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# NATIONAL GEOGRAPHIC

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## Madagascar

### ISLAND AT THE END OF THE EARTH

By **LUIS MARDEN** Chief, Foreign Editorial Staff

*Illustrations by National Geographic  
photographer ALBERT MOLDVAY*

**W**HENEVER I APPROACH an island from the air, I think the Wright brothers went too far. Seeing the land suddenly appear beneath you is nothing like watching a high tropical island grow up out of the ocean. From a ship you see first a white mass of cumulus clouds piled high on the horizon. Then the clouds detach themselves from the sea, and the tips of the highest peaks, small and remote, stipple the edge of the sky like separate islets. Finally, as the land slowly comes up over the curve of the earth, the peaks grow together and rise green and brown on a writhing line of white where the surf splinters on the shore.

But Madagascar is really more of a continent than an island. I was glad, then, to have my first view of La Grande Île from the pilot's compartment of an Air France jet flying at 31,000 feet. The thousand-mile-long island-continent lies off the southeast coast of Africa like a gigantic footprint on the Indian

**Memorial of a mysterious people:** Wooden figures atop a Madagascar grave depict a chieftain's life. From top, he sentences a criminal, counsels a villager, protects his family, and goes on a hunt. On this vast island off Africa's southeast coast, tribespeople of distant origins and distinctive ways dwell among plants and animals found nowhere else on earth.







**DUSK DARKENS A PARADISE ISLET** *as a fisherman poles homeward, balanced casually in his tippy dugout. His stick, sharpened at one end, doubles as a harpoon for spearing fish in coral-encrusted Indian Ocean shallows. The squat lighthouse rises above Sorcerers' Point on tiny Île Ste. Marie, off Madagascar's east coast.*

KODACHROME © N.I.S.

Ocean (map, page 453, and supplement painting). There is nothing between the southernmost tip of Madagascar and Antarctica but 3,000 miles of heaving gray sea and howling winds. This is truly the land *au bout du monde*, at the end of the earth, as Malagasy poet Flavien Ranaivo calls it.

#### Home of the Lemur and a Giant Bird

The 13th-century Venetian traveler Marco Polo never saw Madagascar. Nevertheless, he spoke the truth when he wrote, "You must know that this island is one of the biggest and best in the whole world." And, he might have added, one of the most singular. Only three islands on earth—Greenland, New Guinea, and Borneo—exceed it in size, and none

surpasses Madagascar in the oddity and variety of its plants and beasts.

Whatever Madagascar's origin, the island must have been isolated for a very long time. Strange animals and plants found there exist nowhere else on earth (pages 474-7). Lemurs, the great-eyed monkeylike creatures that represent one dead end in the primates' upward groping toward man, lead the peculiar fauna. But subfossil bones of creatures that lived until comparatively recent times reveal a pygmy hippopotamus no bigger than a dog, a lemur the size of a small pony, and a gigantic bird that laid the largest known eggs.

When I was a boy, I read a short story about that bird. It was called "Aepyornis Island," a fantasy written by that master of English prose H. G. Wells. The story tells of a professional collector who went to Madagascar to search for aepyornis eggs. Although the birds have been extinct for several centuries, in the tale one of the eggs hatches, and the chick grows 15 feet high.

I never forgot that story. One of my principal reasons for coming to Madagascar was to try to find an egg of this titanic bird.

Now the plane's pilot lightly pressed his hands forward and the horizon rose to meet us, a long coastline colored like Mars, ocherous red with touches of green.

Dead ahead lay the port of Majunga, on the broad delta of the Betsiboka. From the river's mouth spread a fan of red, staining the blue Mozambique Channel as though the lifeblood of Madagascar poured from some deep laceration where man had grievously wounded the earth.

Man the Destroyer has slashed and burned most of the great forest that once covered nearly all Madagascar, exposing the bare



Baskets ready for bargains, shoppers clad in rainbow colors and draped in the Malagasy's flowing white *lamba* go to market at Ambalavao. These islanders belong to the highland Betsileo tribe, a people who migrated long ago from Southeast Asia and excel at building the intricate rice terraces that give Madagascar an Asian look.

earth. Eroding rains have washed away much of the organic matter in the denuded soil, leaving a very high proportion of oxidized aluminum and iron salts.

As we flew southward toward Antananarivo, the capital (the French spell it Tananarive), the ocher hills, dusted with yellow green, rose toward the mountains that run the length of Madagascar. In folds between the hills lay dark wedges of forest. Pockets of water caught the light as we passed (page 457).

### Malagasy Ancestry Lies to the East

It was December, the beginning of the austral summer, and the rice fields of the high valleys were flooded with rain. The tender green of the young rice lay on the red earth as though a palette knife had spread rectangles of vivid color on the valley floors.

At the airport I was struck by the appearance of the Malagasy (pronounced MAHL-a-GAHSH-y). Brown-skinned and fine-boned, with straight black hair and large luminous eyes, many of them would have passed unnoticed on the streets of Bangkok or Papeete. The highland Malagasy, though close to Africa, are not of it. They call themselves Malayo-Polynesians, and their ancestors came, according to linguistic, cultural, and anthropological evidence, from somewhere in southeastern Asia. How and when they came to Madagascar is one of the major enigmas of the "Mysterious Island."

In the taxi I took to Antananarivo a sign in French read: "City, 100 francs. Upper city, 150 francs. Cortèges, Marriages, Funerals, Exhumations, Price to be Debated." I asked the driver about the exhumations.

"We Malagasy," he said, "open the tombs of our ancestors every now and then, and wrap the bodies in new shawls, so as not to leave them in nakedness."

"You come from America? If a man has plenty of money, and likes the busy life, that's the place. But if he wants a tranquil life, on little money, let him come to Madagascar."

"I was going to take a job in your country."

Teen-age dandy with a statesman's stance adorns himself with a tasseled breechelout and a comb hung from a forelock. His Mahafaly people, possibly of Arab and African ancestry, dwell in the far south, a region of arid grazing lands where families measure wealth by the size of cattle herds. Dignity and natural poise characterize all the tribes.

When the American consul gave me the papers, I read the address; it was 4500 Something Street in Chicago. When I saw that, I tore up the document. Any place that has street addresses in four figures is not for me."

Antananarivo, 4,000 feet above sea level, rises theatrically from the plain and is built on hills (following pages). The houses of the old town, like overlapping rectangles of pink, brown, and blue in a cubist painting, cluster round and beneath the austere outline of the century-old gray stone Palace of the Queen.

Today Tana, as the French call it, is bursting at the hills, and surrounding rice fields are being drained to build housing developments for the teeming population. The straight and flat approaches leading into the lower

ETHIOPIA © R.S.S.





Clouds of dawn frost the lofty capital, Antananarivo. The pleasantly cool city of 325,000 mingles earth-walled homes, arcaded shops, and new hotels amid jacaranda trees, whose summer blooms paint "Tana" a rich violet. On the heights the President's turreted palace



ANTANANARIVO (C) NATIONAL GEOGRAPHIC SOCIETY

stands near the cloud-hidden Palace of the Queen, where monarchs of the Merina tribe reigned until all Madagascar came under French rule in 1895. Though the islanders proclaimed the Malagasy Republic in 1958, their capital preserves a flavor unmistakably Gallic.





city pullulate with people and vehicles. Great buses belching clouds of black diesel fumes block the way of motorcycles, two-cylinder Citroën taxis, Renault station wagons, ox-carts, rickety rickshas on their last wheels, and throngs of pedestrians.

I bought a secondhand Renault from a firm called Madauto. That name aptly describes the driving in Antananarivo. Taught by the wheel-mad French, the Malagasy outdo their teachers. They come rocketing out of obscure side streets into the busiest avenue in town. After two or three near misses that left me shaken, I began to get the hang of the thing, and soon I was in there expressing myself with my car like all the rest.

### Strong Ties Still Link Isle to France

Under the arcades on the broad Avenue de l'Indépendance, *café terrasses* recall the sidewalk cafes of France. Signs everywhere are in French, and many of the Malagasy are bilingual. The city and its people reflect the years of French influence that have shaped their special character.

The French attempted their first permanent settlement in La Grande Île in 1642, but did not really establish themselves as the dominant influence until the end of the 19th century. In 1895, to "protect the rights" of French citizens, France sent an expeditionary force to conquer the island. The French dominion in Madagascar lasted 63 years and 14 days. On October 14, 1958, Madagascar declared the Malagasy Republic.

Gallic culture has always left a deep imprint on the people of France's overseas possessions; the world is full of dark-skinned "Frenchmen." The first President of the Malagasy Republic, His Excellency M. Philibert Tsiranana, emphasized this in an interview.

"We think French," he said. "The rapport that exists between us and France is first of

all the rapport of friendship. And France is the biggest customer for Malagasy products. But above all, the most valuable heritage France left us is French culture. That will always link us closely to France."

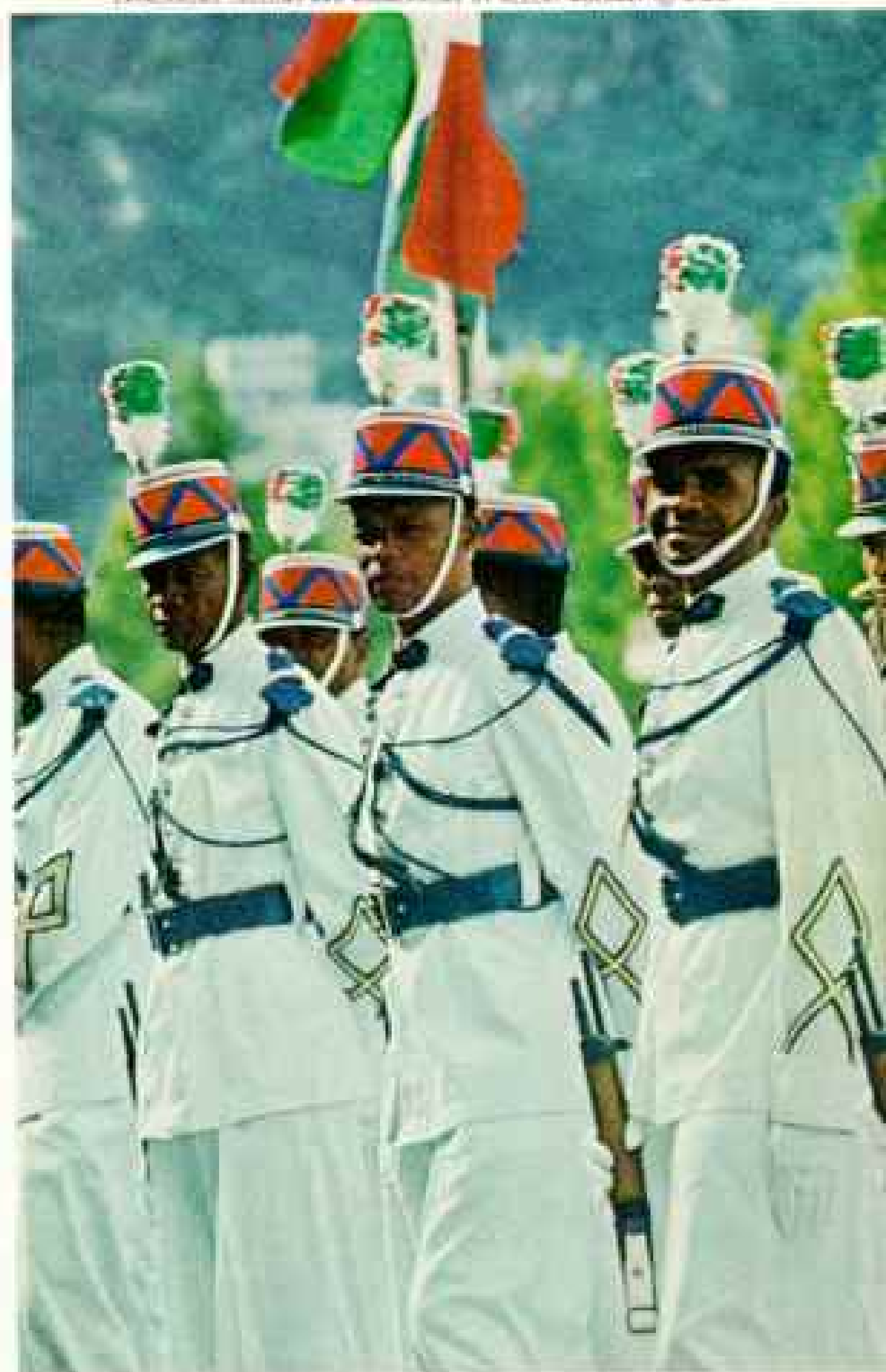
The President is a robust, brown-skinned man with a round, open countenance and a disarmingly frank manner (next page). He is of the Tsimihety tribe, a lowlander from northern Madagascar.

M. Tsiranana spoke of the origin of the Malagasy peoples. "We are the only true Afro-Asians," he said. "Geographically we are an island of Africa, but our people are of diverse origins, principally Asian with some African and even Arab influence.

"We are separated from Africa by a channel only 250 miles wide. Our ancestors, who probably came to Africa from Southeast Asia by way of India, must have crossed the channel to settle on our shores."

Nobody really knows. The most any

STYLING: JILLIAN AND ROSEMARY BY ALBERT WOLFF © S.A.S.



**Cascade of steps** pours shoppers into the parasol-shaded market of Antananarivo. Sellers spread out carrots, cauliflowers, turnips, tomatoes, and artichokes grown in gardens surrounding the city. Farmers stream in each *Zoma*—Friday—to sell at the busy market, now itself called the *Zoma*.

**Resplendent in shakos and chevrons**, a guard of honor turns out for a parade.

scientist will venture is that by the end of the first Christian millennium man was already well settled on the island.

Although there are only six million people—and ten million lyre-horned cattle—in all Madagascar, the population is exploding geometrically. Having read that the President was against "the Pill" and all other forms of birth control, I asked him why.

#### Families Urged to Have 12 Children

"There are not enough Malagasy in Madagascar," he said. "Our country has plenty of uncultivated plains and valleys; it is manpower that we lack. I want every Malagasy to have at least 12 children."

Many of them already do. Although Madagascar's chief crop is rice, which is seemingly planted everywhere, the government has had to import rice for the past three years as the population growth has outstripped the harvests.

When I left the President's palace, I drove higher up the ridge to the summit and the Palace of the Queen. Against the somber stone structure, a square building with a tower at each corner, a sad wind blew trumpet-shaped jacaranda blossoms into drifts like pale violet snow. The stone palace, built by a Scottish architect in 1866, completely sheathes an earlier edifice of wood.

The original palace was built in 1839 for Queen Ranaivalona I, a virago of the Merina dynasty who, turning against the Christianized Malagasy and all European influence, had five thousand of her subjects put to death.

Near the palace stands the single-room dwelling, in dark wood and high-peaked thatch, of King Andrianampoinimerina, most famous of the dynasty. The light-skinned Merina, most Polynesian of Madagascar's peoples and its largest tribal group, inhabit the highlands.

Andrianampoinimerina was the first to unify by conquest the people of the high plateaus, achieving this in the early 1800's. His ambition looked beyond the horizon, and he used to say, "*Nyriaka no valamparihiko*—The sea is the limit of my rice field." His dominion never reached the sea, but his successors continued his conquests until, by 1860, they ruled nearly all Madagascar and held most of the other peoples in tribute, and even slavery. Since independence, lowlanders have gained political ascendancy.

Like the Polynesian dialects to which it is related, the Malagasy language speaks in metaphors and poetic imagery. And here is still another mystery of Madagascar: Although its peoples are subdivided in 17 major tribes, varying in appearance from Asian to African, all speak the same tongue, with minor variations.

Foreigners find the polysyllabic language, which combines whole phrases in words of inordinate length, difficult to pronounce. I told M. Ranaivo, who is the Malagasy Director of Information as well as a poet, that I had seen some exceedingly long names in the list of Merina kings. M. Ranaivo looked over my list.

**Picture-taking President, M. Philibert Tsiranana** snaps an Easter celebration at Antsirabe. The onetime country schoolteacher, who studied technology in France before entering island politics, has served as President since the republic's founding.

Seeing photographer Moldvay take his picture, M. Tsiranana returned the honor with his Minox, and the two later swapped results.





**Homeward the herdsmen:** Beaming boys drive a gaggle of geese toward their highland village after grazing them all day in gleaned paddies. Geese, chickens, and ducks provide protein for the rice-based meals of most Malagasy. Beyond a raw red pathway, eroded earth long denuded of forest supports a scant cover of grass.

"Those aren't really long," he said. "Here is one for you." After writing for what seemed to be half a minute, M. Ranaivo handed me a slip of paper. I read: *Andrianampoinimerinandriantsimitoviaminandriampanjaka*.

"It means," said M. Ranaivo, "The Beloved Prince of Imerina Who Surpasses the Reigning Prince.' That was too long even for the Malagasy, so they shortened it"—he smiled slightly—"to *Andrianampoinimerina*."

Remembering that the Malagasy make sacrifice to *Andrianampoinimerina* as a revered ancestor, I later asked a Malagasy friend about religious beliefs.

He said, "The missionaries did their work well here. Most of the highlanders are Protestant Christian. The Catholics have more strength in the south, where the Lazarist Fathers came in 1648 with the *Sieur de Flacourt*.

"But let me tell you something, monsieur. We Malagasy are merely vaccinated with Christianity. There is not one Malagasy, no, not one, not even among the evolved [Europeanized] people, who would think of building a house without consulting the soothsayer as to the auspicious day to start. The old beliefs are not dead.

"We Malagasy believe in a single deity; we call him *Andriamanitra*, the Perfumed Lord, or *Zanahary*, but we also believe our ancestors will intercede with God for us if we make sacrifice and pray to them" (pages 464-5).

This reverence for ancestors, and the sense of their nearness even after death, explain the preoccupation with death, the tombs built half below and half above ground, and the rejoicing with which the ancestors are taken up into the sunlight periodically.

"The greatest insult that can be offered to a Malagasy," M. Ranaivo told me, "is to wish that his skull may never lie alongside those of his ancestors. If a Malagasy dies far from home, it is the filial duty of his children or other members of the family to bring his body back to the ancestral tomb.

"When the time comes, the *mpanandro*, an astrologer, stands before the tomb and addresses the dead one thus: 'O you who rest in this place, we come to tell you that tomorrow,



when the Eye of Day is half along its course, we will take you and lead you to the Land of Ancestors, where you will lie forever with your family. Therefore be not absently gazing at yourself in the spring, nor captive to the charms of the valley; be at the meeting-place upon the hour.'

"When a body has lain in a tomb so long that the silken *lambamena*, the shawls in which it was wrapped, have disintegrated, it is time for the family to replace the wrappings. The tomb is opened every four or five years and the remains taken out and carefully enveloped in new *lambamena*. The people dance and sing on the way to the village, tossing their burden up and catching it again. Everyone rejoices; this is not a sad occasion,



STACHPOME © NATURAL GEOGRAPHIC SOCIETY

but a happy reunion with the beloved ancestors. After the body has lain under a special awning while cattle are sacrificed and there is more dancing, they carry it back and replace it in the tomb, which is sealed until the next *famadihana*, the turning of the dead."

#### Pacific Paradise in the Indian Ocean

When I remarked to M. Ranaivo that the Malagasy reminded me of Polynesians, he said I should visit their own Tahiti. He meant Nosy Be, a small island off the northwest coast (map, page 453).

I found nearly all the classic South Sea enticements at Nosy Be: coral reefs and vivid fish, outrigger canoes, coconut palms, magnificent beaches. The little postcard port, with red

and white houses facing a semicircular bay, bears the singularly inappropriate name of Hell Ville, after one Admiral de Hell, who in 1841 accepted cession of the island to France.

As I disembarked from the aircraft, I felt as if I were walking into a warm, sweet-scented lagoon. The air was heavy with the fragrance of ylang-ylang, a yellow-green flower that yields one of the basic oils used in perfumery.

Along the shaded, hilly roads from the airport, pollarded trees, heavily cut back to keep their height within reach of the ylang-ylang gatherers, drooped gracefully like bowing ballerinas.

Farther on, pepper vines bearing clusters of green peppercorns encircled the trunks

of shade trees. Glossy-leaved coffee bushes bent under their burden of berries. In succession I passed groves of clove trees, stands of aromatic lemon grass, and plantations of vanilla.

I visited the largest ylang-ylang distillery with the proprietor, M. Fida-houssen Kakal, a gentleman of Pakistani origin. In a dim shed a double row of potbellied gleaming copper stills steamed with a powerful scent that was pleasant at first, but so strong it soon gave me a headache. Men tipped wire cages filled with tens of thousands of flowers into the stills in a yellow cascade.

"It takes 100 pounds of flowers to produce two pounds of essence," said M. Kakal. "The oil drips out here."

He filled a small vessel and held it under my nose. The concentrated essence was so pungently sweet it made my eyes run.

"Ylang can be used as a fixative, as well as for its own scent. You might say, then, that in one form or another our oil goes into nearly all perfumes. Nosy Be produces about 45 tons a year, and France takes most of it."

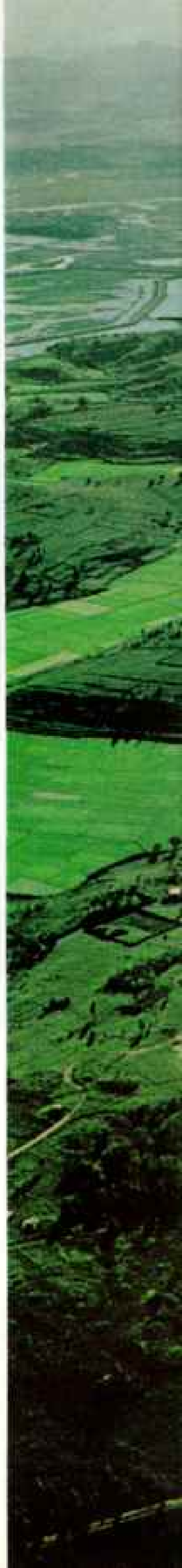
At one end of the island I saw vast fields of sugar cane. So much rum and alcohol is distilled here that plantation vehicles sometimes burn the alcohol in lieu of gasoline.

What an island, where all the perfumes of Araby scent the air and automobiles run on rum!

The DC-4 that stops at Nosy Be makes a circular run from Antananarivo around the north coast and back. I flew clockwise to the north and Diégo Suarez, where in a great bay named for a 16th-century Portuguese sea captain, the French Navy has based continuously since 1895, today under

**Rice fields near Antananarivo carpet valleys along the Ikopa River. On the hilltops, circular walls and dry moats protected villages during tribal wars that wracked the island until the end of the 1700's**

**Step-down roofs of shaggy thatch cap a highlands house near the capital. Building their walls of sun-dried earthen blocks, the Malagasy plaster them with a mixture of red soil and cattle dung.**







agreement with the Malagasy. From there I turned south along the east coast toward Antalaha, vanilla center of the world.

It is fitting that a chief export of this strange land should be an orchid. Or, more properly, the seed pod of an orchid, *Vanilla planifolia*.

Antalaha, where these orchids have flourished since their introduction in 1890, is a steaming-hot little port in the manner of Madagascar's east coast settlements. There is no harbor, no breakwater, nothing to stem the nervous march of Indian Ocean waves that break incessantly on the uncompromisingly straight shore. There are only navigation lights and a string of lighters to take the vanilla offshore to the uneasily anchored ships.

Back of the town the dense, primeval forest clothes the hills. In this region of blood heat and heavy rains grow the finest remaining trees of rosewood, ebony, and a dozen other precious cabinet woods. Nearer town, planted trees furnish leafy shade for climbing vanilla plants that wrap each trunk in a clinging embrace of fleshy leaves.

#### Women Do the Work of Bees

In vanilla's native Mexico, a melipona, a small stingless bee, helps to fecundate the orchid in its quest for pollen. But Madagascar has no melipona, and the flowers must be pollinated entirely by hand.

The yellow-green vanilla orchid opens in the morning and lasts only one day. During the Madagascar flowering season, from October to December, women go from flower to flower before noon, lifting a little tongue with a small stick, and pressing stamen and pistil together. A woman busy as a bee can pollenate as many as 2,500 flowers in a single day.

Of the 32 vanilla exporters in Antalaha, most are French, the rest Chinese and Indian. With M. Fabien Tortel, vice president of the Syndicate of Exporters, I walked through a plantation. In the dappled light of a grove, M. Tortel gently lifted a hanging bunch of seed pods from a tangle of lanceolate leaves.

"They're thin and green because they're immature. It takes nine months for a vanilla pod to ripen; when the tip grows yellowish, it is ready to harvest."

I could smell the processing shed even before I saw it. In the sweet fragrance inside, women were sorting pods.

"The first thing we do with the freshly picked pods is to plunge them into hot water to arrest further ripening and prevent split-

ting," M. Tortel said. "Next we spread the pods out in the sun, taking them in at night, for eight to ten days. Finally the vanilla dries indoors on racks for about ten weeks, before we pack the pods in metal boxes for shipment."

M. Tortel showed me a bundle of pods tied with linen thread (opposite). At one end, minute white spicules glistened like hoarfrost.

"That's pure vanillin, crystallizing as it oozes out of the pod," he said. "Shows it's the highest quality."

"In your country the importers prepare extract from the vanilla pods by cutting them up and steeping them in alcohol. Your housewives use the extract a few drops at a time. The old custom of French housewives is to buy the whole pod, cut it into bits, and put them in desserts. They also bury cut bits of vanilla pod in the sugar bowl. Tell your American housewives these things."

#### Railroad Takes a Spiral Route

The aircraft that flies south from Antalaha lands at Tamatave, Madagascar's chief port. Here two coral reefs and a man-made breakwater shield the port from the winds and waves of the Indian Ocean. Only here and at Diégo Suarez, on this coast, can ships come alongside. There were five vessels under the loading cranes when I landed at Tamatave.

Both a motor road and a narrow-gauge railway run to Antananarivo from the port, but I recommend the train ride. It takes about 15 hours, but it is worth it. The line follows the coast at first, then turns inland at Brickaville and begins to climb through the primitive forest of the Great Island in switchback loops to reach the height of Antananarivo, almost a mile above the sea. At one place beyond Périnet the track makes a complete spiral, the train issuing from one tunnel and then curving back on itself like a snake holding its tail in its mouth.

Early one morning I drove south out of Antananarivo along the road to Antsirabe. At the crest of a hill I stopped to look out over a valley of terraced rice fields. White egrets, gilded by the yellow light of morning, nearly touched wing tips with their reflections as they flapped across the flooded rice fields. In a feathery-topped clump of papyrus a kingfisher, streaked in electric blue, fixed a beady eye on the water.

The asphalted road climbed steadily toward the Ankaratra range, skirting valleys green with rice and noisy with rushing water. The

Fragrant flowers on her head, baby on her back, a mother in Nosy Be gathers blossoms of the ylang-ylang tree. The blooms yield a perfume essence and fixative.

Seeds soon to be cocoa spill from a pineapple-size fruit of the cacao tree; dried and ground, they yield raw chocolate. Groves of cacao, ylang-ylang (right), vanilla, and pepper spice the island air of Nosy Be.



Brawny men with nimble fingers bundle vanilla beans—seed pods of the climbing orchid, *Vanilla planifolia*. Madagascar grows more than half the world's vanilla, selling most of it to the United States. Synthetic vanilla now shares the market.





Hunter of living jewelry offers uraniid moths (*Chrysiroidia madagascariensis*) for sale to passing motorists near Périnet. The Malagasy portray their most colorful and bizarre insects on postage stamps. Strangely, the only close relatives of this moth live in the tropical Americas.

Cloaked in a misty mantle, La Chute de la Lily spills from a ledge in the high plateau country. The Lily River drains Lake Itasy, formed amid the hills when an ancient lava flow closed off a valley.

