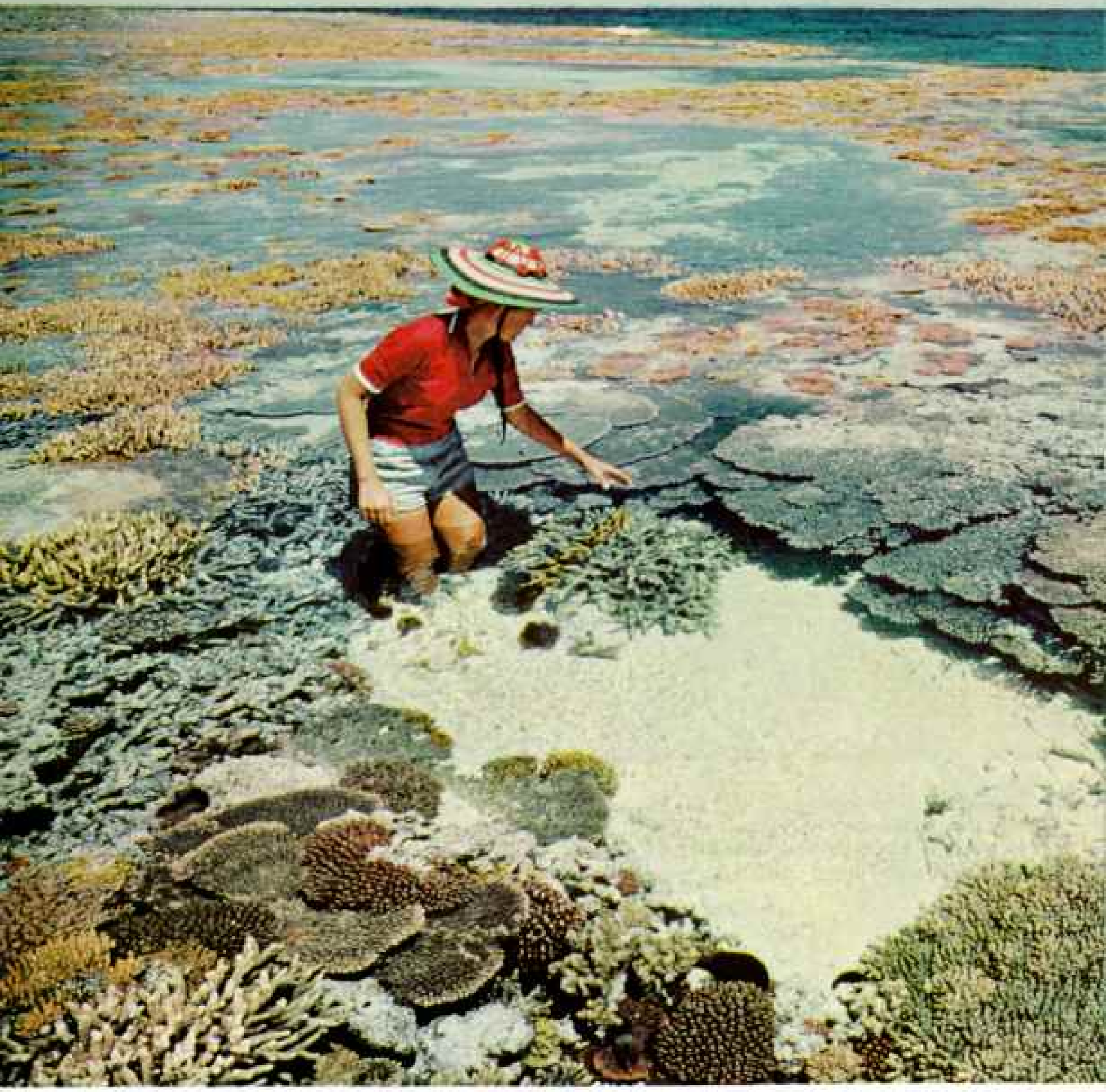
synthesis, but we don't know exactly how. Molecules of carbon dioxide and water, in the presence of chlorophyll and sunlight, go through a series of changes. When the reaction is over, three things have taken place.

First, the relatively simple water and carbon dioxide molecules have combined into the much bigger, more complex molecules we call carbohydrates; that is, sugars and starches.

Second, these molecules have somehow stored within themselves part of the energy contained in the sunlight. This is the energy that powers all the earth's living machines, including man (and also many nonliving machines—all those driven by coal, petroleum, or natural gas).

Third, pure oxygen has been freed for men and animals to breathe.

How does chlorophyll fit into this most important chemical reaction on earth? Chlorophyll is the catalyst that makes



Green-spaghetti arms of zoantharians on a Pacific reef wave against an ascidian's bright orange and a sponge's deep red. Like their close relatives the sea anemones, zoantharians often have tentacles laden with chlorophyll-bearing algae. Author Zahl and his research associates found algae in many such creatures to be dinoflagellates, a form of life part animal and part plant.

These zoantharians are shown twice life size.

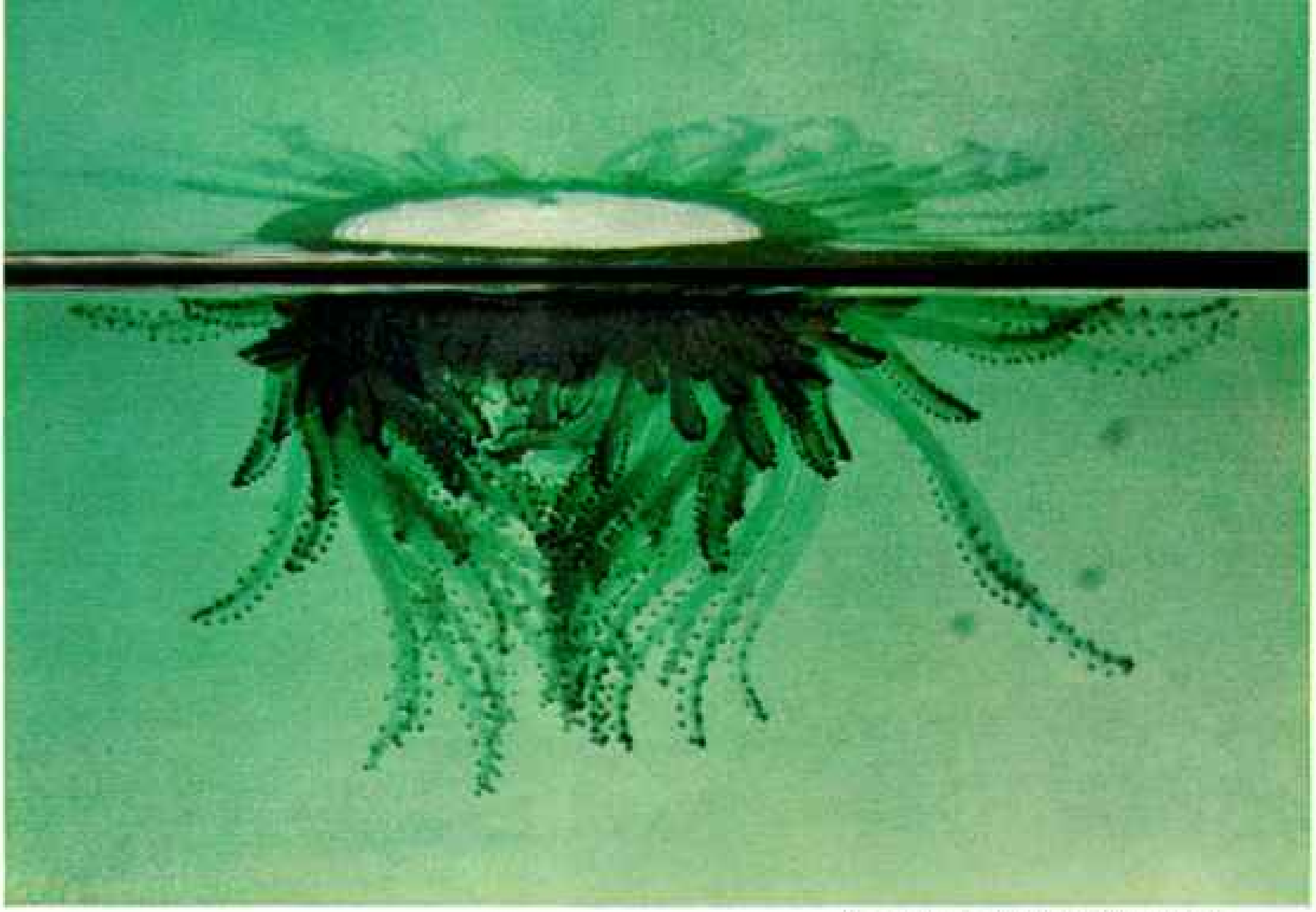
Coral Fans and Fingers Grow in a Sunny Tidal Pool

Polyps, the living flesh of corals, choose the sunlit layer of the sea to accommodate the light-loving algae that live within their bodies. The small green plant cells appear to serve as built-in kidneys, absorbing wastes from the animal host and in return perhaps supplying oxygen released through photosynthesis. Their presence may enable corals to live in closely crowded quarters and so make reefs possible.

Limestone frameworks secreted by the polyps take varied forms—branching staghorns, fanlike platters, lone fingers, and fist-sized clumps. Corals exist in most seas, but reef builders thrive only in warm water.

Here the author's wife Eda wades a sandy pool in the Great Barrier Reef, world's largest coral formation. As much as 150 miles wide, the reef extends 1,250 miles along Australia's northeast coast.

Leathery "lily pads" glisten in a salt-water pond of the Great Barrier Reef. These growths, soft corals whose supple structure lacks the limestone skeleton of other varieties, owe their greenness to millions of algae loading their tissues. Stony corals cluster around



AGFACHROMES © NATIONAL GEOGRAPHIC SOCIETY

Feathery tentacles of a porpita, armed with dotted clumps of sting cells, fish unceasingly for plankton. Porpitas, close relatives of jellyfish, float on the surface; at times they fleck the sea for miles with inch-sized spots of blue.

Sausage sails of eight Portuguese men-of-war glisten in Gulf Stream shallows. Trimmed at will, the sails catch the breeze and propel the animals. Elastic tentacles trap and sting small fish; poison cells sting bathers too, sometimes fatally.

the reaction go, but itself comes out unchanged.

Chlorophyll is a compound of carbon, hydrogen, oxygen, nitrogen, and magnesium. It exists in the plant cell in microscopic stacks of disks, called grana. Somehow the combination is able to grab onto quanta—single packets—of energy from sunlight.

That, scientists theorize, sets off a chain-bumping of electrons through the piled-up disks, much as an electric current flows through the linked cells of a storage battery. In the changed electrical environment that results, hydrogen atoms switch from water molecules to carbon dioxide molecules, and free oxygen is released. Thus starts the mysterious process by which plants—in and out of the sea—produce the food we eat and the oxygen we breathe.

Green Magic Made in a Test Tube

Photochemists think this is how radiant energy from the sun is converted into chemical energy. Intensive work is going on to unlock the secrets we must know if we wish to duplicate synthetically what the plants do. Just last year scientists in Germany and the United States achieved an important advance. They created chlorophyll in the test tube.

Researchers connected with the Technical Institute of Munich took nature's chlorophyll and achieved the final steps in breaking it apart, then succeeded in putting it back together. At Harvard University, a team headed by Prof. Robert Burns Woodward began with laboratory substances, and in complicated chemical steps combined them to produce a few hundred-thousandths of an ounce of chlorophyll (page 214).

Each process is as yet only a brilliant laboratory feat. The isolated chlorophyll molecules thus obtained cannot by themselves perform photosynthesis. But the achievements mark a leap forward. And in the present widespread research effort, science holds a growing respect for the wizardry of the simple green cells of land and sea.

While microscopic single-celled plants are the sea's dominant utilizers of solar energy, the shores of every continent and island are lined with more conspicuous possessors of chlorophyll—the seaweeds, sea grasses, and kelps. A few, such as sargassum weed, float freely, but most cling to rocks on the bottom. Some are buoyed by marvelously constructed floats filled with gas. Off the west coast of South America single kelp plants reach lengths of 150 feet.

Diatoms account for a major share of the photosynthesis in the ocean. But other minute single-celled organisms also have this power. In the Gulf Stream waters where we trolled our plankton nets, certain flagellates—whip-bearing creatures—were more plentiful than diatoms. Through the eyepiece of my microscope I could see these dinoflagellates—"dino" means whirling—each moving about by the lashings of two hairlike whips (page 204).

Dinoflagellates are lower on the evolutionary scale than diatoms—more primitive perhaps than the amoeba. They have characteristics of both plants and animals, yet some cannot with certainty be classed as either. Evolutionists regard such creatures as among the most ancient of all life forms. They are thought to be remnants of the original single-celled stock from which most higher plants and animals may have begun their development a couple of billion years ago.

Some of the dinoflagellates within my view were merely lumps of soft-walled protoplasm. Others had intricate coatings of cellulose. This armor deteriorates after the wearer's death, and so these creatures make no direct contribution to sea-floor sedimentation. But their form and structure and color are marvelously diverse.

Some are milky; they account for the "white water" that herring fishermen consider a sign of good hauls to come. Many are luminescent.* One species, *Noctiluca miliaris*, is responsible for the "fiery seas" of marine lore. By the billions, they can light up the water in flashing sheets.

"Tiny Jim" Turns Sea to Sirup

A dinoflagellate causes the unwelcome "red tide" in Florida. The species to blame is *Gymnodinium breve*—"Jim Breve" in popular parlance. It exists in the Gulf waters off Florida's western coast in numbers of about 1,000 to a quart. But when just the right combination of temperature, tide, and mixture of Gulf waters with fresh takes place, the population explodes. Then as many as 60 million may be found in a quart. The sea turns sirupy and becomes discolored. Fish are poisoned and pile up for miles along the shore, as thickly as 100 pounds per foot. A

*See "Puerto Rico's Bay of Fire," by Paul A. Zahl, NATIONAL GEOGRAPHIC, July, 1960.

BOOMERANGED © NATIONAL GEOGRAPHIC SOCIETY

Velvety mantles spill from cantaloupe-sized tridacna clams, their shells agape in a shallow pool of the Great Barrier Reef. The mantles, no two colored alike, unfold to the sun to benefit algae living on mutual-benefit terms with the clams.

Splash of water closes a crusty goliath, *Tridacna gigas*, one of the Great Barrier Reef's giants. This clam weighs 60 pounds; some attain 500 pounds. Tales abound of divers trapped by the toothed shells, but evidence is lacking.

KODACHROME BY PAUL A. ZAHL, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Affirt with the current, small fish swim before the intake pore of a giant clam's partly retracted mantle. They feed on the microscopic organisms drawn in with the water. Colonies of algae fleck the mantle tissue with gemlike spots.

substance released into the air makes people sneeze and suffer sore throats.

Fortunately, however, dinoflagellates are mainly creative, not destructive.

Suddenly a cluster of foraminifera floated into the viewing field of my microscope. I was struck by the similarity many of them bore to familiar seashells of the visible world —a boat shell here, a periwinkle there, and perhaps a chambered nautilus.

The shells of these little organisms, fashioned from calcium in the sea and deposited over eons of time, form much of the limestone strata now quarried by man. Chalk like that of the white cliffs of England's channel coast is packed with fossil foraminifera, a half million to the teaspoonful (page 212).

In the micro-marine art gallery before me, I was especially intrigued by lacy bits of life called radiolarians. Here are perhaps the most exquisitely beautiful of all living things in the sea. Often the protoplasmic froth that forms their central core is bright orange or red or green. From these centers radiate ultrafine glassy needles of silica. Observed thus in the living state with their colors unfaded, these starry radiolarians had a splendor that was unforgettable (page 210).

It is on such microscopic stuff as this, diatoms and dinoflagellates and the rest, that the voracious life of the ocean depends. The phytoplankton ("phyto" for plant), and the zooplankton grazing upon them, exist in a soupy layer, a veritable chowder of nourishment where the sun penetrates the sea.

Planktonic animals in this layer mysteriously rise and sink in a daily cycle, apparently to bask in the light intensity they find most suitable. Subdued light seems favored; the layer rises toward the surface as the day ebbs, sinks again with the coming of dawn. This migration may cover 500 feet.

Planktonburgers Could Save a Life

How plentiful is the purée of minuscule life? Copepods that can consume 120,000 diatoms in a day have been found to number 60,000 in the belly of a herring. And about half a billion herring a year are landed at British Isles ports alone. Plankton in astronomical numbers support these prodigious eaters—and many more. The sulphur-bottom, or blue whale, largest animal ever to exist on earth, maintains its tremendous bulk exclusively on a diet of plankton.

I wondered how a planktonburger would taste. Fishy, no doubt. But its nourishment might save the life of a sailor adrift on a raft, or a downed airman. Thor Heyerdahl, aboard the *Kon-Tiki*, found plankton "good eating." And Alain Bombard, who crossed the Atlantic alone on a raft, reported that plankton "tasted like lobster, at times like shrimp, at times like some vegetable."

Our haul with the *Research* revealed a

Starry traveler in an inky void, a baby octopus reflects the light of flash bulbs. Internal organs appear faintly within the translucent body, shown 10 times life size. Octopuses have three hearts and the keenest brain of all the nonvertebrates.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Iridescent pygmies forge a colossal link in the sea's food chain. Copepods, whose name means "oar foot," graze on diatoms and in turn nourish larger predators. They may outnumber all the other multicellular animals combined. Among these flea-sized copepods appear a dark-eyed crab larva and a fish egg that looks like a bubble.

bizarre relationship between certain marine plants and animals. In my microscope I saw green-brown single-celled plants dwelling peaceably within the protoplasm of a radiolarian. This was symbiosis—two organisms living together, one contributing to the life of the other.

In warm seas where nutrient salts are relatively scarce, certain dinoflagellates trade their freedom for shelter and food within the prison cell that is their host. Apparently they obtain nourishment from the animal's nitrogenous wastes. In return they produce oxygen and carbohydrates for possible use by the host, or rid the animal of its digestive debris.

I was reminded of a wading expedition my wife and I had made on the Great Barrier Reef of Australia—a marine environment essentially similar to that of the Bahamas.* There we came across a green sea anemone clinging to a rock ledge. Its tentacles waved like strands of limp spaghetti. The anemone's body was tipped toward the sun.

*See "On Australia's Coral Ramparts," by Paul A. Zahl, NATIONAL GEOGRAPHIC, January, 1957.

"Green men from Mars have nothing on that creature," I commented.

Eda asked, "Whatever do you mean?"

"Well, aren't Martians supposed to be green?" I said. "Science fiction writers have imagined their Martians with skin that contains chlorophyll to utilize sunlight directly, the way plants do here on earth. With built-in chlorophyll to synthesize carbohydrates, proteins, fats, and vitamins, such creatures wouldn't need mouths. Or stomachs or intestinal tracts."

"Tell me, professor," Eda jibed, "how do carbohydrates eaten through the skin taste?"

I chose to ignore the remark. The anemone, I knew, and others around it owed their greenish cast to internal "gardens" of single-celled plants rich in chlorophyll. So did some of the incredible coral formations burgeoning at our feet—animals with limestone skeletons spiked like staghorns, convoluted like the surface of a brain, or displaying a velvety covering of coral polyps, each with a corona of waving tentacles. So did the giant tridacna clams, lying like jumbo

cantaloupes in nearly every shallow pool. Shells agape, they were oriented skyward, spreading out a mantle of tissue exquisite with gem spots of color (page 220).

Whirled Cells Uphold a Hunch

Back in my New York laboratory months after the Great Barrier Reef trip, McLaughlin and I macerated some live anemone tissue that had been shipped to us. Then we spun it in a centrifuge. The green cells were whirled apart from the cells of the host.

Next, by means of a glass suction tube no thicker than a fine sewing needle, we put a single green cell into each of a number of test tubes of nutrient broth. These tubes were placed near a strong electric light—our version of the sun. Before long the single cells had multiplied into tens of thousands, and each tube of broth had a greenish tinge.

In examining these cells closely, we made a startling observation. Instead of merely splitting in two to duplicate themselves, some cells underwent a radical anatomical change: They developed two small whips. This transformation, along with certain telltale markings, gave experimental proof to a scientific hunch. The hunch was that pigmented cells living in the tissues of many marine animals the world over are really members in disguise of that queer part-plant, part-animal form of life, the dinoflagellates.

Have the animals of the reef, unable to do what the plant does, taken to symbiosis to get as close as possible to the source of trapped energy from the sun? Their two-legged relative on land—man—is working hard to solve that same green secret, photosynthesis.

If man succeeds, many marvels are in store. There will be a revolution in agriculture, with food for the multitudes made abundantly out of simple carbon dioxide, water, and minerals. There will be factories in the desert, reaching out into the air to take power directly from the sun, with no more need for sun-created coal, natural gas, or petroleum. And there will be a way to make oxygen and food for sustaining travel through space, and for peopling airless planets as far away as sunlight can reach.

Seaweed Gardens Yield Ingredients for Ice Cream and Tooth Paste

After one-celled plants, ocean's most important setting for photosynthesis lies in patches of seaweed along its shores. Besides bright chlorophyll, some seaweeds contain light-absorbing pigments that color them yellow, brown, or purple.

Various seaweeds anchor to rocks, drying up when the tide goes out and swelling like gelatin on the water's return. Others, moored to the bottom with pseudo-roots from which they obtain no nourishment, grow in "forests," the longest plants stretching 150 feet. Some assume narrow, tapelike shapes lest they be torn by heavy waves.

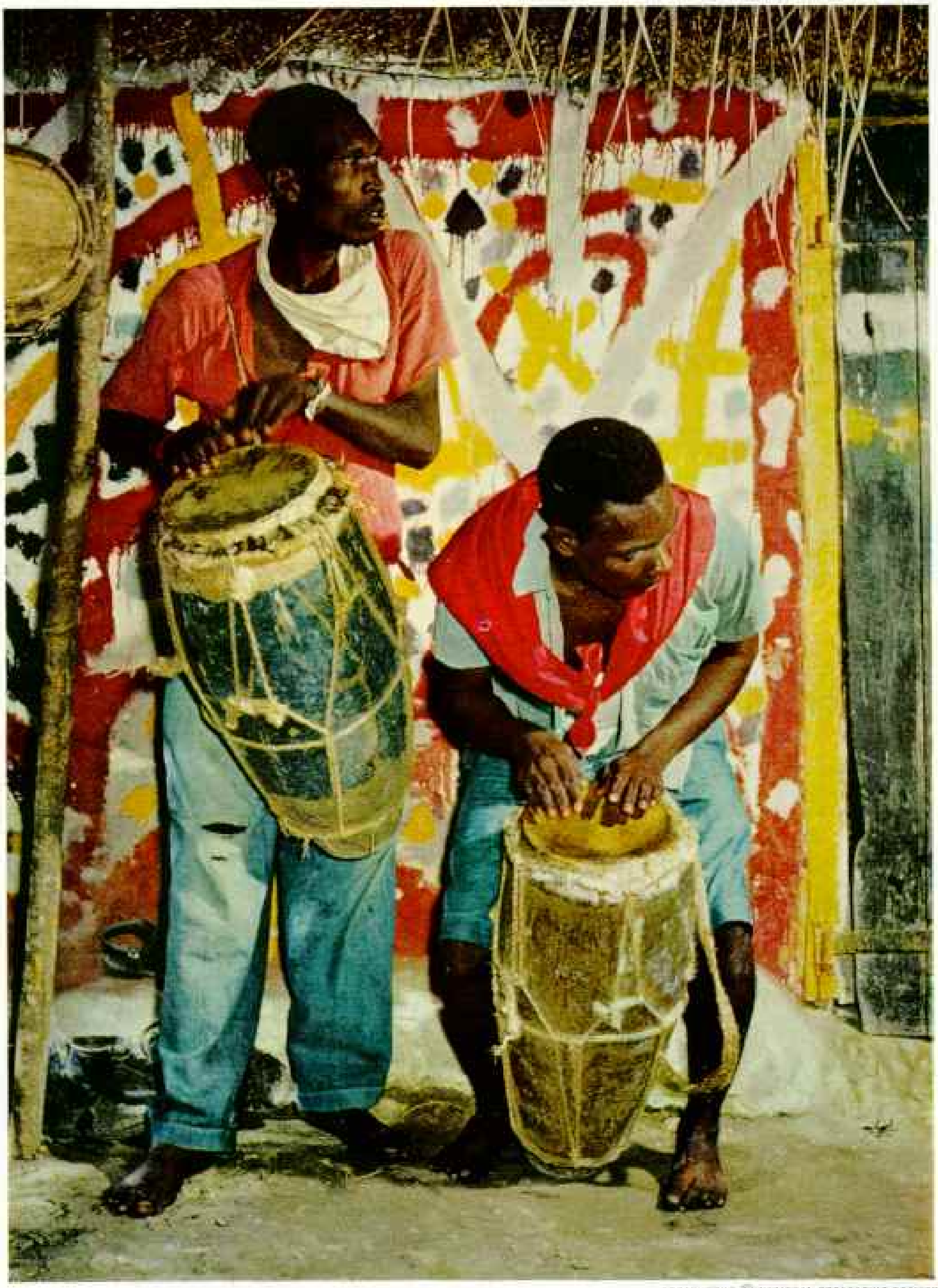
Many varieties of kelp lift their fronds to the sunlit surface by means of bulbous floats. Kelp, as some of the larger varieties of seaweed are called, contributes fertilizer and iodine to man. Makers of soap, ice cream, tooth paste, candy, and dental impressions use other seaweed products.