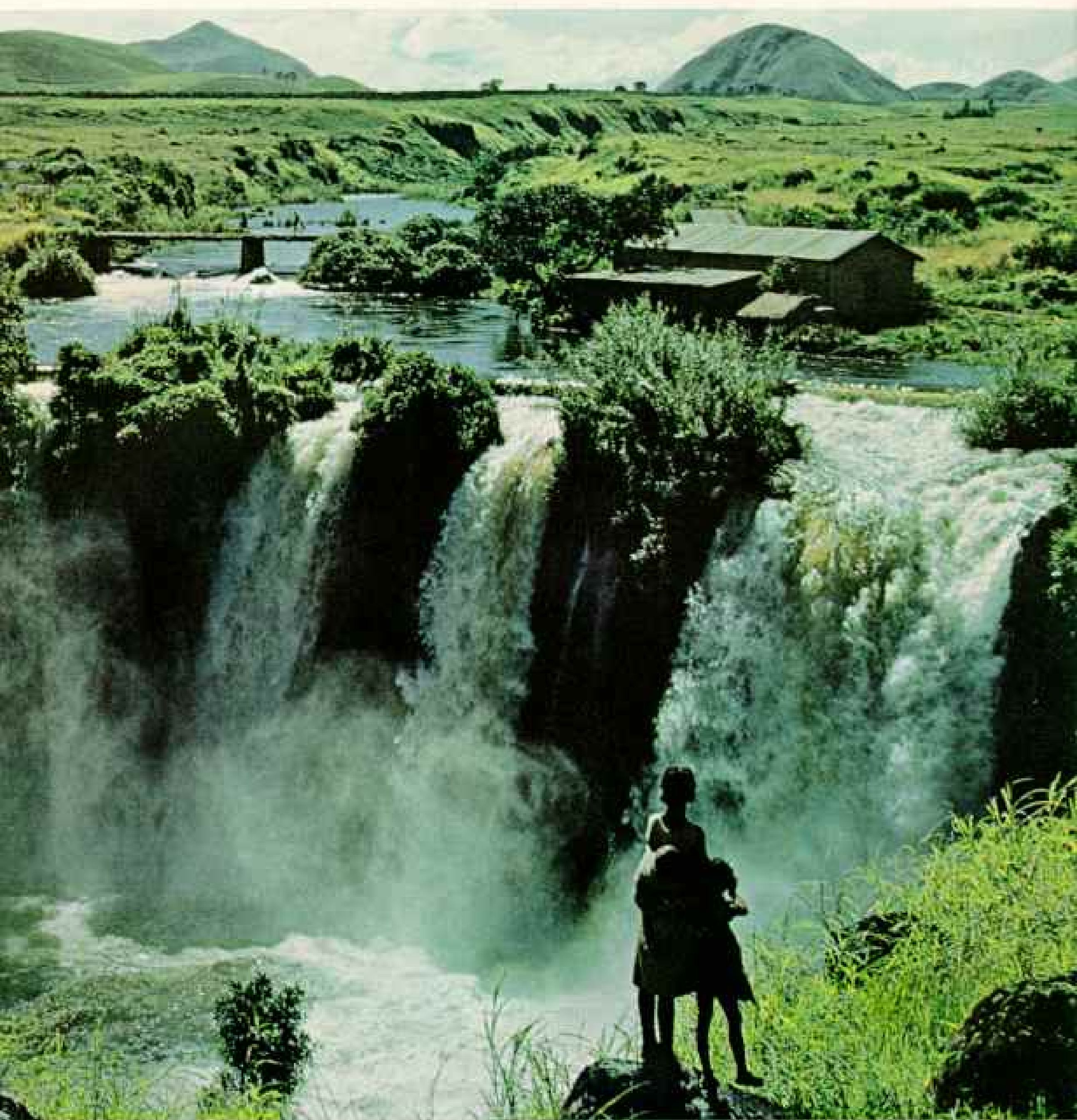
mountains on my right, bare stone peaks at first, grew darker with forest as I approached Ambatolampy, 40 miles from Tana.

There, at a roadside inn called Le Marseillais, the proprietor prepares a dish of crayfish that would make his fortune if he could serve it in Paris. M. Matthieu Brondissino has lived more than twenty years in Madagascar, but he still has not lost his strong Marseilles accent or his southern skill with herbs and seasonings. The crayfish, monsters nearly ten inches long, come from the brawling torrents of the high mountains back of the town.



Seventy miles beyond the inn of the crayfish the city of Antsirabe, shaded by immense trees lining broad avenues, stands on a level plateau. Beneath the city volcanic steam and water pulse and burble, spurting forth in several places as the hot springs so dear to the French heart and liver.

During the French dominion in Madagascar, Antsirabe took on the appearance and atmosphere of a spa in the south of France. Gabled villas with names like Le Rêve stand in walled gardens shaded by somber araucarian pines. At the far end of a broad ave-



nue rises the splendidly rococo Hôtel des Thermes, towered, spired, and turreted. It looks down on the thermal establishment where, properly supervised by a white-smocked physician, one may take the waters.

#### One to Pull, One to Push

More than 600 red-wheeled rickshas roll along the wide, level streets of Antsirabe. At night the ricksha men light candle lanterns that sway like fox fires in the mountain dusk.

The Malagasy call their rickshas *pousse-pousse*, literally "push-push." Since they are

pulled, not pushed, I was puzzled. A ricksha man told me that a second man used to run behind and push on the hills. On steep gradients and with heavy passengers, one would hear cries of "*Pousse! Pousse!*"

"From whom," I asked, "the passenger?"

"No! From the man doing the pulling."

Beyond Antsirabe the *route nationale* winds 120 miles southward to Fianarantsoa, a mist-shrouded city at the edge of the plateau, then turns southwest through increasingly arid country to the west coast port of Tuléar. I went to Tuléar by air, flying from

Antananarivo with Air Madagascar, an enterprising national airline that links nearly every city and sizable town of the nation. The line was once called Mad Air, but the management did not like the sound of it in English.

Dry and hot Tuléar is built on sand flats close to the mouth of the Fiherenana River. In the Mozambique Channel offshore, an 11-mile-long barrier reef encloses enormous natural aquariums of limpid water, teeming with a dazzling variety of Indo-Pacific fish.

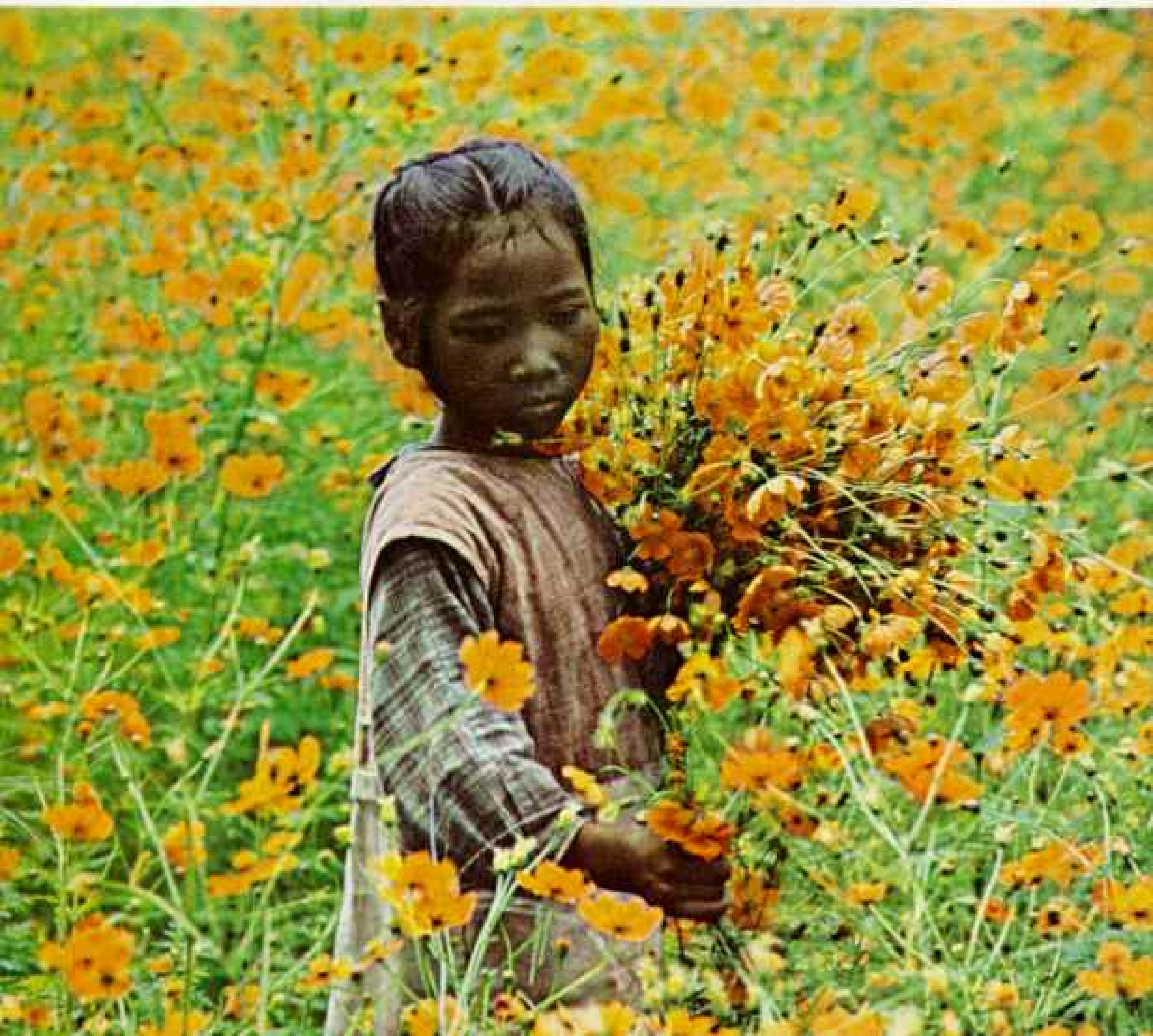
M. Paul Ducaud, an agricultural engineer,

**Immersed in a sea of flowers,** a highland girl gathers wild yellow cosmos near Lake Itasy. Madagascan plants have made their way to distant gardens. Residents of frost-free southern Florida and California know such imports as the traveler's tree, crown-of-thorns, and the flowering flamboyant tree.

drove me upstream along the Fiherenana to see an old tomb of four walls enclosing a pile of stones. It stood in a grove of stunted, thorny trees. Respectfully removing our shoes, we clambered over the rubble to an open space in the middle. There stood a blue-and-white glazed Chinese vase three feet tall. Scattered around it lay rusting swords, sabers, and halberd heads. M. Ducaud enjoyed my surprise.

"Stories go that these things came from either Portuguese sailors or French pirates. The tribes to whom they were given put them on the tombs of their chiefs, after the Malagasy custom.

"During the French occupation, we had a local administrator who took a fancy to that vase. He had it removed to the residency in town. Next morning when he woke up, he saw a thousand silent spearmen surrounding the house. The administrator returned the



vase the same day and sacrificed an ox to atone for the desecration."

While I was in the south of Madagascar, my thoughts turned to the aepyornis, the giant extinct bird, for it is here that its incredibly big eggs are occasionally uncovered. When Marco Polo described Madagascar, the island he had heard about from Arab travelers but had never seen, he spoke of it as the home of the fabulous "gryphon birds."

"They report that they are so huge and bulky that one of them can pounce on an elephant and carry it up to a great height in the air. . . . They add that they have a wingspan of thirty paces and their wing-feathers are twelve paces long. . . . I should explain that the islanders call them *rukhs*. . . ."

The Arabs, who had sailed to Madagascar to trade for slaves from the earliest times, already knew the fabled rukh, or roc, from

tales in *The Book of a Thousand Nights and a Night*. On his second voyage Sindbad the Sailor, marooned on an island, saw "a huge white dome . . . of vast compass. . . . I went round about the dome to measure its circumference which I found a good fifty paces. . . ."

"Methought a cloud had come over the sun.

(Continued on page 468)

Tribal secret leads to an artistic creation. At Ambalavao, Mme. Pierre Mathieu, seated, and her daughter inspect pieces of Antaimoro paper. Madame Mathieu's husband, learning from the Antaimoro tribe how to make paper from the fibers of a local shrub, developed a process of encrusting the papyruslike material with wildflowers, grasses, and leaves. Decorators use it for lamp shades, screens, and wall covering. Cosmos like those at left adorn one sheet.

GETTY IMAGES; GETTY AND REDBUBBLES © S.C.S.





Sacrificing a zebu to sacred crocodiles, men of Anivorano Nord cut the trussed animal's throat and collect a plate of blood.

Fearful-jawed crocodile breaks the surface, anticipating a feast. The beasts reach 15 feet in length.

Blood cast on the water tells the crocodiles that beefsteak awaits. After the ritual feeding, the zebu's head will be impaled on a nearby tree already adorned with the bleaching skulls and horns of previous sacrificial victims.



REUTERS © A.S.P.





## Gory sacrifice summons the dead

COMMUNING WITH ANCESTORS turned into reptiles by a wizard's spell, women call forth crocodiles from Lac Sacré at Anivorano Nord, about 30 miles from Diégo Suarez. Throbbing drums and whining wind instruments accompany the singing, chanting, wailing chorus. Responding to the clamor, the saurians find pieces of a sacrificial zebu (top left) awaiting them on shore. The farther from the water the hungry man-eaters can be lured with pieces of still-warm flesh, the more successful the ritual.

Long ago, the worshipers say, a village stood where the sacred lake now lies. When a passing stranger asked for a drink of water, the villagers all refused him, except for one kindly woman. The wayfarer warned his benefactor to leave; after her departure, a cataclysm submerged the community and the people were transformed into crocodiles. Today descendants of the woman who escaped live in a village a mile from the lake. When one of them falls ill, or a bride finds herself barren, the other villagers implore their crocodilian kinfolk to intercede with Zanahary, the Malagasy deity, in behalf of the unfortunate person.

Nowhere else on the Great Island are crocodiles thus protected. The Malagasy have hunted them ceaselessly for their skins and coarse meat, until the reptiles survive only in the remotest swamps and streams.





Ruined reminders of a turbulent past, walls of lateritic earth and cattle dung near Antananarivo recall days when Merina nobles pursued their conquest of all Madagascar. Built during the 1700's, such fortifications formed bases from which the Merina attacked and



ANTANANARIVO BY ELBERT BOLDNER © N.S.A.

fought off enemy tribes. Hurled spears, called *lefona*, gave the walls their hardest test until the French used cannon in annexing the island in the late 1800's. Today the walls border rice fields and plots of vegetables for the Friday market in Antananarivo (page 450).

Lifting my head I saw that the cloud was none other than an enormous bird . . . which, as it flew through the air, veiled the sun and hid it from the island . . . the dome which caught my sight was none other than a Rukh's egg."

The first authentic word of the giant bird of Madagascar came from the pen of the Sieur Étienne de Flacourt, who was sent out in 1648 by Louis XIII to govern the small French colony established in Madagascar six years before. He landed at Fort Dauphin, on the southeast coast, where languished a handful of Frenchmen, half starving and under nearly constant attack by the Malagasy tribesmen, who did not know they were supposed to be loyal and submissive subjects of the King of France. Nobody had told them.

#### Aepyornis May Still Have Lived in 1655

For seven years, forgotten by the motherland, the Sieur de Flacourt maintained a precarious *présence française* in a small fort on the wave-lashed cove of Fort Dauphin. After he returned to France in 1655, Flacourt wrote *A History of the Great Island of Madagascar*. In this classic he listed the plants and animals of the island. Heading the roster of "Birds that Frequent the Woods" he placed: "*Vouroun patra*, it is a big bird which frequents the Ampatres [the Antandroy tribal region], lays eggs like the ostrich; it is a kind of ostrich, the people of the said region cannot capture it, it seeks the most deserted places."

The fact that Flacourt spoke in the present tense suggests that the fabled elephant bird was still alive in the 17th century. No record has come down to us, however, of any traveler or native actually having seen one alive.

As early as 1832, reports and drawings of giant eggs bigger than anything theretofore known had reached Europe, but not until 1850 did the first intact egg reach Paris. The egg was a foot long and held more than two gallons, eight times the volume of an ostrich egg. It created a furor.

M. Isidore Geoffroy Saint-Hilaire of the Academy of Sciences named the giant bird *Aepyornis* (Greek for "tall bird") *maximus*. Later, nearly complete skeletons revealed that it stood almost ten feet high and must have weighed close to a thousand pounds, the

biggest bird yet known to have trod the earth.

I had mentioned my interest in the great bird to Monsieur Michel Suire, a friend in the Air France office in Antananarivo, and one day he appeared at the Hôtel Colbert with M. Jean de Heaulme, who grows sisal and mines mica and uranium near Fort Dauphin. The original de Heaulmes left France in 1770 to settle on the island of La Réunion, and their descendants preserve the exquisite manners and courtesy of another century that the French call *Vieille France*—Old France.

"Assuredly," said M. de Heaulme, "I can show you an aepyornis egg—there is one in my father's office—and I can direct you to the district where most of them have been found, but I cannot guarantee that you will find one. Broken pieces of eggshell, these I can promise you by the kilo, but a whole egg—*c'est difficile*. We have seen perhaps a dozen over the past 20 years.

"But come ahead, we can at least show you some primitive forest full of lemurs and, who knows, possibly you may find your egg."

#### Coast Rises in Two Great Steps

The Air Madagascar DC-3 took off at dawn for Fort Dauphin. Through hanging gray curtains of cloud and slanting rain the hills gleamed palely. We flew southeast, toward the thickening forest of the eastern slopes.

The highlands drop to the coast plain in two abrupt steps. Against the undulating green of the forest, the cliffs of the first escarpment traced a curving line, broken in places by the white plumes of waterfalls.

The second fold of greenery fell to the coast plain as we slanted down toward the port of Manakara. In one continuous white-lipped beach, straight as a knife-cut, the east coast of Madagascar ran north-northeast.

At Fort Dauphin granite mountains, furrowed as an elephant's hide, bathe their feet in the sea. Fort Dauphin Bay lies open to winds from the north and east and to the constant swells built up by the southeast trade winds. Because of the shallowly sloping shore and unceasing winds, vessels anchor offshore, and lighters transfer cargo.

A small freighter flying the French flag rose and fell at anchor. Barges plied between her and Fort Dauphin's single long pier,

**Unhurried assembly line** at Ampanihy yields a mohair rug in a cycle that starts with raw wool. Woman at left spins thread from goat's hair. At the rear a worker weaves on a giant loom. Others trim the finished product. Featuring a design from a tomb marker (page 471), this rug will sell for the equivalent of \$80.





PHOTOGRAPHS BY ALBERT WILBERT

lightering zebu cattle to the slings that lifted them aboard. Fort Dauphin is the funnel through which pass the Antandroy cattle drovers' sleek herds, bound chiefly for Mauritius and La Réunion.

I drove west in a Land-Rover from Fort Dauphin with M. Henry de Heaulme, M. Jean's father, a big, handsome man with aquiline features and piercing gray eyes, who came to Madagascar from his native Réunion in 1928.

The road climbed through a low pass in the barrier mountains. With surprising suddenness the subtropical vegetation of the coast gave way to strange crownless trees, like bare poles covered with sharp prongs—La Forêt Épineuse, the thorny forest (pages 476-7). Monsieur de Heaulme, who has an encyclopedic knowledge of the flora and fauna of his beloved southland, named the strange trees in Latin, Malagasy, and French.

#### Gaunt Sentinels in a Land of Thirst

On the other side of the pass the plains of the Antandroy stretched before us to the horizon, so parched they are called the "Land of Thirst." The weird thorny candelabra rose to a height of some 25 feet on both sides of the road. One species, looking somewhat like the organ-pipe cactus of the American Southwest, held its columns straight up; another bent its fingers toward the sea.

All these are xerophytes, plants that resist a drought by virtue of thick, spongy bark that conserves the little moisture. On the trunk of the *fantsilotra*—thorny bark—rows of steely thorns grow in a rising spiral. Between them sprout oval light-green leaves no bigger than a thumbnail. This is all the foliage these strange trees hold out to the burning sun of the south.

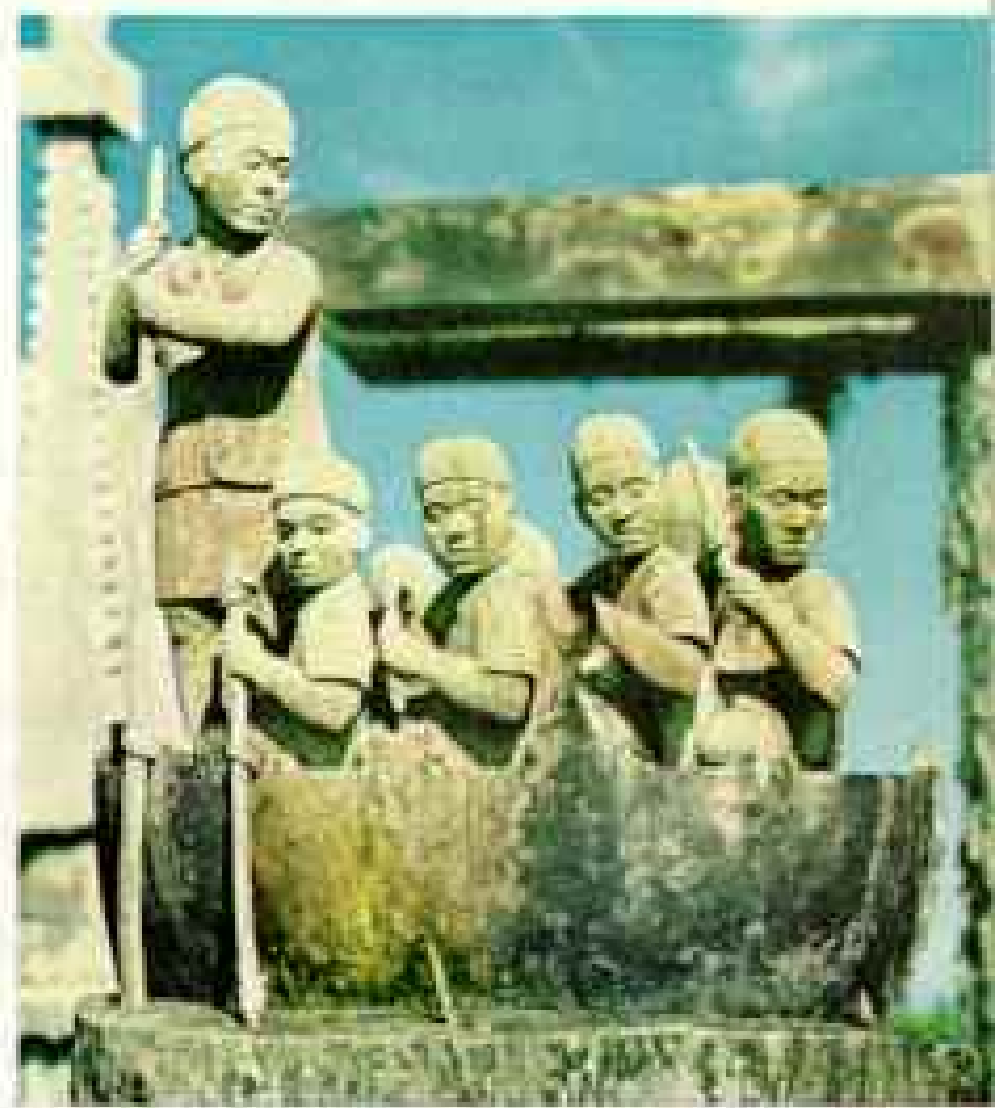
"Have you noticed that all the *fantsilotra* arms



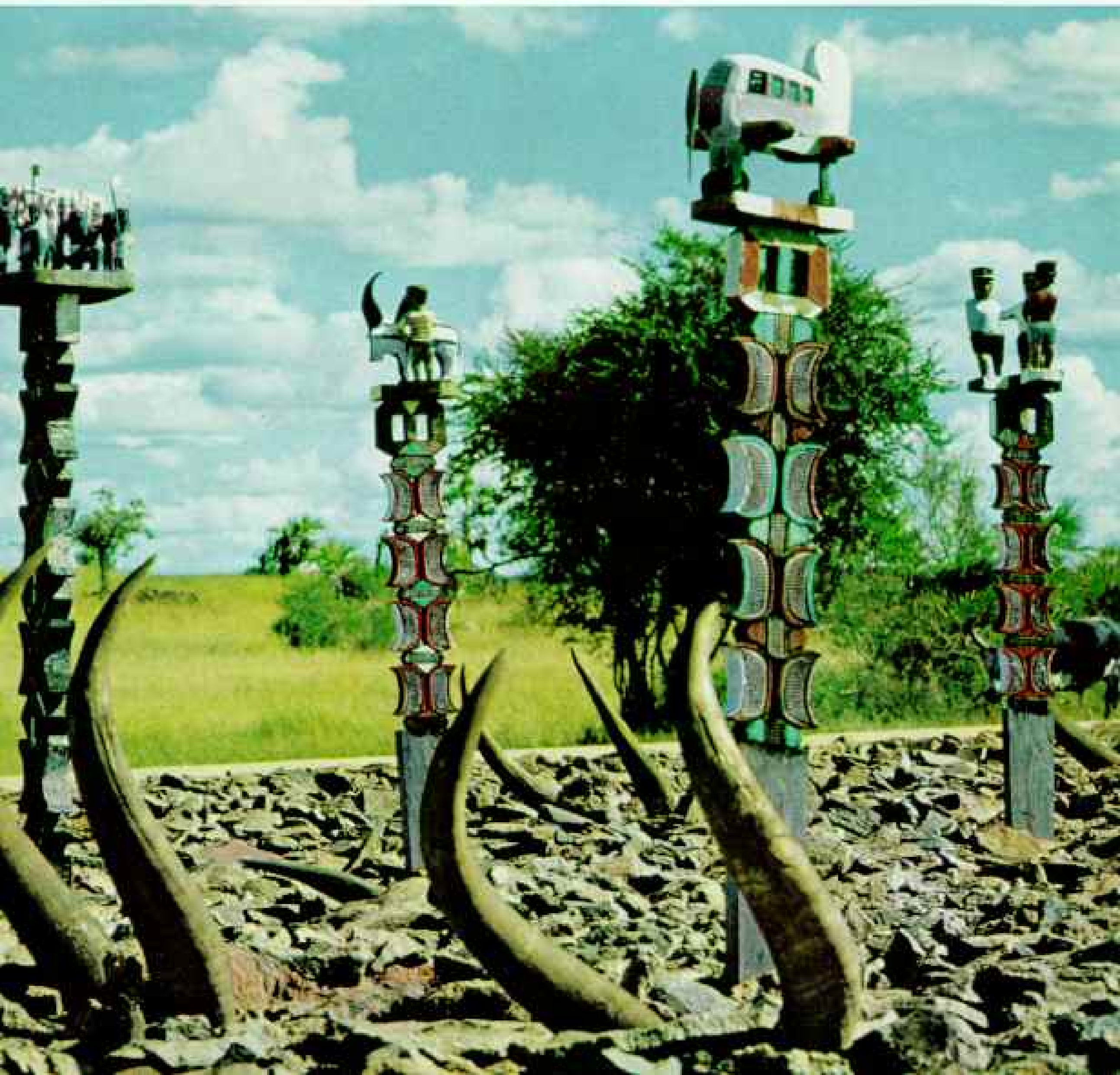


Death influences life for a people who believe that ancestors dictate health, wealth, and fertility of descendants. With songs and gay garb, villagers escort one of their dead to a grave near the northern town of Ambanja.

Horns of sacrificed zebus spike a rock-strewn family tomb near Ampanihy (below). Thrusting above the four-foot-high crypt, wooden shafts with crescent moons and octagonal suns illustrate happy events in the lives of the dead. One took an airplane ride; another rejoiced in his cattle; a third excelled in drum beating. A boat owner (right) leads his crew in a tomb sculpture; in life they carried cargo to ships.



RED CLOTH BARRIER (RIGHT) © R.I.C.E.



point toward the south?" asked M. de Heaulme. Almost the whole forest pointed its fingers toward the South Pole. No one need ever be lost in this phantasmal forest.

When I was in the Antandroy country it was March, and the rainy season was drawing to a close. Rain falls heavily—sometimes torrentially—through much of Madagascar from December to April, but in the south it sometimes rains not at all. In 1967, however, heavy rains filled the dry watercourses of the south.

472 The Mandrare River was racing in a brown flood toward the sea when we crossed it on a steel-girder span. Upstream the ford where

the road formerly crossed was awash with swirling red-brown water.

Just beyond Amboasary on the Mandrare began the straight blue-green rows of the de Heaulme sisal plantation. From a distance the plants looked like the tops of giant pineapples.

Here and there among the rows of sisal rose the bloated, bottle-shaped gray boles of the microcephalic baobab, a tree with an absurdly small head of branches and leaves. The obese columns of the baobab may have a girth of 75 feet for a height of 60 (pages 484-5). The great spongy trunk stores the scant moisture of the south in its light and corky heart.

Yet in the river-bottom lands along the

**Rainless ranks of cloud troop over parched savanna west of Ihosy. Beyond scattered palms,**



Mandrare, the forest was normal. Green-leaved deciduous trees replaced the spiked, tortuous monstrosities of the Forêt Épineuse.

#### Forest Preserve for Furry Acrobats

It was here, in a forest reserve, that I first saw a lemur. We walked slowly down a woodland ridge. The carpet of mold and rotting leaves muffled our footsteps. A flash of yellow-brown shot over our heads, and I looked up into the round staring eyes of a sifaka (*Propithecus verreauxi*).

The lemur, about the size of a cat, with thick, tawny fur and a black face, clung to a branch and stared down through unwink-

ing golden eyes (next page). His head with its pointed snout looked more vulpine than monkeylike. He bobbed his head once like a hawk and uttered the call that gives him his Malagasy name: *SEE-fahk!*

With a guttural *chuk*, another lemur, slightly bigger and with a spectacular long tail ringed in black and white, landed beside him.

"That is a maky, *Lemur catta*," said M. de Heaulme. "There are probably a thousand of them in this reserve, and at least 500 sifaka."

The maky had a little one clinging to the thick fur on her back; it regarded us with questioning round eyes. When they had looked long enough, the lemurs made off, leaping

eroded buttes guard the edge of a vast fault that cleaves this south-central cattle country.

PHOTOGRAPH BY ALBERT ROBERT © T.A.S.







PHOTOGRAPHS BY LINDA HAZDEN © N.C.C.

**Treetop trapeze artist,** a monkeylike lemur hurtles from branch to branch. Powerful hind legs catapult cat-size *Propithecus verreauxi*, called the sifaka, to a leafy perch (below, left). Unique to Madagascar, some 20 lemur species flit through the forests, resembling creatures put together from odds and ends of the animal kingdom: rodent's teeth, bat's ears, monkey's hands and feet, and flowing fox tails. A ring-tailed lemur (*Lemur catta*) arches its distinctive brush (below, right). Ruffed lemur (*Lemur variegatus*) wears an ermine collar. Rarest of all, the aye-aye (*Daubentonia madagascariensis*) flexes long fingers used in his search for wood beetles (far right). A living fossil, the bug-eyed creature now enjoys protection through the combined efforts of the Madagascar Government, the World Wildlife Fund, and the International Union for the Conservation of Nature and Natural Resources.



lightly from branch to branch and landing without perceptible sound or impact.

That evening we sat on the terrace of the plantation house with M. Jean de Heaulme, who had flown in from Fort Dauphin in his twin-engine Beechcraft. We talked again of my chief goal in this part of the country: to find an intact egg of the aepyornis.

"All the eggs I have seen come from the west of here," said M. Jean. "Tomorrow morning I'll send you out in a Land-Rover with a driver who knows the country, and you can start your search. At least you can find fragments of broken shell for dating."

#### Carbon-14 Tests Date Vanished Bird

No one knows certainly when the giant bird became extinct. I had hoped that carbon-14 tests might give a date within the past three or four centuries, late enough for a European to have seen one alive.\* In 1963 Professor René Battistini, geographer at the University of Madagascar, uncovered egg fragments not far from Diégo Suarez, the first to be found in the extreme north. A Japanese scientist tested these and obtained an age of 1,150 years, plus or minus 90.

Beyond the Mandrare the route nationale traversing southern Madagascar is unpaved, but it had not rained in several days, and at dawn we drove at 40 miles an hour toward Ambovombe. The driver, a tall and very dark Bara tribesman, had served in the French Army and spoke understandable French.

We drove across flat bush country, through thorn trees and scrub. Once we passed a file of men, four of whom carried on their shoulders a cloth-wrapped bundle on a bier: the corpse of a woman who had died far from her village and was going home for burial.

Several times we had to stop to yield the road to herds of 50 or 60 sleek zebu, being driven toward the sea for embarkment to Mauritius (page 480). We were traversing the classic cattle country of an island where zebus outnumber people nearly two to one.

At Ambovombe we turned southward toward the dunes at the sea's edge to look for deposits of shell. The road, little more than a deep rut between high agave hedges, passed three villages. At each I stopped to ask for *atodim borombe*—the egg of the great bird—

\*See "How Old Is It?" by Lyman J. Briggs and Kenneth F. Wever, NATIONAL GEOGRAPHIC, August, 1958.



EXTROVERT (LEFT) AND BUSHY (RIGHT) BY ALBERT WILSON © R. G. L.



EXTRACTING LARVAE AND BODILYHONEY BY ALBERT HOLZNER © N.S.A.



## Curious creatures roam a weird landscape

**M**ADAGASCAR'S MOST PRIMITIVE MAMMAL, a tenrec (upper left) leaves quills in a handler's finger. When threatened in the wild, striped *Hemicentetes semispinosus* bristles like a hedgehog. Rubbing its spines together, the tenrec makes ultrasonic vibrations that may be a means of communication.

Masters of camouflage, tree lizards (*Uroplatus fimbriatus*) take on the color of bark to become bumps almost invisible to predators.

Geometrically painted armor of the tortoise *Testudo radiata* often ends up as Malagasy costume jewelry. Other tribesmen believe the tortoises bring good luck and place offerings on their backs.

At ease on a prickly perch, a forest cuckoo (genus *Cooa*) cocks a tinted eye. When it trills at dusk, islanders say it sings its prayers.



Living nightmare, a tangled forest of thorn-studded *Didierea* menaces a rare intruder.





EGGSHELLS BY ALBERT WOLDRY (LEFT) AND LUIS WARDEN © N.S.P.

and always the villagers shook their heads and replied, "*Tsy misy*—There is none."

Beyond the last village the road trailed off into sand and fields of maize. Here we questioned a youth who said casually, "Oh, yes, I can take you to the place."

The Bara threw the Land-Rover into four-wheel drive, and we bumped across hummocky fields toward the sea. At the edge of the sandy slope we stopped, and on foot entered a swale between two high dunes.

#### Shattered Eggs Carpet Southern Dunes

I slipped and slid down the slope after our guide. The heat was like a blast furnace; between the dunes we were shut off from the slightest movement of air. The sun, reflected from the dazzling sand, reverberated in my eyes until my head buzzed.

Far down the slope our guide gesticulated. When I reached him he waved his arm in an arc, grinning broadly. What I had taken to be a field of sea shells was a carpet of *aepyornis* egg fragments, literally thousands of them

stippling a shallow bowl among the dunes (above). There were at least fifty sherds in each square yard. Most were two to three inches square, but we found one shell end as big as a skullcap.

It was impossible to walk without crushing the eggshells, and the sherds cracked underfoot with a tinkle of breaking porcelain. In less than an hour we had filled a large basket. We now had at least twenty-five pounds of shell, and we could have gathered a hundred.

We rode back to Ambovombe to present a letter I carried to Father Joseph Kiefer, a Lazarist missionary from Lorraine. Father Kiefer, a slender, quick-moving man with a pointed beard and a twinkling eye, had spent 12 years in the Antandroy country and spoke the dialect fluently. Pulling a cigarette from the folds of his white cassock, he eyed our basket of fragments and said, "*Tiens*, a good collection, but we must see about a whole egg. A couple of years ago I heard one had been found; it ended up in the hands of an Indian shopkeeper; he sold it to a foreigner."

**Like shattered pottery,** eggshells of the extinct *Aepyornis*—the largest bird ever known—litter a beach at Faux Cap, one of three sites where the author collected fragments.

**Handshake hails discovery** of a whole egg by tribesmen who brought success to the author's search for an unbroken specimen. Torrential summer rains, flooding a plain in the far south, washed out the gigantic egg and left it lodged under a bush.

**Rarest find of all,** another egg presented to the National Geographic Society reveals under X-rays that it holds an embryo of the extinct *Aepyornis maximus*, re-created on pages 488-489. This egg and the one opposite show pitting by ground acids and stains from sheep blood that tribesmen poured on them to ensure good fortune.

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REPRODUCTION BY JOSEPH J. SCHERER © N.G.S.





Horseless cowboy warns motorists of his approaching zebus near Ambalavao. Herdsmen often drive their charges more than 200 miles from range to packing house or port. As in America's Old West, the cowboys sometimes face ambush from rustlers.

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Swinging Chat Botté, or Puss in Boots, a Tamatave nightclub, goes Western; dancers do the monkey and frug to the whanging beat of electric guitars. French influence rules in Madagascar's cities, but tribal dress and traditions still prevail in the country.

ILLUSTRATIONS BY ALBERT BOLDWIN © S.C.C.



Father Kiefer climbed into the Land-Rover with us, and we started west again. Far to the north of Ambovombe a semicircular range of mountains, resembling those enclosing the great walled plains of the moon, embraces a region of upthrust mesas like the Lost World country of the Guianas. Here lie beds of thoriumite, a uranium ore, and deposits of mica and quartz. Southward the ground slopes to the plains of the Antandroy. Monsieur de Heulme had told me of a shallow depression or basin into which, he said, the summer rains drain, sometimes leaving pools of water on the spongy ground. Here the villagers occasionally found an egg, exposed by the rains.

### Tribesmen Search the Trembling Earth

We left the road and struck across country, dodging between thorn trees and bumping over ruts left by the oxcarts. At a village near the edge of the depression, a man in a breechclout came toward us, putting on formal dress by wrapping round his waist a *lambahoany*, the equivalent of a South Seas *pareu*. He shook hands with us all round. He was Fenoandro—Day of Plenitude—the village councilor. Half a dozen other men joined us; we passed round cigarettes and squatted in the shade. Through Father Kiefer, Fenoandro answered our questions.

"Every year," he said, waving his arm in a half circle, "we find one or two, after the rains are finished. This year, we have not found one yet. In the old days, whenever we found an egg, we used to take it to the District Officer; now we offer it to the sisal planters, because we know the Europeans value them. Sometimes we find one buried in the ground; the rain uncovers it and shows us it is there. Once in a while the rain washes an egg completely out of the soil, and we find it under a bush when the water goes down" (page 478).

Fenoandro led us to the edge of a shallow pool of water. He struck his foot on the ground. "Hear that? Feel how the ground trembles? The earth is hollow in places; perhaps that's where the eggs hide."

He pointed to bits of shell lying about. "I can get you a kilo by tomorrow." I had asked for that much to have samples from different sites for radiocarbon dating.

Fenoandro told me that one woman had seen the broken halves of a single egg. I hoped she might find it again so that we could cement the egg back together.

When I returned at noon the next day,

Fenoandro was standing beside his house and asked us to enter. The house was built of split slats of the thorny-bark tree, and its peaked roof was thatched with grass. Mats covered the floor, and two chairs stood at one end of the rectangular house for the *vazaha*, the foreigners, to sit on. Fenoandro, his family, and relatives sat cross-legged in a semicircle on the mats facing us.

Someone gave Fenoandro a live chicken, and, standing, he delivered a *kabary*, a long oration, thanking us for honoring his village with our visit, and wishing us health, prosperity, and a safe return to our homes. He then handed me the chicken. The councilor's old mother, whose face was creased like an old parchment by a thousand fine wrinkles, next presented us with seven hen's eggs.

In turn I made a speech. Taking my cue from my sojourns in the South Pacific, I thanked the old lady for her gifts, and also for presenting Madagascar and the world with three such fine sons as I now beheld; then I handed Fenoandro a bottle of native rum.

Not until we had drunk a tumbler of rum and tasted a kind of yogurt made of zebu milk did we get down to business. With a showman's air, Fenoandro whisked a cloth from a small table and revealed a pile of broken eggshells. "Two kilos," he said.

I expressed my satisfaction. Fenoandro kept looking at me, and the others kept their eyes on him. I turned to the Bara driver and said, "I think they have found something."

Fenoandro, who had been watching me closely, reached under the table and pulled out a bulging *sobika*, a two-handled basket. Silently he removed a cloth. There before my unbelieving eyes lay a whole *aepyornis* egg.

### Blood Wards Off Possible Evil

"You brought us luck, *vazaha*," said Fenoandro. "He"—pointing to his half-brother, a young man with stand-up hair and a small mustache—"found it this morning."

Gently disengaging the egg from the close-fitting basket, Fenoandro handed it to me. It was more than a foot long and, except for pitting where the acid of decaying vegetable matter had eaten into the calcium carbonate of the shell, without a blemish. A star of fresh blood splattered one side. I looked questioningly at Fenoandro.

"*Vazaha*," said he, "when we find a whole egg, even though we know it means a small fortune to poor people like us, we show no



Seaside stockyard on a mountain-rimmed beach near Fort Dauphin holds humpbacked zebu cattle awaiting shipment. A lighter at this major port of the south takes them to an offshore freighter; after swinging aboard by a sling (right), they travel to meat-short Mauritius and La Réunion, British and French islands in the Indian Ocean. Zebus belong to an Indian strain of ox noted for strength, fatty hump, and grunting instead of mooing. In addition to providing food and sacrificial offerings, the cattle serve as draught animals and for trampling fields before rice planting. Malagasy so prize these animals that they have some 80 words to describe them. Loss of favorite bulls has driven owners to suicide.

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ADAM ROSE © NATIONAL GEOGRAPHIC SOCIETY





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"Upside-down" baobab trees appear to wave roots instead of branches against the skyline of the island's southern end. According to African legend, the baobab in some way offended God, and he punished it by turning it bottom-side up. The Malagasy ferment the pulpy fruit—called monkey bread—to brew a beverage, and harvest leaves and bark to make clothes, paper, rope, and medicine.

Canteen of the desert, *Pachypodium* stores moisture in its gourdlike hole. Technician-botanist Georges Andrianasolo collects the unique island plant.



ESCHERICHES BY ALBERT MILITARY © N.E.L.

joy; the egg does not like it. If a man were to seize the egg and rush home, crying to his wife, 'Rejoice, dance, sing, our fortune is made, I have found an egg of the borombe, the great bird,' the egg would surely shatter into a thousand pieces.

"If a man finds an egg but leaves it there, his mother will die. If he finds an egg and takes it up, but does not sacrifice to Zanahary—God—and to his ancestors for bringing him good fortune, his father will surely die. So we sacrifice a cock, a sheep, or an ox, whatever the finder can afford. This morning we killed a sheep and poured its blood over the egg; now we can be happy."

An aepyornis egg brings the finder the

equivalent of five oxen. Fenoandro filled the tin mugs again and we drank to the enormous egg, to the village, and to Madagascar.

I asked Fenoandro where he and his half-brother had found the egg. He waved to the north. "About three rice cookings [one hour] from here. According to what the old ones told us, in the time of the ancients the country round about here was covered with a forest standing in a swamp; there were no men here, but the bush was full of the 'Bird No One Has Ever Seen.' Then our ancestors settled here and burned the forest, and little by little the great bird withdrew and finally disappeared altogether.

"Neither we, nor our fathers, nor our grandfathers have ever seen a live *voronsatrana*," said Fenoandro. "Perhaps it's just as well, because the Old Ones said that anyone who saw one would surely die.

"The great bird was so tall that a man could not reach his head; he stood on long legs, and had three toes on each foot, but no great toe, and no heel. His tail was spread out like a turkey's, and his feathers were all white. His wings were very short, and when he ran, he did not flap his wings."

#### X-rays Reveal an Unborn Chick

This was an astonishingly accurate description of the aepyornis, from one who had never heard of a scientific reconstruction of the bird. Except for the tail and the color of the feathers, a matter of pure conjecture since no remains other than bones have come down to us, and the short wings—the aepyornis had no external wing structure—the rest of the description tallies with what science deduces from skeletal remains.

I shook our egg and heard a rustling noise.

"Sometimes," said Fenoandro, "we find an egg that is fresh, full of the white and yolk." I stared. If H. G. Wells only were alive!

"Yes, wild pigs root up the eggs sometimes, to smash them and eat what is inside."

"But if as you say, neither you, nor your father, nor your grandfather have ever seen a living great bird, how is it possible that you still find a fresh egg now and then?"

"That," said Fenoandro, "puzzles us, too."

I thought of the ritual warning with which Malagasy tellers of tales preface their legends:

*Believe me, believe me not!  
If you believe me, it will be fine,  
If you do not believe me, it will rain...  
It is not I who tells lies, it is  
The Old Ones who have told me this story.*

A scientific paper published in 1957, listing



28 eggs in European museums, states: "It is worthy of note that no *aepyornis* egg shows any trace of the original egg contents."

Much later, in Washington, we peered by stereoscopic X-ray photographs into an even larger egg presented to the Geographic by the de Heaulmes, and we were delighted to see the bones of an *aepyornis* chick about three-fourths developed. Leg bones, foot bones, and vertebrae are clearly visible (page 492). Fortunately for us and for science, something had interrupted the incubation, and locked in his smooth-walled tomb the chick sleeps on, undisturbed except for probing radiation.

In Antananarivo Professor Battistini had told me: "The *aepyornis* was already in Madagascar at the beginning of the Quaternary, about one million years ago. They existed down to comparatively recent times, increasing to incredible numbers, then disappeared in the space of a few centuries.

"Scientists once thought that the *aepyornis* vanished because of a change in climate, that the land grew drier and the birds slowly retreated to perish round the edge of the last water holes. Today we can say unequivocally from geological evidence that the climate of southern Madagascar has not changed appreciably in at least two to three thousand years. No, man must once again bear the responsibility for the disappearance of a species. He must have arrived just in time to kill off the last of the giant birds, either by hunting them, or taking their eggs for food or for use as receptacles, or by burning and destroying the forest that was their refuge.

"One thing is certain—man and the *aepyornis* were coeval, at least toward the end. A recent radiocarbon dating of ash from a human fireplace goes back 1,450 years, the oldest definite date yet found for the presence of man on Madagascar. Dates of some egg fragments are at least three centuries later, so we know that both man and *aepyornis* lived together here—but not for long."

By the time I left Madagascar, I had collected egg fragments from three sites. I hoped to find a date within the period of the French presence in Madagascar, proof that it would have been possible, at least, for a European to

have seen a live *aepyornis*. But I was disappointed; the youngest fragments proved to be 1,970 years old, plus or minus 90, the next 2,930  $\pm$  85, and the oldest 5,210  $\pm$  140.

When I tried to continue west by road to reach Cap Sainte Marie at the southern tip of Madagascar, I was stopped—in the Land of Thirst—by a flood. At the town of Tsihombe the Manambovo River roared banks full. At the ford outside the town, the river separated clotted masses of people and vehicles stopped on both banks. Pedestrians, ox-carts, motorcars, buses, and trucks had been waiting there for three days.

One man said disconsolately: "Nine or ten months of the year there isn't a drop of water in this river. We sink gasoline drums with the bottoms cut out into the dry sand of the river bed. A few inches of water wells slowly up. I have seen people who live far from the river go around in early morning to whip the dew off leaves and grass into a gourd. Now look!" He pointed to the swollen river, rushing past at ten miles an hour.

#### Last Stand at Island's End

I leapfrogged the river in a small airplane, with Jean de Heaulme at the controls. At the Manambovo, the queues of cars and buses had grown longer. The river was falling, but slowly. The plain tilted toward the sea, and we tilted our wing with it to turn south.

At 200 feet we flew along the water's edge, following the coast as it swings southward in the slight promontory of Faux Cap (False Cape), and up the line of unfurling breakers to the jutting headland of Cap Sainte Marie.

On the dunes along these desolate shores the *aepyornis* may have made its last stand. Trapped between man and sea, the great birds must have brooded over the last infertile eggs. Then they slipped into eternal sleep and were covered by the sands.

At Cap Sainte Marie, on the edge of a steep cliff, the road to the south comes to an abrupt finish. To warn the infrequent traveler that he has come to the end of the island at the end of the world, a sign reads: "Stop! Extreme South." Beyond lie only the sea and Antarctica. \* \* \*

**Troubadours of the rice terraces**, the Ny Antsaly Trio have won world-wide fame with ancient folk songs of harvest, herding, and home life. They make their own instruments—*ampongalahy* drum, gourdlike *jejy*, and multistringed *valiha*. Concert engagements and music festivals have taken them to Europe and North America to perform the distinctive Afro-Asian music of the island at the end of the earth.



Stepping out of legend, the world's largest known bird comes to life in a scientific

## Re-creating Madagascar's Giant

FROM A STUDY OF BONES in Paris and New York and perusal of the literature in several languages, NATIONAL GEOGRAPHIC's artist-naturalist Walter A. Weber and I have undertaken to show how Madagascar's extinct elephant bird, *Aepyornis*, may have looked when it walked the earth.

The word "walked" is used advisedly, for no matter what tales Sindbad the Sailor may have told about being borne off by a huge flying bird, *aepyornis* definitely could not have

been guilty; it was as earthbound as the dodo. This fact, of course, was promptly recognized by scientists who studied the skeletal remains of the huge, heavy-legged bird of Madagascar.

The first bones reached Europe 117 years ago. When, over the decades, enough had accumulated to form a complete skeleton, scientists saw that the wing bones of this great bird were vestigial, amazingly tiny for so huge a creature. The two bones by which the wing was attached to the body, the scapula



WALTER A. WEBER

PAINTING BY NATIONAL GEOGRAPHIC STAFF ARTIST WALTER A. WEBER © 1966

reconstruction. A half-ton male aepyornis guards his mate, unaware of an egg-hunting tribesman.

## Extinct Bird

By ALEXANDER WETMORE

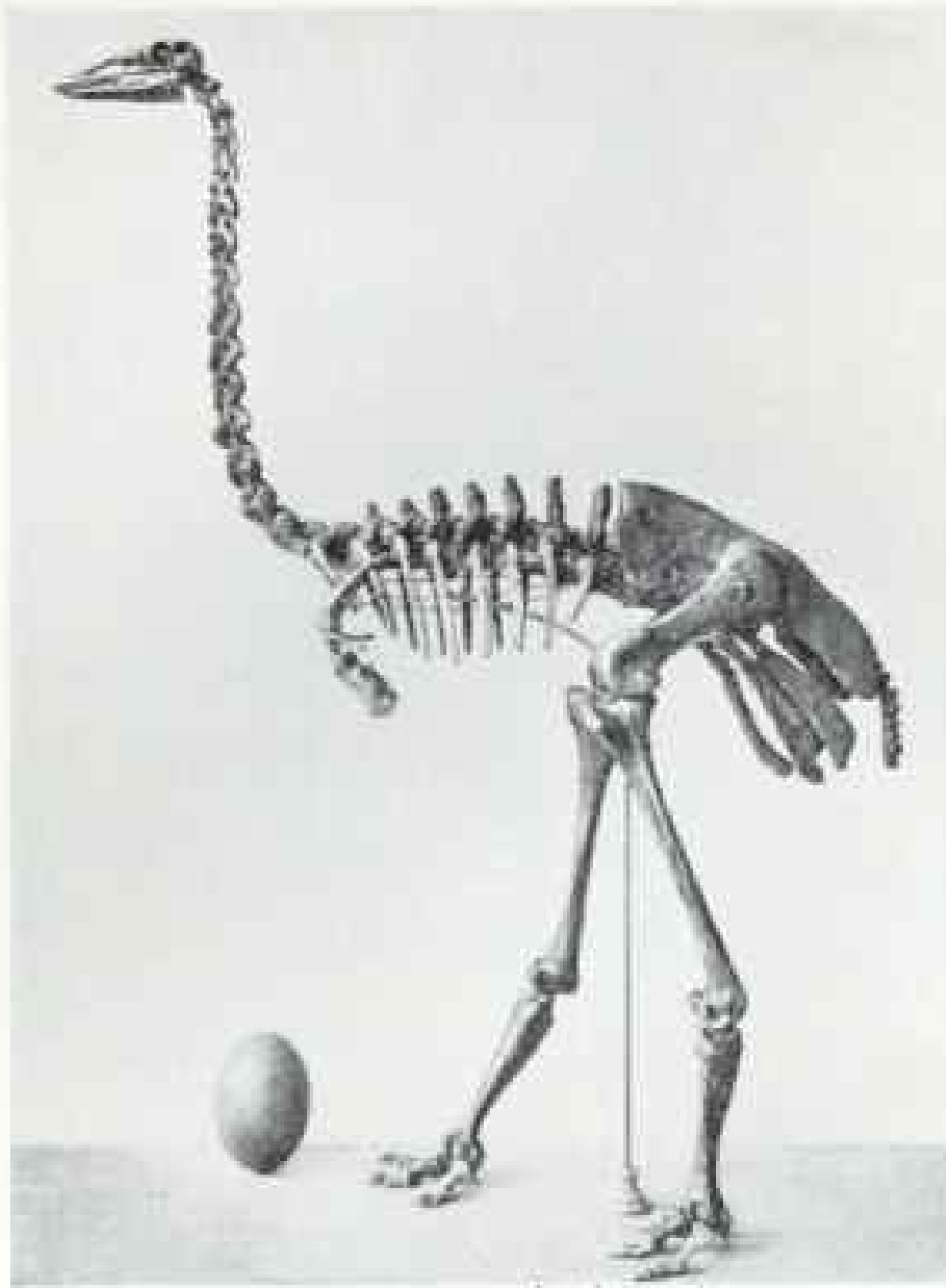
Research Associate, Smithsonian Institution

and coracoid, were fused into one, instead of being separate as in birds that fly. The upper wing bone, the humerus, was club-shaped and small—less than four inches long. Obviously the wing was merely a remnant.

The breastbone reveals further evidence of flightlessness. In flying birds this bone is longer than wide, with a strong keel for attachment of muscles. In aepyornis it is merely a flattened plate, broad but short, its length less than half its width (next page).

**The Author:** A world-renowned ornithologist and authority on extinct birds, Dr. Alexander Wetmore headed the Smithsonian Institution from 1945 to 1952. Chief author of the National Geographic Society's *Song and Garden Birds* and *Water, Prey, and Game Birds of North America*, he serves as both a Society Trustee and Vice Chairman of its Committee for Research and Exploration.

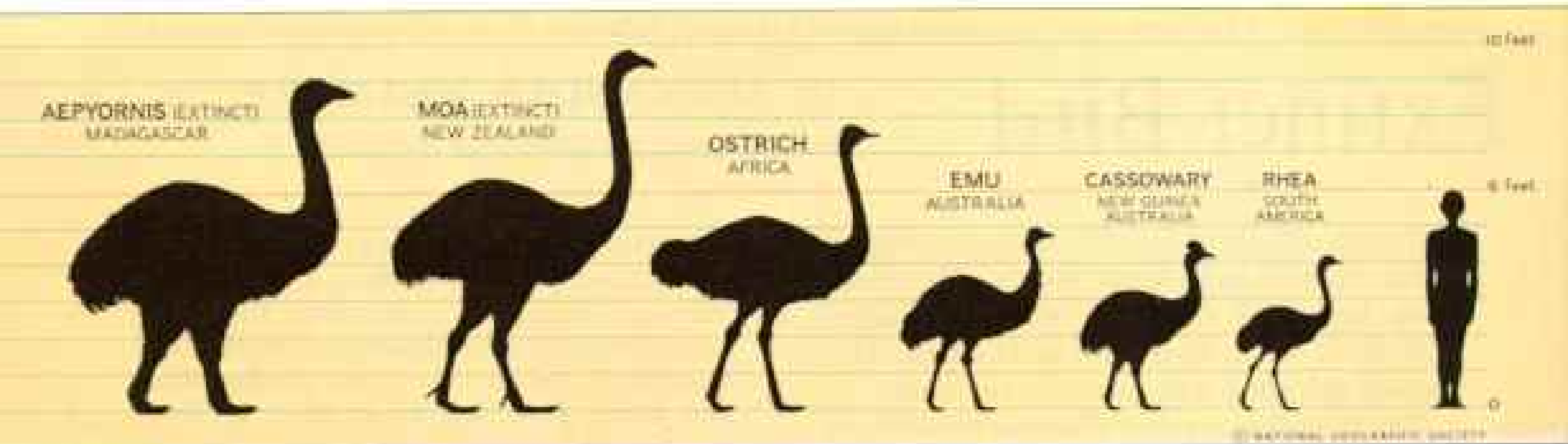




from *Les Aepyornis*, by L. S. GANNON, 1908

Skeleton of aepyornis in the Museum of Natural History in Paris shows a piano-legged heavyweight nearly ten feet tall. The bird's massive foot and leg bones—three thick toes, a short tarsus, a heavy tibiotarsus and femur—suggest it ran no great distances. Shallow breastbone and tiny pronglike wings prove it could not fly.

Scientist and artist collaborate for a study of the anatomy of giant birds before re-creating the probable appearance of aepyornis. At the Smithsonian Institution ornithologist Dr. Alexander Wetmore, left, compares an ostrich femur with the much larger aepyornis femur for artist Walter A. Weber. The American Museum of Natural History in New York loaned the aepyornis bones.



Troop of flightless birds, called ratites for their raftlike breastbones, towers over the avian world. Extinct moa stood taller but weighed less than aepyornis. Ostrich, emu, and rhea run fast and far on long, slim legs. Living birds guided the artist's portrayal of aepyornis's plumage.



BOUCHERIE BY NATIONAL GEOGRAPHIC PHOTOGRAPHER JOSEPH J. SCHERSCHEL © N.G.S.

Almost as incongruous as the undersized wings are the bird's heavy, elephantine legs. For our study we chose *Aepyornis maximus* (literally "largest tall bird"), the biggest of the several species. The incredible femur, or thighbone, of this ponderous bird is by far the largest I have ever seen. The tibiotarsus—in humans the shinbone—is also huge.

The lower joint, or tarsus, to which the toes are attached (in the painting the bare, scaly portion of the leg) is surprisingly short in proportion to the rest of the leg. This tells us that aepyornis was definitely not a distance runner like the slender-legged ostrich.

Indeed, one gets the impression of a muscle-bound and weightbound bird that could not run fast or far even when alarmed. Until the arrival of man, aepyornis probably had no major enemies. There were no large preda-

tory animals except crocodiles. To this day the biggest land carnivore in Madagascar is only about the size of a large domestic cat.

The type of feathering is only conjectural, but we assume that it fell somewhere between the hairlike feathers of the cassowary and kiwi and the heavy plumes of the ostrich. The pygostyle, the last vertebra at the tip of the tail, shows by its relatively small size that the bird probably carried no large tail plumes.

#### Half-ton Male Stood Nearly 10 Feet Tall

All the large flightless birds have mainly black, white, or gray feathers. We have assumed a similar coloration, ascribing the black plumage of the male ostrich to aepyornis *père* and a lighter, grayish coat to his mate.

In summary, our study indicates a gigantic bird with tremendous elephant-style legs. A



EXAMINED BY JOSEF BRANMAN  
AND JOSEPH L. BRIDGES

X-ray into antiquity exposes bones of an aepyornis embryo, about three-fourths developed, entombed within an eggshell more than a foot long. Forklike tarsal bones show developing toes. The longest bone is a tibiotarsus or shinbone; characteristic holes identify vertebrae. Scientists estimate that the egg, when fresh, weighed more than 20 pounds, equal to eight ostrich eggs. One of the largest ever found, the rarity came to the Society as a gift from Henry and Jean de Heaulme of Madagascar.

large male ostrich may be eight feet tall and weigh 300 pounds. This great elephant bird stood between nine and ten feet, and Dr. Dean Amadon of the American Museum of Natural History has calculated its probable weight as close to a thousand pounds.

The aepyornis, because of its unwieldiness and its lack of a hooked beak for tearing prey and talons for holding it, plainly was not a predatory creature. We assume that it was mainly a vegetarian, a grazer and cropper, able to reach with its long neck the lower branches of shrubs and trees.

Through the years I have had occasion to work closely with Mr. Weber, and I was glad to collaborate again as scientific adviser to this distinguished artist-naturalist, one of the world's foremost portrayals of animal life.

Thus the task of clothing the old bones continued until we had a living image of the biggest and strangest bird yet known to tread the earth.