Here the author's children, Eda Kristin and Paul, gather kelp near Brookings, Oregon.

Inch-long baby flying fish swim among the berried branches of sargassum, a floating seaweed concentrated by winds and currents in the Atlantic's Sargasso Sea. Acre-sized patches teem with life: plankton, the spawn of the Atlantic's fresh-water eels, and grotesque fish that crawl the sargassum on finny arms.

Haiti—West Africa

Undaunted by staggering problems, the Caribbean's Creole



KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

in the West Indies

republic fights for a place in the New World sun

ARTICLE AND PHOTOGRAPHS BY JOHN SCOFIELD
Assistant Editor, NATIONAL GEOGRAPHIC

AS I STEPPED with my family from a gleaming four-motored plane onto Port au Prince's sunny Bowen Field, the sound of drums throbbed faintly from a distant hill.

In a customs building gay with murals painted by the famed primitive artists of Haiti, we moved up to have our papers stamped. Still the faraway drums boomed. I wondered aloud to my wife if the sinister voodoo of this Negro republic was really greeting us in broad daylight on a cloudless spring afternoon.

A customs inspector overheard me. "That's not voodoo," he said, and laughed tolerantly. His English carried a soft accent of France. "There's a *combite*, a community work fest, out there somewhere. Farmers have gathered to help a neighbor build a house. The drumbeats mark the rhythm of their songs."

Lizards Lurk in Orchid Fronds

The teeming capital of Haiti lay ten minutes away; a taxi carried us over rutted streets awash with bright-garbed figures and ambling, laden donkeys. Smiling Ethel Kenter, who was a National Geographic Society secretary before becoming the wife of an Anglo-Swiss innkeeper, welcomed us to Port au Prince.

"Here is your room," she greeted, "and this is your nursemaid." Senata, shy and gentle, whisked our daughter off to a garden redolent of breadfruit and banana, mango and almond, and gay with parrots and green lizards that fled to safety in the drooping fronds of orchid plants. There, for a month, while we explored the hills and valleys of Haiti, Sally basked in Senata's devoted care.

French in outlook and almost wholly Negro, Haiti shares the 400-mile-long island of Hispaniola with the Spanish-speaking Dominican Republic (map, page 235). Most densely populated nation in the Americas, Haiti is also the poorest; a per capita income of less than $70 a year condemns most of its 3½ million people to lives of grinding poverty. In the past decade drought, tangled politics, saturated world markets, and a disastrous hurricane have plunged the nation into bankruptcy.

But Haitians have not lost heart. In what was France's wealthiest colony until its slaves rose against their masters and in 1804 declared themselves free, restless energy survives amid the poverty, and there is a desperate eagerness to catch up with the rest of the world.

We talked with young men whose eyes sparkled as they discussed plans to wipe out the illiteracy that springs from having school facilities for only one Haitian in 15. Soil chemists told us how a great new dam was changing the face of the land by irrigating thousands of acres of arid, salt-cursed soil.

In an eroded, overpopulated valley we saw how 20th-century medicine has come to a people who had lived for generations without doctors. And officials administering the United States Point 4 aid program told of a broad redevelopment plan they hope will revitalize Cap Haïtien, the somnolent old capital of French colonial days.

Despite these omens of impending change, Haiti remains "unspoiled." An air of gentle decay lingers over the ornate wooden houses and sun-bright pavements of Port au Prince. Foot traffic flows in the streets to avoid open drains that

Throbbing drums call Haitians to a voodoo temple near Mont Rouis

CITADELLE

slice through sidewalks at breakneck intervals. Women in bright bandannas sit behind toy-sized, hand-powered sewing machines, waiting patiently for a tear to mend or a dress to make on the spot.

Around the Iron Market flows the endlessly varied commerce of a tropical city (opposite). What look at a distance like flag-draped figures turn out to be lithe Negresses peddling lengths of "African" dress material imported from the mills of eastern Europe. Others actually peddle flags—lengths of out-of-date 48- and 49-star United States banners that their customers turn into chic red-white-and-blue outfits. All of it is sold by the *aune* of 47 inches, an old French measure that survives only here and in Switzerland and Belgium.

Human heads carry most of the country's burdens; we watched fascinated as a powerful Negro strode across our path, jauntily erect under the weight of a six-foot caterpillar of nested iron cooking pots.

Taxi drivers, their vehicles identified by fluttering bits of red cloth, race madly, then coast with ignition cut to save expensive gasoline; for a *gourde*—two United States dimes—one can ride anywhere in the busy capital. Sun glints on silvery metal as smiths hammer householders' lamps from tin cans. Sound rockets from hard-backed brushes smacked against polish-laden boxes; thus do shoeshine boys attract their customers.

Poisonous Root Yields Tasty Bread

The republic offers exciting adventures in eating. One night Audrey and I ate green-turtle steaks steeped in wine while Haiti's great drummer, Ti Roro, played for us on an instrument of goatskin stretched over a hollowed log.

Gourmet treats abound: lobster tails drenched in a sauce of flaming brandy; tiny spiced shrimp with heads and legs attached; conch, fried and peppery hot; and the fabulous heart of palm salad that can be served only by killing a stately tree.

In a noisy village market place we sampled

Cupolas on the Iron Market Lend an Air of India to Port au Prince

In two block-long wings built of sheet iron, shoppers find everything from parrots to tin-can chandeliers, from red beans to bobby pins. The structure rose in 1889, during the administration of President Florvil Hyppolite.

Crying "Eskimo! Eskimo!" an ice-cream vendor pushes past the crowd. Concrete stalls have recently replaced the open-air shanties.

Haiti, the populous and impoverished black republic of the Americas, blends Parisian sophistication with African folkways. Three and a half million people dwell in a land only slightly larger than Vermont. Their average income is less than $70 a year. On January 1 they celebrated their country's 157th year of independence.

Diver Jean Coicou plucks a feathery sea plume from Sand Cay, a marine garden in the Gulf of Gonâve.

flat, faintly sour disks of bread made from bitter cassava. A staple in tropical regions, the fresh root contains poisonous hydrocyanic acid, and must be shredded and washed before cooking.

Another evening, with the lights of Port au Prince winking 1,600 feet below the dining veranda of mountain-girt Hotel Ibo Lélé, we feasted on wild duck with a dressing of olives. Host André Roosevelt, a cousin of President Theodore Roosevelt, talked of his years spent in idyllic Bali. He spoke, too, of plans for a great resort hotel on Haiti's undeveloped north coast.

"There are miles of beaches there," he told us enthusiastically. Later we flew from Cap Haïtien to Port de Paix in a trim Haitian Air Force plane; beneath us lay one ribbon after another of creamy surf and shining sand unmarked by human feet.

Wonderland Lies Beneath the Surface

Friends had warned us that swimming prospects were poor in the Haitian capital. The palm-fringed shore of beachless Port au Prince is malodorous with refuse. "But take a suit along," they advised. "You'll want to see the reef with Doc Coicou."

The reef turned out to be Sand Cay, site of spectacular marine gardens first explored by naturalist William Beebe. Three miles out on the sparkling waters of the Gulf of Gonâve, Jean Coicou, physician son of an elite Haitian family, casually jumped overboard. In clear West Indian water, three feet and thirty feet look alike; the flippered and goggled doctor called to us from a depth that barely reached his middle (page 229).

"This is Sand Cay," he announced. "Everybody overboard."

Masked and breathing face down through snorkels that projected above the water, we sprawled lazily on inflated inner tubes; beneath us, shimmering in midday light, a faery world danced with the surface's every ripple. Purple sea plumes as high as a man waved beside massive heads of brain coral. The doctor shredded sea urchins into morsels to attract the rainbow reef dwellers.

In his love for the sea, Dr. Coicou is an exception; most Haitians, like their African forebears, seem happiest on dry land. Rickety sloops venture a few miles from shore with the morning trade wind and beat for home when the breeze turns. Catches are meager: a handful of green or orange pan fish, or perhaps half a dozen spiny lobsters.

Creole Pronunciation Fools a Visitor

Back in Port au Prince we hailed one of the converted half-ton trucks that serve as buses. Above its windshield was lettered *Bon Dieu Bon*—"the Good Lord is Good"—and the destination: Carrefour.

A destination painted on a Haitian bus guarantees nothing. When quitting time comes, the driver may turn toward his home, and apologize after he gets you there.

"Carrefour?" I asked, to be sure. The driver was plainly puzzled. "*Car-re-four.*" I pronounced every syllable. His blank face told me I was getting nowhere. I pointed to the word above the windshield.

"Ah, *Kahl-foo!*" he shouted.

I squeezed onto a back seat already laden with Haitians, chickens, bundles, and a trussed pig.

Haitian Creole, I learned, is no dish for the novice with a smattering of high-school French. The language, etymologists say, is three-quarters Norman French, brought to the island by buccaneers 300 years ago. Add to this a few words of modern French, some Spanish, and a little English, season it with Carib Indian and a hint of African, slur it with the softening influence of the tropics, and let the mixture age; you will have the popular language of 20th-century Haiti.

The island's 18th-century historian, Moreau de Saint-Méry, recorded one of the most

(Continued on page 234)

The Author: Assistant editor John Scofield will be remembered for articles on subjects as diverse as a new volcano in the Azores, Guatemalan Indians, and the divided city of Jerusalem. In future issues he will take readers to the Philippine Islands and the energetic new State of Israel.

Cardboard Horns and Ears Sprout From a Mardi Gras Devil's Cotton Toupee

During Port au Prince's pre-Lenten carnival, work ceases for three days while merrymakers frolic in the streets. Most masqueraders concoct wildly imaginative creations. Only the eyes and lips of this reveler escape grease paint and charcoal. Nose ring, waist chains, and a necklace of wooden beads complete his ensemble.

Sorters Pluck Imperfect Beans From Mounds of Fresh Green Coffee

Coffee ranks as Haiti's major money crop. Most of the beans grow wild on mountain slopes. Picking only a few baskets at a time, farmers trudge down from the hills to sell their crops. Some Haitian coffee, unroasted and unwashed, goes to

the United States, where it is used principally for blending. In recent years a scarcity of food and its high cost have forced landowners to convert some of the finest coffee-growing slopes to vegetable gardens. These women work long hours for little pay. They keep alert for spoiled beans and pebbles that growers sometimes toss into the bags to trick the scales.

Bright kerchiefs and patterned print dresses attest the Haitians' love of color.

amusing of Creole peculiarities. The slaves, he wrote, enrich their speech with imitations of sounds. If a man falls down lightly, they say of him: "*Li tomber bap,*"—"he falls down *bap.*" "*Li tomber boum!*" they say when one falls with a great crash.

Creole preserves a pungent store of proverbs. If work were a good thing, say the villagers, the rich would have grabbed it all long ago. Folk tales, too, spice the evenings. In storytelling sessions the teller asks: "*Cric?*" Listeners encourage him to begin by responding: "*Crac!*"

Ti Malice is a favorite figure in Haitian folk tales. One morning, they say, the king called for Ti Malice. "Tomorrow before I am awake," the ruler ordered, "I want you to milk all the chickens."

The next morning Ti Malice arrived late. The king became terribly angry.

"I am sure, sire," said Ti Malice, "you will forgive me when you hear of my troubles. This morning my grandfather was taken with labor pains. There was no midwife, and I myself had to deliver him of twins."

"Since when have grandfathers given birth to twins?" roared the king.

"Since chickens have given milk," said the crafty Malice. Listeners laugh at Ti Malice's misadventures as if they were hearing them for the first time instead of the hundredth.

Before we left the United States, friends

Shunning sidewalks, pedestrians flood Rue Macajoux in downtown Port au Prince. Automobiles vie with man-powered carts rolling on discarded tires. Radio towers and the Church of Our Lady of Perpetual Help crown the hilltop in the Bel Air district, the city's oldest quarter.

Haiti shares the island of Hispaniola with the Spanish-speaking Dominican Republic. Mountains blanket 80 percent of Haiti, whose Carib Indian name means "high land."

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KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Stony-faced Stares Helped Oust a President

Within the past decade a new method of revolt, the general strike, has proved its power in Haiti. Author Scofield, on a visit in 1957, arrived in Port au Prince in the midst of a demonstration against provisional President Joseph Nemours Pierre-Louis.

There was no rifle fire or bloodshed, Scofield reports. Shops closed. Gasoline stations locked their pumps. Everything on wheels quit running. Townfolk such as this chicken fancier stood and glared at the presidential palace (opposite).

"Thees strike ees a powerful thing," a soft-spoken Haitian told the author. "It ees the weapon of people who have no weapon."

Faced with the shutdown, Pierre-Louis resigned.

National Palace, modeled after the Petit Palais in Paris, houses executive offices and the president's private apartments. Built by a Haitian architect, it also serves as storehouse for the bulk of Haiti's munitions. One chief executive died in an explosion that destroyed an earlier structure on the site. Automobile headlights at twilight streak this time exposure.

pressed one bit of advice on us: "Whatever else you do," they said, "bring back a Haitian painting. You can buy them right off the easel. De Witt Peters is the man to see."

Peters, we learned, went to Haiti from the United States in 1943 to teach English. An artist himself, Peters quickly found his interest shifting to problems other than scholastic: Why, he wondered, have the rich colors and shimmering seas of Haiti inspired so few painters? After six months of teaching, Peters resigned; boldly he set up an art center in a building located, appropriately enough, on the capital's Street of the Revolution.

Art Fresh From the Easel

The American's sympathetic attitude paid off. Talented but untaught amateurs seemed to pop from the very hills and streets.

"All they needed was encouragement," Peters told me when I visited him at the art center. "Truck drivers, schoolboys, servants —everybody, it seemed, wanted to paint."

Today their powerful pictures, created as if seen through the straightforward eyes of children, hang in museums and private collections on both sides of the Atlantic.

As we talked, a painting on the wall behind Peters caught my eye again and again. An angel, blue-robed, swung mystically in space; around her swirled flowering branches that filled every spare inch of the canvas.

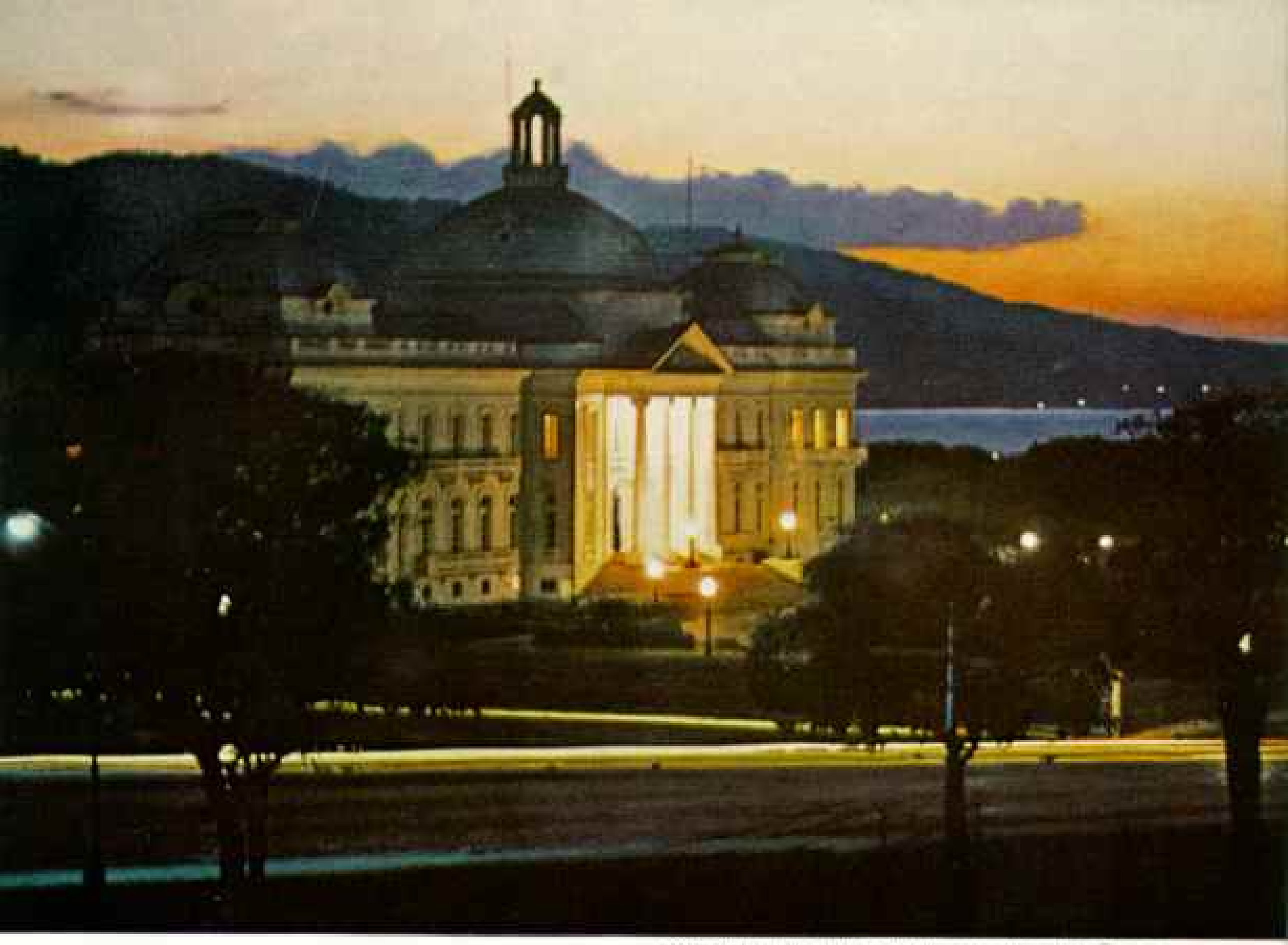
"That is one of the most important pictures ever produced by a Haitian artist," Peters explained. Then he told us the story of the blue angel.

As Peters drove through the little village of Mont Rouis one day in 1945, his eye was struck by a flash of color. Garish soft-drink signs fought for space alongside wooden doors on which were painted birds and flowers; it was obvious to Peters that the doors had been painted by someone who knew what he was doing. A sign thrust out from the restaurant's rickety front to announce prophetically, *Ici la Renaissance:* Here is the Rebirth.

The artist, Peters learned, was a voodoo priest and house painter named Hector Hyppolite, who occasionally turned to more artistic endeavors with cans of furniture enamel and brushes of chicken feathers.

Months passed before Peters met the mysterious Hyppolite. He found him in St. Marc, ill, penniless, and attempting to support a wife and two hungry children.

Hyppolite sold a picture to Peters, and accepted a gift of painting materials. In a few days he appeared at Peters's art center



ROCKEFELLER BY JOHN SCOFIELD, NATIONAL GEOGRAPHIC STAFF © N.G.S.

with a bundle containing 16 more paintings. In a dream, he said, he had been told to paint that many; a man from across the sea would buy five of them.

Here coincidence took a hand in shaping Hyppolite's career. French author André Breton, visiting Haiti, bought five paintings at $8 each. "These should revolutionize French art," he is reported to have said.

Strange Materials Serve as Canvases

Hyppolite moved to Port au Prince and set himself up in a palm-thatched hut; a sign proclaimed "Painting Station Here." Asking permission of the voodoo spirits to suspend his activities as a priest, and unmoved by the fame that brought visitors almost daily to his dirt-floored *caille*, Hyppolite worked steadily. When he died three years later, his paintings had already found their way into collections on two continents.

Hyppolite's emergence was no isolated affair. All over Haiti artists seemed to be lying dormant, waiting for De Witt Peters's sympathetic interest and his gift of painting materials. Micius Stephane, a cobbler, painted at first on the backs of old Standard Oil Company calendars. Louverture Poisson, for one of whose works four museums once competed, began his career by painting on discarded photographic film. Castera Bazile came to the art center as Peters's $30-a-month houseboy. His art paid so well that a few years later he was able to withdraw $2,000 from his bank to buy a house (page 241).

Curiously, the popular art movement, with its overtones of voodoo and black magic, reached its pinnacle in a church. An American woman suggested a series of murals for Port au Prince's Episcopal Cathedral. Bishop C. Alfred Voegeli went to American friends for help, put a new roof on the building, and told Peters to go ahead.

Today the airy cathedral glows with color (page 240). Philomé Obin's reverent Crucifixion dominates the altar. Praying each morning before taking up his brush, the 61-year-old dean of the island's primitive artists depicted Calvary as taking place on a Haitian street. Castera Bazile's Ascension soars above a street where a ball game is in progress.

Vandals smeared oil on 20-year-old Wilson Bigaud's unfinished mural of the Marriage in Cana. The young artist repaired the damage and added to his composition the words *Malgré Tout*,—"In Spite of Everything." In Bigaud's bright vision, a wedding guest rests in a rocking chair, a policeman pursues a

238 Hill woman, clad in homespun cotton, pauses for a smoke on a farm-to-market hike

chicken thief in a corner of the crowded painting. Homely details of brown faces and village life give the Bible's age-old stories a new appeal for the bishop's dark parishioners.

But not every Haitian artist has been as successful as the creators of the cathedral's stunning murals. Teen-ager Roger Christophe, who painted the vibrant picture on page 242, has since forsaken art for the more predictable pay of a job in a metal shop.

No. 1 Problem—Too Many People

A Haitian friend wanted us to get out into the country. "Port au Prince isn't all of Haiti," he warned. "I'll pick you up tomorrow morning at eight."

Next day, as we drove north, the sickly-sweet smell of cane juice hung in the air. It was harvest season. Hard-looking clouds hid distant mountains; by midafternoon they would slide from their craggy perches and drench Port au Prince.

A few miles on, we stopped at the government's Damiens Experimental Farm.

"Our country is too small for so many people," a government agriculturist told us. "In the Artibonite Valley some families get along with less than one-fortieth of an acre of productive land. We have had to put Haitian agriculture back where it was 170 years ago."

"Back?" I asked, surprised.

"Perhaps this will tell you why," he said, and read from a paper on his desk. "As a French colony, Saint Domingue in one year sent from its docks more than 160 million pounds of sugar; by 1825 revolution and neglect had dropped exports to one ton! Now we are up again to about 130 million pounds."

Coffee, which grows wild in many parts of the island, is the major export (page 232). In 1791 Haiti sent out 68 million pounds; tonnage shrank during the troubled 19th century, but rose again during the 20th. Then drought took a hand, tumbling exports. Economic chaos came in the wake of the collapse.

Indigo, a blue dye highly valued in 18th-century Europe, was, next to sugar and cotton, the mainstay of colonial Saint Domingue's economy. But, as free men, the untrained Haitians let the plantations go to ruin. In recent decades sisal has filled the gap; though world prices have dropped, it still ranks as Haiti's second crop.

Other exports include cotton, cacao, and mahogany ware. Natural rubber may someday aid the economy if experimental plantings in Haiti's wild, isolated southwest continue to pay off. And the banana industry, vital to so many tropical lands, is slowly recovering from the neglect and disease that threatened its existence a few years ago.

Rivers and ponds may one day enrich the island's protein-poor diet. In a pool at Damiens I saw eight-pound carp whose ancestors had been spawned beside the Sea of Galilee.

The new State of Israel, with a problem similar to Haiti's—poor land and a lot of people—found pond-raised fish a cheap and nutritious substitute for meat. To try the idea on this side of the Atlantic, the United Nations Food and Agriculture Organization sent an Israeli fish expert to Haiti. Shortly after, baby carp arrived.

"We have also introduced *Tilapia*, a small food fish with unusual breeding habits," an official at Damiens told us. "The male incubates the eggs in his mouth. Then, after the eggs have hatched, the young continue to shelter there until they can fend for themselves.

"Already," he continued, "farmers are taking up the idea of raising fish, and both carp and tilapia are appearing in village markets."

New Dam Brings New Hope

From Damiens we turned inland toward Peligre, to see a miracle in progress.

Until recently the precipitous Artibonite River snaked seaward through a dry, eroded valley (map, page 235). A raging torrent during the rainy season, when tons of precious topsoil were carried away, it shrank during the dry season to a dismal trickle.

Government soil chemist Arnold Haspil told me about the Artibonite Project—Haiti's equivalent of the U. S. Tennessee Valley development—as we twisted over dizzying heights toward Mirebalais.

"In French colonial times," Haspil said, "the Artibonite was one of the world's wealthiest valleys. Then through neglect it became a wasted, eroded area from which 100,000 people tried to scratch a bare existence."

Higher and higher we climbed into Haiti's mountains, to stop finally beside a dam that towered 250 feet in a cleft in the valley. Behind it sparkled an enormous man-made lake.

Already some 55,000 valley acres are under year-round irrigation. Eventually the total may be 80,000. Someday a hydroelectric plant will provide 40,000 kilowatts of power; today all of Haiti has only 20,000.

"You can see," our guide commented, "why Haitians look on this project as something almost miraculous."

Downriver, we paused to watch the rhythmic rise and fall of primitive wooden paddles on wet cloth as countrywomen did their laundry. Then, a few miles farther on, the 20th century intruded again. Dozens of glossy ibises—locally called "rice birds"—rose from flooded fields as government agriculturist Victor Bastien showed us one of his country's most successful farming experiments.

"The lower Artibonite Valley has always been too salty for vegetables," the Columbia University graduate explained. "Fortunately, rice culture requires that the fields be flooded with fresh water; we are washing our soil, and at the same time adding a new export to Haiti's economy."

Second Miracle Comes to the Valley

As we neared the dusty coastal town of St. Marc, a sign we had been looking for directed us up a narrow, rutted side road. It said simply "Hôpital Albert Schweitzer."

A few hundred yards beyond sprawled a long, ultramodern building in which another 20th-century miracle—medicine—had come for the first time to the tragically poor and disease-ridden villagers of the Artibonite Valley. How this came about is one of the most heart-warming stories I have ever heard.

In 1947 William Larimer Mellon—Larry to his friends—was the owner of a string of successful Arizona cattle ranches. As a Gulf Oil Corporation heir and a grandnephew of financier Andrew Mellon, he had had a pleasant and secure childhood. He and his attractive wife Gwen, who shared his love for ranch life, were storybook ideals of a well-to-do American couple looking forward to many years of happy and productive life.

One day Mellon read a magazine article about Dr. Albert Schweitzer, who had given up an honored career as musician and theologian to establish a hospital in West Africa. Mellon and Schweitzer exchanged letters.

The Mellons sold their ranches and enrolled in Tulane University. Five years later he was a doctor, she a laboratory technician and nurse. Together they went to Haiti, where Mellon devoted most of his personal fortune to building a sparkling hospital in an overpopulated valley that had never even had a doctor (pages 246 and 247).

We had come on clinic day. On the concrete terrace stood Mrs. Mellon, surrounded by dozens of Haitians—some of them clutch-

Murals by Native Artists Picture Haiti as the Holy Land

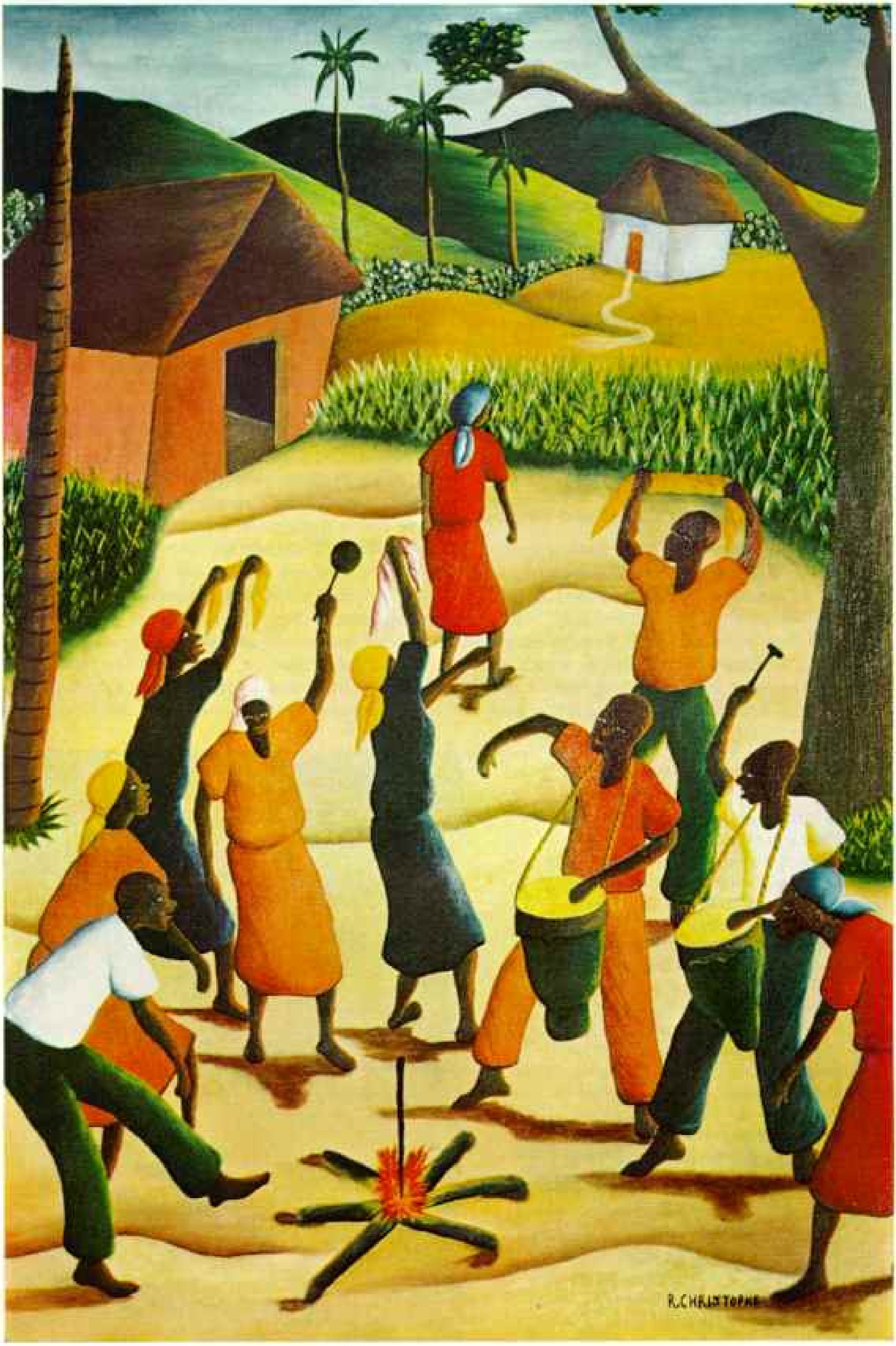
In 1950 the Episcopal Bishop of Haiti commissioned nine primitive painters to execute tempera murals on the walls of Holy Trinity Cathedral in Port au Prince.

Self-taught artists knelt before the altar and prayed for vision and skill. Then, mixing folklore with faith, they depicted Biblical characters as brightly garbed Haitians in tropical villages.

Altar pieces represent (left to right) the Nativity, Crucifixion, and Ascension. Angels drop blossoms from the sky.

School children with shamrock caps crowd pews for this Sunday morning service.

Home is his studio for Castera Razile, once a $10-a-month houseboy at the Port au Prince art center. He painted the Ascension mural at altar's right on page opposite.



ing sick babies in one hand and the reins of donkeys in the other. Patiently she interviewed the villagers in fluent Creole and routed them to examination rooms, dispensary, or admission office.

Inside I found Dr. Mellon gently examining a 10-year-old boy with the ugly lesions of leprosy on his cheek. He doled out a handful of sulfone pills to the boy's grateful mother.

"Fortunately," he said, "leprosy is among the least of our problems. It's easy to handle in this early stage, and there probably aren't a thousand cases in the republic."

Pigs and Mangoes Pay a Bill

Later, after the last of the day's 200 patients had been treated, I had a chance to talk at length with Dr. Mellon.

"Theoretically," he told me, "we charge bed patients $6 a day. But you can't expect even that much of a farmer who has scrimped two or three years to save $10.

"So they give us what they can. A few gourdes. A basket of mangoes. A chicken or some eggs. Sometimes a pig or a goat."

As the only source of medical care for a valley population of 250,000 people, the Albert Schweitzer Hospital must expect a yearly deficit of half a million dollars. So far, Dr. Mellon has paid most of that out of his own pocket. And yet, of the dozens of patients who clustered around Mrs. Mellon that morning, I saw none turned away. Somehow, they are all given a bed, or a packet of pills, or an appointment for another clinic day if their troubles could wait.

As we said our goodbyes, I asked Dr. Mellon if one of his nurses could give an inoculation; I had left Washington before I could complete a series of shots.

Dr. Mellon called in a petite Danish nurse who had served for months in this relatively isolated hospital, with only an occasional visit to Port au Prince to break the monotony. Now she paused, hypodermic needle in hand.

"You can't imagine," she said, "how strange it seems to see a white arm!"

Back in town that evening, I tried to telephone Harry W. Yoe, who directed United States Point 4 operations in Haiti. As I dialed for the sixth time, a Haitian acquaintance looked at me slyly.

"There's a standing joke here that you can't get your party unless you know which wrong number to call," he laughed. Port au Prince has one of the earliest dial systems still in use. When a downpour drenches the lines, it is almost impossible to get through.

Eventually I spent a morning with Mr. Yoe, learning what the United States is doing to help its island neighbor.

"It seems hardhearted," he remarked, "not simply to ship tons and tons of food down here. But we know—and the Haitians know—that such a program, carried out to the exclusion of developmental aid, would be a short-term help, but a long-term disservice.

"We're trying to do things that will bring lasting benefit to the country," he went on. "In Cap Haïtien, for instance, we have started a development plan that should boost the whole economy. New roads, agricultural experiment centers, trained administrators will all help to attract outside investors.

"Already, the West India Fruit and Steamship Company has planted 1,200 acres of bananas near Cap Haïtien, and expects to plant 1,800 more. Haiti also is exporting winter tomatoes from the same region; not long ago on an experimental plot we harvested 33 tons per acre."

A Bull Is a Bull to Villagers

On an earlier visit to Haiti, I had talked with agricultural expert John R. Beasley about other Point 4 operations.

"One of the gravest problems has been that of usury," he told me. "Moneylenders in the towns charge what the traffic will bear: as much as 20 percent a month.

"In the past few years we have helped set up dozens of local credit unions—people's banks, really—where the villagers can borrow at a reasonable rate.

"I just came back from the opening celebration for one at Trou du Nord. You know," he said, "the people really felt that we had done something for them. Out there, a hun-

Voodoo Dancers Sway and Chant: a Haitian Primitive Painting

Roger Christophe, a teen-age schoolboy, created this magical scene and exhibited it at the Centre d'Art, Port au Prince. The young artist has since given up painting for a job in a metal shop. His canvas, which sold for about $20, depicts a village ceremony performed at Christmastime. When the rites reach a climax, participants lift the iron bar from the flames and dance with it in their mouths.

dred miles from nowhere, the villagers see about $25 cash in a year; even so, they served champagne to show their appreciation!"

Beasley told me, too, about a Point 4 attempt to improve the bloodlines of Haitian cattle. A man took a fine Brahman bull through the countryside. But a bull was a bull to the hill people; they refused to pay $1 as stud fee when they could breed to a local animal for nothing.

"We haven't given them enough education along with the bull," was Beasley's wry comment.

A few mornings later I started out again to see Cap Haïtien and the Citadel, star attraction of the no-longer-isolated north coast. With me rode Robert A. Wilson of Dowagiac, Michigan, an ex-Marine who had stayed in Haiti during the first three critical years of United States control.

As we drove, Wilson reminisced about the occupation. "Just before we Marines came ashore in 1915, a mob dragged President Vilbrun Guillaume Sam from the French Legation and tore him limb from limb. A woman, they say, paraded through the streets carrying his head on a pole."

"What turned people against him?" I asked.

"After taking office, Sam rounded up every political opponent he could get his hands on. In a moment of panic, Sam's officers slaughtered 167 of them. The woman who carried Sam's head had lost a son in the massacre."

President Sam's immediate predecessors fared little better. Revolutions accounted for 14; one was poisoned; another was blown up in his palace. Then, in Sam's regime, the situation hit rock bottom. U. S. Marines swarmed ashore to restore order, and a year later the two nations signed a treaty by which the United States undertook to help Haiti.

The occupation lasted 19 years. But during Herbert Hoover's Administration the United States awoke to the realization that Haitians, independent since 1804, wanted to solve their problems as free men. Gradually

Mill-bound Sugar Cane Rides Oxcarts and Cage Cars

Eighteenth-century Haiti, then known as Saint Domingue, was France's proudest colony. In one year it exported more than 160,000,000 pounds of sugar. To till the plantations, owners populated Haiti's productive plains with slaves from Africa.

Sugar still bulks large in the republic's economy. Laborers cut cane stalks into pieces, bind the bundles with leaves, and transport them on oxcarts to cage-sided rail cars for shipment to refinery or rum distillery.

Sugar cane fields checkerboard the Arcahaie Plain. Green squares hold ripening cane; fallow ones await a new crop. A small rum distillery flanks the highway. This aerial view looks toward the Gulf of Gonâve.

KODACHROME BY JOHN SCOFIELD, NATIONAL GEOGRAPHIC STAFF © N.G.S.

KR KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Sobbing and afraid, a 12-year-old faces a doctor for the first time in her life. She is one of hundreds who have come on clinic day by foot, burro, and bus to the Albert Schweitzer Hospital in Deschapelles. Her sympathetic comforter is Gwen Grant Mellon, cofounder of the hospital that she and her husband, William Larimer Mellon (opposite), built with their own funds (page 241).

controls were lifted, and in August, 1934, the Marines were withdrawn.

President Franklin D. Roosevelt, arriving shortly afterward on a goodwill visit, found the nation functioning peacefully under its own civil servants, policed by a small but efficient gendarmerie, and with a growing awareness of its needs in the fields of health, economics, and sanitation.

Now we were in Gonaïves. Instead of the dusty lanes I expected, we saw wide paved streets. A modern cathedral soared above a green park and trim rows of workers' houses.

Wilson, I noticed, was shaking his head in wonder. "Forty years ago," he said, "Gonaïves had the reputation of being the dirtiest, dustiest town in Haiti. Ramshackle houses and baked dirt."

Beyond Gonaïves we began to climb; in one dizzying ascent after another our car mounted the spine that divides the island's north and south. The country changed. Parched scrub gave way to hillsides clothed with the lush green of banana leaves.

At a settlement high in the hills we felt ourselves transported to Africa. In the shade of a thatched hut men rhythmically lifted clublike pestles and drove them into the depression of a huge tree-trunk mortar. They were crushing millet for the evening meal, just as it has been done in Africa since the childhood of agriculture.

Drum and Shell Sound an Invitation

Beyond mountain-girt Limbé, where the highway is a muddy track pressed between green hills, a babel of voices flooded the air. A few yards from the road men and women heaved on massive timbers in cadence with the tooting of a conch-shell trumpet and the compelling thumps of a drum.

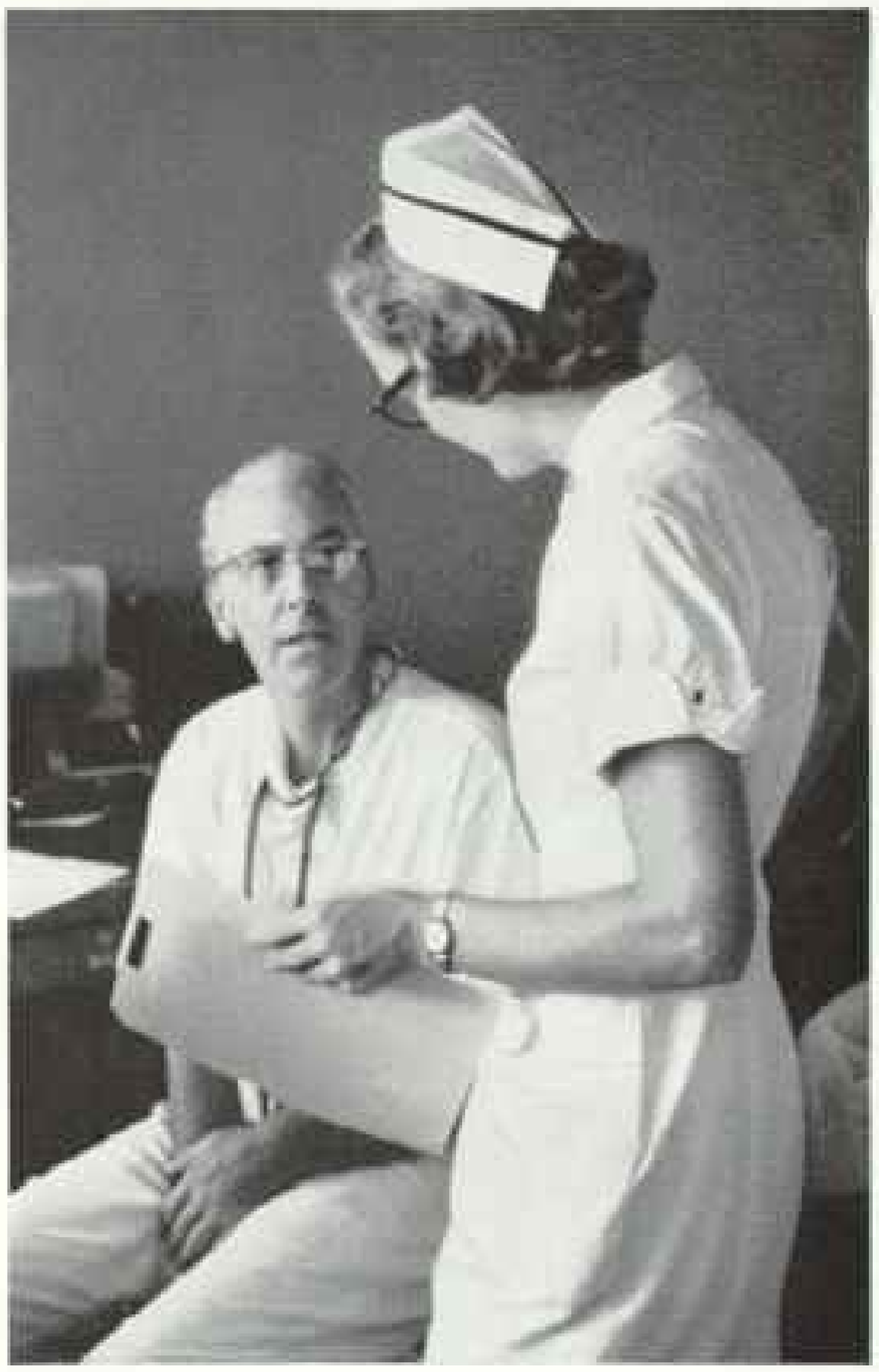
This was a combite; I remembered the drumbeats of another of these community house-raising parties near Port au Prince the day we arrived. Here was pure Africa again; Haiti's combite is a direct descendant of the *dokpwe*, by which the people of faraway Dahomey, in West Africa, share the labor of clearing fields and erecting houses.

Gleaming with perspiration, the trumpeter shouted happily: *"Bon jou', blanc"*—"Good day, white man." Between blasts of the conch he sang in liquid Creole; villagers dropped timbers and tools to listen.

"He's making up verses about you," our English-speaking driver laughed. "You should take off that fancy shirt and join them; they'll feed you if you are a good worker." We stopped to chat, and then drove away with the happy blare of drum and trumpet dinning in our ears.

Near Cap Haïtien a monument loomed on a cactus-grown knoll. This was Vertières, site of Haiti's last battle for independence. Here in 1803 Jean Jacques Dessalines decisively whipped Napoleon's veteran General Rochambeau. And here, too, the French general stopped the battle when the horse of Haitian brigade commander Capoix was killed; Rochambeau, they say, sent his own mount to the unhorsed Negro, then resumed the hopeless attempt to save Haiti for France.

Next morning we toured the old capital of Saint Domingue. Historically, Cap Haïtien is one of the richest areas in the Americas. Here on Christmas morning of 1492 Columbus's *Santa Maria* went aground; near by rose La Navidad, where the navigator left 40 men to establish the first European settlement in the New World. Later around this colonial



Dr. Mellon sold his Arizona cattle ranches and enrolled in medical school at the age of 39. Seven years later, in 1956, he opened a hospital to the 250,000 people of Haiti's disease-ridden Artibonite Valley.

city occurred many of the events of Haiti's war for independence. I asked if any relics of those days had come to light during the government's modernization campaign.

"Not exactly," a Capois explained. "I'm afraid we didn't have time for historical research. But now and then the dredge that was used to deepen our port picked up an old cannonball; you could hear it a mile away when it went through the pump! And a few years ago Edwin Link brought his research vessel *Sea Diver I* here and found what may have been an anchor of the *Santa Maria*.

"There's a sequel to the story," he went on. "The Haitian Government, you know, put $7,000,000 into the restoration of Cap Haïtien—not an enormous sum by your standards, but a lot for a small nation.

"Shortly after the project started, residents caught the fever. Without being prompted, they put on a clean-up campaign; homes were repaired and repainted by everyone who could afford it. People spruced up; children even stopped dropping trash on the streets.

Pans of sea water evaporating into salt tile the Artibonite delta near Grande Saline;

"Now that the road between Cap Haïtien and Port au Prince is passable all year round, there is even talk of completing a jeep trail up there." He aimed a forefinger toward a pair of blunt peaks; on one, the "Bishop's Cap," 3,000 feet above sea level and 13 miles away, a huge structure was visible.

This fortress, which Haitians proudly refer to as the eighth wonder of the world, was what we had come to Cap Haïtien to see. Islanders say—and I, for one, can believe them—that thousands of men, women, and children toiled for 13 years to build it, and that 20,000 died before it was completed. For sheer bulk of accomplishment, only Egypt's Pyramids have impressed me as deeply as did this crumbling monument of a Negro king.

We gathered in the village of Milot early next morning for the long climb to Henri Christophe's Citadel.

A few steps from our starting point lay the ruined palace of Sans Souci; here the onetime waiter created a Negro nobility, complete with a Count of Limonade and a Duke of

a coastal sloop under full sail beats slowly northward in the Gulf of Gonâve

Marmelade. And here in October of 1820, paralyzed and fearful, his land seething with revolt, he ended his own life—with a bullet of solid silver, our guide solemnly declared.

Neglect and tropical decay have robbed Sans Souci of much of its splendor, though the great stairway still echoes to the sound of well-shod feet as visitors from other lands explore the tottering hulk. A worn marble statue stares blankly at what was once a garden. And beneath crumbling floors lies Sans Souci's "air-conditioning" system: channels through which Henri's architects diverted the cooling waters of a mountain stream.