The origin of these great birds is uncertain, but the long-held supposition is that they came from Africa. Madagascar is separated from the African mainland by more than 200 miles of ocean, and this separation is believed to date from Mesozoic times, which ended 60 million years ago. Fragments of fossil bone from Egyptian deposits of 30 to 40 million years ago have been identified as remains of primitive relatives of the aepyornis. If the ancestral birds were flightless, they may have arrived in Madagascar in late Cretaceous

times, before the close of the Mesozoic era.

A recent suggestion, to me less probable, was that the early ancestors still had functioning wings on which they flew to the island. There, free from active predators, they became terrestrial and changed slowly to the giant aepyornis of our illustration.

These opposing ideas are merely theory. Our only certain information comes from the many aepyornis bones found on the island in deposits of Pleistocene and geologically recent age. From these, seven species—differing in form and size—have been named.

#### Science Sees an Aepyornis Embryo

Not until man arrived on the island, probably less than 2,000 years ago, was aepyornis apparently subjected to pressures that it was not fitted to meet. It seems likely that human encroachments, such as cutting down the forests and hunting the birds and their eggs, brought decrease and final extinction, possibly near the beginning of the European period. But there is no definite record that the birds were seen in the flesh by European eyes.

To our astonishment and gratification, the larger of the two eggs brought back from Madagascar by the GEOGRAPHIC's Luis Marden proved to contain the remains of a well-developed embryo. X-ray photographs clearly show bones of a chick, perhaps three-fourths developed (left). Stereoscopic X-ray pictures were even more eloquent and scientifically valuable.

THE END



PHOTOGRAPH BY JESSE J. SCHERLING © R.G.S.

Thick and hard as crockery, an egg fragment collected by staffman Marden told its age. Pulverized for radiocarbon dating tests, his samples ranged from 2,000 to 5,300 years old.

On display in Explorers Hall at National Geographic Society headquarters in Washington, the egg fascinates a young visitor.



# Journey Into the

By MELVILLE BELL GROSVENOR.

"Joy of the whole earth," sang the Psalmist about Jerusalem, a city holy to Christian, Jew, and Moslem. Here an Arab wayfarer looks across the Valley of Kidron, where Christ walked to His agony in the Garden of Gethsemane. On Mount Zion, center, a tower marks the Tomb of David, poet-king of Israel's ancient glory. The golden Dome of the Rock, right, rises on the site of Solomon's Temple and of Herod's Temple, where Christ taught. Moslems revere the Dome as the place where Mohammed ascended into heaven.

Pharaohs and emperors, sultans, caliphs, and kings vied through the ages for this prize in the hills of Judaea, a grim but valiant saga that dramatically unfolds in the new National Geographic book, *Everyday Life in Bible Times*.

PHOTOGRAPH BY THOMAS HILTON © NATIONAL GEOGRAPHIC SOCIETY

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**A**CROSS THE VALLEY OF Kidron spread the massive walls and huddled houses, the towers and domes of Jerusalem. As I stood on the Mount of Olives gazing upon this Holy City of three great faiths, I thought how many momentous events had taken place here!

Here, says a hallowed tradition, Abraham prepared to sacrifice his son Isaac. Here rose the City of David, and here Solomon built his temple in the days of Israel's glory. I could almost hear the tinkling of the Queen of



# Living World of the Bible

LL.D., Sc.D. Editor-in-Chief, National Geographic Society

Sheba's caravan—"a very great train" of camels bearing "spices, and very much gold, and precious stones"—making its soft-footed way into Solomon's resplendent capital.

Jerusalem knew the heavy tread of conquerors: Nebuchadnezzar, who carried its populace off to Babylon; Rome's iron legions. . . .

Jesus walked here during His last days. Where the Dome of the Rock gleams in the sun stood Herod's Temple; there Jesus scourged the money-changers. Below me the olive trees in

the Garden of Gethsemane reflected His agony in their gnarled and twisted forms. On Mount Zion, far to my left, was the traditional room of the Last Supper. In the distance ahead I could pick out the Church of the Holy Sepulcher, enshrining the place where Jesus fulfilled His promise to "give his life as a ransom for many." I thought:

*If only there were a book that could capture the power of this scene. . . .*

My hostess was Bertha Spafford Vester, grand lady of Jerusalem, beloved for her Spafford Memorial

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Overcome with emotion, Jewish pilgrims reach out to touch the Wailing Wall, one of their holiest shrines, denied to them until last June, when Israeli forces ended 19 years of Jordanian control of Jerusalem's Old City. Some tuck prayers between the massive blocks of this remnant of the wall surrounding Herod's Temple, destroyed by the Romans in A.D. 70.

Evicted Arabs, saving flower pot and shutter, leave their home overlooking the Wailing Wall. After Israeli troops captured the Old City during last spring's brief Arab-Israeli war, they ordered Arab families here in the traditional Jewish Quarter to seek houses elsewhere. In front of the wall bulldozers cleared buildings for a block-square plaza and thousands came to pray. The Israeli authorities opened the city's shrines, including Islam's Dome of the Rock (background), to worshipers of all three faiths.



Children's Hospital. For decades she has been the American Good Samaritan, serving the sick and the needy.\*

As we visited the Old City's shrines, she regaled me with stories of Lawrence of Arabia and other famous figures she had known in a lifetime that had already seen three wars roll over the Holy Land. She spoke of the "nightmare world of terror," the whine of bullets, the shellfire and bomb blasts she lived through during the Arab-Jewish war of 1948-49.

#### A New War Sears the "Magic City"

Now as I write, a fourth conflict—the Arab-Israeli war of 1967—has left its savage scars on Mrs. Vester's home city. But I remember her words during my visit: "With all the bitter setbacks, with all its changes, Jerusalem remains a magic city. I never tire of its sights, sounds, and smells."

She had shown me some of that magic. In a convent cellar we studied paving stones where Roman soldiers of Jesus' day had scratched lines for a game. We walked under arches on the Via Dolorosa, the Way of Sorrows, past porters bent under burdens. Threading streets lined by houses of golden stone, we heard the shouts of peddlers, the stony clatter of stiff-legged donkeys, and I thought: How much here reminds us of Bible times!

*National Geographic* writers and photographers could reveal the past through the present. . . .

I rode into the Judaeian hills, where shepherds tended their sheep. The car rounded a bend and there—spilling down a terraced hillside—lay

\*Mrs. Vester wrote of "Jerusalem, My Home," in the December, 1964, *Geographic*.





Bethlehem. Surely this sight greeted Mary, great with child, and Joseph when they came here to be taxed.

Another road, winding eastward down through rocky wilderness, took me near the Dead Sea. Beyond rose the mountains of Moab, whence Moses glimpsed the Promised Land. Before me spread the Jordan Valley, etched green by the twisting river in whose waters John baptized Jesus.

Beside Jericho's palm-studded oasis I clambered up a tell where one settlement after another had grown upon the debris of its

predecessors. I peered into a pit—9,000 years down through history—to the roots of a Stone Age tower in man's oldest known walled town, already ancient when Joshua and the Israelites invaded Canaan.\*

*The book could show how the spades of science cast new light on the Biblical world....*

Bible times came alive for me as I went among people seemingly straight out of the Scriptures, touched stones hallowed by his-

\*See "Jericho Gives Up Its Secrets," by Kathleen M. Kenyon and A. Douglas Tushingham, NATIONAL GEOGRAPHIC, December, 1953.

Swinging his death-dealing ax, Abraham defeats the hostile kings of Canaan. Wakening the enemy at dawn, he and his servants breach a barricade of chariots and send the Canaanites scrambling for helmets and weapons. Later the Lord promises Canaan—the land from the Nile to the Euphrates River—for Abraham's seed. Since both Arabs and Jews claim



tory, trod the ground prophets had walked.

How I wished that a Geographic book could evoke the same rich experience for our members, whisking them to the Bible Lands through the magic of color photographs and vivid text! Such a book would deepen our understanding of the Bible by making ancient times live again. We would come to know the daily life of peoples in the cradles of civilization, sharing their trials and triumphs.

Upon my return I called in Book Service Chief Merle Severy and told him of the book I envisioned. He had traveled widely in Bible

Lands and for years had studied their history. His enthusiasm matched mine.

Together we planned *Everyday Life in Bible Times*. Our book would be a flesh-and-blood re-creation of Old and New Testament life. We would focus on the towering figures—Abraham and Moses, David and Solomon, Jesus and Paul—and describe the world each knew in terms of everyday life.

Thus you will see Mesopotamia, the land “Between the Rivers” where civilization rose, through the eyes of Abraham; Egypt through the eyes of Moses; Palestine through the eyes

descent from the Patriarch, their habitation of the Holy Land fulfills the promise. This vivid painting is one of 36 specially commissioned works appearing in *Everyday Life in Bible Times*. In its 448 pages, eminent scholars, map makers, artists, and staff writers and photographers combined skills to retrace the footsteps of Bible figures through the world as they knew it.



of David and Solomon. You will come to know Galilee and Jerusalem as Jesus knew them; the cities, seaways, and highroads of the Roman Empire as Paul saw them.

We turned to seven renowned scholars whose explorations and researches have cast new light on the world of the Bible.

As consultant, Dr. James B. Pritchard, Curator of Biblical Archeology at the University of Pennsylvania Museum and excavator of Gibeon, gave generously of his vast knowledge during the long months the book was taking shape.

Picture layouts even followed him to his excavations at Tell es-Saidiyeh in the Jordan Valley, and printer's proofs to the American University in Beirut, where he taught this spring—until war drove him home. In his keynote chapter, "The Adventure of Rediscovery," Dr. Pritchard parades thrilling finds and patient detective work that have confirmed and elucidated the Bible narrative.

#### Crumbling Clay Tells Story of Love

Life in the Tigris-Euphrates Valley, traditional site of the Garden of Eden, Tower of Babel, and the Great Flood, is evoked by Dr. Samuel Noah Kramer, Dr. Pritchard's distinguished University of Pennsylvania colleague. Dr. Kramer explains how Sumerians invented writing, and tells how, after weeks of poring over crammed symbols on crumbling clay, he found a tablet celebrating the marriage of King Shu-Sin about 2000 B.C.

"Casually I began reading it. Then I read it again and again, enthralled by one of the oldest love songs written down by the hand of man." You may read that poem in Dr. Kramer's essay on the world of Abraham, in which he conjures up the life in mighty Ur, where the Patriarch began his epic journey.

In Damascus, the world's oldest continuously inhabited city, I thought how welcome that oasis, watered by snow melt from the Anti-Lebanon range, would have been to Abraham and his clan, driving their flocks in from the vast Syrian Desert. Exploring teeming bazaars, I heard a babel of tongues as men in patriarchal robes haggled in shops. I recalled that metalworkers and cloth merchants here had contributed the words "damascene" and "damask" to our language.

Life in Pharaoh's Egypt is described by Dr. John A. Wilson, Professor of Egyptology at the University of Chicago's Oriental Institute. Moses, an alien founding, was reared as an Egyptian prince. In school he would have heard the maxim known to us through



**The Exodus:** "Out of the land of Egypt. . . Unto a land flowing with milk and honey" Moses led his people from Pharaoh's bondage. Scholars reconstruct the probable route, here traced on a photograph taken 115 miles up from an orbiting Gemini spacecraft. Avoiding forts and trade routes like the Way of the Land of the Philistines, Moses

zigzagged across the desert. In the Wilderness of Sin, manna refreshed the hungry travelers. From Mount Sinai Moses brought back the Ten Commandments on two tables of stone, as portrayed by Rembrandt (above). And from Mount Nebo he looked upon the Promised Land before he died.

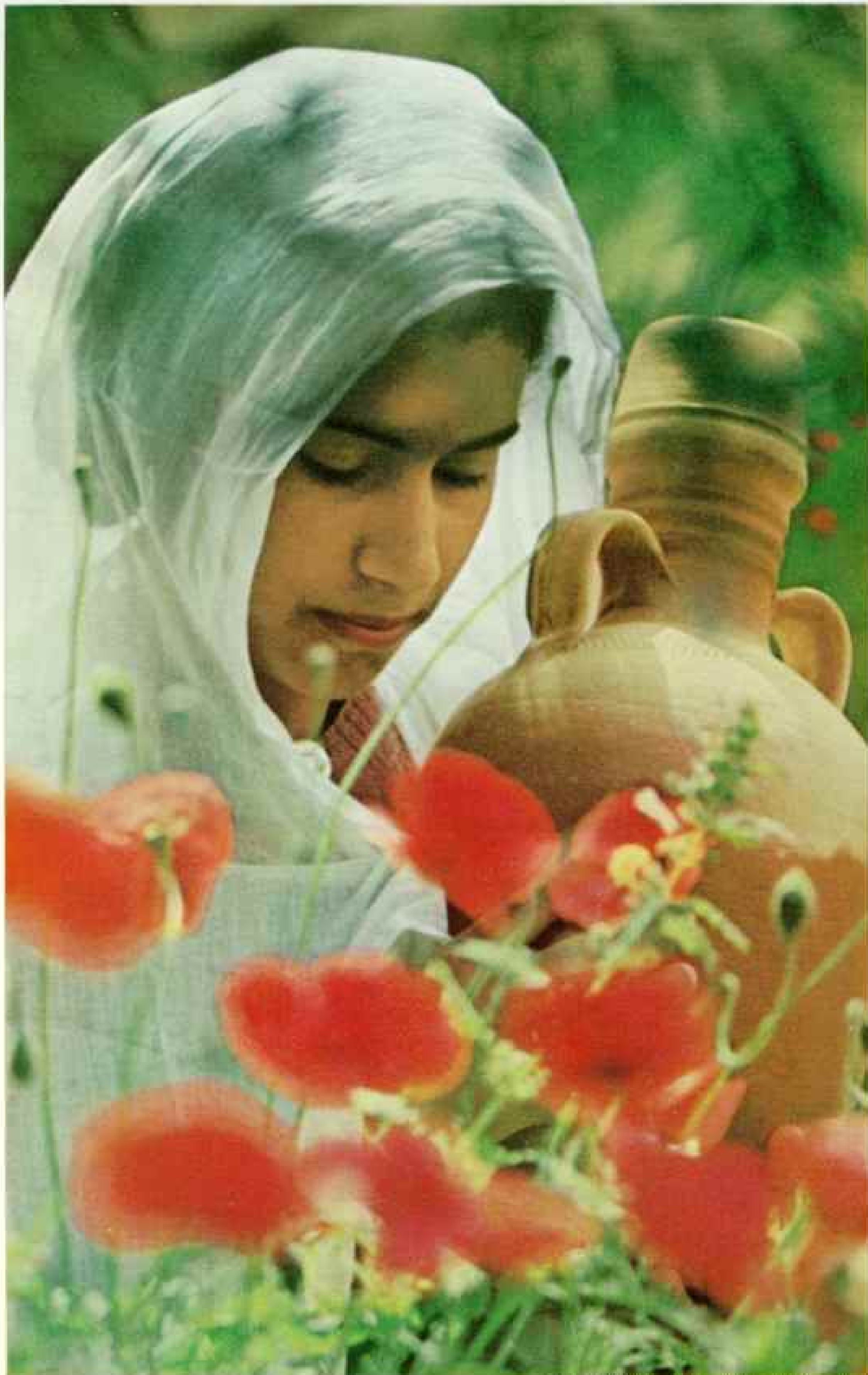
**Goal of Moses' journey,** Israel today prospers in communities like Nahalal, a *moshav ovdim*, or cooperative of independent landholders, established in 1921. Jewish settlers, reclaiming a malarial swamp six miles west of Nazareth, laid out the community in a circle for defense. Each family owns a 25-acre pie-slice strip, and produces what it wishes. The farmers market as a group their beef, poultry, eggs, milk, fruit, and vegetables.





PAINTING: ILLUSTRATED COURTESY STAATLICHE MUSEEN, BERLIN; EXTRACTION: LABOUR BY BARR; ROMANIZATION BY KENNETH BRIDGES © B.C.E.





ancient papyri: "The ear of the boy is on his back, and he listens when he is beaten."

Dr. Wilson explains that Ramesses II, who ruled for 67 years, is traditionally regarded as the Pharaoh who made the lives of the children of Israel bitter with bondage.

Ramesses! The monarch who studded Egypt with his monuments. In distant Nubia he fronted his temple at Abu Simbel with four 67-foot colossi of himself, which 20th-century nations would spend millions to save from the rising waters of Aswān High Dam.\*

Seemingly Ramesses could leave no stone uncarved. I saw his boasts as far away as the Dog River in Lebanon. Here on a cliff I gazed on 33 centuries of inscriptions—among them hieroglyphs carved on Ramesses' return from a campaign against the Hittites.

For all his riches and life-and-death power over multitudes, this "Pharaoh of the Oppression" could not rid himself of toothache. Recent X-rays of Ramesses' mummy reveal that the god-king had cavities, receding gums, missing teeth, and painful abscesses.

#### "Rebuilt" Temple Follows Bible's Clues

I am fascinated by Dr. G. Ernest Wright's portrayal of the world of David and Solomon. Dr. Wright is Chairman of the Old Testament Department at Harvard Divinity School and excavator of Shechem. Describing David's slaying of Goliath with a sling stone, he notes: "You can still find water-smoothed stones like those David plucked from the brook in the valley southwest of Jerusalem."

Using the Bible as his blueprint, Dr. Wright supervised the "rebuilding" of King Solomon's Temple in a richly detailed three-page foldout painting, one of 36 Biblical scenes specially commissioned by NATIONAL GEOGRAPHIC that appear in the book. And, in his vivid word picture, he takes the reader inside. The Bible often gives clues that archeology can explain and enhance. A Psalm, for example, tells of birds nesting in the temple. Dr. Wright shows that they would have entered through windows under the roof—a borrowed Egyptian idea that was

\*See "Saving the Ancient Temples at Abu Simbel," by Georg Gerster, Ph.D., GEOGRAPHIC, May, 1966.

the ancient origin of the cathedral clerestory.

Solomon imported cedars of Lebanon for his temple. Winding high into the Lebanon range, I found a remnant of the cedar forests of antiquity. The snowy mountains suggested why the name Lebanon derives from a Semitic word meaning "white." The aromatic timber adorned palaces; it built fleets for trade and solar boats to transport Pharaohs' souls.

The cedars were shipped from Byblos, and as I stood amid the ruins of that ancient Phoenician port, I pictured its harbor crowded with ships. Here came grain and olive oil from Palestine; copper from Cyprus, island for which the metal is named.

"Byblos also shipped Egyptian papyrus throughout the Mediterranean world," my guide told me. "It gave its name to these scrolls—*biblos*, which is Greek for book. From this comes our word 'Bible.'"

#### Pillars Journeyed to Baalbek by Sea

At Sidon, south along this storied coast, a Crusader castle on an islet guards the harbor entrance. With the slap of waves in my ears, I explored the fortress, hastily built of whatever lay at hand—including the columns of a Phoenician temple that protrude from its walls. I looked back at the town, gilded by the afternoon sun. Fishing boats were drawn up on the beach. The fishermen's ancestors in Biblical times perhaps extracted from shellfish the famous purple of Phoenicia—a dye so costly that the color became associated with royalty.

In a fertile valley on the other side of the mountains stands Baalbek, enduring symbol of pagan splendor (next pages). What amazed me most was the journey the great red granite pillars made to this Roman "City of the Sun." Quarried at Aswān, in Upper Egypt, they were floated 700 miles down the Nile, then shipped through the Mediterranean, and hauled by brute force up into the valley.

But power the Romans had. And power is the theme historian H. W. F. Saggs of the University of Wales develops in portraying the stirring march of empires across the Biblical stage: Assyrians, who "came down like the wolf on the fold," Babylonians, Persians,

"Whosoever drinketh of the water that I shall give him shall never thirst" (John 4:14). Thus Jesus spoke to a Samaritan woman at Jacob's Well, near Nablus, when He revealed Himself as the Messiah. Today several hundred Samaritans, like this woman on a hillside splashed with poppies, still live in Nablus and in the environs of Tel Aviv. Following the first five books of the Bible, they celebrate Passover with a sacrifice of lambs.

Alexander the Great, Roman legions that rendered Palestine unto Caesar.

Famed for his Dead Sea Scrolls excavations, French archeologist Père Roland de Vaux of Jerusalem's École Biblique re-creates life under Rome's shadow in the Jerusalem and Galilee of Jesus' day. And Dr. Emil G. Kraeling, Biblical scholar and biographer of Paul, fleshes out a portrait of the great missionary who carried the "good news" that changed history's course.\*

Ever since I was a boy, Paul has fired my imagination. Such journeys he made! "Thrice I suffered shipwreck, a night and a day I have been in the deep," he wrote in his Second Epistle to the Corinthians. His description in Acts 27 of "being exceedingly

tossed with a tempest" strikes a responsive chord in anyone who has felt the crash of green water on a lurching deck.

I have visited Paul's birthplace, Tarsus, where Cleopatra on a gilded ship with purple sails and silver oars—Plutarch tells us—voyaged to meet Mark Antony. I have strolled the "street which is called Straight" in Damascus, where Paul came, converted to Christianity in a blinding vision. I have seen the site of Antioch, where he set out on his missions and men were first called Christians.

But it was in the Greek city of Corinth that I felt closest to Paul. Wandering amid its shattered glories, I recalled his despair when

\*See "Jerusalem to Rome in the Path of St. Paul," by David S. Boyer, *GEOGRAPHIC*, December, 1956.



his flock lapsed into worldliness. A favorite passage from I Corinthians 13 welled up in memory: "Though I speak with the tongues of men and of angels, and have not charity, I am become as sounding brass. . . . And now abideth faith, hope, charity, these three; but the greatest of these is charity."

I felt Paul's presence then—and you will share this feeling in *Everyday Life in Bible Times*. NATIONAL GEOGRAPHIC photographers and writers traced his footsteps and those of other Bible personalities. They crossed wind-carved dunes once plied by Solomon's caravans, fished the Sea of Galilee where Jesus called the disciples, followed Moses through the wastes of Sinai.

They journeyed to Ur, Babylon, Nineveh,

Persepolis, Ephesus, Memphis, Thebes; the caravan cities of Aleppo, Palmyra, and Petra; Holy Land sites from Dan to Beer-sheba. They trekked to remote Mount Ararat, which lifts its snowy crown nearly 17,000 feet in Armenia; to the lonely tomb of Cyrus at Pasargadae in Persia; through Arabia to the land of Sheba.

They climbed a sacred mountain to witness chanting Samaritan priests sacrifice "a burnt offering unto the Lord." They met women in flowing headdresses coming to draw water, like Rebekah "with her pitcher upon her shoulder" (page 502).

They brought back the most comprehensive coverage in color photographs and vivid reporting ever made of the Bible world.

SMITHSONIAN INSTITUTION © N.G.P.



Enduring monuments to Roman might, pagan temples at Baalbek, Lebanon, rose while Christ's message was spreading through the Empire. Here at a bustling crossroads, the conquerors reared giant hand-hewn blocks and columns over a shrine to a local baal, or lord. In the colossal courtyard, where two visitors stroll on the far left aisle, priests once awed subject peoples with blood sacrifices. Six 65-foot pillars from the Temple of Jupiter, among the tallest ever carved, stand beside the richly decorated Temple of Bacchus, center. In its entrance (above) a winged spirit still flies amid the finest Roman temple ruins extant.



Complementing these are striking works by ancient artists—tomb paintings, objects of gold, ivory, lapis lazuli, Byzantine mosaics, and masterpieces of Cimabue, Leonardo da Vinci, Michelangelo, Raphael, El Greco, and Rembrandt. All are reproduced in color.

Many years ago, when I was new on the GEOGRAPHIC staff, I worked on a story that evoked the shepherd's life in the 23d Psalm, photographed in a Holy Land setting of "green pastures," "still waters," and deep-shadowed valleys. Through the years I have thrilled to discoveries in Biblical lands reported in NATIONAL GEOGRAPHIC by Breasted, Woolley, Schaeffer, Mallowan, Glueck, and other great archeologists. The Society has supported excavations by Dr. Theresa Goell on Nemrud Dagh in Turkey, and Dr. Kathleen Kenyon at Jerusalem.

#### Rich Compendium of Biblical Lore

*Everyday Life in Bible Times* brings this lore of discovery together. I found that all I had read, all I had seen on journeys through Bible Lands, came into sharp focus as I reviewed the text, studied the maps, and marveled at the illustrations.

Did you know where we get our expression "scapegoat," the word "scallion," or the name "Palestine"? Did you know what mound, where 20 cities lie one on top of another, has been identified as the Bible's Armageddon?

In these information-packed pages you will find answers to these and countless other questions. Scallions were onions from Ashkelon, a city conquered by the Philistines—whence the name Palestine. Armageddon, connoting a cataclysmic war, derives from Har (Mount) Megiddo, a Biblical stronghold destroyed many times in battle. And scapegoat? On ancient Israel's Day of Atonement the high priest symbolically heaped the people's sins on a goat and then let it escape.

Sample response from members has indicated that this book, four years in preparation, will be one of the most popular our Society has ever published.

Mammoth high-speed presses, printing in six colors, worked a Biblical 40 days and 40 nights to produce 400,000 copies of *Everyday Life in Bible Times*—largest single book printing in the Society's 79 years. The beautifully bound volume is now ready for mailing to members. THE END

#### HOW TO ORDER EVERYDAY LIFE IN BIBLE TIMES

WALK hand in hand with noted scholars as they reconstruct the world of the Bible in rich and fascinating detail. The new 448-page volume, completely indexed, belongs in your home as a companion to the Bible itself.

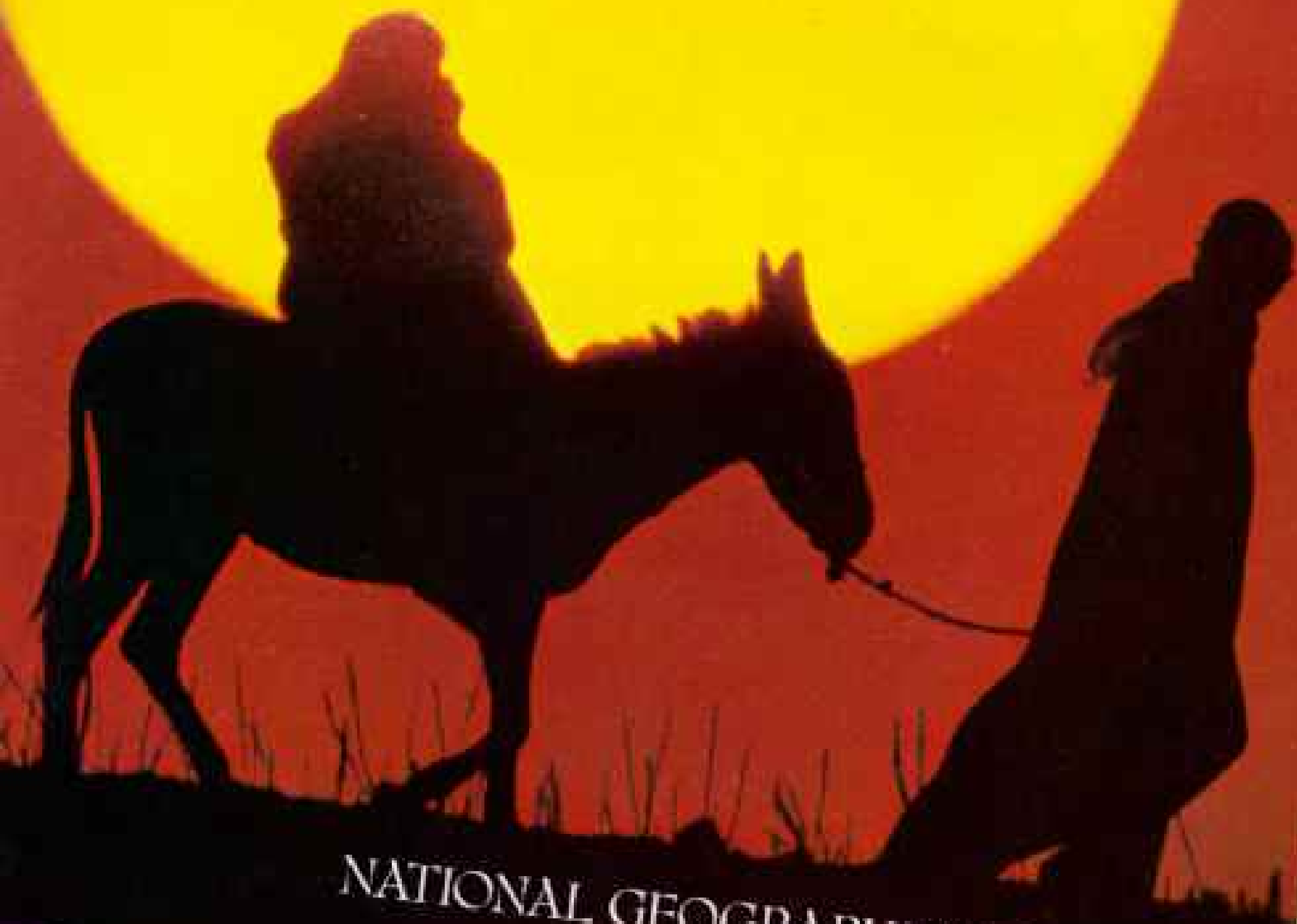
Bound in gold-stamped linen and buckram, the book includes 528 vivid illustrations, with 412 in

full color; also 11 special page maps and a wall map showing "Lands of the Bible Today" on one side and "The Holy Land" in enlarged scale on the other. Available at \$9.95, plus 40¢ postage and handling, only by direct order from the National Geographic Society, Department 434, Washington, D.C. 20036. Request later billing if desired.