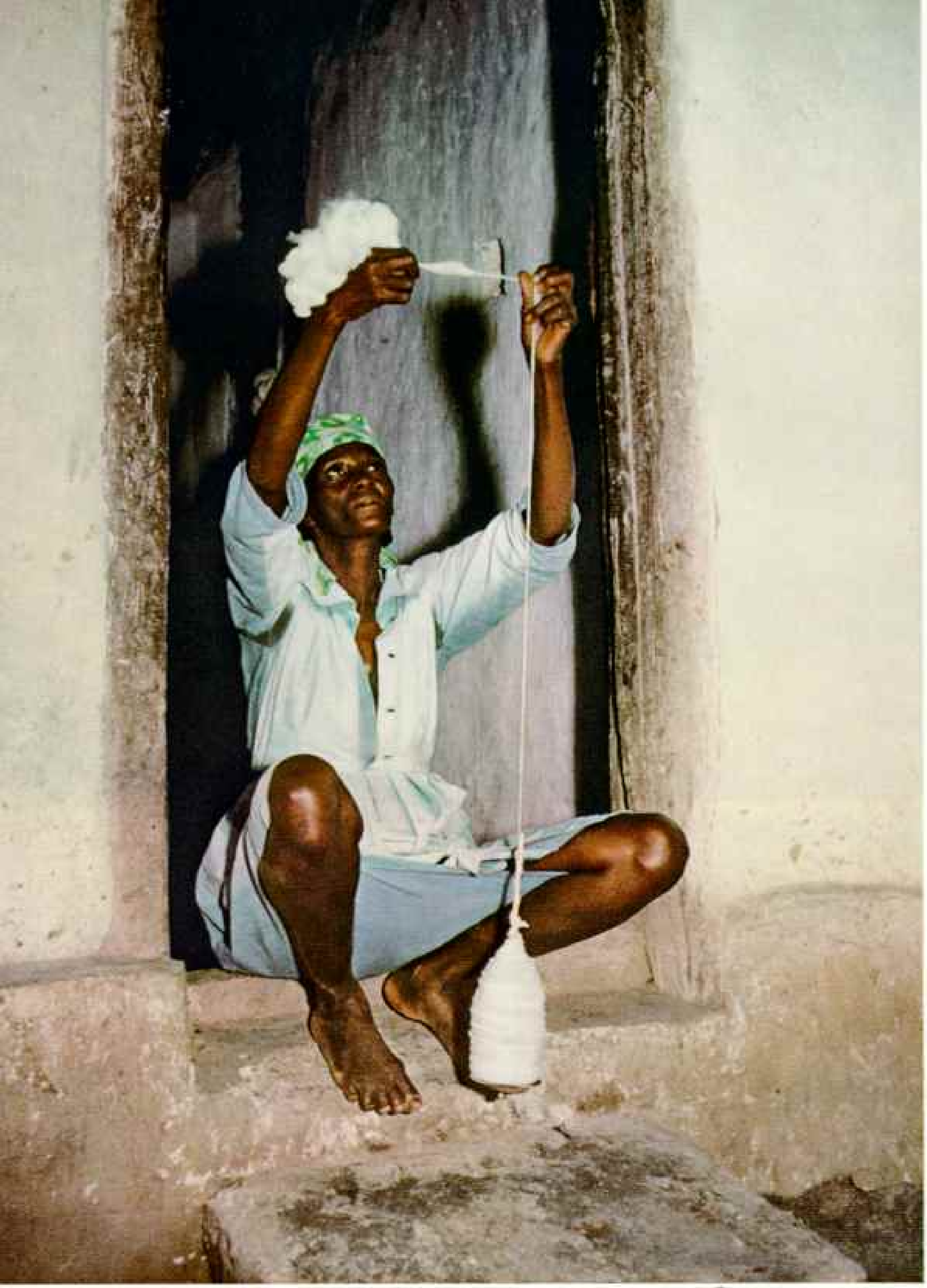
As we stopped beneath the venerable "justice tree" that shaded the monarch's open-air court, I recalled some of the stories Haitians tell about their first king.

Once, Haitians say, Christophe wanted to impress an emissary of George III with the strength of his army. He set up a review at Sans Souci; all day long one unit after another, each with its distinctive uniform, marched past. What the British king's representative did not know, Haitians tell you with a chuckle, was that the same men were marching to and from a near-by barracks, changing uniforms each time they disappeared from sight.

And once the monarch demonstrated the discipline of his troops by marching a platoon toward a dizzying parapet of the Citadel. Not a man flinched, goes the story, as they stepped to their deaths below.

Seed corn dangles from a rat-proof frame in a hill village near St. Raphaël. Though members of the farm family may go hungry, they would not dream of jeopardizing next year's crop by touching the ears. Squatting in the yard, the wife winnows sorghum, a staple grain that Haitians call *pitì-mi*. Girl by the doorside of this thatched hut pounds grain in a log mortar.

Snowy sisal, strung on wires to bleach and dry, stripes a field on the Cabaret plain north of Port au Prince. Machines with heavy metal rollers crush spikes of the pulpy plant, a species of agave, leaving yard-long threads of strong fiber. Sisal is Haiti's second most important export; most of it goes to manufacturers in the United States for making rope and binder twine.



KOJACHROME © NATIONAL GEOGRAPHIC SOCIETY

Spinning on her doorstep, where she can watch activities in the village street, a woman on Cabrit (Goat) Mountain makes yarn from tufts of cotton. Rugmakers will use the thread, which is too coarse for clothing. Cotton grows untended in many Haitian dooryards.

But Christophe, I found, had redeeming qualities, too—and Haitians are coming to appreciate them.

"Men call him a tyrant," an acquaintance told me, "but they are not entirely fair. Even today we have not caught up with the prosperity of northern Haiti as Christophe developed it a century and a half ago."

By creating a nobility on the European model, the crafty ruler stimulated new appetites in his people and drove them to improve their standards of living. Illiterate, he hired secretaries to read to him, and invited to his court European men of science.

To encourage honesty, Christophe had small valuables planted in villages and along roads; if a finder failed to report his windfall, punishment was swift and severe.

The king disliked careless dressing; his example survives in ordinances requiring the wearing of shoes in the principal cities.

Bishop's Cap Reveals Its Bounty

Beyond Sans Souci we turned toward the crown of the Bishop's Cap. The stony trail coils through a forest where tropical fruits grow in prodigal abundance. Dashing into the brush time after time, a barefoot youngster tirelessly brought me samples of the mountains' bounty: bananas, wild coffee, breadfruit, orchids.

Up these very slopes, sweating gangs of conscripts had hauled hundreds of huge cannon. When they faltered, so the stories say, Christophe would order a man killed; the rest, spurred by this stark lesson, would resume the desperate upward struggle. If they slowed again, another man was killed.

Forest walls pressed close as our horses groped skyward. Then, suddenly, the Citadel towered over us.

The king's huge, lonely fortress dwarfs its makers; men shrink to toys in the lee of its soaring prow. Veils of cloud drift through empty galleries; ranks of cannon and thousands of iron projectiles lie corroded and useless in its magazines (pages 254 and 255).

Ironically, the Citadel remains untested, its cannon unfired. Napoleon's armies never came back. After Christophe died by his own hand, Haiti drifted into an exhausted slumber that lasted more than a century.

Back in Port au Prince, Audrey and I tackled the one thing that had so far eluded us: voodoo.

"You are here at the worst possible time," people told us. "Carnival, then Lent, then Easter. Everyone is too busy." But each Saturday night the drums gave a different answer, booming and throbbing from a dozen points. Voodoo was there if we could find it.

PHOTOGRAPH BY JOHN SCOFIELD, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Miracle of the sewing machine fascinates back-country wives. Too poor to afford ready-made clothes, they barter foodstuffs for a few yards of cloth and sew dresses by hand. Their instructor, trained in a home economics school at Port au Prince, demonstrates this hand-powered model.

Haiti's countryfolk see little conflict between Christianity and voodoo. The Great Master, they say, shouldn't be bothered with little problems. Reverently asking His permission before starting a Saturday night ceremony, they get down to cases with deities whose job it is to take care of everyday matters: crops, sickness, love, money.

The rites themselves are often colorful, noisy, and exciting—and as often boring and unintelligible to the outsider. Despite a government that eyes voodoo with surprising tolerance, visitors are seldom welcomed at important ceremonies; too many have taken home "eyewitness" accounts of blood-maddened orgies and mumbo-jumbo under the tropic moon.

Abandoned Citadel, built by King Henri Christophe in 1817, crowns a mountain in northern Haiti. Christophe, a waiter who became a general and proclaimed himself king, erected the fortress to ward off a feared invasion by Napoleon's armies. Twenty thousand lives and 13 years' labor went into the construction. The invasion never came.

Cannon that never fired a shot lie rusting beside caches of cannonballs on the Citadel's galleries. Walls 8 to 12 feet thick encircle the eyrie, which surveys a sea of tropical greenery from its 3,000-foot perch. Fittingly, the main court became the tomb of King Henri, who committed suicide with a silver bullet following a paralytic stroke.

Oddly, a white man—ex-Marine Corps pharmacist's mate Stanley Reser—finally opened the doors for us.

Until his death not long ago, "Doc" Reser was reputed to be the island's only white voodoo priest—a distinction he neither confirmed nor rejected. He had been the subject of one book and a chapter of another; lurid Sunday newspaper features had chronicled his doings. Most important to us, Reser had the reputation of knowing more about voodoo than any foreigner on the island.

The Doc lived in a little cottage near Pont Beudet, 11 miles upcountry from Port au Prince. As we drove across the Cul de Sac plain, oxcarts loaded with sugar cane swerved from the road to let us pass. "Madame Saras," orange-and-black weaverbirds introduced from the same land that sired the slaves, rasped in roadside trees.

A smiling woman in a bright print dress stood framed in Reser's doorway. Sunlight glinted on gold-capped teeth as she told us *le docteur* was not in. Would we have a chair? He might be back by evening.

A week later we tried again. A solidly built American emerged from the back room.

Over half-sized cups of fragrant coffee, Stanley Reser told us how he happened to settle in the West Indies.

"I like to tell Haitian youngsters I've been here longer than they have," he said. "It's true, too; I came in 1927. When the occupation ended in 1934, I stayed on as director of the insane asylum."

Cold Water Cooks an Egg

Outside the door of Reser's house, in a hibiscus bush scarlet with blossoms, a green Hispaniolan parrot coughed and shrieked in a sickly treble: *hak-hak-hak—whooo-o-o-o-oop!*

"One of the servant's kids caught whooping cough," Reser chuckled. "The parrot heard it so many times he learned to imitate it."

These were just preliminaries. Reser knew we wanted to talk about voodoo. He leaned back in his chair.

"I can't explain voodoo to you," he said. "Strange things happen. They happen in other countries too, but more often in Haiti.

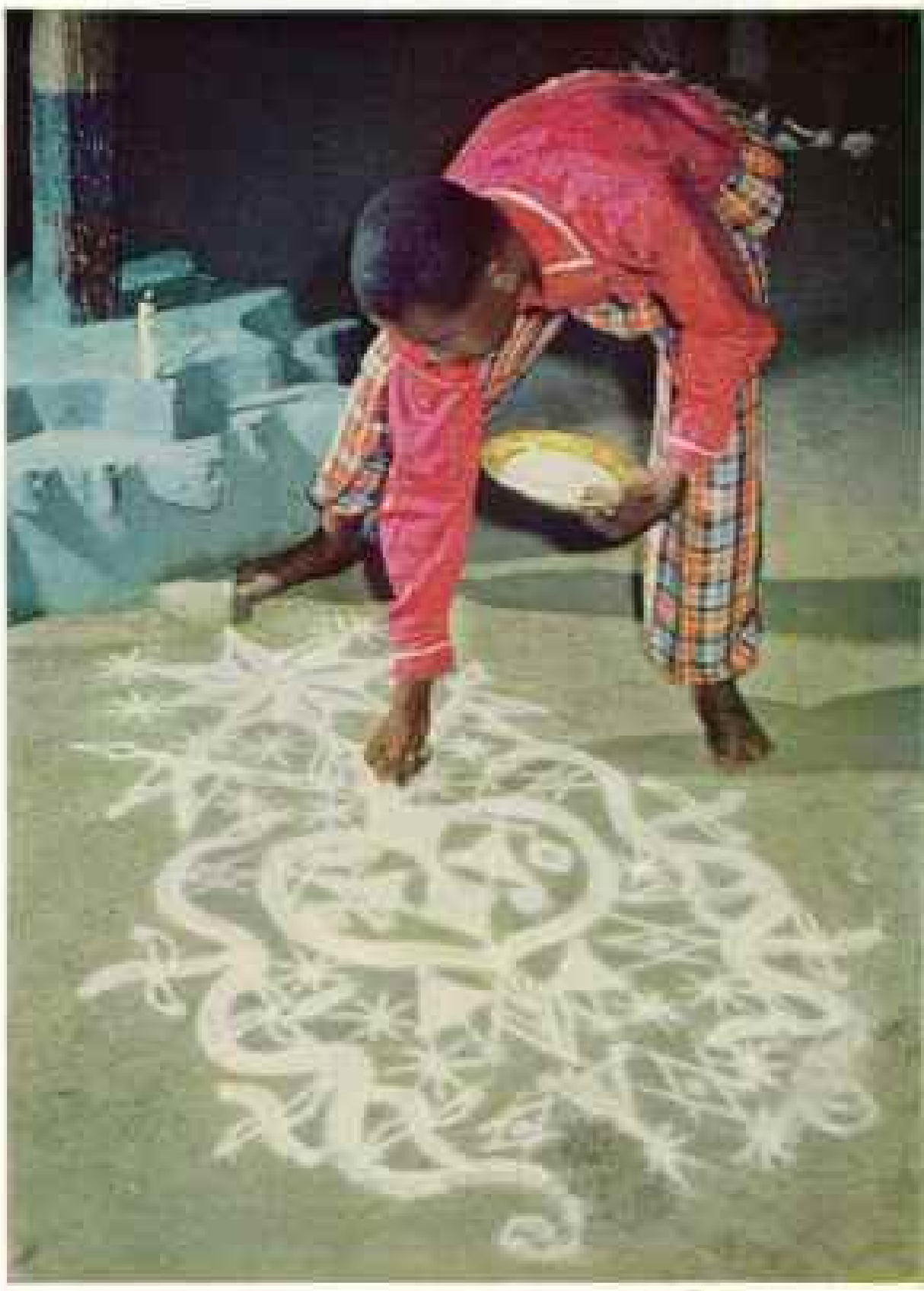
"Listen. One day I visited a *mambo*, a voodoo priestess, in a suburb of Port au Prince. She asked if I had ever seen food cooked without fire. To be certain the food was uncooked, I bought an egg myself. The mambo dropped it into a glass partly filled with water. Then she put my hand over the glass, and placed her own hand on mine while she mumbled

Mystical voodoo rite, the *bruler zin* initiation ceremony, begins at midnight and ends at dawn. Drums, silent during prayer, roar hypnotically when the participants dance. At the climax initiates test their faith by dipping hands and feet into pots of boiling oil.

To summon the *loas*, or gods, the high priest sprinkles rum and coffee on the ground and shakes gourd rattles laced with bells, beads, and snake vertebrae.

A religion primarily African in origin, voodoo supplements rather than supplants the Haitian's Christian faith. Rituals seethe with emotion. Faces here reflect moods ranging from ecstasy to sheer exhaustion.

Sifting cornmeal between thumb and forefinger, a voodoo priest draws an elaborate *veve*, or ritual design, to invite deities to a ceremony. Participants may kiss the design before the dancers' feet obliterate the tracery.



PHOTOGRAPHED BY JOHN SCOFIELD, NATIONAL GEOGRAPHIC STAFF © N.G.S.

some words. After a couple of minutes she told me to break the egg.

"The water was still cold; so was the egg. But she swore it was cooked. When I broke the egg, it was hard, except that a thin layer next to the shell was soft and clear. The egg had been cooked from the inside. How? I don't know!"

Stanley Reser believed the story, I am sure, just as he believed other stories he told us that morning. Voodoo was for him a belief in spirits of field and forest that intercede unpredictably in the affairs of men. And it was a belief in the voices of the dead brought back to share their wisdom and experience with the living. But nowhere in Reser's scheme of things were there the usual trappings of voodoo described in sensational Sunday features: orgies, human sacrifices, or ritual cannibalism. Voodoo, I was learning, is merely another religion of simple people trying to adjust themselves to the uncertainties of earthly existence (pages 226, 242, and 256-9).

A few nights later, thanks to Reser's interest in our quest, Audrey and I saw a *bruler zin*, a voodoo initiation ceremony, in Port au Prince's crowded La Saline district. A gasoline lantern hissed balefully under an open-sided palm-thatched shed. For hours drums roared; steel clanked on steel as an *ogantier* set the cadence with a spike beaten against a horseshoe.

One after another the voodoo deities were invoked. A pair of black chickens was sacrificed; oil and rum were poured on the earthen floor. White-robed girls danced, then crouched along the edges of a tentlike sheet; under it an initiate breathed the choking fumes of a ritual fire before emerging to take her place in the religious community.

The sun was rising as we started home. As we walked, we could hear the ceremony throbbing on until the voices, and then even the sound of the drums, were lost behind us in the tangled skein of streets.

That morning Audrey and I said our goodbyes to Haiti. At Bowen Field a vendor offered last-chance souvenirs. He looked familiar. I caught his eye and he grinned in recognition.

"Voodoo," he said, "last night." His arm swept in the direction of the crowded dock area where we had watched the fire ceremony a few hours before. He had been one of the participants.

He lowered the basket from his head and gave Sally a tiny doll carved from a nut. "*Au 'voir,*" he said, smiling. "Come back." Then he hoisted his wares and strode away.

Sacred Waterfall's Misty Spray Bathes a Voodoo Pilgrim

Thousands of Haitians converge each July on Ville Bonheur for a festival honoring Our Lady of Mt. Carmel. At near-by Saut d'Eau, a 100-foot cascade, many expose their bodies to water that supposedly cures all disease. After bathing, the pilgrims discard old clothing and put on new. This celebrant carries a bowl made from half a gourd.

Favor seekers at Saut d'Eau tie cords about the trunk of a coconut palm and light candles. Voodoo followers believe the grove hemming the falls harbors spirits, especially the forest god Ibo Lélé.

Exploring New Britain's Land of Fire

ARTICLE AND PHOTOGRAPHS BY E. THOMAS GILLIARD

AS INTERNATIONAL CONFERENCES go, this one ambled along amicably enough. Every nicety of diplomacy and protocol was in play. Nevertheless, it was clear that a fiasco was in the making, one that could be a disaster for me.

The site was a dripping camp in a tiny village clearing chopped from the jungle west of the Alimbit River, on the little-explored island of New Britain, largest of the Bismarck Archipelago.

The participants included David Moorhouse, a tall, hawk-visaged young patrol officer representing Australia, which governs New Britain as a United Nations trust territory, and myself, a middle-aged ornithologist representing the American Museum of Natural History, the Explorers Club, the National Geographic Society, and the incurably questing curiosity of science. The third conferee was a wild man.

Advice: Get Help From Wild Men

Barely a week before, in the minute settlement of Kandrian on the island's southwest coast, Assistant District Officer Campbell Fleay had put it bluntly: "Go to a village called Hualil—the end of the line so far as our maps go—and try to make contact with a character named Iangmili. He's chief of a gang of 'wild men' we've been trying to soften up this past year. There is a chance he will help, but if he won't, you might as well give up your hopes of exploring the interior."

This was hardly bracing news for an expedition planning "to explore, collect, and make a photographic survey of the flora and fauna" of the island's high mountains. Already my principal goal—to find the bird of paradise on New Britain—seemed disturbingly remote.

The name "wild men" had been given by coastal natives to some 200 or 300 extremely tall and remarkably uncordial residents of the interior. A few had recently been seen near Hualil. When Patrol Officer Moorhouse had last visited the region, his orders read: "Under no circumstances are you to

High in the crown of the Whiteman Range, a hunter surveys the rain forest of New Britain. The Gilliard expedition laboriously chopped its way across unexplored wilderness bristling with bamboo to this summit camp, where it collected rare birds and mammals.

Sparrow-sized river kingfisher, *Alcedo atthis*, inhabits the lowlands.

attempt to adopt aggressive measures. Take precaution against attack. . . . Virtually uncontrolled. . . . Withdraw to Hualil if attack develops."

So we had come to Hualil. The mysterious "bush telegraph" had signaled our approach, and, as we had hoped, the great man himself appeared in our camp. He towered well over six feet, carried a 9-foot-long spear, and wore an expression of scepticism upon his sharp features. This was Iangmili (page 265).

Sitting on a packing box, I followed the rapid pidgin English between David and the leader of the wild men. In a dialect totally incomprehensible to us, Iangmili spoke with an older companion, presumably his "prime minister," whose manner was quite cool.

At first it seemed as if Iangmili might agree to our proposal that he guide us into the interior, but after some minutes the prime minister prevailed. The wild men would not help. As silently as he and his chief had appeared, they vanished back into their jungle. And despite my numbing disappointment, I could not escape a feeling of understanding and admiration for their decision to keep their land inviolate.

David expressed himself in Australian slang. "That tears it," he said. For once, even my wife Margaret was momentarily unable to muster up her unfailing optimism.

To stay at Hualil was to accomplish nothing; to retreat toward Kandrian was to admit defeat. Our objective was the interior—the heights of the unknown Whiteman Range that runs like a vast spine through the center of western New Britain (map, page 264). There was only one possible decision: We would go on.

"After all," Margaret said, "this man Iangmili wasn't downright hostile. If he won't help, perhaps he won't hinder."

"We may be able to get fresh carriers from villages along the trail," David suggested.

This decision made, dinner began to taste better. We could not know it then, but this seeming blow to our hopes would not result in the expedition's failure. We would go on to find species and subspecies of birds unknown to science, and we would see some of the most bizarre country ever explored. Perhaps the collapse of our own little summit conference was for the best in the long run, for it strengthened our determination to see this business through despite all obstacles.

Narrow Passage Poses a Challenge

The exploration of New Britain had been on my mind ever since 1953, when I sailed between the Huon Peninsula of northeastern New Guinea and the western tip of New Britain. Both coasts were clearly visible from shipboard. This turbulent, narrow passage between the islands mysteriously barred many species of animals which elsewhere managed to cross broad ocean barriers.

Looking for an explanation, I was astonished to learn how little was really known about New Britain, and especially about its central mountains. Even during World War II the Japanese contented themselves chiefly with such coastal bases as Rabaul and Cape Gloucester. Allied bombing neutralized Rabaul, and United States troops invaded the island's western coasts. But interior New Britain remained remote from the war.

As an ornithologist, I was equally intrigued to discover that, although zoological surveys had been made of the Gazelle Peninsula on the island's eastern tip, and in the Willaumez Peninsula on the northern coast, the central mountains remained virtually untouched.

The Whitney South Sea expedition had succeeded in reaching the inland heights in the 1930's, but left before being able to make an adequate study of the bird and animal life. Later, William F. Coultas, the expedition leader, had written, somewhat cryptically,

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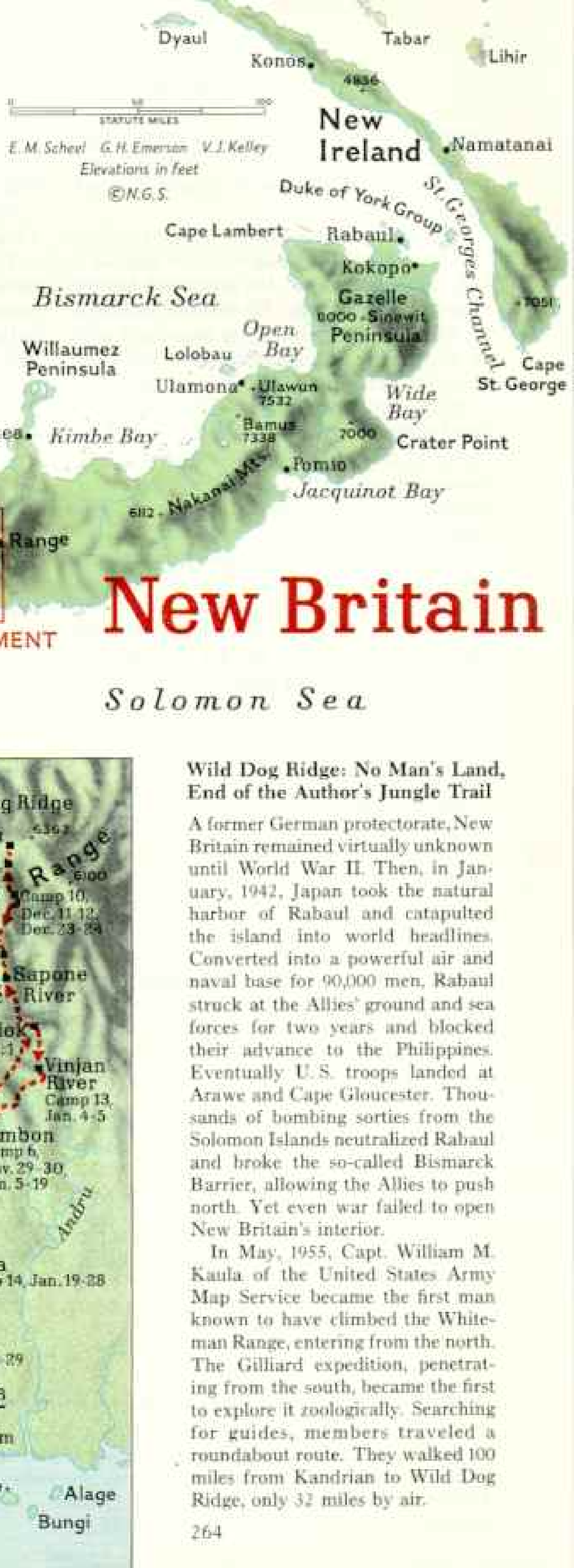
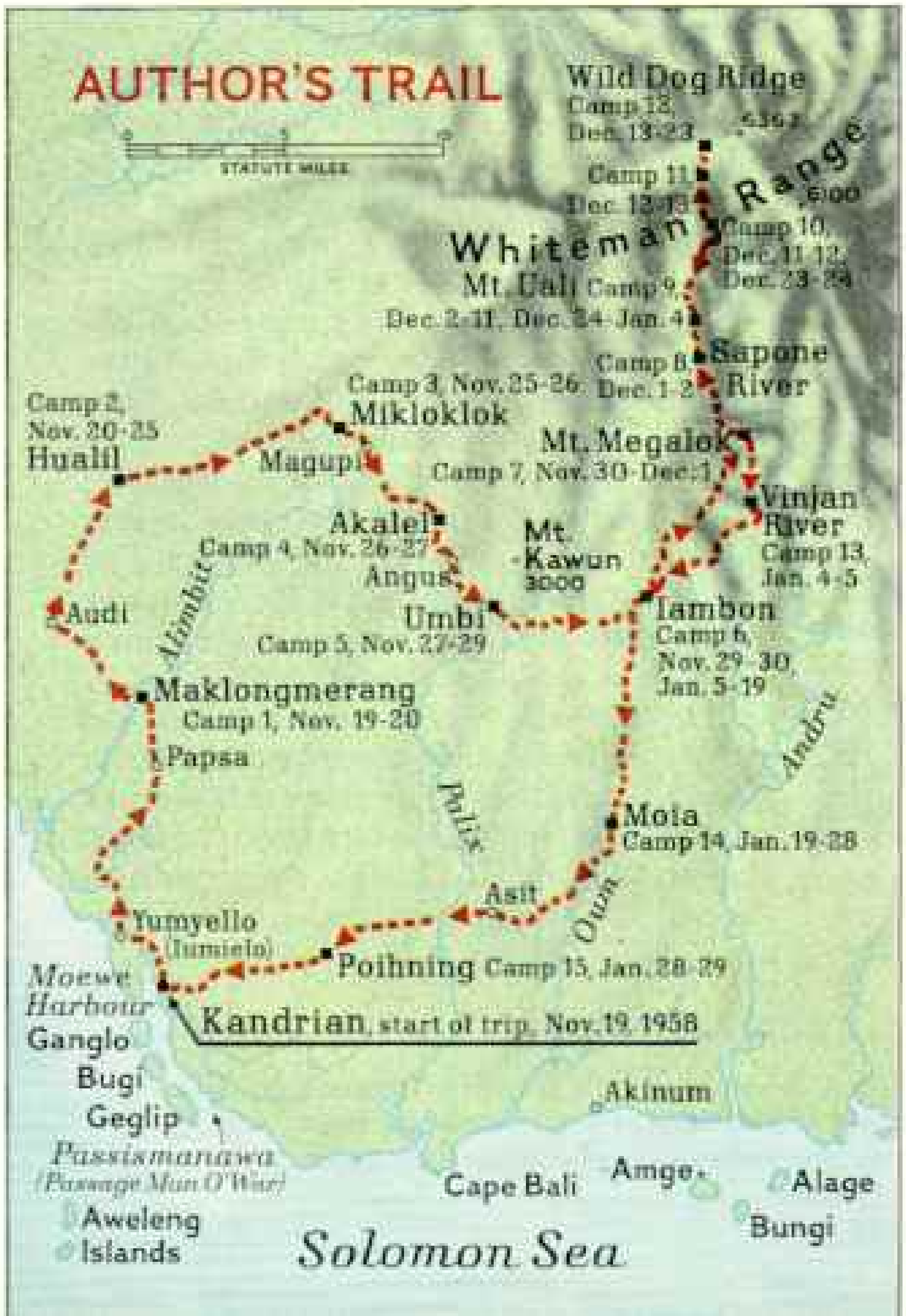
The Author: In this article explorer-scientist E. Thomas Gilliard brings Society members another absorbing account of his adventurous travels. This expedition to the wilds of New Britain, like three predecessors in the southwest Pacific, was sponsored jointly by your Society, the Explorers Club, and the American Museum of Natural History, where Mr. Gilliard is Associate Curator of Birds. He is the author of a recently published book, *Living Birds of the World*.

Porters Fording the Palix River Stoop for a Drink on the March

At Kandrian, expedition leader Gilliard enlisted 92 natives of New Britain to transport the party's gear. Fearing to invade the dreaded Yakin, "land of fire," half the men quit within two weeks. Others slammed loads into trees and rocks to discourage their leader. A few days later these men, too, refused to continue.





Wild Dog Ridge: No Man's Land, End of the Author's Jungle Trail

A former German protectorate, New Britain remained virtually unknown until World War II. Then, in January, 1942, Japan took the natural harbor of Rabaul and catapulted the island into world headlines. Converted into a powerful air and naval base for 90,000 men, Rabaul struck at the Allies' ground and sea forces for two years and blocked their advance to the Philippines. Eventually U.S. troops landed at Arawe and Cape Gloucester. Thousands of bombing sorties from the Solomon Islands neutralized Rabaul and broke the so-called Bismarck Barrier, allowing the Allies to push north. Yet even war failed to open New Britain's interior.

In May, 1955, Capt. William M. Kaula of the United States Army Map Service became the first man known to have climbed the Whiteman Range, entering from the north. The Gilliard expedition, penetrating from the south, became the first to explore it zoologically. Searching for guides, members traveled a roundabout route. They walked 100 miles from Kandrian to Wild Dog Ridge, only 32 miles by air.

that the time was not then ripe for a survey because of native unrest.

Here was an irresistible challenge: a piece of virgin land with an unknown people, one of the few such areas remaining in our world today. It cried out for study.

With our sponsors' backing, and approval from New Britain's District Commissioner, John R. Foldi, and his superior, Brig. Donald M. Cleland, Administrator of Papua and the Territory of New Guinea, we undertook the challenge.

Islanders Smoke Tobacco and News

The business of fitting out an expedition would fill a large volume, and I hope that someday Margaret will write it. She is an expert in the field. Besides the problems of food, specially adapted shotguns and ammunition for bird collecting, and the hundreds of other bits of camping and scientific gear, there was, for example, the New Britain islander's taste in smoking to be considered.

As part of his wages he favors twist, or stick, tobacco made in Virginia and Kentucky and packed in 30-pound cartons. He prefers to roll his own cigarettes—in newspaper. Something about the taste of printer's ink blended with the powerful black tobacco rejoices his soul. So, packed among our voluminous supplies were 100 pounds of neatly folded newspapers.

Not until we were ashore in New Britain did we discover that every last one was the same issue of the *Sydney Morning Herald*. I think I could recite that issue from memory, down to the cricket scores.

We landed at Kandrian after sailing through the Passismanawa, the main channel into Moewe Harbour. *Möwe*, the German word for seagull, is a reminder of the days before World War I, when the Kaiser controlled New Britain. "Passismanawa" is an intriguing example of the pidgin English spoken by the people of New Britain and its neighboring islands. It alludes to a long-ago occasion when a German cruiser steamed into the harbor; thus the channel became a "passage for man-o'-war," or Passismanawa. Simple, once you've got the hang of it.

The ship in which we crossed from New Guinea was a mission vessel made available to us by the Right Reverend Godfrey David Hand, Anglican Bishop Coadjutor of New Guinea. Waiting to meet us when we landed at Kandrian were officers Fleay and Moor-

Chief of the nomadic "wild men," Iangmili refuses to guide the expedition into the Whiteman Range. Interviewed at Hualil by Australian Patrol Officer David Moorhouse (left), he wears a castoff sweater plus a hat and belt given to enlist his help. Despite failure to gain Iangmili's aid, the expedition cached supplies and moved ahead.

house. While our supplies were being unloaded, they introduced us to the eleven other Caucasians and two Chinese who, along with a few natives, comprise the settlement. Though tiny, Kandrian is the metropolis of the region. Missionaries included, there are fewer than two dozen white people living in the entire area governed by this patrol post—one-third of the island.

Of more immediate and depressing concern was the fact that Kandrian possessed exactly two wheeled vehicles—a tractor and a disabled jeep—and precisely one mile of road, leading to a clearing where a landing strip was being axed out of the jungle. I had hoped to find vehicles to haul our gear at least ten miles inland.

Expedition Gear Borne by 92 Porters

During our approach, I had glimpsed our objective, the Whiteman Range—a great sooty-colored mass that rose abruptly from the jungle and disappeared into a raft of white clouds. It was, I estimated, perhaps 30 to 35 miles from the coast as the crow flies.

"We can provide you with porters as far as Hualil," Fleay had said. "That's about 30 trail miles from here; beyond there, I can't guarantee anything." Then he had told me about Iangmili.

Thus, on November 19, we set out, looking rather like a mass migration. With Margaret and me walked Moorhouse, swinging his lean, six-foot-two frame along at an infantryman's easy pace. Behind followed a happily chattering file of 92 porters, male and female, and five Sepik hunters we had brought with us from New Guinea. Three were veterans of our previous expeditions.* Equipped with shotguns and fine-meshed silk nets, the Sepiks would do much of our hunting and collecting.

Somewhere along the line were David's native police boys, led by Lance Corporal Mandina, a veteran of ten years' service in this area. These superbly trained and devoted men, covering some of the worst trails I have ever seen, kept us in touch with the patrol post throughout the expedition and served as our liaison officers with the jungle people.

So off we marched—in the wrong direction. Our route was comparable to that of the chap who goes from Paris to Moscow by way of London. The Whiteman Range lay northeast of Kandrian, but Fleay had warned that we would be unable to find any porters on the more direct route. So we headed northwest to Hualil and our abortive conference with Iangmili.

Now, still far from our goal, we were on our own. There was nothing for it but to

*See, in the NATIONAL GEOGRAPHIC: "To the Land of the Head-hunters," October, 1955; "New Guinea's Rare Birds and Stone Age Men," April, 1953; and "New Guinea's Paradise of Birds," November, 1951, all by E. Thomas Gilliard.

Camera in hand, the author listens as Patrol Officer Moorhouse points to a landmark in gorge-creased, forest-clogged terrain.

At home on the Whiteman Range, Margaret Gilliard prepares a mammal specimen. In this rude lean-to, the author's wife baked bread and made appetizing meals from canned meats and rice. Sleeping here on bunks made of branches, the Gilliards heard the nerve-tingling cry of dogs, onetime pets of slain venturers into the Yakin. They named the spot Wild Dog Ridge.

cache much of our gear and food in this three-house village and head northeast. Our route would soon become a barely discernible footpath. When it ran out we would cut our own trail, straight for the summit of the Whitemans, which I estimated to be about 24 air miles away.

Sodden Forest Hides a Surprise

The native trace led toward the Alimbit River, and, in a driving rainstorm during the afternoon of our first day out of Hualil, we heard a distant thunderous roaring in the jungle. It grew louder with our every step.

"What is it?" Margaret cried over the awesome noise. I glanced at David. His pleased expression was that of a good host about to spring a surprise on his guests.

Minutes later we came across an amazing spectacle—an enormous hole, fully the size of a railroad tunnel, in the side of a limestone hill. From it rampaged a boiling torrent of water, like some herculean fountain.

"The source of the Alimbit River," David yelled through cupped hands into my ear. "I've heard the natives speak of it, and I thought we might be approaching it. Quite a show, isn't it?"

It was indeed a fearsome sight, and as we moved on, we passed over fissures which gave forth an eerie, hollow roaring. Somewhere beneath us, the giant flood was surging toward its rendezvous with the surface.

The United States Army's official war historians had, with unusual bitterness, observed that "although there is perhaps no ideal place to fight a war, the New Guinea-Bismarcks-Solomons area was one of the worst possible places." I could understand why.

Our narrow, wretched trail through the

rain forest led over one limestone hummock after another, punctured with rock-rimmed openings to subterranean watercourses. Occasionally we passed through what David called villages, most with only two or three houses and fewer than a dozen inhabitants.

Every day brought a deluge, usually beginning about 1 p.m. and continuing off and on until midnight. The forest dripped continually. Even with seamen's oilskins we managed only occasionally to dry out when we made camp. Here and there along the trail, the monotony of jungle and limestone was broken by banks of red clay and temporary streams filled with a curiously milky water.

It was David who pointed out that we were now breaking "new ground." New, that is, to the white man, for the natives had used this

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Mustache of pig tusks and beard of cowrie shells help this warrior frighten his enemies. He holds the mask in place by clamping it in his mouth. Symbolic designs adorn his shield, which he made of two planks lashed together with rattan (page 271). Accompanying chief Iangmili to the conference at Hualil, he kept watch for signs of danger.

rain-sodden trail for generations, as indicated by roots across the trace, bent by the weight of countless passers-by.

And here we fell into that category of which Phineas T. Barnum noted that there was one born every minute. Our New Britain Barnum turned out to be a smooth-talking little fellow named Iason, whom we met at the village of Akalel.

In persuasive pidgin, Iason announced that he could lead us straight to the summit of the Whitemans. We hired him on the spot.

Behind this primitive confidence man we walked through jungle so dense and canopied that it was literally impossible to see the forest for the trees. Had the Empire State Building stood only 200 feet from the trail, it would have been invisible; so we had no way of checking Iason's ability as a guide.

He led us first to a conical, flat-topped hill. Here, at a place called Angus, we came across one of the oddest human settlements I have ever seen. It was, in effect, a living grave, occupied by two ancient men, each in his low thatched hut. No longer able to farm or hunt, these men exemplified New Britain's native system of old-age security. Supplied with food and firewood, they had been brought here to await their end.

Presents Left for the "Living Dead"

One was blind, with a great, empty grin. The other was an apparition of bones loosely caught together in a bag of charcoal-blackened skin, wearing a mask of cassowary feathers.

Each man lay on a bed of poles placed about ten inches above a small, glowing pile of embers. The blind man's face was covered with ashes from blowing on half-dead coals.

Beneath the floor, Iason told us, were bodies interred by relatives when finally they had found the embers dead, for despite the seeming callousness of this method of caring for the aged, the relatives are extremely considerate of the occupants of such living graves. Often they travel many miles to bring food and firewood for as long as is needed.

When we hit the trail again, we left presents of food, tobacco, and matches for these men whose lives had overrun their courses.

From time to time we passed native gardens, all surrounded by massive log fences for protection against the feral pigs which roam the island. These gardens often include coconut, banana, betel nut, and breadfruit trees. Other common crops are taro, sugar

cane, and plantain. Much of the gardening is done by the women while the men are off hunting in the forests.

Finally Iason led us to the village called Umbi, where we discovered that his claim to know a trail into the mountains was baseless.

"The old scoundrel says he thought this was as far as we wanted to go," David reported after Iason, with a shrug and a sly grin, had confessed his ignorance of any trail beyond Umbi. "Now that he's got your money and tobacco, he's simply telling us to go to blazes. I'm afraid we've been had."

Iason's face was a picture of injured innocence, but his eyes shone with the gleam of the eternal knave. He departed with a few of our choicer observations in pidgin ringing in his ears.

We were now some sixty maddeningly roundabout trail miles from Kandrian, and the summit of the Whiteman Range seemed as inaccessible as ever. Even less encouraging was the attitude of the nomadic garden makers of Umbi. Sullenly, they declined their help, and so unfriendly were their mutterings and glowerings that we decided they were hiding something.

Later, Corporal Mandina learned that the Umbi people

Red clay and white ash paint a patriarch's face. Comb in mud-caked hair supports cockatoo feathers.

Hibiscus blooms cover the head of a smiling hunter. Orange petals crown the scowling boy.

Multiple whorls fingerprint the shield of an Arawe hunter encountered near Moia. His eight-foot palmwood spear is sharp enough to kill a pig or a man.

Arawe men, who live in the tropical rain forest near Kandrian, are spear fighters. Their shields resemble those of the wild men.

did in fact know of a trail into the Whitemans, but would show it to no outsider. It led, Mandina reported, past the scene of several native murders, and they feared trouble from the authorities.

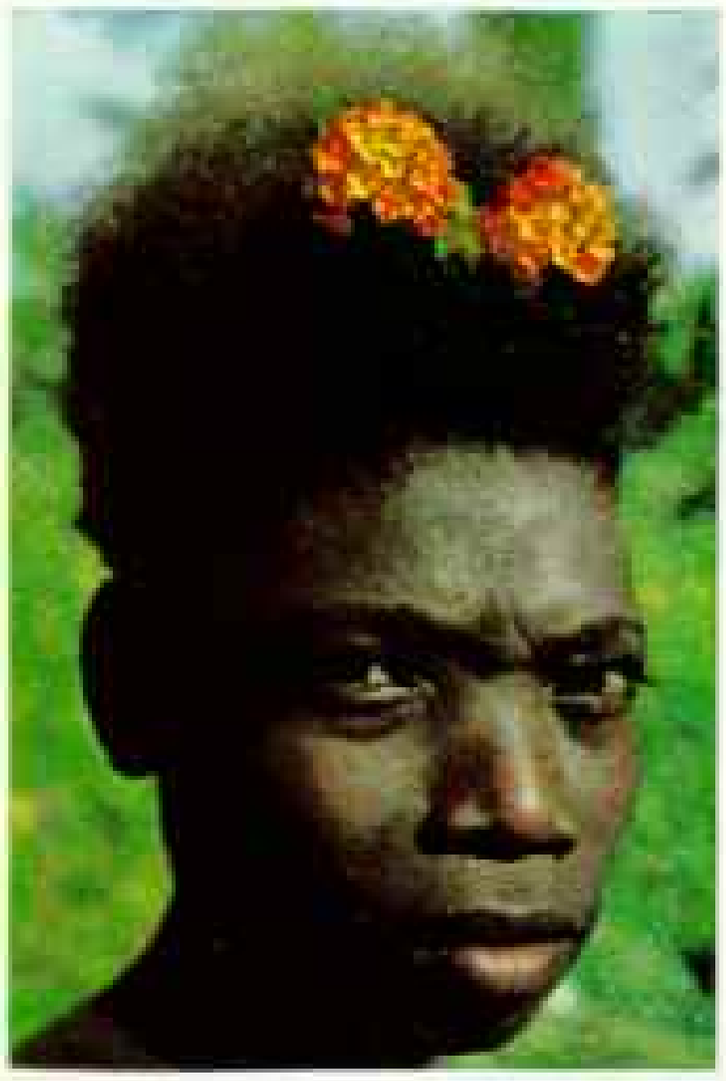
Then, just as if it had been scripted by a Hollywood scenario writer, we got a break. Visiting at Umbi were some natives of a village called Iambon. Yes, they declared, there was a trail from Iambon into the interior, and yes, there was a guide—no Iason this time, but a skilled woodsman named Selselio. Even better, we would probably have no trouble finding fresh porters.

Yakin: Haunted Land

At Iambon we had reached the village closest to the summit of the Whitemans, some 15 air miles distant. Even more heartening, a trail led from here back toward Kandrian, assuring us of a more direct return trip than the circuitous route thus far.

"Before we all get too terribly cheery," David cautioned, "let's not forget that we're approaching Yakin—the 'land of fire,' as these people call it. They're afraid of it; say it's haunted by wild dogs, and that it's very bad luck to enter it."

Until now, our zoological survey had been made as best we could manage as we marched inland. At Hualil, while waiting for Iangmili, we had caught and prepared a few specimens. More had been added along the trail.



But only now were we approaching the area where our real work could begin, where we would try to solve a mystery which had brought me to this eerie land of underground rivers, unclimbed peaks, and seemingly endless jungles. Somewhere in the mountains ahead, I hoped, we would encounter birds never before seen by Western science.

But would we find birds of paradise? These glorious birds are plentiful, both in species and numbers, in New Guinea, only 55 miles across the water between the islands; yet none had ever been found on New Britain. Somehow, even the flightless cassowary had managed to cross that barrier, but of birds of paradise no trace had ever been reported.

Here was one of the primary reasons for this expedition. From now on, every ear would strain to hear the bugled caws, every eye would seek the distinctive plumage of that magnificent bird.

The old woodsman Selselio agreed to lead us toward Vakin. As we followed him along the trail out of Iambon, David told me something of the history of that community.

"A white man, chap named Alf Robinson, was murdered near by about eight years ago," he said. "He'd been recruiting laborers for a coastal plantation, made the mistake of displaying too much wealth: bush knives and hatchets and other tempting trade goods. One old rogue, so the story goes, walked up behind Robinson and asked his pals, 'What say I do him in?' Which he did, unfortunately for Robinson."

"And then?" Margaret asked.

"Oh, naturally, the murderer was caught. Afterward Iambon was made a 'book' village,

PAINTINGS (¾ LIFE SIZE) BY MARGARET GILLIARD © NATIONAL GEOGRAPHIC SOCIETY

Discovery of two species and three races of birds new to science climaxed 1,000 hours of hunting. In all the world, the author estimates, no more than 75 species remain to be found. The long-billed honey eater opposite proved to be a new genus as well. Mr. Gilliard named it *Vosea whitemanensis* for the late Charles Redfield Vose of the Explorers Club and the mountains where it dwells.

The author named the black-masked thicket-warbler at right *Cichlornis grosvenori* in honor of Dr. Gilbert Grosvenor, Chairman of the Board of Trustees of the National Geographic Society. A new species of a genus found hitherto only in the distant Solomon Islands and New Hebrides, this warbler inhabits bamboo forests.

Margaret Gilliard painted the birds in their habitats because photography proved impossible.

regularly inspected by a patrol officer who signs a book kept by the village *lululai*, the government-selected headman. The *tultuls*, on the other hand, are the unofficial village leaders, put up for appointment by the villagers themselves. At any rate we've had no trouble since," he concluded.

"By the way," David spoke up a few minutes later, "do you recall that surly-looking type we saw back at Akalei—the one I asked you not to photograph?"

"Distinctly," I answered. "The villagers seemed rather awed by him."

"Robinson's murderer," David said, and grinned at my expression. "Oh, it's all right. He's served his sentence. But there's no point in making him more famous by taking his picture. Might go to his head."

Once more I was struck by the spirit and courage of these youthful patrol officers who venture alone into the wildest areas and, it seems, by fair play and sheer force of personality maintain law and order. Sometimes they are murdered; yet the finest of Australia's young men strive mightily for appointments as cadets in this fiercely demanding service.

David's superb handling of our carriers through some of the worst country I have

KODACHROME BY E. THOMAS GILLIARD © NATIONAL GEOGRAPHIC SOCIETY

Swinging, swaying, and groaning as if about to break, a branch-and-rattan bridge spans the Palix River. Margaret Gilliard and bearers test its strength. Crocodiles eight feet below await the first misstep. Difficult as the crossing was, members of the expedition found it easier than hacking a step-by-step passage through bamboo forests. Porters carry foot lockers and drums of kerosene.

experienced amply demonstrated his status as a master of the bush and a leader of men.

For three days we followed the grizzled but agile Selselio some 25 trail miles into the foothills of the Whitemans. On the third day, at the foot of a steep mountain, he quit. No man, he declared, had ever been beyond the point we had now reached, and he wasn't going to be the first. He would remain with us, but regardless of argument, bribe, and cajolery, he would not lead us into unknown horrors.

There was nothing to do but to set the path myself, while David arduously coaxed the carriers along. Frightened and unhappy, they deliberately banged their loads against rocks and jammed them between trees in protest. Somehow we kept going.

Our progress now resembled that of a giant caterpillar munching its way through a forest of enormous parsley. At the head of the column were the machete men, in alternate pairs, slashing their way through the vegetation. Margaret and I followed, guiding them by compass. Behind us toiled our weary carriers who undoubtedly would have deserted us had it not been for the efforts of David, Corporal Mandina, and the other trained men. Unfettered by local superstitions, my Sepik hunters were fearless in this wild land, but their example failed to inspire their New Britain cousins.

Into a Land Unknown to Man

Cutting through bamboo with machetes has one notable disadvantage. When severed near the ground, the stalks inevitably hang in the treetops, and a second cut is needed to open a tunnel. Thus, each trunk leaves two knifelike spears, one at about eye level, the other aimed somewhere between the feet and the vital organs. Each step is thus fraught with interest.