*Everyday Life in*

# BIBLE TIMES



NATIONAL GEOGRAPHIC SOCIETY

# Threatened Glories of

**U**NDER A HOT and steamy sun, the shallow soup-warm waters teemed and crawled with languid life. Dense schools of foot-long garfish drifted like clouds above the rank bottom growth and ooze of pond and slough. Water snakes and turtles lay in the weeds, and primitive-looking birds stalked the shallows, scurried over the lily pads, or clung in the trees.

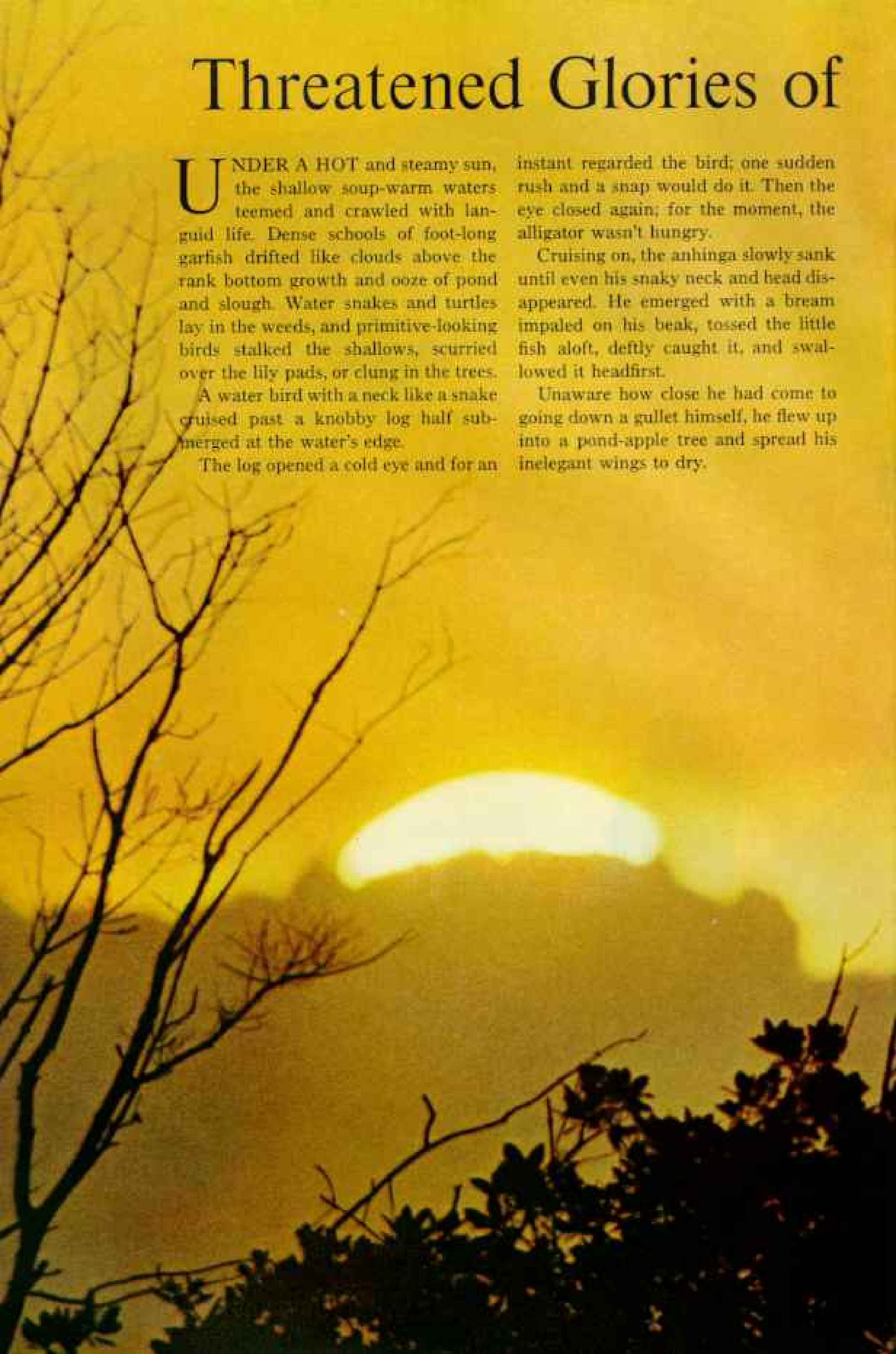
A water bird with a neck like a snake cruised past a knobby log half submerged at the water's edge.

The log opened a cold eye and for an

instant regarded the bird; one sudden rush and a snap would do it. Then the eye closed again; for the moment, the alligator wasn't hungry.

Cruising on, the anhinga slowly sank until even his snaky neck and head disappeared. He emerged with a bream impaled on his beak, tossed the little fish aloft, deftly caught it, and swallowed it headfirst.

Unaware how close he had come to going down a gullet himself, he flew up into a pond-apple tree and spread his inelegant wings to dry.



# Everglades National Park

Against a green riot of tree, fern, and vine, this snakebird made a grotesque picture—calling to mind the world's first birds, when the scales of crawlers were turning to feathers and earthbound reptiles were learning to fly.

"It seems like a scene from the Age of Reptiles," exclaimed a visitor from the North. "It's like stepping back ages to a time when the great coal deposits were being laid down."

"That's so," said the friend beside him. "But unless we all do something about it, this park will be as dead as the pterodactyl."

The scene was the Anhinga Trail in Everglades National Park (next page). The man who

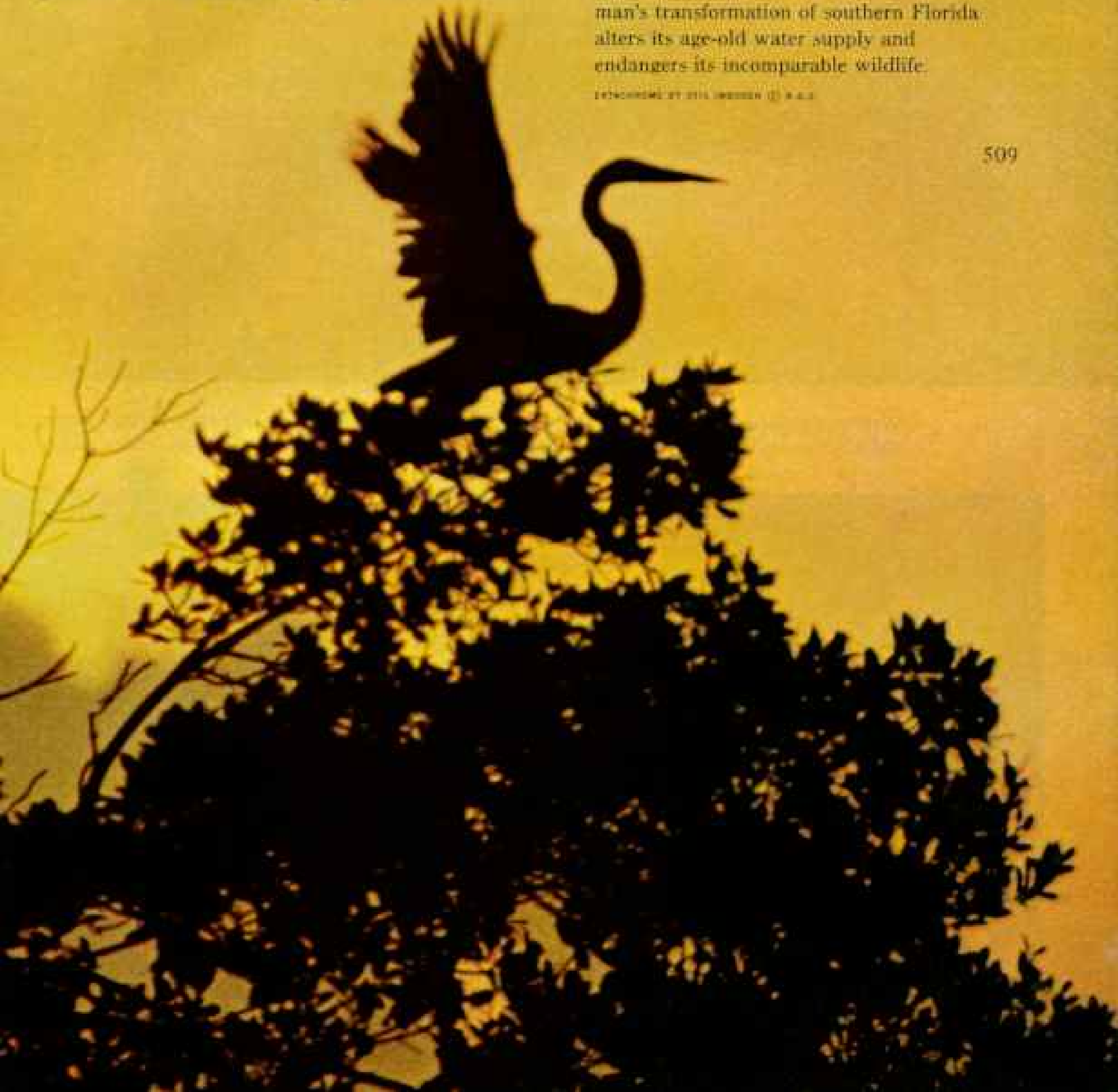
By **FREDERICK KENT TRUSLOW**  
and **FREDERICK G. VOSBURGH**  
Editor, National Geographic

*Illustrations by*

**FREDERICK KENT TRUSLOW**  
and staff photographer **OTIS IMBODEN**

Like the dawn of time, a fiery sun rises from the mists of Florida Bay and stirs to life a roosting American egret. Scenes from days when the world was young abound in vast Everglades National Park. But man's transformation of southern Florida alters its age-old water supply and endangers its incomparable wildlife.

ILLUSTRATION BY OTIS IMBODEN © 1963





Walkway through wonderland, the Anhinga Trail winds a third of a mile over Taylor Slough, a microcosm of life in Everglades National Park. Limpid waters teem with fish, turtles, alliga-



Afloat on a lily pad, a purple gallinule (left) turns people-watcher; like all the creatures along the trail, this gaudy fellow is unafraid. Long-toed feet bear him lightly over the spatterdock.

Death in disguise, an alligator (right) surfaces beneath a clump of weeds—and two coots and a grebe give him full right of way.

Anhingas (far right), also called snakebirds, darters, or water turkeys, nest near the trail. Father takes off for fishing while mother feeds her catch to the young.

Last year such wildlife brought more than a million visitors to Everglades, the country's third largest national park after Yellowstone and Mount McKinley.





tors, and more unusual kinds of birds than most people see in a lifetime. Midwinter brings the best concentration of wildlife—and of wildlife-watchers, too, like this Christmas-season crowd.



RODACHENBERG BY FLIP BISHOP (LIPPER) AND FREDERICK KERT THUNLIN © N.S.A.

made the grim pronouncement was my friend and co-author Frederick Kent Truslow, the retired New York business executive who has built an ulcer-free second career as one of the world's great naturalist-photographers (page 524).\*

Fred has infinite patience with birds. He will spend fourteen hours on a soggy seat in a swamp, or on a swaying perch high in the air, to record the crimson glory of the roseate spoonbill, the home life of the bald eagle, or the wide-winged majesty of the wood ibis, the country's only stork. But he grows impatient of any delay in taking steps to save them.

"People aren't blessed with bright colors or wings, but they do have the brains God gave them," he says, "and they ought to use them to save this place before it's too late."

"But," you probably answer, as I did at first, "we made this vast area a national park twenty years ago. Nobody is allowed to shoot a bird here, or a deer, or pick a single flower. What more can we do? Why is this in danger?"

"You'll see," said Fred, not one to waste words.

Day by day, as I explored the park, I saw ever more clearly the problem—water—and, beyond that, busy man himself, ever multiplying, altering his earth.

#### River 50 Miles Wide, 9 Inches Deep

Most people think of the Everglades as a swamp. Actually its heart is a river—a "river of grass," in the apt phrase coined by Florida writer Marjory Stoneman Douglas.

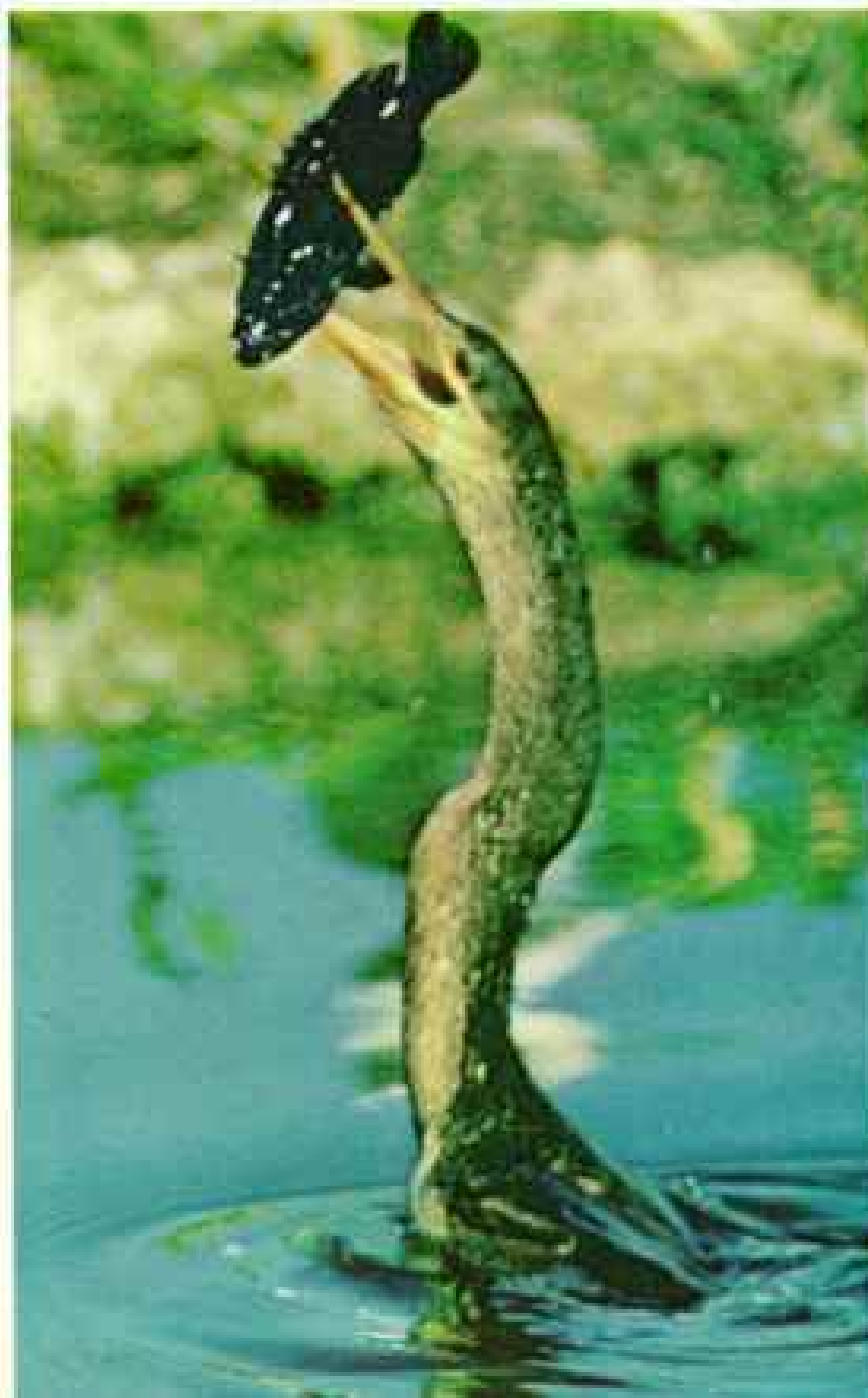
"*Pa-hay-okee*," the Seminole Indians called it, meaning "grassy water."

"This is the greatest expanse of saw grass in the world," said a park ranger when we stopped to walk the *Pa-hay-okee* Trail and gaze out over the true Everglades—a billow-

\*Mr. Truslow's articles in NATIONAL GEOGRAPHIC include: "When Disaster Struck a Woodpecker's Home," December, 1966; "Eye to Eye With Eagles," January, 1961; "The Dauntless Little Silt," August, 1960; "Return of the Trumpeter," July, 1960; and "Limpkin, the 'Crying Bird' That Haunts Florida Swamps," January, 1958. In addition, Mr. Truslow's bird photographs have illustrated four other articles and made a major contribution to the Society's books *Song and Garden Birds of North America* and *Water, Prey, and Game Birds of North America*. To the latter he contributed two chapters and 92 of its finest photographs.

Expert fisherman, an anhinga surfaces with her catch. Swimming underwater, she spears large fish, grasps smaller ones.

Banquet for one, a bass hangs impaled on the anhinga's beak. The bird usually carries large fish ashore for the kill.



ing ever-ever land (painting, pages 332-3).

The waving saw grass reminded a Middle Westerner of the seas of wheat on our Great Plains. To me it recalled the grassy plains of East Africa, with their herds of antelope and lazy, well-fed lions.

But only when seen from a distance does the saw grass resemble either one. This is not a grass but a sedge, its long, thin leaves triple-edged with fine saw teeth that can cruelly rake your clothes and skin. Although usually not as tall as a man, it sometimes reaches twice that height. And it likes to have its feet in water most of the year.

Look closely now, and you will see our river—a few inches of water around the roots.

"You are looking at the widest, shallowest, and strangest river in America," the ranger is saying. "It is fifty miles wide in places and flows at most a third of a mile a day. Even in fall, the wettest season, its average depth is rarely over nine inches; most of it is often bone dry for weeks in spring, the dry season."

The river's source, in simpler times, was occasional spillover from Lake Okeechobee,

66 miles to the north, and seasonal rains over the Everglades. But draining of mucklands south of the lake to grow crops altered the age-old pattern of runoff, and much of the water that used to flow south was channeled directly to the sea.

Then in mid-September, 1928, a hurricane roared in from the Caribbean and scored a direct hit on big, shallow Lake Okeechobee. Fill a saucer with water, then sweep your hand through it and you will have some idea of the effect. The resulting flood killed at least 1,500 people; some estimates put the toll as high as 2,500. No accurate count was possible; in some places, bodies were heaped in piles and burned.

In faraway Washington an appalled Government took action, and in 1930 the Army Corps of Engineers began work on what was to become known as the Herbert Hoover Dike to end spillover from the lake forever. From the south side this great embankment was continued around the lake. It has been under construction ever since, and the Engineers say they expect to complete it within

*A toss of the head and the anhinga deftly catches the bass headfirst to keep the fins from raking her gullet.*

*Down the hatch! One big gulp and the tight-fitting bass begins its one-way journey down the anhinga's long throat.*

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RESEARCHED BY FREDERICK VENT THULLOW © R.A.E.







GRACEFUL AS BALLET DANCERS, *American egrets thrust and parry in a brief air battle for fishing rights at Nine Mile Pond.*

PHOTOGRAPH BY FREDERICK BURT THILLER © 1995

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the next three years, increasing the lake's safe storage capacity by more than a million acre-feet.

Meanwhile, over the years, they have designed and built an elaborate system of levees and canals to keep Lake Okeechobee from ever reaching danger depth. Before the hurricane season each year, billions of gallons are drained to the Atlantic and the Gulf of Mexico (maps, page 518).

Working closely with the Engineers is an energetic state agency, the Central and Southern Florida Flood Control District, created in 1949. Besides helping to control floods, its duties include assuring all hands an ample supply of fresh water.

As resort cities burgeoned along the coast, demand for water had grown enormously. Some Miami area residents a few years before had had a startling experience: When they turned on their faucets, the water from their wells came out salty—undrinkable.

What had happened? Miami and much of this coast lies on a series of rocks composed mostly of porous limestone. Geologists call the formation the Biscayne aquifer—literally, "water carrier." Fresh water flows through it as if through a sponge. But the sea presses in from the other side, and if the sweet water has too little force, salt water will invade the aquifer. That's what had happened when the taps flowed salty.

#### Dam-borne Road Cuts River of Grass

To keep this vital sponge full of sweet water and to store reserves for unrainy days, the Corps of Engineers and the Flood Control District have created a vast system of shallow, grassy reservoirs, called conservation areas, north of the park.

Open to the public, these areas preserve thousands of acres of glades country for hunting, fishing, camping, boating, and other recreational use. But inevitably they interrupt the natural flow of the river of grass southward into the national park.

This became agonizingly apparent after 1962, when completion of Conservation Area 3, just north of the famous Tamiami Trail, resulted in the building of an earthen dam along the park's northern boundary. The dam, or levee, with the road on top, replaced a nine-mile section of the old Trail (page 520 and map, page 519). The Engineers built six sets of gates in the levee—four to release water into the park and two as emergency outlets from the conservation area.

During the years that followed, the gates

were kept closed much of the time, and the park found itself gasping for water, especially in the tragically dry spring of 1965. Last spring drought again stalked the Everglades, but this time the state requested that the gates be kept open. Result: a greatly reduced kill of fish and other wildlife.

Recurring cycles of drought and flood are nothing new to the Everglades. June and July usually bring rains which reach a climax in the autumn hurricane season. In late winter and spring the Glades dry up. All creatures dependent upon fresh water congregate in ever-shrinking sloughs and water holes.

Rainfall directly upon the park has always  
*(Continued on page 522)*



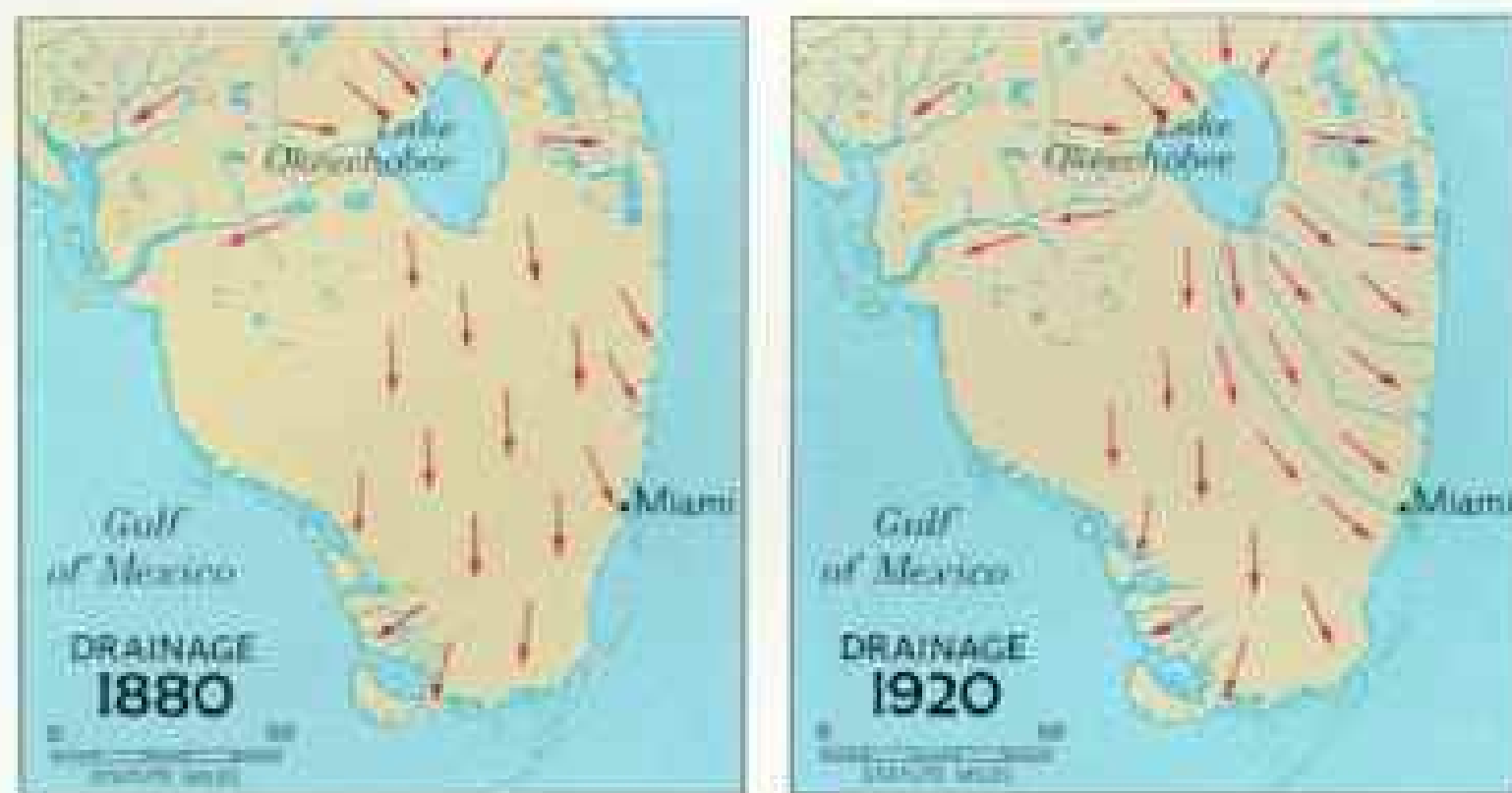
RETIROPHOTOS BY OTIS WATKINS © N.R.S.

Danger on the horizon: Fire Control Aid Ralph Johnston, left, and Ranger Erwin Winte keep a sharp watch from the Shark Valley Observation Tower (page 553). Especially in times of drought, a carelessly discarded cigarette or match, a camper's fire, or lightning can kindle the saw grass. Sighting along an Osborne fire finder, Mr. Johnston determines direction and distance of smoke, then directs fire fighters to the scene by air and land.

Glades fire (right), raging north of the park, consumes all vegetation. Sometimes even the peat soil burns.



**LIFE-GIVING WATER** once seeped naturally southward from Lake Okeechobee to the sea. Then the needs of man altered the flow. By 1920 canals dug to drain land for farming diverted part of the water to the ocean. Today, to prevent floods, billions of gallons annually are drained from the lake to the Gulf and Atlantic through the Caloosahatchee River and the St. Lucie Canal. An ever-more complex system of channels, levees, and water conservation areas regulates the remaining supply for irrigation, city needs, and maintenance of wildlife in Everglades National Park.



MAPS BY JOHN P. WOOD AND HERBERT HENRY  
 ILLUSTRATION BY EDWIN  
 NATIONAL GEOGRAPHIC SOCIETY

Marquesas Keys



FLORIDA

Gulf of Mexico

Atlantic Ocean

Florida Bay

EVERGLADES NATIONAL PARK

Gulf of Mexico

1967

Red arrows show direction of drainage  
 • Pumping stations  
 • Water control structures

1:125,000

Gulf of Mexico

DRAINAGE 1880

Gulf of Mexico

DRAINAGE 1920

1:125,000

Lostmans R.

Broad R.  
Harney R.

Port de Leon Bay

Little Sable Creek

Lake Ingraham

Lostmans River Patrol Station

Hullagh R.

Chokoloskee Island (privately owned land)

Everglades City

Cape Romano

Ten Thousand Islands

Ochopee

EVERGLADES NATIONAL PARK RESERVE



Visitor Center near the entrance gives a foretaste of the 1,400,533-acre national park. Cabbage palms, Florida's state tree, ring the building.





ERDACHRORE (ABOVE) BY STZS IMAGERY; ERDACHRORE BY LAURENCE B. LOWRY © S.A.S.

**Nine-mile barrier** stretches between the park on the south, left, and Conservation Area 3 (map, preceding pages). Six sets of sluice gates along this section of the Tamiami Trail—the highway connecting Tampa and Miami—control the flow of water. Australian pines, or casuarina trees, line the abandoned section of the old Trail. Ten-mile-long Canal 67 Extension, foreground, completed in 1967, brings help to the eastern side of the park by carrying water from the conservation area when supply permits; the accompanying levee helps retain water in the park. Proposed Canal 28, near Forty Mile Bend, far distance, would pour a similar transfusion into the western side.

Like petals scattered before the wind, egrets flutter over Big Cypress Swamp, northwest of the park. Early-morning sun tints saw grass and cypress. In dry times in the park many birds move north, roosting at each water hole until they have fished it clean.







provided about 85 percent of its water supply, but virtually all of this is lost by evaporation and by transpiration through the foliage of plants. Especially in a prolonged drought, the flow from the north and east can be crucial. Under natural conditions, excess water from up Okeechobee way used to arrive when needed most. Taking weeks to filter southward, it extended the wet season here, shortening the drought and cushioning its effects.

### A Slow, Thirsty Death for Millions

Without this flow from the north, a long rainless season that would have been bearable may become excruciatingly severe and bring slow death to millions of creatures.

"Everglades Life Periled by Drought," proclaimed newspaper headlines as I flew to Miami and drove to the park under an unrelenting May sun in '65. "Fourth Straight Year of Drought."

Where the road crossed Taylor Slough, near the turn-off to the Anhinga Trail, a National Park Service sign still said, "Fishing in this area reserved for the birds." But there were no fish, no birds—and no water. I walked dry-shod across the slough.

At Royal Palm Pond, where the Anhinga Trail begins, Park Naturalist Sam Mendlen looked tragic. Around the edge of the shrunken pond lay hundreds of dead and dying garfish.

"They're not the weakest species, but the strongest," the naturalist said. "The bass and bream are gone long ago. Fish can't live when the water gets stagnant and there's no oxygen left in it. See 'em pulling into the bank? Those fish are dying. We're pumping oxygen into the water, it helps some. Pumping water in too, from a 30-foot-deep well.

"You don't see many small gators now. When food's in short supply, the bigger gators eat the smaller ones, and so on down the line."

That night I dreamed of a gator pool. At first it was full of happy little gators. The pool got smaller and just before I woke up, I saw that it held a single gator—a nightmare beast as big as all the others put together.