Climbing, as we now were, also presents problems. Chair-sized rocks—debris from some ancient upheaval or eroded and tumbled away from higher cliffs—are caught and balanced in the vegetation. It is not particularly amusing to dodge a jagged rock hurtling down the trail, dislodged by a careless step ahead.

Quite apart from the truly wretched terrain was the eerie emptiness of this region. There were bird calls, to be sure, the insect noises, and the other sounds of the rain forest. But we saw no sign that man had ever passed this way before, not even the islanders. Here, in fact, was a land nobody wanted.

On our fourteenth day out of Kandrian, we made our ninth camp 3,000 feet high on the slopes of Mount Uali, deep in the foothills of the Whiteman Range. At last we could begin the serious work of this expedition.

I now understood all too clearly why earlier

Forest Dwellers

HUNTING BIRDS in the high forest, the author felt enveloped by fog and moss. "A weirder setting can hardly be imagined," says his log. "All the ridge floor is bedecked with moss. Trees, trunks, vines, and stones wear cloaks of sponge. In the midst of the dark-green shroud, gnarled limestone rocks stick up like sun-bleached skulls." This eerie region contained a surprising amount of wildlife.

Lower down, *Lorius hypoinochrous*, the coconut lory at upper left, proved to be a veritable flower in the tropical forest. A flick of green feathers spotted with a single dot of orange revealed the passage of *Loriculus aurantiifrons* (left), one of the world's smallest parrots.

Sweeping overhead in a flock, a red-knobbed fruit pigeon, *Ducula rubricera* (above), gave promise of meat to blowgun hunters.

Sometimes a living pincushion moved, and Mr. Gilliard saw a hungry nestling of the giant forest cuckoo, otherwise known as *Centropus violaceus* (opposite).

surveys had failed to collect the mountain avifauna of New Britain. Simply getting to these savage heights had been an appalling chore.

My objective was to accomplish 1,000 hours of hunting. Any shorter period, I knew from long experience, would be inadequate for a thorough zoological survey of this strange new region.

But in addition to my own program, there were studies we had promised to undertake for fellow scientists. Cornell University asked for egg-white samples; Yale ornithologists requested embryos of the mound-building megapode; the British Museum wanted examples of bird parasites.

Artificial Sky Foils a Daily Deluge

Camp No. 9 would be our base. From here we would try to reach the actual summit of the Whitemans, perhaps six trail miles away. We pitched our three tents, four tarpaulin flies, and a couple of leaf houses, and erected an artificial sky of polyethylene. Beneath this we could make photographs in spite of the daily downpour.

Our day began at dawn and ended usually around 10 o'clock at night. Our Sepik hunters and I roamed the surrounding forests, shotguns at the ready for any strange birds, or checked the delicate and nearly invisible Japanese mist nets, hung across corridors chopped in the jungle wall along some ridge.

Margaret divided her time between preparing and labeling specimens as the expedition's mammalogist and supervising the camp's housekeeping (including some spectacular baking). The only similarity between these chores is that both require the patience of Job.

Already we had reached an unexplored zoological niche. Proof of it was a tiny spine-tailed parrot brought in by one of our hunters. This orange-bellied pygmy parrot (*Micropsitta bruijnii*) was one of a species hitherto not known to exist in New Britain. Indeed, it was one of the birds that Dr. Ernst Mayr, Agassiz Professor of Zoology at Harvard University, prophesied would eventually be discovered in New Britain because they are known from the neighboring islands of New Ireland and New Guinea. And now we had found it.

"If this tiny parrot could cross 55 miles of water," I declared firmly to Margaret, "surely a bird of paradise could make it. We're bound to find one higher up."

David and I prepared to find our way up to the summit. Then, unexpectedly, New Britain unveiled yet another of its weapons against invading man.

Every day on our march from Kandrian through the lowlands we had been drenched by torrential rains. Here, high on the mountainside, the weather pattern changed. The rains diminished alarmingly, and mere hours after a storm the spongelike limestone stream beds glared white and dry.

We had provided for water storage, of course, but our supply of plastic-lined bags was limited. And simply to boil rice, the staple food of our team of men, consumed the now-precious liquid by the bucketful.

All hands turned to the desperate search for moisture. Rambur, my leading Sepik hunter, finally succeeded in finding a rock seep; in three hours, drop by drop, the seep produced just half a bucket of water.

"I'll bet no New Britain patrol officer ever worked so hard for a drink of water before," David said as we climbed back from an inspection of Rambur's discovery. This, from a man who, in the past several years, had walked some 700 miles through tangled jungle, brought home to me the true difficulty of our situation.

Bamboo Nodes Make a Water Source

Days later, as if to demonstrate its sheer contrariness, New Britain treated us to a full-dress thunderstorm that filled every water container to overflowing. Where we had been grateful for ounces, now we watched hundreds of gallons of rain water run to waste.

Another discovery was to prove vital to our trip toward the summit, where rainfall was erratic. We found that we could tap the enormous reservoir of the jungle by chopping open the bamboo growing in gulleys. Each node provided half a spoonful of water, and

Like a Fly in a Spider Web, a Parakeet Blunders Into a Net Set for Bats

Late one evening on Wild Dog Ridge a flight of tiny, bullet-fast birds brushed past the author. Mr. Gilliard could only guess their identity. Cutting a window in the bamboo forest, he rigged a Japanese mist net and trapped *Charmosynopsis rubrigularis*.

Color in the Jungle

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

it took nearly an hour to gather half a bucketful. Nonetheless, here was an unfailing supply—provided we didn't run out of gullies. Bamboo growing on the ridges, we learned, usually contained no water.

Only one danger lurked in this system. Fine hairlike spines grow like tiny beards at each node and these, the natives told us, could pierce the stomach and intestines or, if one became lodged in the eye, could blind a man. The answer was a simple filter. Although it had nothing to do with the aims of our expedition, I count this among the more important of our findings, and it may prove helpful to those who next venture into New Britain's high limestone mountains.

The day before our planned attempt to reach the summit above Mount Uali, Tesako, another of our Sepik hunters, returned to camp from a hunting patrol which had taken him to an altitude of some 4,000 feet.

An enormous grin transfigured his face, and the moment I saw the trophy he had brought back, I knew that it alone would justify all our efforts so far. I had never before seen anything like it.

Tesako's find was a greenish, long-billed honey eater (page 272). As I examined it, my excitement mounted. It was true—this was undoubtedly a hitherto undiscovered species!

Rare Prize Prompts Jungle Banquet

Zoologists and bird watchers the world over will know how rare such a discovery is, especially in ornithology, but anyone who has ever come into possession of some precious prize can understand my elation.

Camp No. 9 indulged itself in a first-rate banquet that evening, celebrating this first major success—the discovery of what we subsequently found was not only a new species but a new genus. We named it *Vosea*

IN THE EVERLASTING twilight of the dripping rain forest, the author searched for color and found it, but only in exquisite dabs.

Pinkish cup fungi sometimes provided a pedestal for the twin-eyed butterfly (opposite) of the *Tenaris* genus, a member of the Amathusiidae family found throughout tropical Asia.

Here and there a fiery mushroom popped up from a fallen log, a scarlet-bodied dragonfly came to rest, or a jewel-like silk spider caught the eye.

The search for water. In the lowlands the expedition traveled in hours-long downpours, but on the Whiteman ridges rain stopped for days on end. Everyone turned to the desperate hunt for water. Cut stalks of bamboo proved one sure but meager source; the trunks of trees, another. Here a bearer pours water extracted from a tree's hollow. His friend, catching it in a leaf, drinks it on the spot.

whitemanensis. The generic name Vosea honors the late Charles Redfield Vose, a member of the Explorers Club who had given financial aid to this and a number of my previous explorations before his untimely death in an Alaskan airplane crash.

Vosea whitemanensis, we dared to hope, was the best possible omen for our next move.

Off very early that next day, we soon encountered the most rugged terrain we had yet traversed. And by midmorning our hopes were dashed.

The summit forests lay before us, atop a towering mountain wall. But obviously we had misjudged their distance, for between us and our goal yawned a great abyss, fully 2,000 feet deep and at least four miles wide.

We stared disconsolately at this fresh obstacle. There would be no jubilant summit ascent that morning, as we had planned; it might take days, perhaps a week, for the party to cross this gorge and set up a new camp.

Giant of Its World

Swallowing her disappointment, Margaret agreed to a new plan. She would return to Camp No. 9, and from there send runners with supplies for David and me on our dash toward the elusive mountaintop.

Sometimes following animal trails, mostly hacking our own path, with a compass in one hand and a bush knife in the other, David and I struggled down through the big gorge. Fighting our way up its far side that afternoon, skirting house-sized blocks of limestone, we established Camp No. 10 beside a rushing stream at an altitude of about 2,500 feet. Only five carriers accompanied us. The expedition was now stripped down to barest essentials.

We made one more camp where we emerged from the gorge, then climbed on toward the crown of the Whiteman Range.

The twelfth camp—our summit camp—was established just 24 days after our departure from Kandrian. As if in reward for our doggedness, the very first bird I shot from this camp was an unknown race of the much sought *Phylloscopus trivirgatus*, a species never before found on New Britain. Minutes later, the redoubtable Tesako brought down a second specimen. I felt like a man taken to a diamond mine and told to help himself.

Moss-felted Stones Give an Eerie Touch

Day after day we hunted, and our specimen cases began to fill with a galaxy of species.

But this was an unearthly place, and cold. A felting of dripping moss covered every tree trunk and much of the rock, giving the white limestone left exposed an unhealthy resemblance to a scattering of great, pitted human skulls.

The season was changing and our shelter, a nine-by-twelve-foot tarpaulin stretched over slender poles and walled with leaves, lay open to the chill monsoon winds from the sea.

Barely had we finished erecting this frail

Life-sized image of a giant silk moth spreads across two magazine pages. Wing span totals 10⅞ inches. A male, the insect displays the long tail tips lacking in its mate. Together with thousands of smaller moths, *Coscinocera hercules* flew into the expedition's camp on Mount Uali and swarmed around the lanterns. All other work stopped while the Gilliards collected the insects.

fortress that first night at the summit camp when there arose from the jungle beneath us a sound that set the back of my neck a-crawl—like the wail of some displaced Irish banshee exiled to this fantastic island world. A second joined in keening chorus, then a third, and still others, until the night was filled with this incredible mourning. Just beyond the pale glow of our campfire, the limestone skulls grinned at us from their shrouds of sodden moss.

"It sounds like a chorus of lost souls," I said.

"More likely some distant cousins of the Hound of the Baskervilles," David replied. "But let Mandina tell you the story."

So, as we huddled close to that mercifully

cheerful campfire, the police corporal related a tale as eerie as the sounds it explained.

The howls came, he said, from a pack of dogs which had run wild after their masters—two brothers from the village of Iambon—had been killed about ten years previously. The brothers had dared to break the taboo against settling in the Yakin. Hunting the area's abundant game, they prospered mightily. Then they were murdered, presumably by jealous men from Umbi who had visited them to trade for meat.

"Their wives and dogs escaped into the forest. There they still live because they fear to come out," Mandina concluded. "And the dogs howl at night for their lost masters."

The police corporal's tale explained the suspicious actions of the villagers we had met at Umbi, and the reluctance of the residents of Iambon to venture into this land where sudden death had punished a broken taboo.

Unofficially, David and I decided to name this part of the range Wild Dog Ridge. But why was this region called Yakin, "land of fire"? Volcanoes were unknown in the vicinity. A possible answer lay to the north on Willaumez Peninsula, where some volcanoes still are active; perhaps their smoke had been seen by islanders south of the range. Or perhaps it was so named for the lightning bolts that often strike the mountains.

Now that we had shattered its taboo, Yakin seemed to have lost its terrors. Our base camp began to receive "tourists" from miles away, and our carriers, returning to their villages, were treated with the deference due heroes who have braved the unknown.

Nine days before Christmas, official duties recalled David to Kandrian. He had been a tower of strength throughout the rigors of the past weeks. How he managed to persuade our carriers to cross some of those awesome gorges and climb the sharp ridges I shall never comprehend.

The day after David left, the forest made magnificent compensation for my loneliness. I probably would not have exchanged the find for an unknown species of bird of paradise.

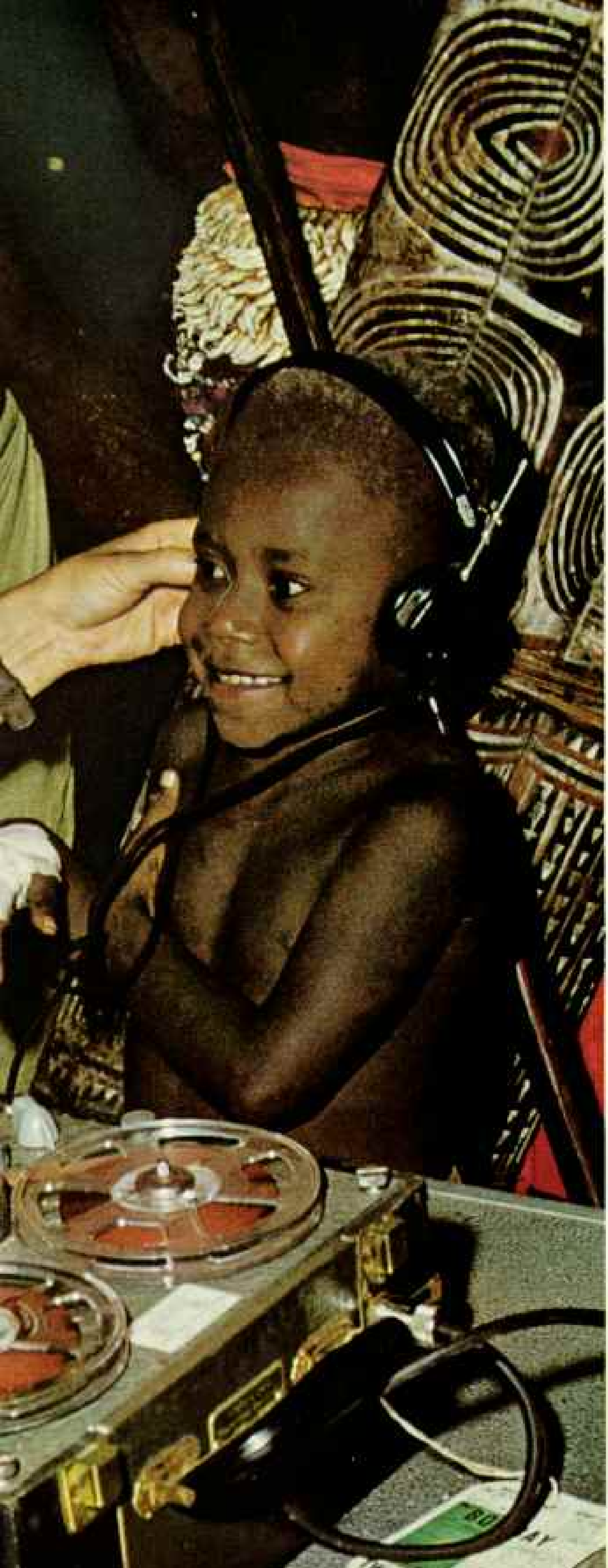
I had never in my life seen anything like this brownish bird, about the size of a hermit thrush, with spines in its tail and a black mask. It had been one of a small group that had come walking noisily through the underbrush, occasionally jumping up on logs to peer about them, my hunters told me.

It required eight days of concen-

Brandishing spear sticks, boys and girls charge back and forth during a sing-sing at Moia. Margaret Gilliard, holding a microphone, records their chants.

Child at upper left beats a lizard-skin drum and stuffs his mouth with leaves in imitation of the warriors' pig-tusk decorations (page 268).

"Later the kids spread out to sleep on the grass," says Mr. Gilliard. "Dogs snuggled in the family circle like adopted offspring."



Smiles spread as sing-sing dancers hear their own voices from Mrs. Gilliard's tape recorder. Earlier she had bandaged the boy's injured hand.

"There is pandemonium around the tents," wrote the author as the festival began at Moia. "Men kill and cook the pigs. . . . The heat of the dance is now obvious. Men are sweating, and women are grimy with dust. Feet pounding the clearing, they do the same dance to the same music, hour after hour."

Forehead painted with ashes, an elder wears a necklace of cowrie shells and a pendant of pig tusks.

KODACHROMES © NATIONAL GEOGRAPHIC SOCIETY

trated hunting—with an added bounty of money and tobacco—before Rambur, stealthiest of my Sepiks, managed to take a second specimen. Despite all my efforts I never saw the bird alive. I determined to name it *Cichlornis grosvenori* in honor of Dr. Gilbert Grosvenor, as a token of my gratitude to him and to the National Geographic Society for their support of my field work in the South Pacific (page 273).

Grosvenor's black-masked thicket-warbler is a new species of a hitherto monotypic genus known only from the distant Solomon Islands and New Hebrides. How the stock got across the wide water barriers to the mountains of New Britain remains an unsolved question.

With the trail back to base camp now fairly well traveled by our runners and supply carriers, Margaret decided to join me, and on December 20 we had a grand reunion at the summit camp. After her hard two-day trip, she amazed me by settling calmly down to the job of skinning a beautiful specimen of forest wallaby shot the night before by Corporal Mandina. This, I decided, was true scientific detachment.

About one thing I was positive. Christmas was going to be spent in the relative comfort of our 5,000-foot base camp, science or no science!

Before we left the heights of Wild Dog Ridge, we built a cairn. Inside it, with what ceremony we could muster in that inhospitable place, we cached a bottle containing a note previously written by Moorhouse, and one of our own on museum stationery. Ours said in part:

TO WHOM IT MAY CONCERN: This is the location of the American Museum of Natural History-National Geographic Camp No. 12. It was occupied from December 13 to 23, 1958—Twenty-three species of birds were collected and observed from the camp, some new to science, and three species of mammals. . . .

Will the finder please communicate with me at the above address.

Sincerely,
E. T. Gilliard

DO NOT REMOVE FROM THIS SITE

This accomplished, we headed down from the heights to our camp on the lower slopes. Never has a base camp looked lovelier, and we celebrated Christmas by lingering over breakfast

Deadly blowgun rises three times the height of its six-foot owner. To bag a pigeon in a tree, the hunter inserts an arrow and noiselessly thrusts the thin tube up through the foliage. A puff of air speeds the feathered shaft to the target, often at point-blank range.

Gilliard and His Hunters Erect a Cairn as a Record of Achievement

Rambur, a Sepik from New Guinea, shakes hands with the author on Wild Dog Ridge. Lance Corporal Mandina of the Australian Constabulary Forces stands second in line. One mammal collected was *Petaurus*, the marsupial sugar glider below.

until 9 o'clock that morning, at which time I discovered that the bird skins we had brought down from Camp No. 12 needed rewrapping.

Regretfully putting aside the mail from home which David had sent in with additional supplies from Kandrian, we spent our holiday hard at work. Mava, one of our Sepiks, brought in a big wallaby, which made just as fine a Christmas dinner for the boys as the most succulent roast pig. Margaret and I, not caring for wallaby's gamy taste, dined less regally on tinned meat and peas.

Christmas wouldn't be Christmas without a surprise, and we had one—an earthquake. During a driving rain in the late afternoon, the mountainside shook so hard water sloshed from our buckets. The camp was on a cliff edge, and I visualized it tumbling down in a landslide.

"Let's get out of here," I shouted, dashing from the tent. When the tremor stopped, I looked back. Margaret was

still sitting calmly; she had preferred to keep dry and take her chances with a landslide.

For nine days we continued hunting and working, despite daily torrential rains. In addition to our biological pursuits, I spent a lot of time on the purely geographic problems of ascertaining by triangulation and resection the exact location of our base and summit camps, our routes, and some of the adjacent heights. The value of an ornithological discovery diminishes somewhat if you aren't sure just where you found it. One result was the finding of several errors in the wartime maps we were using.

When, on January 4, the time came to begin our return to Kandrian, I felt a pang of regret at leaving the mountains. Our camp on Wild Dog Ridge and base camp at Mount Uali will go down in biological history as the type localities of five new birds—as well as a large number of other unknown and little-known animals. These include forest rats, bats, lizards, and snakes.

I wondered if the wild dogs, still seeking their murdered masters, might not visit our cairn of nights to sniff suspiciously before they sent their mournful howls echoing through the jungle.

On our journey inland, we had been considered madmen bent on risking the vengeance of unknown terrors. Now we were the conquerors of the dreaded Yakin, our march took on the air of a triumphal procession. The problem was no longer to persuade carriers to work for us, but to select the best of many who sought to join our stringing caravan.

We stopped for a time at Iambon, where Margaret soon established a roaring trade in specimens: ten butterflies for one string of red beads; a box of Chinese matches for a frog.

With our zoological survey all but completed, we were able to give more attention to the anthropological aspects of this island people. We heard many tales of strange beliefs and practices, now dying out: ritual slaying of widows, and the killing of one of a pair of twins; "pointing the bone," to cause a victim's death by magic; and orgies of eating followed by long periods of near-starvation.

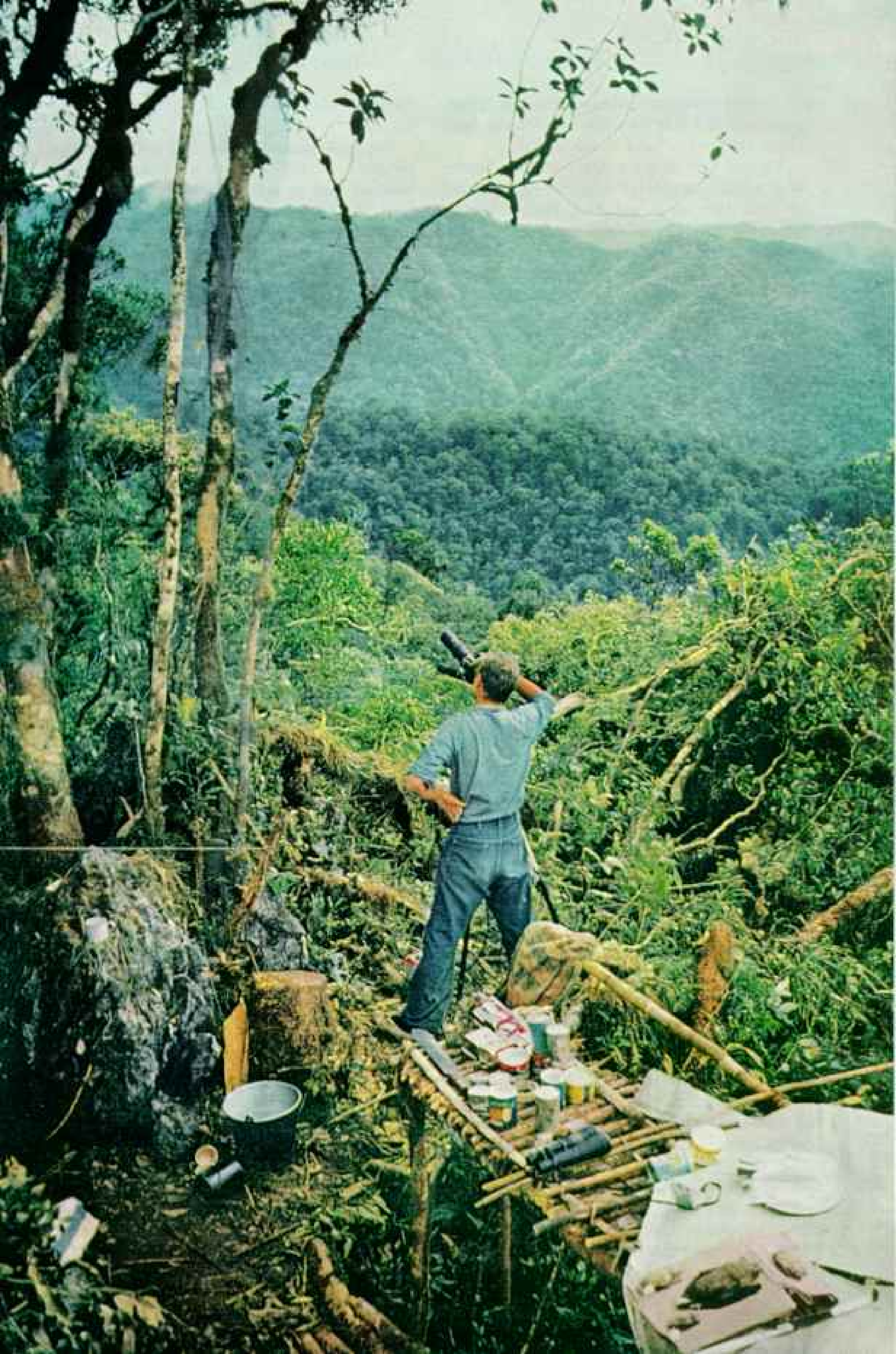
At the village of Moia, about 15 miles from our goal at Kandrian, we encountered muscular blowgun hunters, carrying fantastic weapons (page 288).

These blowguns probably are longer than those used anywhere else in the world; one I measured at fully 22 feet fired a three-foot arrow. The gun was made from seven sections

Mounting a Long Lens, the Author Focuses on a Bird in the Treetops

During the last days atop Wild Dog Ridge, Mr. Gilliard confided to his log that he was "deadly tired." A forest "so pure it seemed to refresh the soul" disenchanted Mrs. Gilliard when she found 19 leeches in her boots. Despite hardships, the expedition proved a success. New Britain's interior yielded its secrets to science; the zoological survey begun fifty years earlier in more accessible areas was complete at last. Table holds scientific specimens, including bats.

Swishing a grassy bustle, a woman porter bears her burden with a smile. The box balanced on her head holds expedition equipment.



of slender bamboo, spliced with leaf wrappings and resin. It was so flexible that it bent like a reed when held in the middle.

To use this delicate weapon, the hunter finds a place frequented by game—a flowering or fruit tree, or a drinking pool. Then he slides the thin tube through the foliage, which helps support it, until the muzzle is from two to five feet from the point where the target can be expected to perch or browse. Often, driven by a puff of air, the fire-hardened arrow tip will have pierced the target by the time the shaft's tuft of parrot or pigeon feathers emerges from the tube.

Still hunting, observing, photographing, and collecting, we moved on from Moia toward the coast. It was essential that we leave New Britain before the middle of February; bad weather around that time of year makes sailing Vitiaz Strait to the port of Madang, in New Guinea, a dangerous undertaking for small craft. Even in moderate weather the passage is bad enough.

Rollers traveling across the virtually clear oceans from Micronesia meet their first obstructions in this region of shores and straits. When we had come over in the mission vessel from Madang, our course lay in their troughs; we had to take a beam sea. Margaret had turned an interesting shade of chartreuse, and I wondered grimly why I hadn't chosen a sensible occupation. Going back in bad weather, through wind and wild waves, would be appalling—even if we could surmount the problem of finding a local captain willing to undertake the crossing.

"Puk-puk" Deflates a Native Ego

Moving from village to village on this excellent trail from Iambon to the coast, we were constantly astonished at their seeming self-sufficiency and isolation. Earlier on our trek we had even found villages absolutely unknown to the territorial government.

Equally intriguing was the vanity-blasting frankness of the villagers in their conversation. A man suffering from a fungus infection of the skin which gives it a scaly appearance is addressed simply as "Puk-puk," the native word for crocodile. I don't doubt for a second that with my glasses I was "Old Four-eyes" in the native vernacular.

On January 29, just 72 days after we had marched away from it toward Hualil, we returned to Kandrian. We had trudged an estimated 100 air miles—approximately 175 trail miles—and established 15 separate collection camps.

Far more important, we had completed our program of 1,000 hours of high-mountain hunting and so accomplished the chief purpose of this exhausting expedition: a comprehensive zoological survey of the Whiteman Range. Our work had covered the last unexplored niche of birds and mammals on the island of New Britain. We had "wrapped up" a job begun more than half a century before, and one of the last blank spots on ornithology's world globe had been filled in.

We knew that we had discovered two new species of birds—our greenish, long-billed honey eater and the black-masked thicket-warbler. We knew that we had found three races of birds never before known to exist in New Britain. Our specimen cases were jammed with other birds and mammals still awaiting study or identification.

Back in the United States, we would face the fascinating chore of fitting all of our specimens into their proper biological relationships—a job that would take many months, perhaps years.

Elusive Bird May Yet Be Found

Yet even as I relaxed under my first hot shower in one of the government residences at Kandrian, that original question gnawed at me: Why had we found no birds of paradise? It is a riddle that puzzles me to this day, and I cannot escape the thought that somewhere, in some obscure spot in those inhospitable mountains, birds of paradise may yet be discovered.

Our trail into the Whitemans will—I sincerely hope—become an avenue for other specialists intent on studies of the interior heights, their vegetation, animal life, and their amazingly few inhabitants. The most fortunate, I believe, will be those scientists who succeed where we failed and make firm friends with Iangmili, the leader of the wild men. Perhaps he will then let them enter and study his domain.

Most of all I hope that they will collect and let me examine any bird plumes Iangmili's people might use for adornment during their strange jungle rites. And I hereby promise not to say "I told you so" if I find a bird of paradise plume among them. I will simply be a much relieved ornithologist, and that gnawing question will go away and leave me content.

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COVER: *Palmwood spear and painted shield protect an Aravae hunter of New Britain (page 271).*

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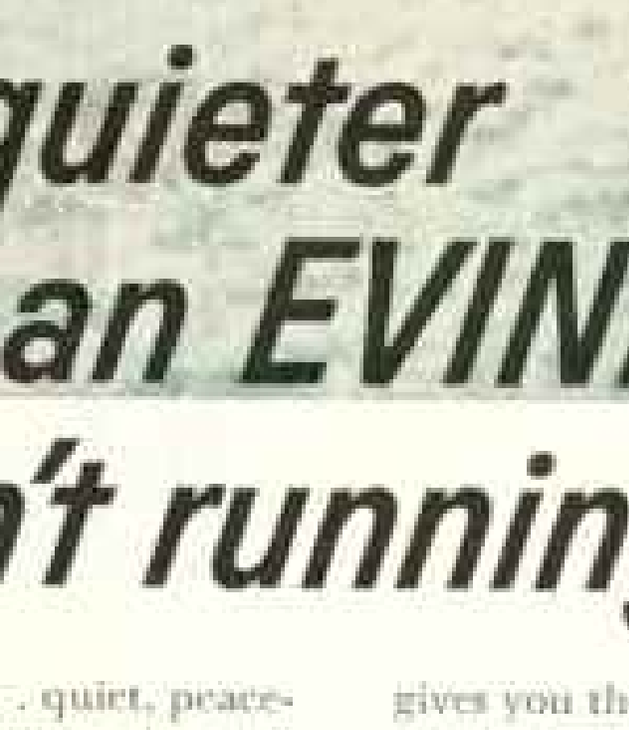

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WHAT'S A HOATZIN?

In flight, it's a flailing, graceless thing. But it excels in less bird-like activities—in climbing trees, for instance. Among its other eccentricities are eyelashes and underwater aquatics, and a diet of muckamucka plants and thornbush. *Opisthocomus hoazin*—also known locally as "General Battenburg's turkey" and "Stinking Hannah"—seems to delight in violating the laws of logic.

At The Society's request, J. Lear Grimmer, Associate Director of the National Zoological Park, went to British Guiana. National Geographic naturalist-photographer M. Woodbridge Williams went with him. Soon they will bring you a stimulating look at the life and habits of this feathered nonconformist.

You will enjoy it. Your friends would enjoy it, too. Use the blank below to nominate them for Society membership.

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP CHECK ONE

mail to: THE SECRETARY
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON 6, D. C.

I NOMINATE for Society membership the person named at left. (Use separate sheet for additional nominations.) ☐

(GIFT MEMBERSHIP) I nominate and enclose $_____ for dues of the person named at left. Send gift card ☐ ☐

I DESIRE INFORMATION concerning membership and the NATIONAL GEOGRAPHIC. (Fill in at left.) ☐

$6.50 MEMBERSHIP DUES for calendar year 1961 include subscription to NATIONAL GEOGRAPHIC and apply in United States, U.S. Possessions, and Canada. Elsewhere, $8 (determined by postage differential). Life membership, $150 U.S. funds. Make remittances payable to and send direct to the National Geographic Society. 2-61

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What the Scallop Shell meant to the fountain builders of Rome

Bernini's Bee Fountain, Rome ▶

● Rome was an inland city that dreamed of the sea.

So its fountain builders turned for inspiration to the universal symbol of the ocean voyage—the scallop shell. Here you see the Fontana delle Api, or Bee Fountain, by the sculptor Bernini whose work in the early years of the seventeenth century was known for his lavish use of the scallop.

Linked to the sea-birth of Venus, the scallop came to symbolize the sea and those who go on a quest. Later, it was the badge of the medieval pilgrims who traveled to the shrine of St. James in Spain and of Crusaders who had gone on a quest to the Holy Land.

Symbol of the voyage, the search, the quest—in modern times the shell has supplied both the name and trademark of one of the world's most enterprising companies.

Under this familiar symbol, Shell men explore the most difficult places on earth to enrich the world's oil supplies. They drill in arctic wastes and deserts, even under the floors of the seas.

But that is only the beginning of the quest carried out under the sign of Shell. In scores of laboratories other Shell workers search for and develop new and better products from petroleum—new chemicals to increase the food supply of the world, new kinds of synthetic rubber, a new yarn of unusual properties, and, of course, finer gasolines and motor oils.

When you see the sign of the Shell, let it remind you of the never-ending search for new and better products from petroleum, and ever finer standards of quality. *The Shell Companies: Shell Oil Company; Shell Chemical Company; Shell Pipeline Corporation; Shell Development Company; Shell Oil Company of Canada, Ltd.*

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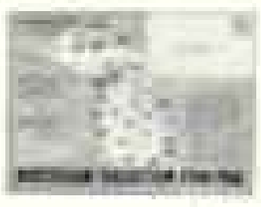

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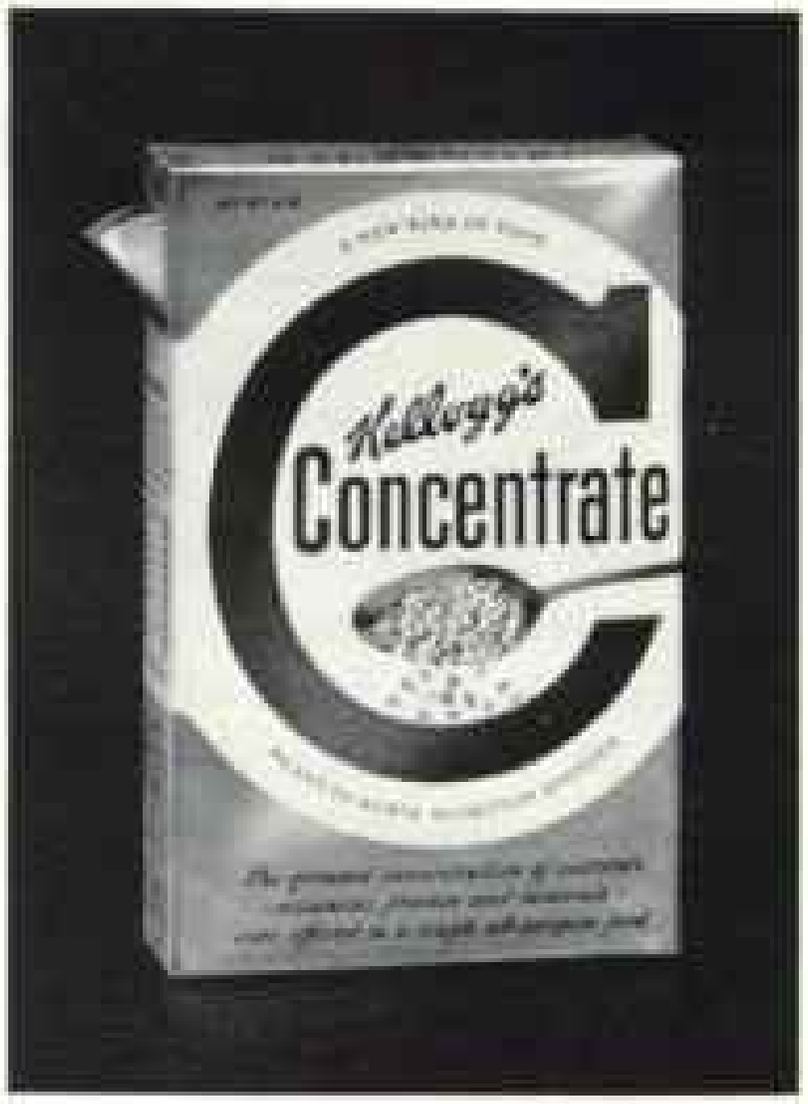

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VITAMIN B_1 (thiamine): as much as three ounces of ham.

VITAMIN B_2: more than five carrots.

VITAMIN C: about as much as a four-ounce glass of tomato juice.

NIACIN: more than three ounces of boneless, lean beef.

IRON: as much as two ounces of beef liver.

VITAMIN D: as much as two glasses of vitamin D milk.

VITAMIN B_{12}: as much as an ounce of meat or fish.

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That is today's Greece . . . all its ancient wonders now accessible in complete vacation comfort!

You can't help enjoying your prestige as an American visitor. For you will find in modern "Hellas" an invariably friendly people. They are proud of their country . . . its mythology . . . its classic architecture . . . its breath-taking scenery . . . its balmy climate. You will learn more about Greece talking to them than you can usually find out about a foreign country. (Many Greeks speak English; it is taught in the schools.)

Besides, Greece presents day-after-day delights to the traveller. Rewarding ruins to see . . . sites of stirring scenes mentioned in Greek history . . . altars to gods and demi-gods and goddesses . . . novel Mediterranean foods to feast upon (the seafoods are deliciously prepared) . . . a climate so benign that you dine or dance under the open sky and stars . . . swimming almost all year 'round . . . a centuries-old amphitheater where you see a play performed out-of-doors (the acoustics are still perfect).

3000 years of history and legend crowd in

upon you everywhere. On the road to Delphi, you suddenly recall that it was here Oedipus met his father, Laius, King of Thebes. Unrecognized, Oedipus was struck with a whip, to make room for his father's chariot to pass. Enraged, the young man attacked and killed his father, the tragedy described by Sophocles in *Oedipus Rex*.

Currency exchange is favorable to Americans, with drachmae 30 to the dollar. And you'll find it easy to remember the coinage of Greece in converting drachma prices into dollars. About $10 a day will cover everything.

You'll be tempted, as everyone is, to purchase a few Greco-Roman antiquities (dug-up coins, pottery, statuary) for which you'll need a government permit. Or you may see a fascinating Byzantine icon or some silver jewelry with Grecian *motifs*.

Travel in Greece will give you many golden opportunities to try new dishes. And they have such an interesting custom in *tavernai* (restaurants) . . . you are expected to walk right into the kitchen and select what you want from the cooking pots.

In the cities, sitting at tables outside confectioners' shops, you can indulge in various *glyka tou tapsiou*, all sweetmeats made in a pan and cut up into small pieces.

If you drop in at a *kafenion* (coffee shop) Greek coffee is served, in tiny cups, accompanied by a glass of cold water, as is the custom here.

Greece adds modern convenience for the traveller, to a civilization that was ancient when B.C. changed to A.D. See Greece!

TRAVEL QUIZ
(FOR FEBRUARY)

Dogs pay bus fare in:

☐ *England* ☐ *Germany* ☐ *Mexico*

The transit authority in Poole, England, recently ruled that dogs must pay half fares on buses. If you're an adult *human*, you'll have to pay full fare. And you'll want to be sure to carry The First National Bank of Chicago Travelers Checks. Only you can cash them!

Pineapples were first grown in:

☐ *Thailand* ☐ *Paraguay* ☐ *Samoa*

The pineapple's original home was Paraguay. Natives there adopted the fruit as a symbol of friendship and hospitality. You'll find the people of Paraguay feel the same way about The First National Bank of Chicago Travelers Checks. They're known and accepted everywhere!

***Markkas* are units of currency in:**

☐ *Greenland* ☐ *Portugal* ☐ *Finland*

Exchange your First National Bank of Chicago Travelers Checks for *Markkas* in Finland. Checks are $10, $20, $50, $100—each denomination in a different color for instant identification. Ask for them at your bank!

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Consider the view from our sentry box. All summer long, parades and pageantry, march pasts and music! Indeed, the Canadian scene features some of the most eye-filling spectacle to be found anywhere, and some of the liveliest festivals and special events —there are festivals honoring lobster, the strawberry, Shakespeare and trout . . . there are Nova Scotia's Highland Games, the Calgary Stampede, Vancouver's International Festival of the Arts. And consider the parade of pleasures along the dramatically scenic Trans-Canada Highway; your relaxed view from a world-famous resort after a satisfying day of golf, tennis, sailing or swimming. If you're going places, consider Canada. The summer here is quite a parade.

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At least it seems like it, once you're amid the color of ancient Spain. The click of heels, the clap of hands, Olé! it's exciting! But castanets aside, why not take a whirl at being part of the gay life of Europe. The thrill *is* worth the trip.

And, of course, it takes BOAC to make the pleasure complete. Whether your destination is the Plazas of Madrid or the Piazzas of Rome, the jet flight to Europe on BOAC's Rolls-Royce 707 is the ultimate. It's the service that does it. Called the best in the world . . . all over the world.

As to the cost, it's a trifle considering the fun you'll have. The 17-Day Excursion Fare by jet is in effect now. Only $393.20 Economy Class Round-Trip from New York to Madrid; just $350 to London. Even less on the jet-prop Britannia.

Come on, jet over with BOAC! Then feel like a Flamenco dancer . . . or a gondolier . . . or a bagpiper. Your Travel Agent will help with the transformation. Just ask him. Or write to BOAC for 1961 Tour folders. Choose the place . . . you'll like the change!

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Thousands of cottages in Britain still wear wigs. (This one is at Arkesden in Essex.)

How to tour Britain for $100 a week—without skimping

Prices in Britain are amazingly low. Study them before your next vacation. If impressed, see your travel agent. And send for free British travel aids (see below).

MANY AMERICANS are surprised that you can have the time of your life in Britain for $100 a week.

It's anything but a skimpy, Spartan sort of vacation. Most prices in Britain just happen to be lower than in the U.S. For instance:

$3.75 a night is the price of bed and breakfast in Britain's charming inns. You can stay in a comfortable London hotel for about $6.00—breakfast included.

35 cents buys a Scotch and soda; 14 cents, a foaming half-pint of ale.

$2.40 is ample for an orchestra seat in London's theatres; $3.50 at Covent Garden. The best seat at the Shakespeare Season of Plays at Stratford (Spring through Fall) costs you about $2.80.

14 cents (one shilling) admits you to the Tower of London (see the Crown Jewels for another 14 cents).

4 cents is all you pay to visit the Royal Botanical Gardens at Kew. Over four hundred British castles and mansions are open. Average price: 35 cents.

Free! You don't pay a ha'penny for the Lord Mayor's Show (November); Changing of the Guard (almost every day); Trooping the Colour (June).

2.9 cents a mile is the price of train travel in Britain. You can go from London to Edinburgh *and back* for $20.02.

$38.40 rents a drive-it-yourself car for a week, September through June. (You pay about 25 per cent more in July and August.) Insurance included. No charge per mile. Gas for about 800 miles: $13.60. Total $50.

Come in Spring or Fall. You save money—and roads are uncrowded.

$5.60 is the fare for a leisurely three-day boat trip from Kingston to Oxford. You can rent a canoe for less than $10 a week; a six-berth boat for about $65.

$17 for cashmere sweaters; $12 for good woolen skirts; $15 for leather handbags. Men's hats for $7; Scottish tweed jackets for $25.

$500 duty-free. You can bring home $500 worth of British goods per person without paying U. S. customs.

Free travel aids. Before you plan your trip to Britain, see your travel agent. And send for free British travel aids—maps, a calendar of coming events, and a lot of other information that's great fun to pore over. Write British Travel Association, Box 180. In New York—680 Fifth Avenue; in Los Angeles—606 So. Hill St.; in Chicago—39 South La Salle St.; in Canada—90 Adelaide St. West, Toronto.

Typical expenses on a two-week vacation in Britain

3 nights in London (including breakfast)	$18.00
11 nights in country inns (including breakfast)	41.25
14 lunches with half-pint of ale	16.00
14 dinners with highball	33.00
500 miles by train	14.50
Car hire, one week (800 miles)	50.00
Sightseeing	4.00
3 nights at the theatre	7.20
Incidentals	15.75
TOTAL	$199.70

Transatlantic fares will also surprise you. From October 1 through March 31, you can travel from New York to London *and back* for as little as $328 by air, $338 by sea.

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(Above) The historic Alamo, in downtown San Antonio, is the shrine of Texas liberty and a mecca for tourists.

(Right) A search that never ends...the search for natural gas and oil, key factors in Gulf South prosperity.

(Below) A sportsman's paradise . . . in scores of Gulf South locations. This scene taken near Shreveport, La.

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moves over to welcome you in. With the new Thunderbird 390 Special V-8 engine, suddenly the landscape comes alive. Corners turn straight and roads flatten out. This is the 4-passenger luxury car with sports car personality. It is unique in all the world. ¶ Automatic transmission, power steering and power brakes are standard—of course. Interiors are the newest and purest expression of Thunderbird elegance. Thunderbird comfort. Engineering is in the tradition of timelessness that has won Thunderbird the finest resale record of any luxury car. Check the new trend at your Ford Dealer's—on your way to Thunderbird Country.

unmistakably New, unmistakably Thunderbird

1961

When your blood pressure goes up

here's how to help bring it down

ONLY a few years ago, doctors could do little more than say to their patients: "You must learn to live with high blood pressure."

That advice still holds good. But nowadays there are specific treatments by which this condition can often be controlled when not complicated by some underlying disorder.

Many new drugs are largely responsible for helping to reduce the risks of this condition. These drugs, which must be prescribed by physicians, can lower blood pressure and may reduce the possibility of damage to the heart and blood vessels.

Since high blood pressure affects to some extent an estimated 6 million people in our country, you should know these facts about it:

1. Hypertension or high blood pressure is often discovered during a health examination—a good reason why everyone, especially those middle-aged or older, should have periodic medical check-ups.

2. Hypertension occurs more than twice as often among overweight people as among others. A combination of overweight and high blood pressure is a serious matter. So keep your weight down.

3. Anyone can develop high blood pressure. It is more common, however, among people who are subject to a great deal of tension and anxiety.

Many people with high blood pressure or hypertension live long, useful lives through moderation in living habits, weight control and faithful observance of their doctors' instructions.