Reality was bad enough. Pools that once supported hordes of fish, turtles, gators, and

wading birds had disappeared entirely, leaving only a cracked expanse of dried mud. From one the track of a big alligator wandered off into the dusty distance.

Rangers were roping homeless gators and trucking them to distant water holes. Others had enlisted technical aid from demolition experts at nearby Homestead Air Force Base.

"We've been making artificial gator holes," said Ranger Erwin Winte, "blasting down to the water table with dynamite. But these are only stopgap measures. Until it rains we've got to try to do *something*."

That very night the heavens opened. The rains of June had come at last, and the Everglades' worst drought was broken.

I remember the delight of 9-year-old Eddie, the Wintes' son.

"Look," he said, "this was dry mud last week. You can still see the cracks on the bottom. But now there's two feet of water already. And see, there's a little fish. I wonder how it got there." I wondered too.

Thus quickly the Everglades recover, in the age-old pattern of famine and feast. But each time the toll of wildlife runs high. We are living on capital.

### Otters Fall Prey to Alligators

With not enough food and water, alligators die or eat each other. Mammals suffer too, especially such water-dependent creatures as the playful otter. Half-starved alligators lie in wait for them at the few remaining water holes.

"I saw gators wipe out what I took to be a whole family of otters one dry year," Fred Truslow told me. "Caught six in the same pool, one after another."

Birds can fly elsewhere in search of water, but often at the cost of a new generation. Consider, for example, the wood ibis.

Every winter for as long as anybody knows, these storks of our southern United States coasts have been coming to south Florida to breed in great rookeries in the Everglades.\*

\*See "Our Only Native Stork, the Wood Ibis," by Robert Porter Allen, with photographs by Frederick Kent Truslow, NATIONAL GEOGRAPHIC, February, 1964.

**Dressed for courtship**, a snowy egret doubles its beauty in nature's mirror. He or she (the sexes look identical) stands immobile on a spatterdock leaf, alert for a fish to come within range. Brilliant yellow feet help identify the snowy, *Leucophoyx thula*, and give it another name, "golden slippers." Nuptial plumage on crest and back almost led to extinction of the snowy and the American, or common, egret (*Casmerodius albus*, pages 509 and 514-15). Plume hunters slaughtered thousands for ladies' hats until federal statute outlawed the practice.





Bavages of drought along the Anhinga Trail concern co-authors Frederick G. Vosburgh, left, and Frederick Kent Truslow. A winter resident of the area for 12 years and a Park Research Collaborator on bird life for seven, Mr. Truslow has seen year after year of drought bring devastation. Worst was 1965, in April, water barely covers the bottom of Taylor Slough (below). One month later (right), the slough becomes a mud flat.

Last spring's drought was nearly as bad, as the mudbound gator (right) can attest. But this time the state was more generous with water, and the Park Service kept Taylor Slough from running dry by pumping from three wells, night and day.





WETLANDS (BELOW) BY JAMES A. WELLS, WETLANDS (OPPOSITE, LOWER) AND BIRCHWOODS BY STEPHEN W. S.E.







Under the fecund Florida sun, the shallow waters of the river of grass breed unimaginable quantities of organic life, and with the seasonal drying at the end of the rains in October or early November, the pools that remain become bowls of fish soup. It's this living soup that draws the wood storks here, coming in by the hundreds on broad wings with a spread of fully five feet.

#### Both Parents Feed Hungry Storklets

The wood stork is a gape feeder; he gulps anything fishy that his big beak hits as he swings it around in the ponds. But there had better be plenty of fish in this stew. Both papa and mama are eating for two—or three or four—for they feed the young by regurgitation. If the soup is too thin or the pond too distant, it will be impossible to gorge and deliver the outlandish quantities needed to raise a nestful of hungry storklets. Sometimes hundreds will build nests, lay eggs, hatch young—and abandon them.

"What happens then," says Fred, who has seen it, "I'd rather not be asked to describe. But vultures like it a lot."

This year, for the first time since 1961, the storks did well, nesting off and on from December to June and raising 3,000 babies.

"I'm convinced that the storks can nest successfully only if rainfall is supplemented by a substantial flow of water through the gates on the Trail," said Dr. William B. Robertson, Jr., National Park Service Research Biologist.

Under the present federal-state agreement, the park gets water "when lake levels permit"—specifically, when the level of Lake Okeechobee stands at least 12½ feet above mean sea level. To speed movement of the water southward, the canal system is being improved at a cost of more than \$3,000,000, four-fifths federal and one-fifth state funds.

The difficulty is that, in a widespread drought, lake levels might *not* permit. Last spring, Florida's Governor Claude R. Kirk, Jr., personally requested that releases of water to the park be continued throughout the drought,

**Baby gator bites back.** In a split-second drama of the Everglades, a full-grown wood ibis, a yard tall, with scimitar beak and powerful wings, pecks at a 16-inch alligator—and gets more than he bargained for. "The little fellow leaped for his throat," says the alert photographer, Fred Truslow, "but in this instant the bird has turned to avoid the strike. Next moment he fled the field." Actually not an ibis but a stork—the only one native to the United States—*Mycteria americana* may seem no beauty when earth-bound (right). But in flight, huge wings edged with ebony give the bird the grace of a poem.



ILLUSTRATION BY FREDERICK KENT TRUSLOW © A.S.S.

even though the Lake Okeechobee reserve had sunk below the 12 $\frac{1}{2}$ -foot minimum. But there is no guarantee that this will always be done.

This fall a four-year study of the Florida water problem is due for completion by the Army's Corps of Engineers, and conservationists hope it will propose a means of reducing the present waste of fresh water.

As Park Superintendent Roger W. Allin has said: "Many feel that the dumping of this important natural resource to the Atlantic or the Gulf of Mexico should not be permitted, and plans to reroute these surplus waters back to their historic watersheds and through Everglades National Park should be given early attention."

"Whatever the cost proves to be," said Park Service Director George B. Hartzog, Jr., "I am sure that our conservation-minded country will not hesitate to save Everglades National Park, the only unit in our entire system where unique natural-history values are seriously threatened with destruction. The only question is whether action can come before it is too late."

"We didn't acquire this subtropical wonderland twenty years ago to let it go by default," declared conservationist Conrad Wirth, Director of the National Park Service from 1951 to 1964 and father of Mission 66. "But if we don't act promptly and wisely, we'll have a dried-up mud flat on our hands."

#### Water Shortage Affects All

Army Engineers and the Flood Control District reply that they aren't anti-park or anti-animal, but that the needs of farmers, cities, and their own conservation areas, too, must be met. They point out the difficulty of storing water in a land almost as flat as your hand, where most of the rain falls within the five months from June 1 to November 1, and where nature's only reservoir, Lake Okeechobee, must be kept no more than two-thirds full at that very season lest another hurricane drown thousands. But they agree that modern engineering genius can improve the present situation—at a price.

Says Brig. Gen. H. G. Woodbury, Jr., Director of Civil Works, Army Corps of Engineers: "Since the Central and Southern Florida Flood Control Project began, the park has received more water—probably double the amount—than it would have received otherwise under identical conditions of rainfall. Though this partly completed project is beginning to function well, to the benefit of all south

Florida, including Everglades Park, we are now restudying the area's comprehensive needs to ascertain how the program can be made even more effective in meeting the critical and difficult water problems there."

Even from a practical and local viewpoint, the issue can no longer be regarded as people versus animals. Their interests are much too closely bound together. Biologists point out that the multimillion-dollar shrimp industry, as well as south Florida's lucrative sport and commercial fisheries in Florida Bay and off its southern Gulf Coast, depend on the flow of fresh water through the park. Brackish "nursery" waters are in danger of becoming too salty to support baby shrimp and the myriad lowly shallow-water creatures that form the base of the fish-food pyramid.

#### A Million Visitors a Year

More and more Floridians are coming to appreciate, too, the importance of the park's fate to their vital industry—tourism. Each year the haunting beauty of the Everglades, and their incredible richness in wildlife, bring more visitors to this unique corner of the country. Last year, for the first time, Everglades joined the list of national parks attracting more than a million visitors annually. The total has risen half a million in seven years.

As the visitor from the North approaches the park in winter, it seems as if all the bird life from home has been shaken down into this toe of the Nation, like goodies in a Christmas stocking. Except for the thin line of the Florida Keys, this is as far south as birds can get without a long overwater hop. There are robins, catbirds, goldfinches, and a host of other small summertime friends, as well as many birds of prey.

Here, too, as we drove to the park last spring, were more reminders of how man is closing in upon his remaining wilderness areas: a big rocket-engine plant only a mile from the park entrance and nearby the controversial Canal 111, which park officials feared would drain off sorely needed fresh water and allow salt water to invade the land. The rocket tests, however, terminated with the third firing last June, and, in the battle of C-111, park officials and conservationists have won a partial victory—agreement to provide gates to prevent salt-water intrusion, and openings in the canal wall to shunt fresh water into the park.

At the Visitor Center just inside the park entrance, you stand at the dizzy elevation of 5 $\frac{1}{2}$  feet above sea level. Driving from here to

Boardinghouse reach. With a neck more than half its total length of two feet, a Louisiana heron, *Hydranassa tricolor*, grabs another helping of fish.



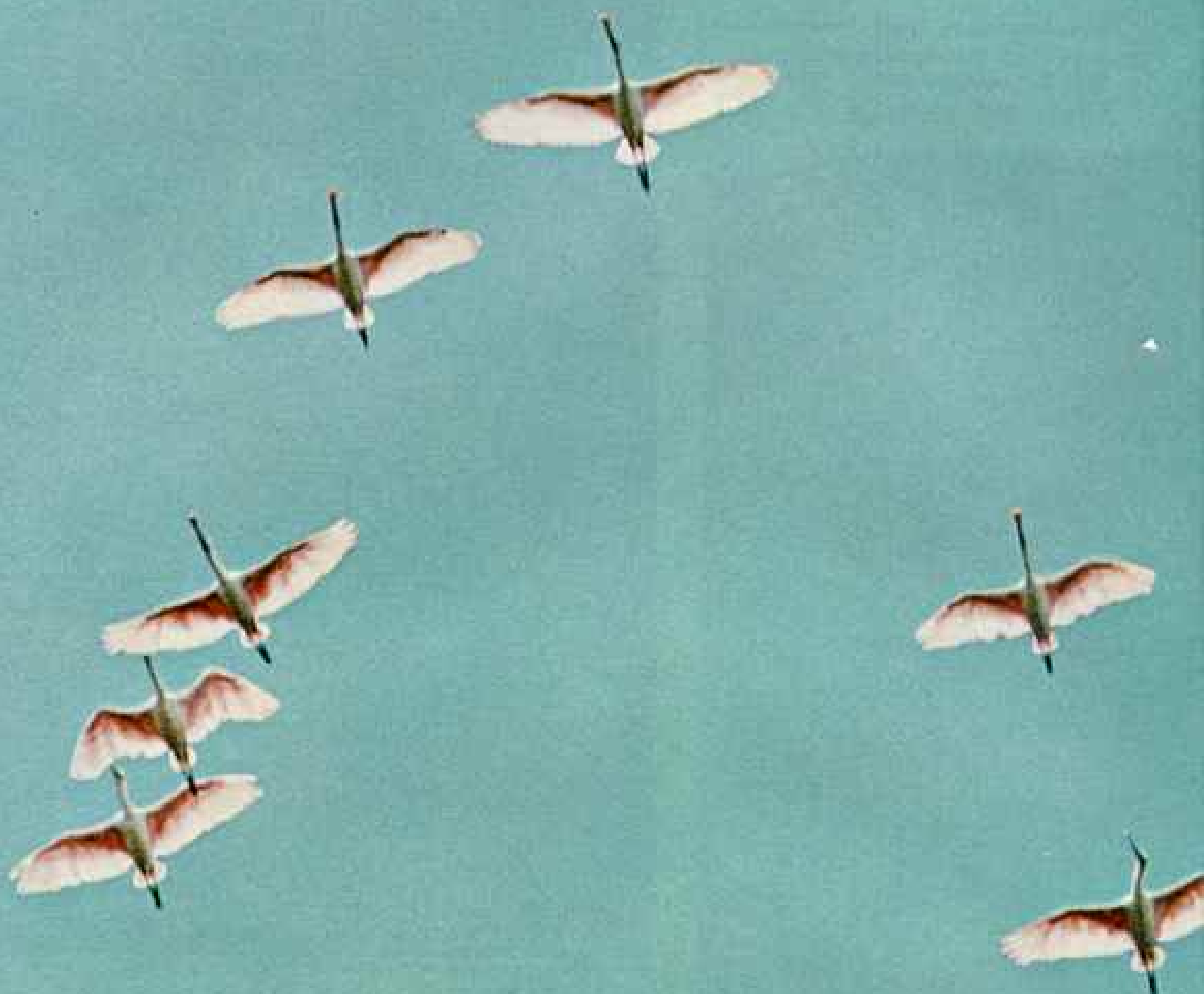
RESEARCHER BY JAMES A. KERN (ILLUW) AND FREDERICK RENT TRUSLOW © N.A.C.

Preening yellow-crowned night heron spreads underwings to the sun. A tinge of yellow on the brow (not visible here) gives *Nyctanassa violacea* its common name.



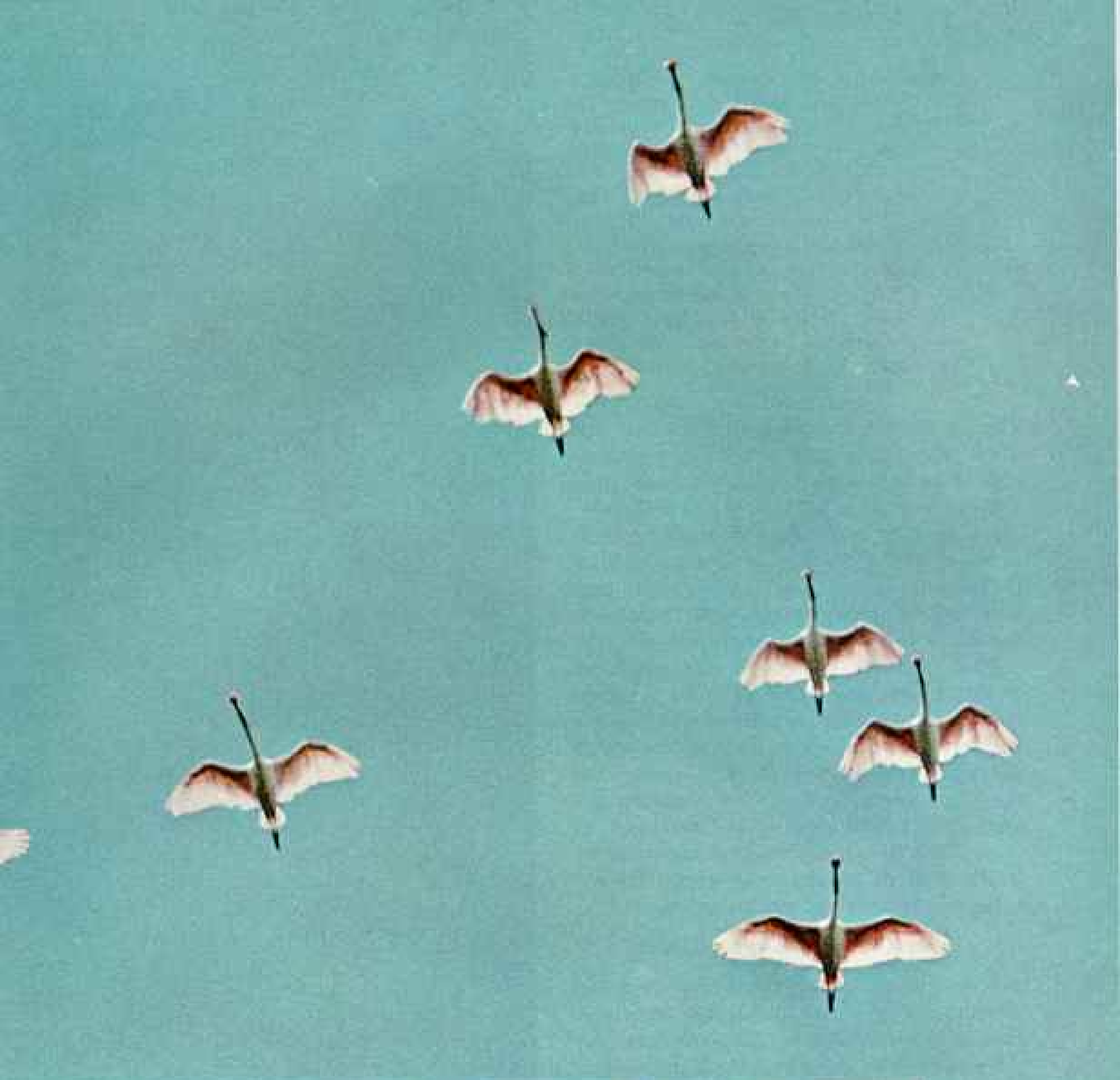
Drought-stranded garfish proves easy prey for a half-starved black-crowned night heron, *Nycticorax nycticorax*.





GLORY OF THE GLADES, *roseate spoonbills wing toward a feeding ground. Some fly up from the West Indies to breed, displaying their most brilliant plumage during the Christmas season. But hundreds of others spend the whole year in southern Florida. Dining in a brackish pond (inset), *Ajaia ajaja* shows its pink-and-white plumage accented with carmine. When small fish, crustaceans, or aquatic insects touch the inside of the groping beak, it automatically snaps shut.*





PHOTOGRAPH BY FREDERICK REYD TRUSTEES I. C. P. S.

Sea of saw grass spreads to the horizon in this painting by GEOGRAPHIC artist Lisa Biganzoli. White ibises wing their way across the wilderness while an alligator, a red-bellied turtle, otters, and raccoons congregate at a water hole abounding in bream, garfish, and largemouth bass. "Flying" underwater, an anhinga seizes a fish. Lacking water-repelling oil, another snakebird hangs wings out to dry. Yellow-billed American egret, smaller snowy egret, crook-necked Louisiana heron, and a great blue heron stalk the shallows.

Florida Bay at Flamingo—a little less than forty miles—you go downhill at an average rate of an inch and three-quarters per mile. But in a region so low and flat, a few inches can alter land and nature as much as thousands of feet in the Rockies. Altitude, slight though it is, divides this Delaware-size park into three different worlds—the pinelands, the saw grass, and the mangrove coast.

First because highest is the pinelands world, a beguiling place of wind soughing through long needles, of calling bobwhite and hammering woodpecker. By night the woods stir with unsuspected life as raccoons and opossums come forth to feed, bobcats and gray foxes prowl, and white-tailed deer, by some miracle, avoid breaking their dainty, fragile legs in nature-made booby traps—holes dissolved in the porous limestone.\*

#### Pines Yield to Saw-grass Glades

From these rocky, pine-clad five-foot "mountains" you descend a few imperceptible inches and enter the true glade country—the world of saw grass, hammock, and slough.

What an adventure this must have been in the days when early explorers braved the Everglades—men like Maj. A. P. Williams in 1883 and Hugh L. Willoughby, "Ex-Lieutenant Commanding Rhode Island Naval Reserve," in '97. Even then, only 70 years ago and well within the memory of men now living, all the area south of Lake Okeechobee and west of a thin strip of pineland facing the Atlantic was a watery wilderness known only to the secretive Seminole. Even the Williams expedition had probed no more than a wavering north-south line as far as the Harney River (map, page 519).

As Willoughby wrote in *Across the Everglades*, "in our very midst, as it were, in one of our Atlantic coast States, we have a tract of land one hundred and thirty miles long and seventy miles wide that is as much unknown to the white man as the heart of Africa."



He and a companion crossed by canoe, from the mangrove swamps of the Gulf Coast near the Harney's mouth to the infant town of Miami. "What a change," he wrote, "had been made in this place since the same time last year!—from two houses it has been made a town of two thousand inhabitants. Of course, its splendid big hotel, with every modern convenience, will prove a great boon to the tourist, but for me the picturesqueness seemed to have gone; its wildness has been rudely marred by the hand of civilization."

\*For other GEOGRAPHIC articles on the Everglades, see: "Wildlife of Everglades National Park," by Daniel B. Beard, January, 1949, and "Haunting Heart of the Everglades," by Andrew H. Brown, February, 1948.



GEORGIC ART DIVISION © NATIONAL GEOGRAPHIC SOCIETY

In the Everglades this lover of wildness surely found it. He and a companion bucked the saw grass in two canvas canoes, with a bicycle-wheel cyclometer mounted on one to measure distance. Some days they were able to pole and push their way eastward only two or three miles and once they had to backtrack 13 miles (map, page 519).

The saw grass, Willoughby wrote, "is the great barrier to Everglade travel; it pays better to go twenty-five miles around than half a mile through. What makes this grass so formidable and so much to be dreaded is the saw-like edge with which it is armed on three sides. . . . The nose and face suffer much."

Yet Willoughby found much to admire:

"The popular impression has always been that the Everglades is a huge swamp, full of malaria and disease germs. There was certainly nothing in our surroundings that would remind one of a swamp. Around the shores of the little islands the mud may be a trifle soft, but pure water is running over it, and no stagnant pools can be found. In the daytime the cool breeze has an undisturbed sweep, and the water is protected from overheating by the shade the grass affords. Water-plants of various kinds and several varieties of fish and reptiles keep the balance of life, as in a self-sustaining aquarium."

After a flight over the park, I had to agree that except by plane this would be about the



Mangrove islands blossom with birds at East River Rookery. Thousands of wood ibises and a sprinkling of egrets raise their young in this labyrinth—in good times. But drought, storms, or cold



KODACHROME BY FREDERICK HEYI TRISLOW © N.S.S.

weather may result in few or no stork babies. This year, breeding from December to June, the birds hatched 3,000 nestlings. Park experts attribute this to the plentiful supply of water the previous year.





Headquarters for exploration into the southern reaches of the park, Flamingo offers restaurant, motel, marina, campgrounds, and Visitor Center. From here sight-seeing and charter boats thread mangrove channels in search of birds and fish. Long Pine Key, six miles from the park entrance, affords camping facilities only.

Dinner of leftovers fills the pouch of a brown pelican at Flamingo. He and a flock of rivals wait for scraps from the fishermen's cleaning table, like the remains of this freshly filleted fish.

worst journey in the world. At the little amphibian's controls was Ranger-pilot Ralph Miele, and with us went our biologist friend Bill Robertson.

My first impression was of a land part water, part weeds, flat and wholly deserted. Then I saw dust rising from the "Hole in the Doughnut"—privately owned farmland still within the park—and picked out the long road running generally southwest to Florida Bay at Flamingo.

#### A World for the Birds

Yes, there were some signs of man, but most of the scene seemed to be for the birds—too wet for walking, too dry for a boat. Near ponds where wading birds were feeding, the watery land was ashimmer with wings. A few showed the black and white of the wood storks; and over turquoise Florida Bay, other large white birds with black wing tips flapped along in dignified flight.

"White pelicans," Bill shouted above the drumming of the engine. "They come here in winter from the northern Great Plains.

"We're going to check for spoonbills and eagles now."

As we swung lower and turned, I saw an island frosted with white and pink.

"Tern Key," said Bill. "Roseate spoonbill rookery. About 200 nesting pairs. Not bad."\*

Now we were over another island, and in the top of a hurricane-ravaged black mangrove I saw an untidy-looking nest with a white-headed bird of prey in it.

"Not yet," Bill said. "That's only an osprey. You'll see the difference."

Another island swung into view, another tree, and a nest like a small haystack, but no eagle that I could see.

"Two young," announced Bill, and with the glasses I made out two bits of fluff.

And now on majestic wings came the mother. (Or was it the father?) No osprey this; she looked twice its size and so lordly of mien that she might have flown right off the national coat of arms. But instead of arrows and an olive branch, she gripped a small, anticlimactic fish.

We left the little ones mobbing their mother for the catfish, and in an hour's flight Bill counted 20 active eagle nests. On some sat a great white-headed bird; in others we saw eggs or eaglets (page 541).

"There's no other place in the country outside Alaska," said Ralph, "where you can see as many bald eagle nests in an hour's flying."

All the eagle nests were close to salt water, most of them in dead trees in the all but inaccessible mangrove realm along the park's west rim, a maze of islands and channels.

In one long, placid channel I saw what I thought at first was a boat; then I realized it was a manatee, or

\*See "Roseate Spoonbills, Radiant Birds of the Gulf Coast," by Robert Porter Allen, with photographs by Frederick Kent Truslow, NATIONAL GEOGRAPHIC, February, 1962.



sea cow, its flat tail stirring up a wake of mud as it churned along near the bottom. Biggest animal in the park, the manatee measures up to 15 feet and weighs as much as 1,200 pounds. Now strictly protected in Florida, it helps man by eating aquatic plants that clog canals and streams.

Finally we sighted civilization again—a few scattered houses on an island gleaming strangely white.

"That's Chokoloskee Island," the pilot said, "just outside the park boundary. It's built up largely of the shells of oysters the Indians ate."

These were the long-vanished Calusa and their predecessors, who lived here perhaps as long ago as the time of Christ.

Gliding in over the white wooden houses of the fishing village that stands today upon this monument to vanished gourmands, we landed at nearby Everglades City, where Ranger Dick Stokes greeted us grimly. Alligator poaching hereabouts was rife, and even when the rangers could catch the culprits, getting a conviction was like pulling gator teeth.

But Dick brightened as he showed us an ancient pottery bowl and conch-shell tools he had recently found and added to the National Park Service's collection of Calusa relics.

#### Only a Remnant of Indians Now

Today the Indian is gone from the park, except for a narrow strip just inside its north boundary along the Tamiami Trail. There dwell some 190 members of the Miccosukee tribe, usually considered a branch of the Seminole. From the air, we glimpsed their palm-thatched *chickees* beside the busy Trail.

Some saw-grass areas outside the park were crisscrossed by great curving tracks, as if dinosaurs had been playing tag.

"Tracks of swamp buggies and airboats used by hunters," the pilot explained.

Deer hunting here has become big business, with elaborate camps, airplanes, and two-way radio as well as huge-tired swamp buggies and high-speed airboats. In the park, such vehicles are not allowed, except for patrol and emergency use by rangers.

I remembered some notes NATIONAL GEOGRAPHIC photographer Otis Imboden made after a roaring ride with Ranger Winte in an airboat, an almost-flying machine with a 150-

horsepower airplane engine and propeller.

"Noise like something out of Hades and exciting blast of wind in your face. High saw grass parts and bushes fly past as you glide over a dew-deep streak of watery grass and lily pads.

"Secret of steering is to throw the craft into a fast 'drift,' like a powerful racing car making a curve. You have to step on the gas and send the boat into a broad sideslip at every turn. Twin air-rudders moved by joy stick. Foot-pedal accelerator like automobile. Biggest difference—*no brakes!* Only way to stop suddenly is to make a skidding about-face.

"Machine is perfectly adapted to the limited geography of the Glades. High seat for driver puts him above grass-top level. Latest adaptation is slick vinyl plastic coating on flat hull bottom; reduces friction for an extra five or ten miles per hour. Usually boats cruise from 30 to 40 mph. Capable of 60 to 70 mph—when there's water in the Glades."

Now from the air we see a skyscraper. At least it seems like one in this flat landscape—a concrete tower rising 65 feet above the saw grass and underbrush. The Park Service completed it three years ago to provide a fire lookout and give visitors a view of the all but invisible, inches-deep Shark Slough—the heart of the river of grass. In the pool at the tower's base we can see dozens of gators, tails swinging from side to side like sculling oars.

This Shark Valley Observation Tower draws increasing numbers of tourists from the Tamiami Trail, seven miles away. Oil prospectors built the original road, but the Park Service has made it a 15-mile loop to assure visitors new sights in both directions.

#### "Glows and Glories" of a Teardrop Isle

More miles of saw grass dotted with hammocks, and from their distinctive shape I realized fully for the first time that these are indeed islands in a stream.

"Each hammock is an elongated teardrop of greener hardwood vegetation," Bill Robertson pointed out, "with its streamlined comet-tail pointing downriver. See how each is aligned with the water flow in a sweeping curve south and then west?"

"Some hammocks have a sort of natural moat where the organic acids have etched

Bridge to nature's realm, a boardwalk zigzags through Mahogany Hammock. Boy Scouts on a botany hike and other eager visitors stroll past cabbage and paurotis palms, vines, mosses, ferns, orchids, and bromeliads. Nearby grows a mahogany tree more than 11 feet in girth, largest in the United States. Hammocks, or islands of hardwoods, and bayheads—smaller domes of bay, magnolia, and holly—punctuate the saw-grass sea.



away the adjoining rock. This helps to protect the hammocks from glades fires, but in times of drought they can be destroyed—not only the vegetation but the soil itself.”

I wondered how dirt could burn—till later I walked over a typical hammock. Here is botany gone mad. I thought of Robinson Crusoe's tropic isle and remembered lines from Tennyson's *Enoch Arden*:

*The lightning flash of insect and of bird,  
The lustre of the long convolvuluses  
That coil'd around the stately stems, and ran  
Ev'n to the limit of the land, the glows  
And glories of the broad belt of the world. . . .*

Here the very earth seems living. Wholly organic, the hammock peat itself falls prey to a really determined fire. In a dry year even the peat of the saw-grass plains may burn.

But now the pinelands reappeared, and the red-and-white amphibian planed to earth at the little strip near park headquarters.

Having seen the park as the eagle—or the eagle-counter—sees it, we joined the hundreds coming by car to this tropic wonderland.