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2. Corvair Lakewood 500 Station Wagon

3. Corvair 500 4-Door Sedan

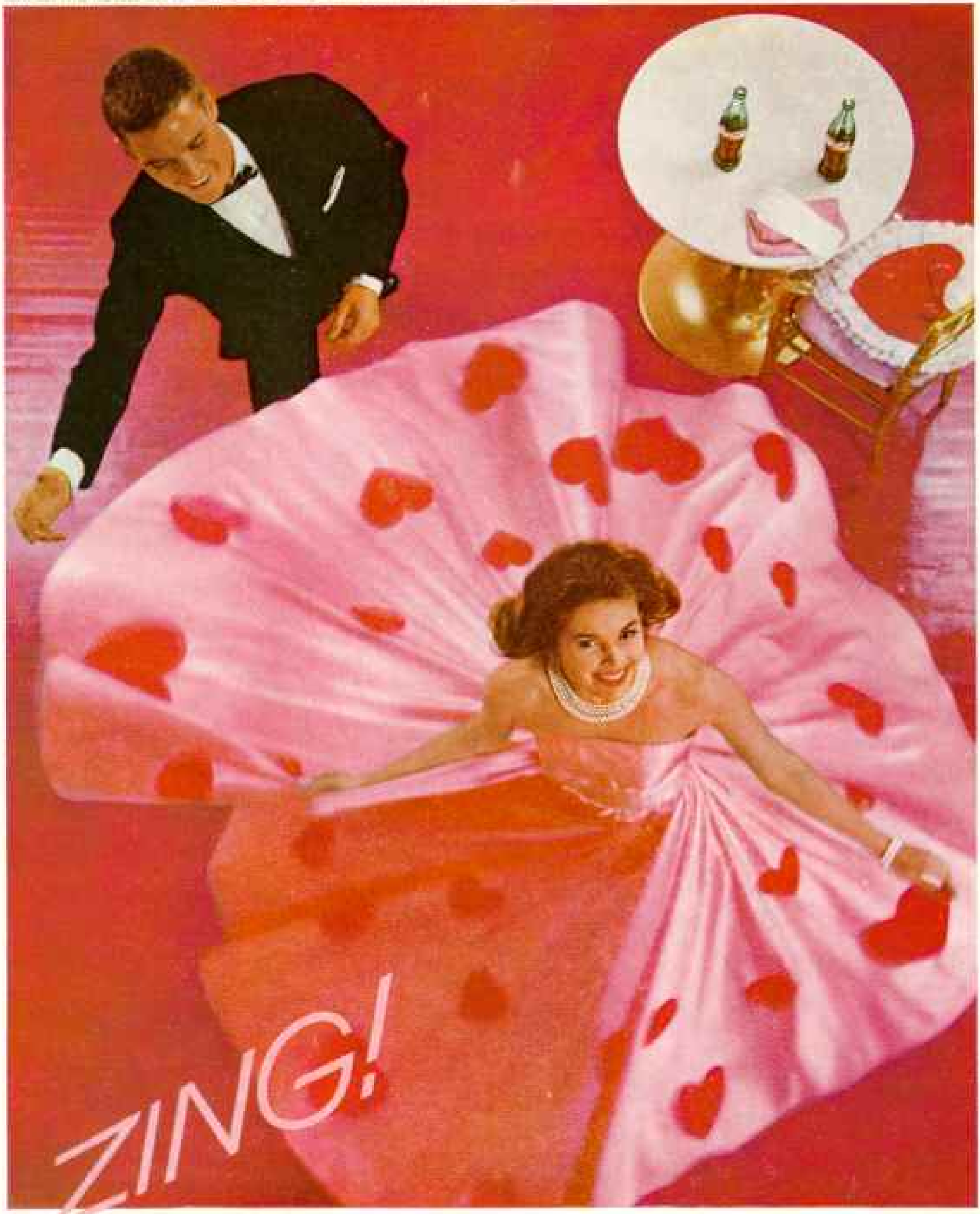
Three thrifty ways to go wandering

Well, who wouldn't like to get away from it all in cars like Corvair? Especially when it costs you so little. (Corvair's not only priced 'way down, every model keeps right on saving with quicker cold-start warmup, no antifreeze-buying blues, and lots of other ways your dealer will tell you about.) What's more, Corvair gives you your money's worth of riding comfort and handling ease. Make the first leg of your vacation trip a jaunt to your Chevrolet dealer's. Bon voyage! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

1. *Monza* – Wouldn't you look dashing, driving a Monza Club Coupe with its handsome bucket-type front seats!
2. *Lakewood* – Corvair's rear-engined station wagon gives you up to 68 cubic feet of space, 10 of it under that lockable bonnet.
3. *500 4-Door Sedan* – Nearly 12% more luggage space up front this year, but no change in Corvair's brisk handling.

'61 CHEVY CORVAIR

corvair



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Changes slides by itself! And the lens zooms!

Now one projector brings you the two newest ways to better color slide shows—automatic changing, and a zoom lens.

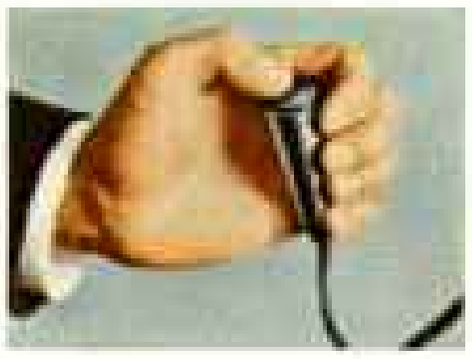
Just turn it on—the Kodak Cavalcade Projector automatically changes up to 40 slides in a row at pre-selected intervals of 4, 8 or 16 seconds.

And the brilliant *f*/3.5 zoom lens is a real convenience! With it, you can set up your Cavalcade Projector almost anywhere in the room—up close to the screen or back from it—wherever there's a wall outlet handy. Then, to make your picture fill the screen exactly, you simply slide the zoom lens forward or back.

See *all* the showmanlike features. Kodak Cavalcade Projector, Model 520 with Zoom Lens . . . less than $140, or as little as $14 down. Deluxe Model 510 with Zoom Lens . . . less than $160, or as little as $16 down. *Prices are subject to change without notice.*

Easy editing—you remove, insert slides with the tray in projector.

Zoom lens makes picture subjects grow bigger or smaller on your screen.



Remote control lets you change slides from up to 12 feet away. (Optional.)

See your dealer for exact retail prices.

Another fine projector — Kodak 500, Model B. From less than $68, or as little as $7 down.

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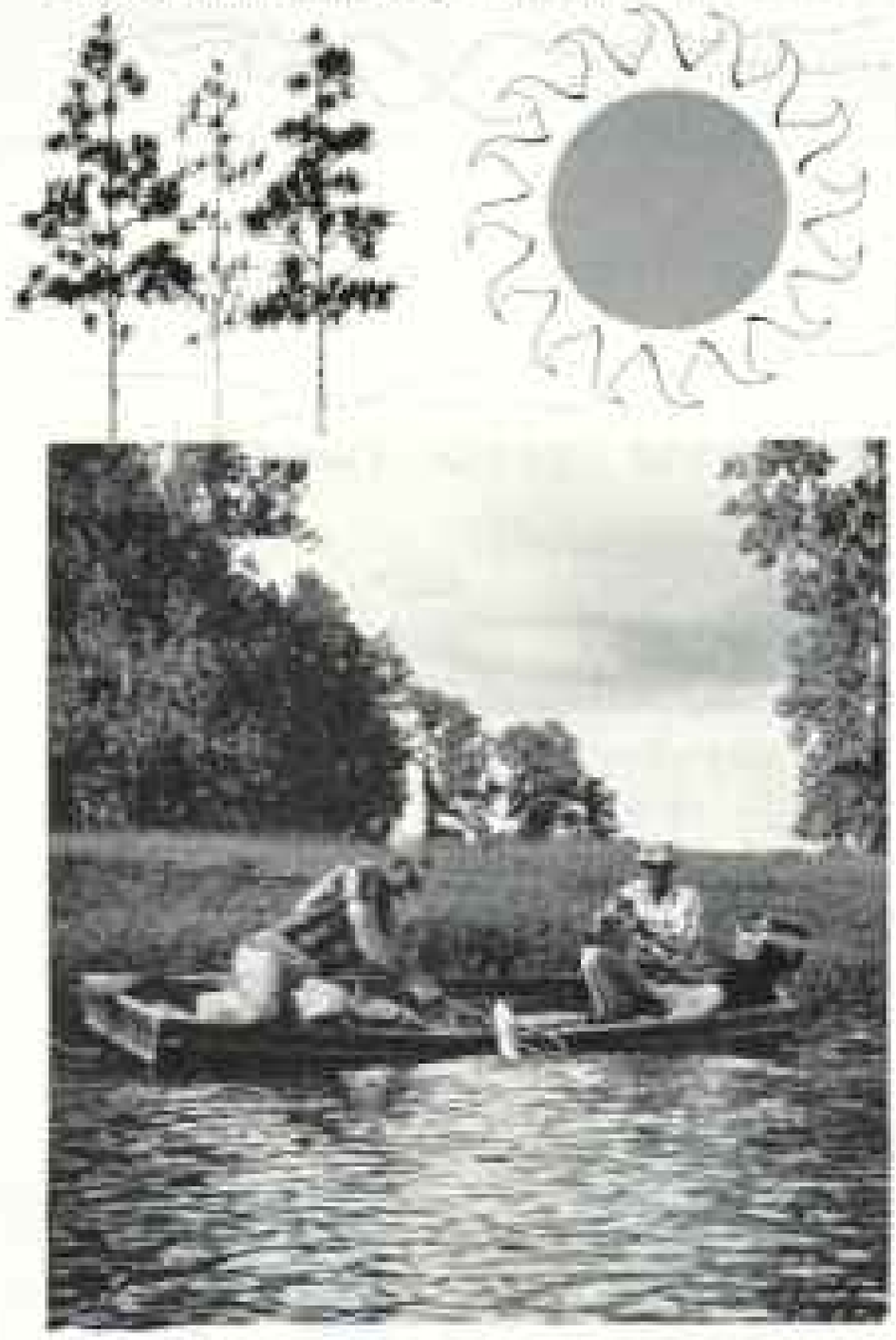

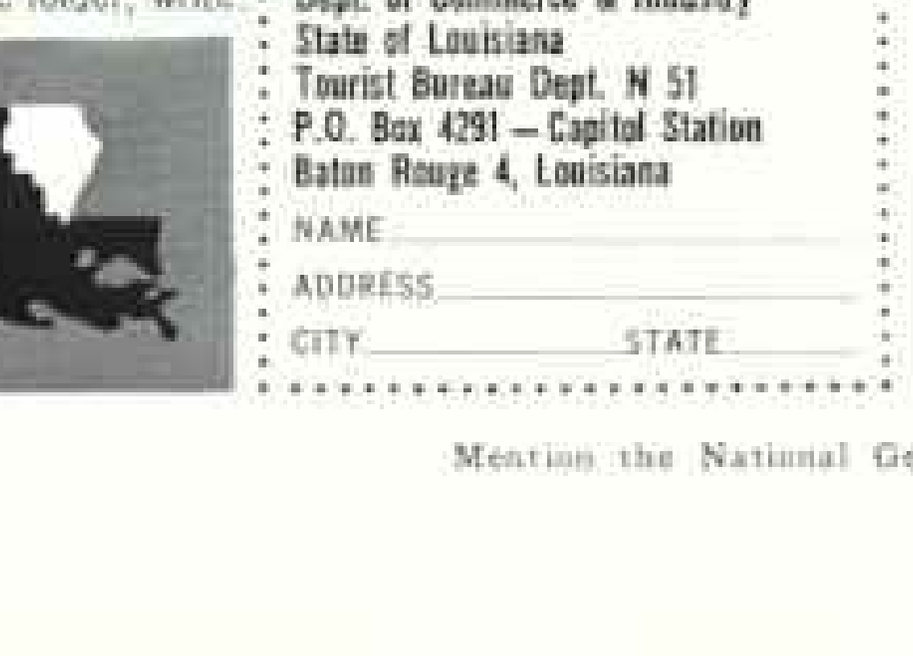

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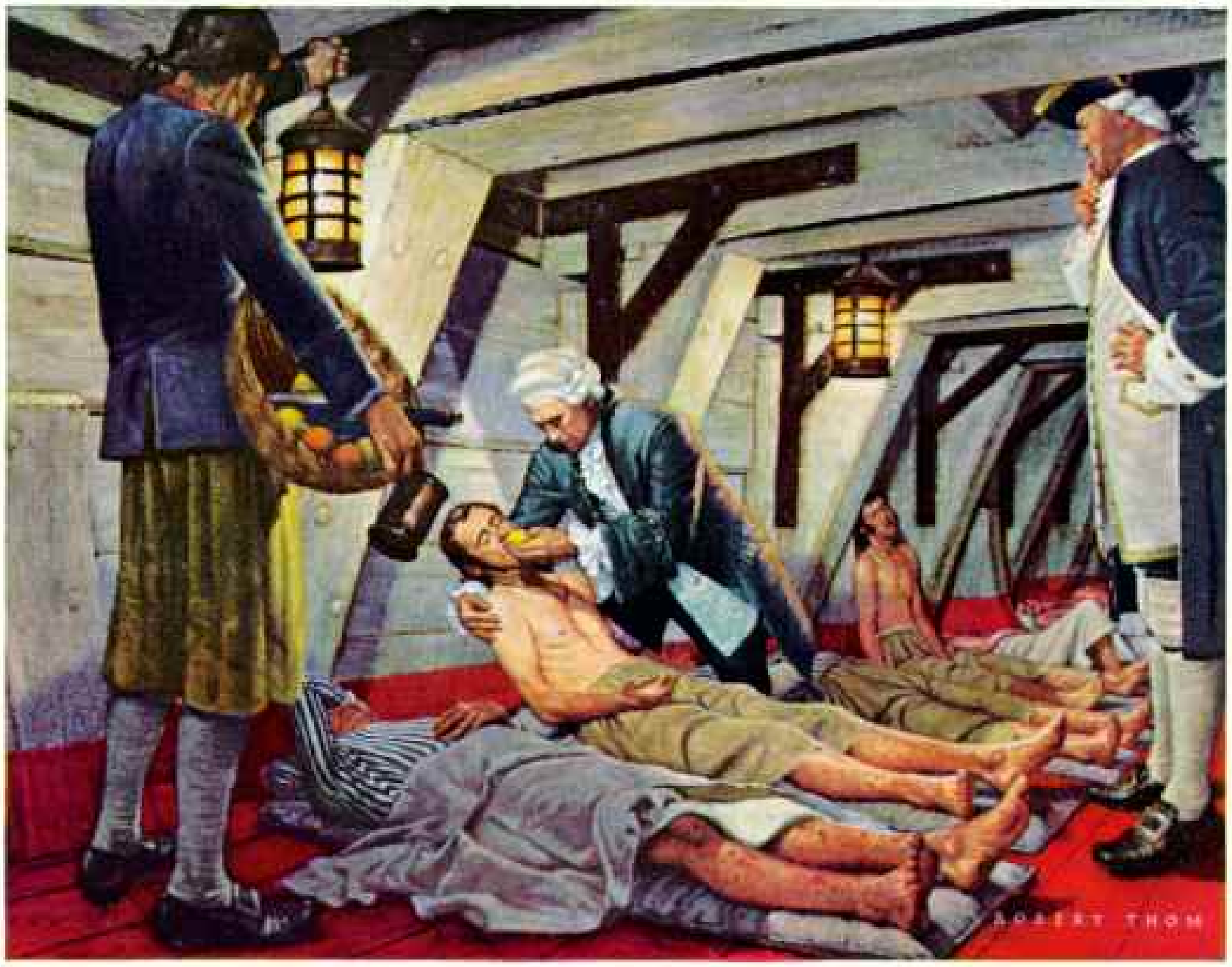

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Lind's recommendation was the addition of fresh limes, other citrus fruits, and their juices to diets of seamen. Though not adopted generally by the British Navy until after his death, this diet saved countless lives. British seamen, thereafter called "Limeys," were the first large group of people to receive routine prophylactic vitamin therapy. Although some vitamin deficiencies in man cannot be prevented or corrected as dramatically and as simply as scurvy, modern medical research is constantly giving physicians better and more effective weapons for use in the fight for better health for people world-wide.

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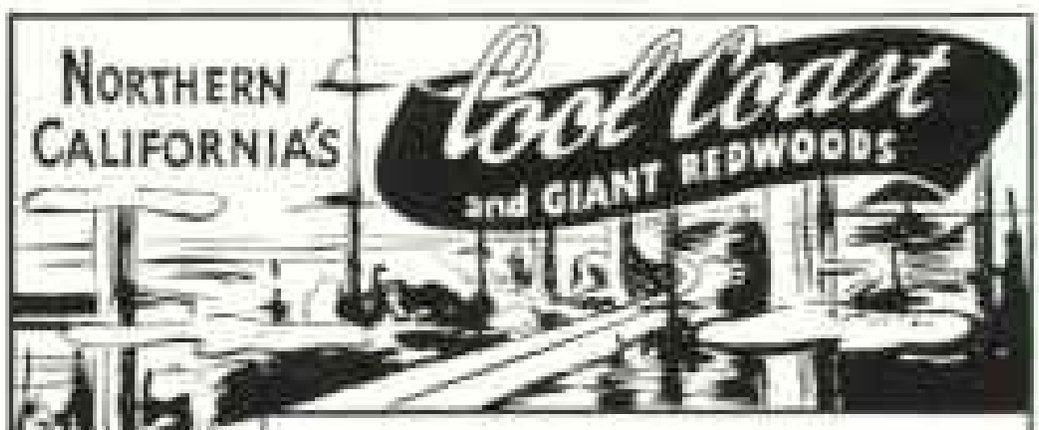

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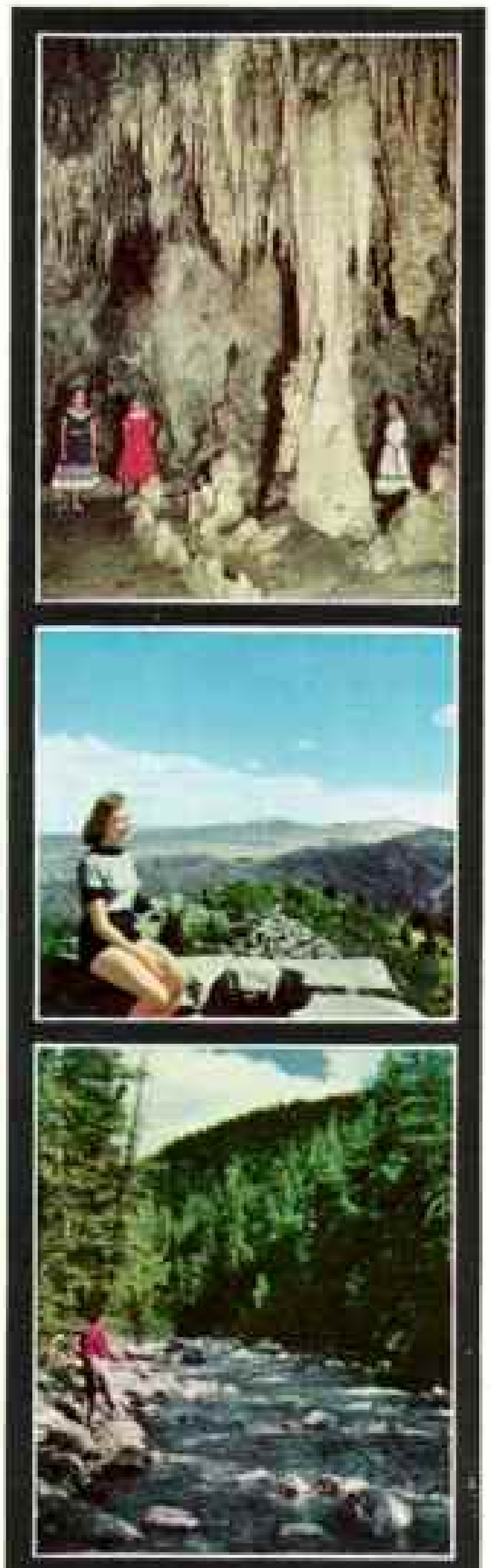

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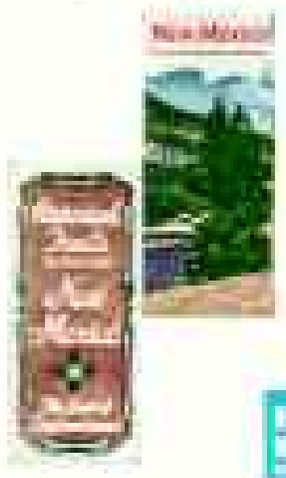

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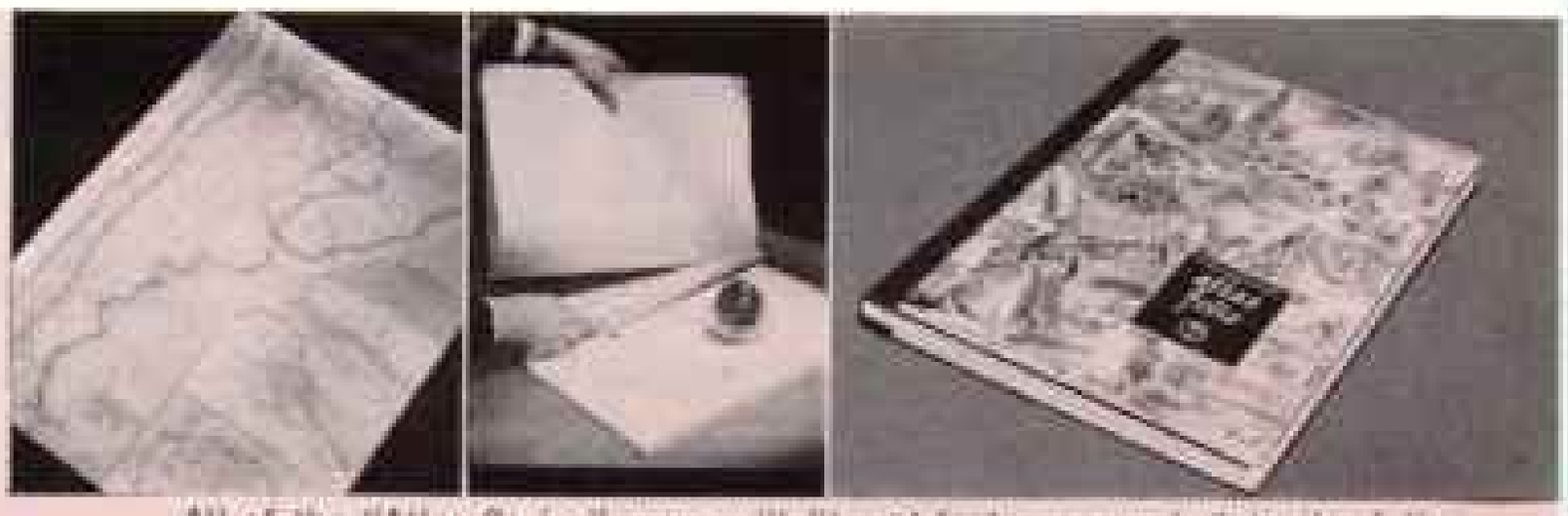

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HOW TO HAVE EUROPE ALL TO YOURSELF

by Ludwig Bemelmans

For me, the only time to go abroad is when everybody else isn't. That is, either before the tourist tide floods, or when it ebbs.

Things are different during my time to go.

Traveling, for example. Take my most recent visit. At the very start of the trip, a traffic jam delayed my arrival at the airport. The plane had left the gate and was already at the starting line.

Normally, in "high" season, this would have been grave, caused delay, upset plans, and cost a good deal of money. Now, it didn't matter. The young lady at the counter said: "Don't worry, we have a seat on the next plane, leaving in an hour." This plane was not crowded, I had a good crossing, no time was lost. The same would have been true had I been traveling by ship, which I did a previous time across.

I've found that during certain times of the year, you get all the best that Europe has to offer. They are Spring, late Summer and Fall.

The chef has time to bother with your order and it is served properly. No one cares how much time you take to study the menu, how many questions you ask about wine. You take your time, nobody is waiting for you to get up from your table.

You have your choice of rooms. The maid will have time to do some pressing for your wife, or sew a button on your shirt. You can enjoy visits to museums, theatres and art galleries without disturbance. You are not crowded in by the great population shift that includes Europeans, as well, since all *Europe* is on the move during the regular tourist season, too!

No matter where you are in Europe, at my time, the people themselves come to the fore, like a photo in the developing tank, suddenly sharp and clear. *You see them in the frame of their natural lives; you hear them as they are; you have time for them, they have time for you.*

For me, this is the only time to go. L.B.

FREE—*full color illustrated folder "See Europe Now" covering 21 European countries and travel map. See your travel agent or write to the National Tourist Office of the country you want to see. Box 258, Dept. 143, New York 17, N. Y.*

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"Not for you, darling...this is girl talk"

Oh.

Well, back to the bench saw.

But if you *could* hear both ends of this friendly visit, you'd realize that girl talk really gets a whale of a lot accomplished.

This single telephone chat, for instance, could

—serve you up a new recipe for apple cobbler tomorrow night

—suggest a sure-fire cure for the two-year-old's midnight thirst

—discover a place you can buy fine boxwood plants for only a dollar each

—tell you how the Marshalls got their basement dry in just one week.

In addition, the girls will decide who ought to be on next year's school board and make a date to go to the hairdressers together.

Girl talk—over the phone or over the fence—is something every enlightened husband ought to encourage. After all, *he's* often the beneficiary!

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Ice on the windshield has long been a serious hazard to winter driving. But now you don't have to worry about stopping every few miles to scrape it off. The laboratories of Union Carbide have developed a pressurized spray that defrosts windshields instantly, melts ice for easy removal, and prevents further freezing —even at zero temperatures!

This chemical ice-breaker—PRESTONE Spray De-icer—was created through the kind of research in petro-chemicals that gave you PRESTONE brand Anti-Freeze . . . still the most dependable all-winter cooling system protector. Union Carbide's pioneering work has produced hundreds of new and unusual chemicals that go into the making of fast-drying paints, wonder drugs, wrinkle-free textiles and a host of other useful things.

These are only a few examples of how modern chemistry helps make your life safer and more enjoyable. The people of Union Carbide will continue their search for new and better materials to meet the challenge of tomorrow's world.

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