“In the course of a walk through a hammock in the Park,” biologist Bill Robertson has written, “you might observe, say, a raccoon, a blue jay, and a black snake—nothing tropical about any of these creatures; they could be seen as readily in Illinois or Connecticut. However, the tree that the raccoon climbs, the insect the blue jay catches and the lizard that the black snake has just eaten are likely to be the tropical species not found elsewhere in the United States.”

This paragraph in his book *Everglades—The Park Story* sums up for me much of the park's appeal, its combination of the familiar with the bizarre and exotic. Here are many immigrants from the tropics. Most arrived by wave or wind, but some plants doubtless came as seeds in the stomachs of birds.

At Royal Palm, once a Florida state park and nucleus of the national preserve, two of the finest nature walks begin—the Anhinga Trail and Gumbo Limbo Trail. The tropical hardwood called gumbo limbo is also known as the sunburn tree because its reddish peeling bark suggests an appalling case of Florida's commonest beach indiscretion.

Within thirty feet of the winding boardwalk that carries the Anhinga Trail over water and mud, a pair of anhingas had built a nest and the mother snakebird was feeding her young (page 511).

“That's one of those anaconda birds,” said a lady.

“She'll learn a lot before she leaves this place,” said Fred with a grin.

“See that great blue heron over there?” He pointed to a four-foot bird with an ideal build for a basketball player. The heron stood so still I had missed him.

“Well,” Fred continued, “I was here one day making pictures when a party of city people came through. The man who did most of the talking spied a great blue heron standing there like something somebody had painted.

“‘Look!’ he said. ‘Artificial birds! The Park Service ought to be ashamed of itself.’

“Just then the old heron spied what he had been waiting for. That beak and neck shot out like a snake striking. He missed, gave out with an angry squawk, and stalked off around the bend like a center who had just been sent to the showers for too many fouls.

“The city man, I noticed, was a little quieter after that.”

Mrs. Ruth Mendlen, a park naturalist like her husband Sam, came along with a party of Cub Scouts in tow.

“What would you do if a mosquito started to bite you?” one boy asked another.

“I'd slap it.”

“Well, you'd be destroying wildlife. I'd just let it bite.”

“Then you'd be feeding the animals, and that's against the park rules, too.”

### Birds Become People-watchers

In twenty minutes along this wooden trail we saw uncountable numbers of creatures, from soft-shelled turtles in the lily pads and banded water snakes coiled in clumps of grass to big and little alligators and a host of swimming and wading birds. Here some of the country's most elusive and striking herons, egrets, grebes, and bitterns become so accustomed to people-watching that you can approach them within a few feet. Among them were a wood ibis (pages 526-7) and a limpkin (page 544). But I looked in vain for roseate spoonbills.

“We'll see them later,” Fred said. “They're ordinarily coastal, but I hear there's a great show right now at a brackish pond down the road.”

Sure enough. By gracing an insignificant little pond with their presence, the spoonbills had piled up traffic like a bear jam in Yellowstone.



Charcoal bits of fluff open eager mouths for a tidbit of catfish. A female bald eagle offers just the right-size morsels for her three-week-old youngsters. Except for Alaska, the Everglades harbor the greatest nesting concentration of *Haliaeetus leucocephalus*, our majestic national bird.

Sheltered by a motherly wing, a seven-day-old owlet accepts a bite of cotton rat. The baby will soon open its eyes and will fly when about six weeks old. First reported case of a barred owl nesting on the ground, this female raised her young for six years beneath the old fire tower in Shark Slough. With construction of the new tower, she moved to another home.

ILLUSTRATION BY FREDERICK KENT TRUBSON © N.A.S.





**Botanical detective,** Dr. Frank Cooper Craighead threads Little Sable Creek, towing a canoe for even narrower passages. Dr. Craighead, as a Park Research Collaborator, studies the effects of water-level changes on plant and animal communities under a National Geographic Society grant.

"They're coming farther inland to feed now, and you see them here in larger numbers," said District Naturalist Vince Mrazek.

In this one small pond and its backdrop of trees we counted 67 "pinks," as Fred calls them, the adults as radiant as a tropical sunset (pages 530-31). Every now and then one would go into action, fluttering its wings, hopping from spot to spot, and swinging its great horn spoon through the fishy water.

Visitors from the North often confuse the spoonbill with the flamingo, today all but gone from Florida except for captive birds.

Although there is no record of wild flamingos ever nesting in the United States, large flocks of these brilliant West Indian birds used to visit south Florida—so many and so often at the turn of the century that they gave their name to the little settlement on Florida Bay that now is the Mecca of park visitors (page 536). Today one rarely sees a free-flying flamingo in Florida. The last group



**By fast boat to a mangrove maze: Privately**

seems to have been a flight of six photographed by National Geographic President-Editor Melville Grosvenor seven years ago.

On the way to Flamingo we passed almost unknowing from the saw-grass world to the world of the mangrove. But first we walked through Mahogany Hammock (page 539), where the country's largest mahogany has withstood innumerable hurricanes.

#### A "Snake" That Strangles Trees

In this green shade it is easy to imagine a cougar lurking to pounce out at the deer we had seen splashing through the Glades. But even in the safety of the park, very few of these great cats remain, and many of those "seen" by tourists turn out to be bobcats.

To me the most eerie and unrelenting predator in this tropic gloom is not an animal but a plant—the strangler fig. It begins life as an air plant in the top of a tree, where the seeds are often dropped by birds. It sends



ILLUSTRATIONS BY JILL WILSON © R.S.S.

owned craft follow a National Park Service launch through Buttonwood Canal to Whitewater Bay.

roots dangling down to the ground, and as it grows it becomes a writhing, seeking snake, ever extending and ever tightening its great gray constrictor coils around its victim tree, like the serpents of Greek legend around Laocoön and his sons. Cut it off and it lives again as an air plant until it can put down new roots. This botanical snake has no mercy and finally squeezes its host to death.

There are real snakes, too, including rattlers, though visitors rarely see them.

"Usually a rattler will try to keep out of your way," said Fred as we drove along, "but I once met one that followed me.

"I was making pictures on the Anhinga Trail when Park Naturalist Malcolm Ross came along with a party of visitors. It was up at the end where the boardwalk loop trail meets the old road, and just at the edge of the road he had seen a big diamondback rattler.

"'Hey, Fred,' he said, behind his hand, 'keep your eye on this snake till I finish with

these people and can catch him.' 'Sure,' I said. Then I strolled back toward my equipment, thinking I might get a picture of the snake—and the snake came right along with me.

"'That's funny,' I thought. 'Is that snake following me? Or does he just happen to be going the same way I'm going?' I walked across to the other side of the road—and the rattler crossed the road too. I crossed back—and he did the same.

"Just then an elderly couple came along and the man said, 'Do you know there's a snake following you?' 'Yes,' I said. 'I suppose it's a pet snake,' he said. 'No,' I had to tell him, 'I never saw him in my life before—and I recommend you get outa here!' They did.

"By that time the snake and I had come about 75 yards, and he was right behind me. So I got up on the wooden fence at the nearer end of the boardwalk loop and tucked my feet up. I didn't feel any too secure, because the snake came and coiled up right under me,

looking up, and a two-and-a-half-foot fence didn't seem any too high because it was a six-foot snake.

"Pretty soon Malcolm and his party came around the loop and he looked where the snake had been. Then he saw me 75 yards away on the fence, and when he got close enough he called, again behind his hand: 'Where's the snake?' 'Right here,' I said with a gesture, not caring to speak loud. Then he saw it, right at my feet.

"'How did it get there?' he asked, surprised.

"'It followed me,' I said. 'How else do you suppose it would get there?'

"'Well,' he said, 'you stay right on that fence.'

"'What you think I'm going to do, get down?' I asked.

"He went and got a snake stick and caught it, and he and Sam Mendlen put it in a bag. It didn't put up any fuss. In fact, it hadn't tried to hurt anybody, just followed me.

"If Malcolm and Sam hadn't been there, I wouldn't expect you to believe it, but that's what happened, and I can't explain it."

On the Mangrove Trail at West Lake we saw vivid signs of hurricane fury. Flamingo itself, in September, 1960, felt the full force of



First close-ups of the limpkin eating his favorite food took Mr. Truslow four weeks of patient observation and conditioning the bird to his presence. Stalking shallows (above), the limpkin finds an apple snail. Taking it ashore, he uses one mandible to hold the shell while the lower one deftly cuts out the meat (center). Jerking his head upward, *Aramus guarana* drops the meat in mid-air, then strikes swiftly downward (lower) to catch it high in his beak.

PHOTOGRAPHS BY FREDERICK BENT TRUSLOW © K. S. S.



In the green gloom of a mangrove thicket, white ibises (*Eudocimus albus*) groom themselves while a friendly snowy egret seems to keep watch. Ibis beaks and legs, suffused with color in the courtship season, will fade during nesting time.



Donna, which deroofed and gutted the newly completed Visitor Center. Hurricane-driven tides reached its second story and left malodorous mud and seaweed on the dining-room floor to prove it.

Year by year, such storm tides build new land by piling up mud inshore. But the busiest land builder is the mangrove, which begins its terrestrial life on these mudbanks. As your car descends a few crucial inches on the long road to Flamingo, fresh water gives way to brackish and the first small outposts of the "walking forest" appear. Each mile they gain in numbers and size, red mangroves atop

their long curving stilts, called prop roots.

"By means of such roots," said a trailside marker, "this tree 'walks' farther and farther out into the water. . . ."

This tree not only walks; it swims. Its fruit stays on the tree till it grows an eight-inch seedling. When it falls it floats, often for many miles and weeks, till eventually it lodges on a mudbank and a new mangrove begins. Debris and mud pile up in the roots and new land comes into being.

If you jump up and down on some of these mangrove islands—Banana Patch, for example—the land all around you shakes.







Climbing to nowhere, lubber grasshoppers cling to a stalk near the Anhinga Trail. Greenish-black when young, *Romalea microptera* wears tawny armor in maturity. Morning dew jewels a spider's web (right).



KODACHROME BY JAMES

"Two-thirds of the park's land area has been built up from the sea bottom in the past 4,000 years," we were told by Dr. Frank Cooper Craighead, retired Department of Agriculture scientist and authority on Everglades plants.

A National Park Service Research Collaborator, he still ranges this forbidding terrain at the age of 76 in pursuit of his botanical researches, now supported in part by the National Geographic Society (page 542). This indomitable scientist is the father of Drs.

Frank and John Craighead, whose articles and photographs on nature subjects from eagles to grizzlies have informed and entranced Society members for three decades.

"Florida Bay," he observed, "which makes up nearly one-third of the park's area, is a curious arena where new land is constantly being built. Banks of mud precipitated by marine plants and shells reach the surface and are colonized by red mangrove seedlings. Here such colonization has resulted in the



KERR (ABOVE), DETACHROME (LEFT) AND FOODCHROME BY OTIS WOODRIF © W.A.S.



Banded beauty of the hammocks, a zebra butterfly sips from the blossoms of a Spanish needle. At the fall of evening, fifty or more *Heliconius charitonius* may congregate on a single branch to sleep.

Florida Bay keys, now built up one to three feet above mean tide.”

If you were 12 feet tall—and didn’t sink in the muddy bottom—you could walk anywhere in this broad bay. Depths in the park’s portion at mean low tide range from a few inches to rarely more than 4 or 5 feet, and a maximum of 11.

People who go boating on Florida Bay without careful briefing on depths and channels often spend hot, sunburned hours waiting

for rangers to tow them off a mudbank, or wading and pushing waist-deep in water and knee-deep in sticky marl. Park rules require boating parties to file a trip plan in advance.

On a map at the Flamingo Visitor Center, one extremely shallow area bears an unofficial name, The Wet Lawn. Perhaps the same joker named First National Bank—the first mudbank a boat would encounter in approaching Cape Sable from south or west.

This white sandy cape abounds in exquisite



shells, and tour boats bring loads of visitors from Flamingo to collect and picnic on the sands. Here on Cape Sable you stand at the southernmost mainland point in the United States—53 miles farther south than Brownsville, Texas.

On sandy Cape Sable, on spring and summer nights, huge loggerhead turtles swim in from the sea and drag themselves over the sand to lay eggs beyond reach of the waves. But the eggs are not beyond the reach of the humanlike hands of hungry raccoons, and most of them disappear inside these black-masked brigands. The rapacious coons almost put an end to the hatching of loggerheads on these sands. Perhaps this was the way the mammals brought doom to the dinosaurs millions of years ago.

Recently the rangers have been trapping coons here and exiling them to distant parts

of the park. Result: Egg destruction, formerly 80 percent, has dropped to 20 percent.

Rounding Cape Sable in a ranger patrol boat one day, we wound among the mangrove islands of Whitewater Bay, so called because its surface is often streaked with foam.

At Oyster Bay we stopped to watch an eagle on her nest in a tall blighted tree. Suddenly the boat shook, then again. Something was striking our hull.

"Porpoises," said the ranger at the helm. "They want us to come out and play."

Obligingly he started the engine, and immediately two porpoises appeared at our bow. For 30 minutes they sported along at 10 miles an hour as we sped down a channel called Joe River, their great gray glistening backs often clear of the water and almost within arm's reach. Once they vanished; then, as if pleased with their joke, came rocketing



Twilight calls Miccosukee Indian children to the Tamiami Canal to fish for bream or bass. The bridge leads to the tribal council *chickeechobee*, a great or big house, open-sided and palm-thatched like the shelter at left. The only Indians left in the park, Miccosukees run a restaurant, store, and service station, and offer airboat rides into the northern Glades. At a new school and community center (below), Lena Billie baby-sits with her granddaughter, Alberta Jean Billie.

EXTREMUM (LEFT) AND EODACHRUM BY THE IREDDON © N.S.S.



back from opposite sides of the channel, to vie with us for another 10 minutes before disappearing with a final flip of the tail. We knew they were the same two because both had recognizable scars on their backs, one a long, deep old wound that was possibly inflicted by a shark.

Sightseeing boats from Flamingo make similar trips, and these are wonderful fishing waters. The brackish shallows make ideal nurseries for shrimp, marine worms, and small fish that feed larger fish, such as sea trout, snook, and tarpon.

#### Nation's Only Crocodile Nearly Extinct

By boat from Flamingo one can readily cross Florida Bay to Key Largo, where a resident ranger watches over the breeding roseate spoonbills and the few remaining crocodiles. In the United States these big salt-

water saurians now survive only in extreme southern Florida waters.

"The other day, in the hope of making some pictures, we went to a place just outside the park where I've sometimes seen crocodiles," said Fred. "There were none to be found, and a man living nearby told us he saw some fellows with a rifle shoot three.

"A crocodile isn't pretty," he mused, "and he's like the alligator but more so—he'll eat anything that moves, not caring whether it's your pet dog, or you, for that matter. But these are the last crocs in the United States. It took Mother Nature a long time to make them, and once gone they are gone forever. If they'd stay in the park they might have a chance, but they don't—and their future doesn't look good."

From Flamingo in the southwest to Everglades City in the northwest means a drive of

140 miles, counterclockwise around the park. By water it is about 70 miles, and perhaps some day sightseeing boats will make regular trips between the two. I hope so, because it would be a memorable ride, threading the labyrinthine channels of the Ten Thousand Islands region.

Everglades City (population 552) calls itself the park's western water gateway. From here and Chokoloskee, charter and concession boat captains take visitors to the nearer rookeries, ancient Indian sites, and mangrove islands. On such a ride a couple of years ago Otis Imboden jotted these graphic notes:

"Our guide and helmsman has a good Florida Cracker accent—'arristers' for oysters, 'hewrikin' for hurricane, 'hearin' for heron—and a rhythmic patter as colorful as it is original.

"Shows us the breather tubes from the roots of the black mangrove. 'This here mangrove makes tannic acid, and some folk says the tree makes the water so acid the roots has to turn up fer air.'

"Points out oyster bars like sand bars. 'These is eatable arristers.'

"Signs mark boundary of park as it crosses Chokoloskee Bay. 'The park is kind of spotted here, and there's parts that's in and parts that's out.'

"Pileated woodpecker on telephone pole. 'He hears those wires hummin' an' thinks it's a worm inside that pole.'

"'The mullet is the onliest fish that's got a gizzard just like a chicken.'"

#### Chokoloskee Keeps Its Early Ways

Ornithologists don't know what a woodpecker on a telephone pole thinks about, and ichthyologists say they never saw a mullet with a gizzard, though this mud-scooping bottom feeder does have an unusually long digestive tract—seven feet of intestine in a 13-inch fish.

But the gizzard belief is firmly rooted hereabouts. Dick Stokes later told of a slick country lawyer who tried to have a case of illegal stop-netting thrown out of court on the ground that the mullet, since it has a gizzard, must be a fowl instead of a fish.

Today the tour-boat spiel is less colorful, and a new marina, visitor center, and ranger office have been built on the waterfront.

All this newness contrasts sharply with Chokoloskee, now linked with Everglades City by a causeway but still a world apart.

Unchanged since Seminole trading-post days, a barn-red building stands on stilts in a

palm-fringed clearing at the water's edge. This is Smallwood's Store and the U. S. Post Office, surely one of the quaintest under the flag. On the shelves or hanging overhead are all the wares of an old-time general store—dark bottles of patent medicine, machetes, halters, oil lamps with ornate reflector plates.

Miss Thelma Smallwood presides over all this, as postmistress and heir to her father's emporium. She sees no reason to change things. The barnlike building on its pine piles has withstood many a hurricane, and Miss Smallwood herself seemed to me to embody the same immovability.

#### Park's Indians Adopt a Constitution

Driving back toward Miami on the Tamiami Trail, we stopped at the Indian village on the edge of the park.

"Don't call us Seminole," we were told. "Call us Miccosukee."

They claim to be a separate tribe whose ancestors lived and hunted in northern Florida where the town of Miccosukee now stands and were driven south in the early 19th century.

When the park was established in 1947, all the Indians within its boundaries were offered land farther north, near Dania, Big Cypress, and Brighton. Many, however, preferred to stay, and the U. S. Bureau of Indian Affairs arranged with the National Park Service to have a slice of the park 5½ miles long and 500 feet deep along the Tamiami Trail set aside for their residence and use.

With the encouragement and help of state and federal agencies, this group formally organized the Miccosukee Tribe of Indians of Florida on January 11, 1962, and adopted a constitution forbidding anyone to try to change its tribal beliefs and religion.

The tribe runs a filling station, grocery store, and the finest restaurant for many miles. Private enterprise offers Indian-versus-alligator wrestling matches and colorful products of the Florida Indian's inevitable Singer sewing machine.

Near the restaurant, brown-faced Indian boys were playing a wild version of touch football. Younger children had bright plastic toys, one an imitation automobile dashboard and steering wheel.

These are hardly vanishing Americans, we decided, especially after meeting Council Chairman Buffalo Tiger, with seven children, and his brother, Tommy Tiger, with twelve.

Buffalo Tiger, a slender, youthful-seeming man in his forties, wore a blue shirt with bright panels of Indian patchwork and a



BOBACAT BY JOHN LIVINGSTONE, PHOTO RESEARCHERS, INC. © N.A.S.

**On the lookout for lunch,** a bobcat peers from his perch atop a dead tree festooned with a butterfly orchid plant. He feeds chiefly on rats, rabbits, and birds. A larger cat, the wide-ranging cougar, also prowls the Everglades, but in lesser numbers.

beaded tie clasp. He showed particular pride in the restaurant and took personal responsibility for hunting down a fly that had entered with us.

The Miccosukee also seemed proud of their school, with 40 pupils, ages 6 to 18, and were beginning to get used to the new "modern chickees" designed by the Bureau of Indian Affairs. With electric lights, hot water, electric ranges, and flush toilets, they made quite a contrast to the palm-roofed chickees that survive nearby—little more than a roof of palm thatch on four poles. But one concession to yesterday has been made in designing the modern chickee: Over the regular roof is laid an old-style roof of palm fronds.

At the nearby Shark Valley Observation Tower, we found Ranger Winte concerned about over-bold alligators.

"In spite of everything we can do, some visitors feed them," he said. "Old Snaggletooth there is getting the bad habit of crawling halfway up the bank to beg for handouts. Big gators should always be treated with respect, but they get particularly dangerous if people feed them."

"Once I was photographing a nine-footer in the pond here," said Fred, "trying for a shot of just the nose and eye out of water.

"The gator went past, then turned around toward shore. I thought that was strange.

"Then he started up the bank and headed

for me. Must have thought I had some food for him.

"I lit out for a quonset hut that was here then. Luckily the door was open. I went through and slammed it, and the next instant big George hit it with a bang.

"When I looked out, I saw that my normally gentle little wife had appeared on the scene and grabbed up a two-by-four to come to my rescue. But by that time George had decided there was nothing in it for him and gone back to the water. I don't know why that alligator didn't get me, because a big gator can move awfully fast for a short distance."

When an alligator grows too bold, the rangers rope him and haul him away to a less-frequented part of the park—like a nuisance bear in Yellowstone.

All along the roadside, as we drove on eastward, lay grim reminders of careless slaughter. Motorists dash along this stretch of the Tamiami Trail—named for Tampa and Miami, its terminal cities—at an often illegal and deadly pace, deadly sometimes to themselves and more often to the innocent. Often the road's shoulders are littered with bodies of raccoons and possums, turtles, water snakes, even hawks and other birds.

Water-logged pasture poses no problem for the Everglades' almost amphibious deer. This smaller variety of the white-tailed, or Virginia, deer abounds in the park and other glades areas to the north, but casual visitors seldom see them. Everglades deer



Beside me Fred was silent, but I knew he was thinking of other roads where the same careless killing takes place every night—and of the multiple deaths that result when parents can never return to their young.

Then we saw a new highway sign that made us take heart. "Slow. Use Caution. Save Our Animals."

When we stopped at the big steel gates in the levee that dams the river of grass, we saw that the level of water on both sides was the same. Precious water was still being released into the park from the conservation area to the north.

But the price of wildlife, we knew—like the price of liberty—is eternal vigilance. Headed homeward beside the Tamiami Canal and the long row of casuarina trees, we both were wondering the same thing: Will man always make provision for nature's wild creatures in the world of tomorrow? Or will multiplying man and his machines crowd more and more animals off the earth forever?

Remembering the delight I had seen on the faces of visitors to Everglades National Park, I thought I knew the answer, at least so far as America is concerned. Anyway, I fervently hoped so.

THE END

feed in the early morning and late evening, keeping to isolated hammocks in the heat of the day.

Park's only vantage point, Shark Valley Observation Tower serves rangers watching for fires and sightseers viewing the "river of grass." With summer rains the park revels at last in life-giving water.

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EXTACORING (LEFT) BY PATRICIA CARLFIELD; SCORING BY JEFF WESSER © 1982





INDIAN OCEAN  
UNVEILED ON A  
DRAMATIC NEW MAP

# Science Explores the Monsoon Sea

By SAMUEL W. MATTHEWS

Photographs by  
*ROBERT F. SISSON*

Both National Geographic Staff

**H**IS NAME WAS ABDULLAH. He was 10 or 11, a hard-worked ship's boy knobby of knee and elbow, dressed in ragged shirt and pants. All day he bailed the bilge, hauled on rough hemp lines, made the captain's tea—and watched the strangers who sailed in the creaking old dhow *Sagar Pasha*, or Ocean King, over the Gulf of Kutch on India's northwest coast.

Then the foreigners began diving. In face masks and flippers, they rolled off the rail into breeze-flecked shoal waters. They came back aboard with seaweed, shells, and globs of mud, all of which they put into small jars.

Abdullah watched in wonder. Mud? Why would these crazy Americans come all the way to Kutch to stuff mud into bottles?

Could Abdullah have spoken English, or the marine biologists Gujarati, the language of his native state of Gujarat, they might have told him of the International Indian Ocean Expedition, of the many men and ships then at work on the sea that rolls from Kutch far over the southern horizon.

Indeed, in a program that would last for more than six years, scientists of some thirty nations of the world were taking the measure

of an ocean—its rocky floor, the waters that fill it, the life within it, the winds that sweep it. On gentle swells and in wild gales, 40 research ships would sail a million miles across the sea of the Indies. Drifting on lonely ocean reaches, they would track currents, probe with echo sounders across unseen mountain ranges and canyons, bring up strange forms of life in their nets, and measure forces that shape the weather and the earth itself.

One result is the striking portrait of an ocean without water—**Indian Ocean Floor**—that accompanies this NATIONAL GEOGRAPHIC. The special supplement was one of the last projects conceived by Assistant Editor Newman Bumstead, Chief of the Society's Geographic Art Division, who died suddenly on May 8, 1967. Painted by Heinrich Berann, an Austrian artist famed for mountain panoramas, it reveals many of the findings of the six-year ocean survey.

The painting follows an extraordinarily detailed diagram of the Indian Ocean bottom prepared by geophysicists Bruce C. Heezen and Marie Tharp of Columbia University's Lamont Geological Observatory, in Palisades, New York (page 557). By plotting depth soundings of hundreds of scientific voyages—a tangled cat's cradle of ships' tracks—and converting them to three-dimensional perspective, the Lamont team produced one of the most accurate and informative maps of an ocean floor yet created.

Mr. Berann, working closely with Dr. Heezen and Mr. Bumstead, added north-south curvature of the earth for even greater perspective. From his painting, in high relief, jump features of earth's wrinkled face that were unknown a few years ago: submarine mountain ranges, mid-ocean "microcontinents," undersea river valleys and plains, and jagged ridges and clefts in the sea bottom that support startling new concepts about earth's geologic past. The over-all view is much as if an astronaut, orbiting far out in space, were to look down upon a world drained of all its water.

## "Forlorn Ocean" Invites Research

Although only the third largest of earth's four oceans—Pacific, Atlantic, Indian, and Arctic—the Indian Ocean covers 28,350,000 square miles, one-seventh of the planet. It rolls 6,600 miles from the tip of Africa to Tasmania and, with the Arabian Sea and Bay of Bengal, about the same distance from the coasts of divided Pakistan to Antarctica.

Mariners of ancient Egypt and Phoenicia,



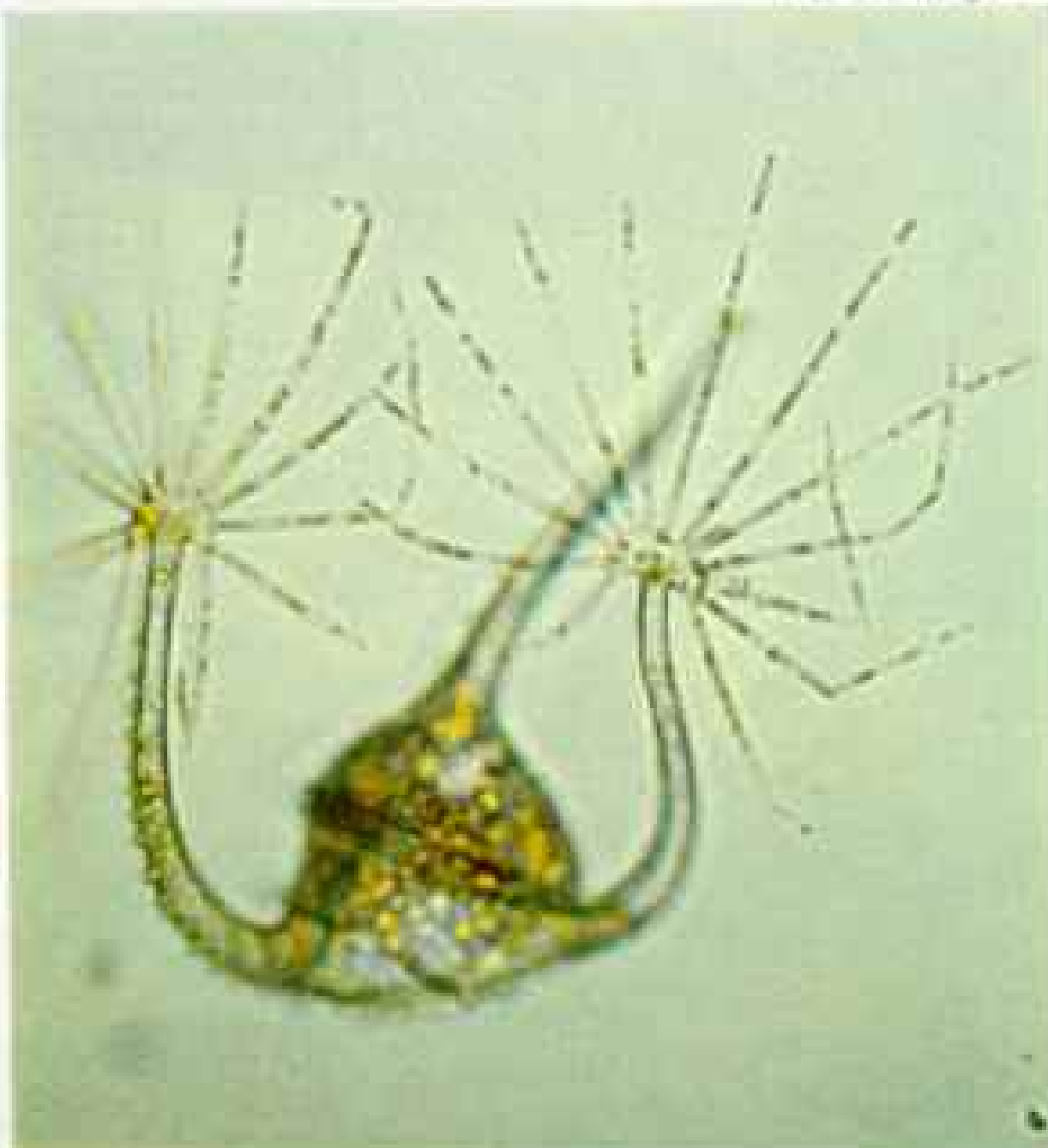
Giant dip net swings over the side of the U. S. research vessel *Anton Brown* during the International Indian Ocean Expedition of 1959-65. The net collects samples of plankton, minute forms of life that provide the basic foodstuff of the sea. Captured in one such haul, a dinoflagellate of the genus *Ceratium* (lower left), magnified here 450 times, has characteristics of both plant and animal.



Skin-diving Sikh off India's coast, biologist Hardevsingh Toor brings up a nautilus shell bearded with seaweed.

In the most extensive sea exploration ever launched, scientists of some thirty nations—including the United States, U.S.S.R., and United Kingdom—scrutinized waters that cover a seventh of the globe. The expedition probed below, above, and on the surface of this vast expanse.

Discoveries made during the study promise better long-range weather forecasting and more productive fisheries. The map-painting that supplements this issue portrays much of what was learned of the Indian Ocean's mountain-ribbed floor.





far-trading Arab and Malay seamen, Portuguese carracks, British Indiamen, and China clippers long ago sailed the monsoon sea. Merchantmen and tankers, warships and liners today plow its shipping tracks.

To scientists who study the seas, however, until mid-20th century the Indian Ocean was a true *mare incognitum*. They called it the "forlorn ocean," so few had been the research voyages ever made there. When, in 1958, a cooperative full-scale assault on a single ocean was proposed by the august International Council of Scientific Unions, the Indian Ocean became the immediate choice.

Here were laboratory-like conditions—an ocean whose predominant winds reverse with the calendar. In winter months from the north and northeast, in summer from the south and southwest, blow the great winds of the northern coasts—the monsoons, from an Arab word meaning "seasons" (page 559).

Nowhere else, on an oceanic scale, does such a reversing system exist; nowhere else could thus be studied the effects of wind and weather on currents, temperatures, mixing of waters, and the myriad forms of sea life.

Research vessels began going out, from Britain, the Soviet Union, the United States; more than two dozen other nations sent ships or scientists. Data centers were set up in Washington and Moscow, a weather center and a biological station in India. Officially begun late in 1959, the International Indian Ocean Expedition continued through 1965. Its discoveries will be reported for years to come.

The sea-floor map-painting vividly depicts some of the IIOE's more striking finds:

- A hitherto unknown mountain range, 3,000 miles long and up to 13,000 feet high, rises like a knife edge from the eastern ocean basin. First charted by American vessels and later by the Soviet oceanographic ship *Vityaz*,

Antiquated fleet of sail-driven outriggers at Negombo, Ceylon, plies an ocean teeming with marine life, as the IIOE discovered. Yet island fishermen fail to meet the needs of their people, and Ceylon has to import fish.

Plotting unseen panoramas, Miss Marie Tharp and Dr. Bruce C. Heezen of Columbia University's Lamont Geological Observatory draw the physiography of an ocean bottom with depth soundings taken on hundreds of voyages. Their diagram of the Indian Ocean floor, the most detailed yet produced, guided Austrian artist Heinrich Berann in creating the supplement painting.

## How to explore an ocean bottom

**S**UPPOSE all the water could be drained from an ocean! What would the bottom look like? The remarkable map-painting that accompanies this issue, **Indian Ocean Floor**, combines scientific discoveries and an artist's skills to answer that intriguing question. To present visually the incredible detail newly available from the Indian Ocean Expedition, Heinrich Berann shows the round earth as flat from east to west, but rolling gently away northward, so that most of the vast Asian landmass is visible.

Color, as well, gives depth to the map: light green for shallow seas and continental shelves; medium blue for sediment-covered plateaus and hills of the mid-depths; dark violet-gray for the abyssal plains; darker still for the great trenches. Towering undersea mountains and plunging slopes of this waterless ocean are highlighted as if at sunrise.

Elevations and depths include heights above the ocean's "ground floor," the 16,000-foot average depth of the abyssal plains. Thus, for example, La Réunion island, which rises 10,069 feet above the sea, stands revealed as the tip of a 26,069-foot mountain, rivaling earth's loftiest peaks in height.



HOUGHNESS BY JOE COVELLO, BLACK STAR, AND ROBERT F. FISHER, OPPOSITE © R. & G.



Banyan trees, bowed by the summer monsoon, bend eternally inland on India's coast.

the Ninety East Ridge is the straightest range of such length ever found under the oceans. It runs almost due north and south along the 90° east meridian of longitude, from the Bay of Bengal across the Equator to the latitude of southern Australia.

- Off the mouths of the two great river systems of southern Asia, the Indus and the Ganges, ocean-bottom sediments slope hundreds of miles seaward. Deep valleys and canyons furrow these "cones," showing the force and extent of undersea avalanches of mud and silt-heavy water that periodically spill from the edges of the continental shelves.

So powerful are such turbidity currents—they are known to reach 40 to 50 miles an hour—that they sometimes snap submarine

cables lying in their paths. As they hurtle down and out across the floors of the oceans, they carry their loads of sediment onto the deep, smooth abyssal plains—the flattest areas known on earth's crust.

#### 240-foot Waves – Under Water

- Another discovery, still unexplained, may somehow relate to these unseen mud avalanches. In 1964 the U. S. Coast and Geodetic Survey ship *Pioneer* sailed into an area of oddly disturbed water off the northern tip of Sumatra. The ocean surface boiled in broad, parallel bands, alternating with slick areas of calm water. *Pioneer's* instruments showed that, beneath the surface, layers of colder and warmer water were undulating in 240-foot



KODACHROME BY ROBERT F. SIMON, DIAGRAMS BY GEOGRAPHIC ART DIVISION © R. S. S.

### Mountains temper the force of winter winds.

waves—more than twice the size of the largest surface wave on record. Some crested near the surface, others dived as deep as 900 feet. They passed at five knots or more, running seemingly from horizon to horizon—yet what caused them remains unknown.

During the Indian Ocean Expedition, I traveled more than 40,000 miles to record parts of its work. The South African Surveying Ship *Natal* took me within yards of the jagged headland of the Cape of Good Hope. Here, nearly 500 years before, Bartholomeu Dias and Vasco da Gama had first sailed out of the Atlantic and found rolling away before them the long-sought sea road to the East.\*

\*See "Prince Henry, the Explorer Who Stayed Home," by Alan Villiers, *GEOGRAPHIC*, November, 1960.



Winds and currents reverse with the seasons in the Indian Ocean—a phenomenon known nowhere else on earth in such magnitude and extent.

In heat of summer (upper diagram), low pressure hangs over Asia. Spilling into the depression, the southwest monsoon from May to September brings moisture from the sea, and torrential rains fall on India. This summer monsoon drives currents clockwise in the northwestern Indian Ocean.

Chill of winter (lower diagram) builds high pressure over the land and speeds cool, dry air out to sea. Between November and March the northeast, or winter, monsoon halts the seven-knot pace of the Somali Current and sets it flowing the other way.



BOOKCOVERS BY ROBERT F. TISDEN © N.A.S.

Seagoing scientists study plankton in a cabin once used by President Harry S. Truman. During the Indian Ocean survey, Woods Hole Oceanographic Institution operated the *Anton Bruun*, the former Presidential yacht *Williamsburg*.



Seven hundred nautical miles out from South Africa and 450 south of Madagascar, S.A.S. *Natal* chanced one night on a shoal where no shoal should be. Her depth recorder showed the bottom rising suddenly to a jagged reef scarcely 60 feet down.

*Natal* had found the uncharted peak of a huge, steep-sided seamount, towering some 16,000 feet above true oceanic depths. Walters' Shoals, which appear on the painting and on new Indian Ocean charts, bear the name of *Natal's* captain, Comdr. Johan C. Walters, now Hydrographer of South Africa.

On the eastern shores of the Indian Ocean, photographer Bob Sisson and I walked the still-steaming beaches of Bali only days after its sacred volcano, Mount Agung, had erupted.\* We landed on the lonely coral atoll of Cocos (pages 568-9), where Charles Darwin came in the *Beagle* in 1836, and on lava-ribbed Mauritius, once the home of the luckless dodo, today one of the world's most crowded islands.

Three-quarters of a million people—Indian,

\*See "Disaster in Paradise," by Windsor P. Booth and Samuel W. Matthews, NATIONAL GEOGRAPHIC, September, 1963.



Leaning outboard, staff scientist Sidney L. McGuire hauls in a Nansen bottle that samples water at a predetermined depth. Skilled hands (above) add chemicals for oxygen analysis.

Chinese, African, French, and English—jam this sugar-cane island, one-third the size of Delaware. Under the Union Jack since Britain won it from Napoleon in 1810, Mauritius stands now on the threshold of independence.

"To feed so many people—and always they increase—we must look more to the ocean," said voluble and friendly Jean de Boucherville Baissac, Fisheries Officer of Mauritius.

"For the Indian Ocean Expedition, we measure tides and make weather reports for this region—*mon Dieu*, the cyclones that come here sometimes! But the hunt for possible new fisheries is most important to us."

#### Réunion Lifts Peaks of Snow and Smoke

Southwest of Mauritius by 110 miles lies La Réunion, an overseas department of the French Republic. Its Piton des Neiges—Peak of Snows—rises to 10,069 feet, highest point in the wide expanse of the Indian Ocean.

Air France put Bob and me down at Réunion's airfield, a hotel named La Bourdonnais put us up, and a French colonel of *gendarmerie* flew us by Alouette helicopter over the island. Swooping along stark volcanic cliffs and gorges, we learned—to our nerve

ends—that Réunion is an even younger island geologically than Mauritius. Its peaks rake the sky with sharper tines; one, La Fournaise—The Furnace—still occasionally erupts. We flew almost into its smoking crater.

"We are close enough, no, for you to see our up-and-down island?" rasped the colonel's voice in our earphones. We nodded vigorously, and in unison.

Mauritius and Réunion both are volcanic outcroppings, the tips of great towers of basalt thrown out over the ages through cracks or fissures in the ocean floor.

Another upheaval from earth's interior, incredibly larger, splits the entire Indian Ocean basin; it constitutes the single most significant feature charted by the IOE.

This is part of the world-wide Mid-Oceanic Ridge, an enormous range of undersea mountains and valleys running down the middle of this ocean basin, as it does in the Atlantic and parts of the Pacific. Up to 1,500 miles wide, towering 10,000 feet and more, yet with its peaks still covered by 3,000 to 6,000 feet of water, the Mid-Oceanic Ridge is now regarded as the longest continuous feature of the earth's solid face.



BOBACHOWICZ © NATIONAL GEOGRAPHIC SOCIETY

In lifeboat drill on the high seas, crewmen pull for the *Braun*. The name of the 243-foot-long ship honors a Danish marine biologist who helped organize the world's oceanographers in a study of an entire ocean. During the expedition, 40 scientific vessels cruised a million miles, and research was carried out in shore stations from South Africa to Thailand and Australia.





Clam-diggers harvest a free meal opposite Bombay's apartment-walled Marine



PHOTOGRAPH BY ROBERT F. SIMON © W.A.S.

Drive. This chief city of India's west coast served the expedition as "weather central."



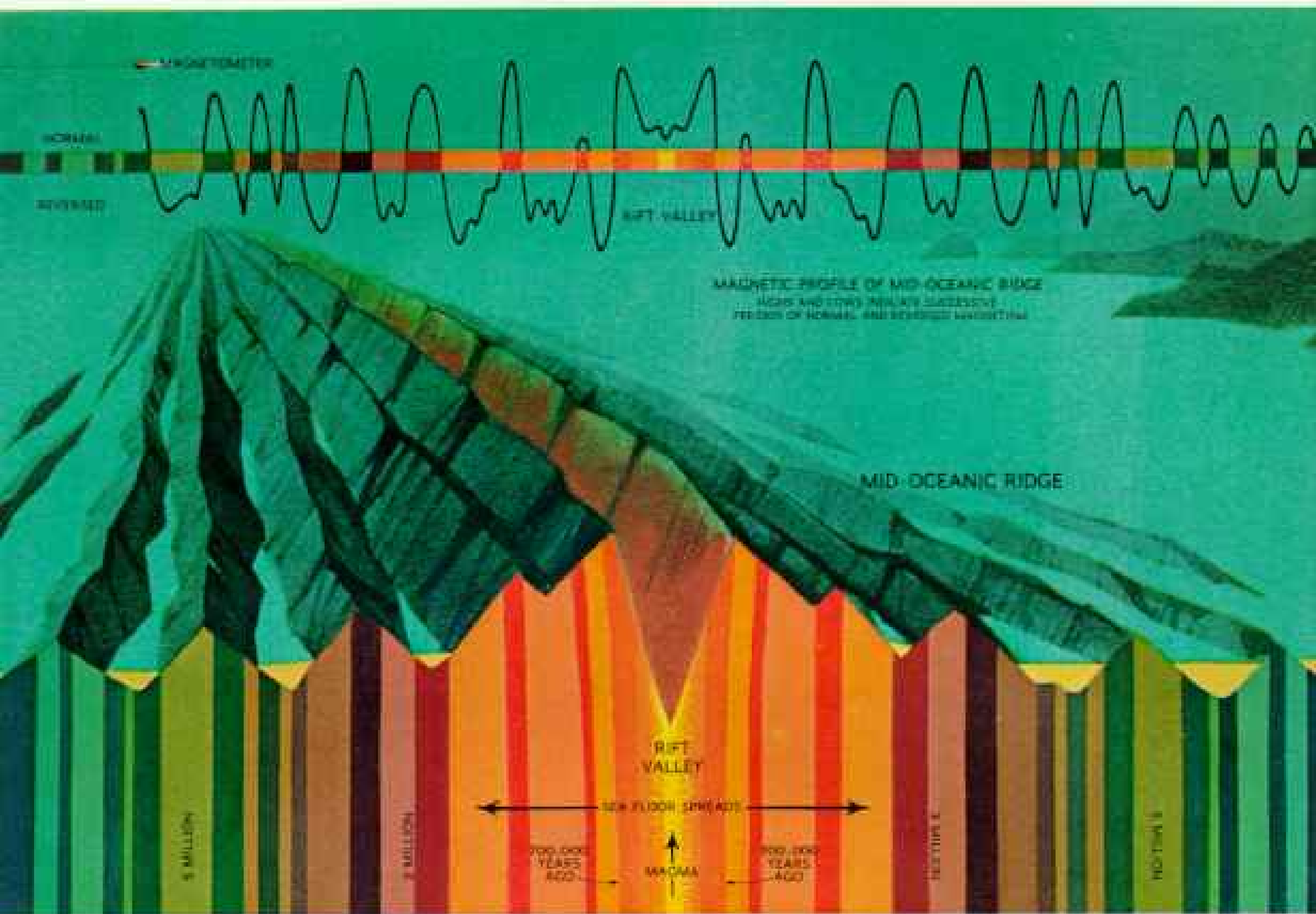
Mapping a major find, Comdr. J. C. Walters, skipper of the South African ship *Natal*, plots Walters' Shoals, 450 nautical miles south of Madagascar. Possibly atop a dead volcano, they lie only 60 feet deep in open ocean.

Live volcano, Bali's sacred Mount Agung towers 10,308 feet. Its eruption in 1963 killed more than 1,500 people.

REPRODUCED BY RICHARD F. SIEGEL  
AND SAMUEL W. MATTHEWS (ABOVE) © U.S.S.



Open wound in earth's skin, a tremor-racked rift slashes the Indian Ocean basin, as shown on a National Geographic globe slit by a knife. The survey mapped for the first time this section of a world-girdling fracture that rambles 40,000 miles, cleaving a submarine mountain range of its own making (top). A branch of the fracture, the Great Rift Valley, slices eastern Africa, forms the Red Sea, and reaches across the Holy Land,



PAINTING BY WILLIAM H. BOND, GEOGRAPHIC ART DIVISION, © U.S.G.

Magnetic milestones reveal an ocean floor on the move. In studies on land, geophysicists have learned that earth's magnetic poles have changed places at least seven times in the past three million years. The last such reversal occurred about 700,000 years ago. Each left a record: Magnetism of particles in molten lava aligns with earth's magnetic field, and as the lava hardens, this alignment locks in place like a permanently frozen compass needle.

Armed with these facts, expedition scientists towed sensitive magnetometers across the Mid-Oceanic Ridge, built during the eons as magma welled into a central rift valley, cooled, and split apart as more intruded. Finding bands of reversed magnetism, they proved that the age of sea-floor rock increases the farther the rock lies from the rift. Distances of the reversals, identical on both sides of the rift, show that the ocean basins are widening as much as two to three inches a year. As the sea floor spreads, geophysicists believe, the continents slowly move as well.

In the Indian Ocean the ridge forms an upside-down Y (opposite and supplement painting). One arm curves out of the Atlantic around the foot of Africa; the other comes in from the Pacific, south around Australia. They meet east of Mauritius, near its outlying island dependency of Rodrigues, and together go north and then northwest across the Arabian Sea as the Carlsberg Ridge.

When the expedition began, the existence of the ridge in the Indian Ocean was known, but not its extent. Depth soundings during a multitude of crossings soon began to fill in blank spots and chart its shape.

In the early 1950's a dramatic discovery had been made, chiefly by Miss Sharp and Dr.

Heezen of Lamont, while mapping the Mid-Atlantic Ridge. They found that along its crestline runs a deep cleft, or rift valley. Now this rift showed up in the Indian Ocean, too; the Lamont research vessel *Vema* very early found the rift on crossings south and east of Madagascar. Other ships confirmed its existence wherever the great ridge was plumbed.

The oceanic rift follows with remarkable exactness a path that geologists earlier marked out by plotting the epicenters of ocean-bottom earthquakes around the world. Thus it is believed—and most earth scientists now agree—that the mid-oceanic rift forms a continuous world-wide system of crustal fractures, a fault or crack in earth's rocky



skin that meanders on for nearly 40,000 miles.

All along this crack earth-shaking forces are at work. Here on the thin sea bottom, geophysicists say, earth's crust is being pulled apart and new rock added, welling up in molten form from the underlying mantle of the planet.\* And from the crack, constantly breaking and filling anew, the ocean floors are now known to be moving outward as fast as two to three inches a year.

Rocks dredged from the crestral slopes of the Mid-Oceanic Ridge support this conclusion by their relative youth, their lack of fossil evidence of life, and the absence of overlying sediments. Ships passing back and forth over the ridge recorded magnetic differences in the sea floor, revealing progressively older bands of rock the farther outward they lay from the rift, thus measuring the rate at which the sea floor has been spreading for millions of years past (diagram, pages 564-5).

#### Fractures Hint of Drifting Continents

The Red Sea and the adjoining Gulf of Aden, arms of Africa's Great Rift Valley, are both relatively young in geologic terms, and growing steadily wider. Earthquakes constantly wrench their floors. Sensitive probes, lowered to penetrate into the sea floor, show very high rates of heat flow from below.

Indeed, U. S., British, and German ships found deep holes or pockets of hot, super-salty water at the bottom of the Red Sea, up to 133° F., lying beneath much colder waters. Held down by their high salt content and hence greater density, these deep pools of sea water are the hottest ever found, and hold up to 50,000 times the normal concentrations of heavy metals—iron, copper, silver, and gold.

The yawning Java Trench along the Indonesian arc, where the Indian Ocean floor dives to its greatest depths, is taken to be one result of the inexorable outward creep of the ocean bottom. Others are the huge canyons and fractures visible on the map-painting, slashing across the Mid-Oceanic Ridge.

Two British ships, H.M.S. *Owen* and the new Royal Research Ship *Discovery*, studied closely one such fracture that slices the northern end of the Carlsberg Ridge, shifting it 170 miles. The Berann painting shows a

striking alignment of this Owen Fracture Zone with the sharply cut east coast of Madagascar, 2,000 miles south, and with the Malagasy Fracture Zone, 1,000 miles beyond. It appears almost as if the earth once were struck by a giant cleaver, leaving a scar the length of the ocean basin.

Many intriguing scientific guesses relate to this oddly straight line of fractures and others like it elsewhere in the ocean. They add to mounting evidence that leads most earth scientists today to accept the once violently controversial Wegener theory of continental drift. Dr. Heezen, for one, points to such fractures as evidence that the subcontinent of India once lay much farther south, part of a southern "protocontinent" called Gondwanaland. When this primordial land-mass sundered, perhaps 200 million years ago, Antarctica, Africa, and Australia moved gradually apart. India, split from Madagascar, drifted northward until it collided with Asia. Their meeting formed the Himalayas and the high Tibetan plateau.

Northeast of Madagascar the Seychelles sit atop a mesalike block of continental granite, the only mid-ocean granitic island group known on earth. They and other microcontinents in the Indian Ocean—Madagascar itself, the Kerguelen Islands plateau, and Ninety East Ridge—are all, Dr. Heezen believes, remnants of the ancient breakup of Gondwanaland and the northward drift of India.

#### Seafarers Settled the Great Red Island

Madagascar, like the Seychelles, is a geologically ancient island, a 1,000-mile-long upthrow of high red hills and plateaus resting on a foundation of granite. Fourth largest island in the world, after Greenland, New Guinea, and Borneo, it is the home of peoples whose origins and arrival are lost in the past.

Though some are Africans, others are more closely akin to Malays, far to the east and north across the ocean. Their languages have strangely similar words; their facial structure is of the East rather than of Africa. How and why their ancestors came to the great red

\*See "Surtsey: Island Born of Fire," by Sigurdur Thorarinsson, *GEOGRAPHIC*, May, 1965, and "A New Volcano Bursts From the Atlantic," by John Scofield, June, 1958.

**Mineral harvest from the sea:** Indian workers at Mithapur haul salt from evaporation pans beside the Gulf of Kutch. From this oceanic raw material Tata Chemicals Limited extracts gypsum and bromine and magnesium salts, converting them to chemicals used in the manufacture of rayon, glass, paper, soaps, and pesticides.



Tropic isle for his playground, Allan Michon, eight-year-old son of a French scientist, swings on a coconut frond at Nosy Be. Biologists conducted shore studies from an oceanographic research center on this island off the northwest coast of Madagascar (map, page 453).

Nearly swamped by surf, boatmen leave North Keeling Island, one of the remote Cocos group lying south of Sumatra. They came to this uninhabited speck from the main atoll, 15 miles away, to harvest coconuts. Far-ranging expedition scientists visited the Cocos to study mollusks, and found shellfish strangely more akin to Pacific species than to those of the Indian Ocean.

Model atoll: Charles Darwin used the South Keeling group of the Cocos Islands as a basis for his theory of coral-atoll formation. In 1827 a Scottish sea captain, John Clunies-Ross, settled on the necklace of 26 islands enclosing a lagoon seven miles across. Five generations of his family have held it under a grant from Queen Victoria. Some 480 residents—mostly of Javanese descent—work copra plantations. An airstrip on West Island, left, largest of the atoll, serves as an emergency landing field for jet airliners flying between Australia and South Africa.



island, somehow riding the winds and currents, no one really knows.

Such migrations are of a time unremembered. But over thousands of years, as long ago as the early kingdoms of Egypt, other sailors and explorers in graceful, sharp-prowed sailing craft have passed to and fro on the Indian Ocean's monsoons.

Arabs and Indians in far-ranging dhows still sail south and west down the African coast on the winter monsoon. When the winds turn, as always they do, the ships go home again to the Gulfs of Aden and Persia and Kutch.\* Bob Sisson and I went to Zanzibar, where the dhows still come to trade. But it was May, and the monsoon had already swung

"You've just missed them," we were told. "The only ships still here are a few big *kotias* from Kutch—the Indians."

We walked Zanzibar town's shadowy, winding streets to where they lay moored. Several stood propped on mud flats for work on their bottoms. On their high stern quarters, above rough-timbered rudders, carved nameboards read "Kutch-Mandvi." They were 2,800 miles from home.

We followed the Arab dhows north by air to Mombasa, in Kenya, but there, too, they had come and gone. In their place in old Kilindini Harbor, under the gray battlements

\*See "Sailing With Sindbad's Sons," by Alan Villiers, NATIONAL GEOGRAPHIC, November, 1948.



ILLUSTRATIONS BY SAMUEL W. MATTHEWS (COMPOSITE), ROBERT F. DEEBA (ABOVE) AND R. F. HOLMES © R.S.P.



of Portuguese-built Fort Jesus, lay a dark-blue little ship flying the Stars and Stripes. She was the *Argo*, of Scripps Institution of Oceanography, halfway around the world from her home port of San Diego, California.

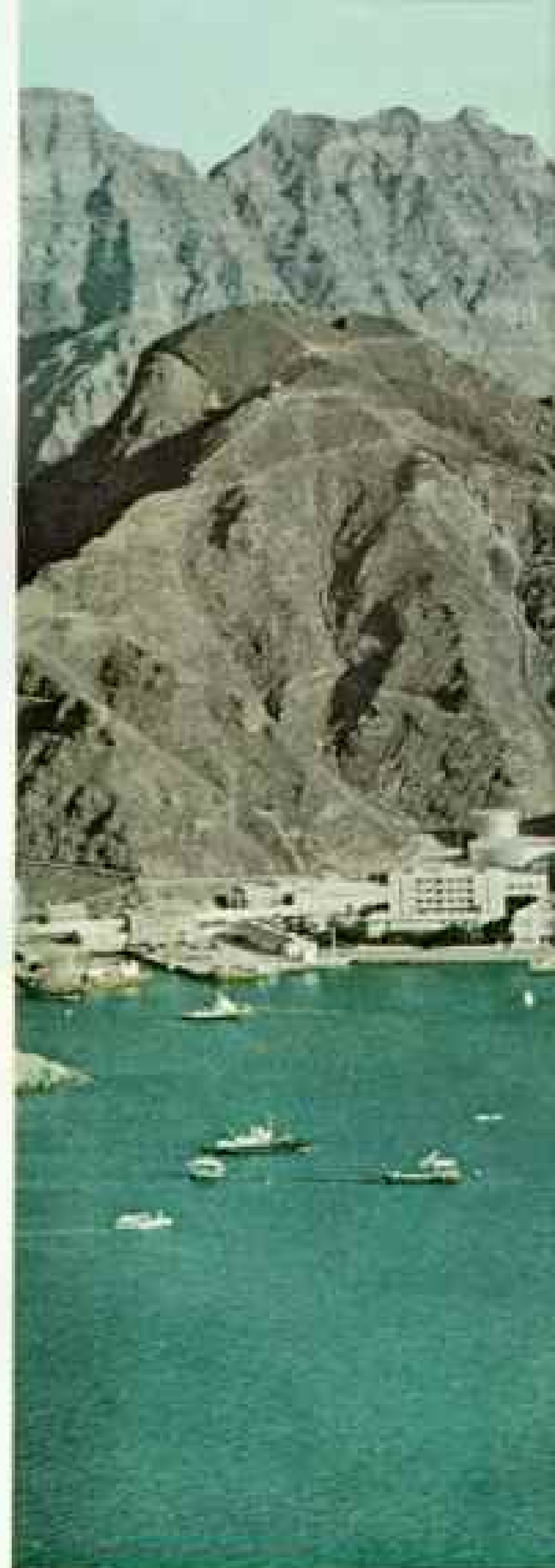
#### Oceanic River Reverses Its Course

*Argo* had been away a full year. She had crossed the Indian Ocean five times, following the Equator back and forth to measure its currents and deep-flowing undercurrents in both monsoon seasons. She had sailed far south to the Kerguelen Islands, where French scientists manned a lonely research station, and cruised east to Darwin on the Timor Sea, surveying the sea bottom wherever she went.

Off the Somali coast, where the dhows by now were riding the monsoon northeastward, *Argo* and the British *Discovery* and other research ships had confirmed the existence of one of the swiftest surface currents yet measured in any ocean. Under the steady, driving southwest wind, the Somali Current in places flows at more than seven knots, a river in the ocean a hundred miles wide and thousands of feet deep. The Atlantic's Gulf Stream, in contrast, rarely exceeds four knots.

The Somali stream is the only such current along a continental edge known to cross the Equator—and the only one that every year reverses its course. When the monsoon winds turn and blow from the northeast, this racing





Only the cargoes change. Present-day Sindbads load soft drinks aboard a small dhow at Aden, a pivot of East-West trade for thousands of years. Their lateen-rigged sailing vessel—a type used by Arab sailors for untold centuries to haul spices, silks, gems, and slaves—will take the cargo of Coca-Cola across the gulf to Somalia.

river in the ocean slows, stops, and finally flows the other way (diagrams, page 559).

In Bombay, farther north and east, a rambling old astronomical observatory served the IIOE as “weather central.” Chattering teleprinters and an electronic computer decoded weather data radioed from as far away as Moscow and Tokyo, Canberra and Pretoria. An automatic weather buoy, nicknamed NOMAD, rode at anchor in the Bay of Bengal, transmitting readings around the clock. Instruments on a raft in the Arabian Sea measured the exchange of heat energy between the ocean and the atmosphere—the “heat

engine” that helps drive the world’s weather.

Balloons 100,000 feet aloft, rockets stabbing 250,000 feet through the stratosphere, and orbiting TIROS, ESSA, and Nimbus weather satellites, hundreds of miles overhead, recorded energy flowing to and from space, and cloud patterns over the ocean (page 573).

Dr. Colin S. Ramage, an American who directed the IIOE weather studies, described to us flights by specially instrumented aircraft into the centers of tropical cyclones. Strapped down and hanging on, weathermen measured winds of nearly 120 miles an hour blowing around the eye of one storm.



PHOTOGRAPH BY ROBERT F. ZIEGLER © N.A.S.A.

On the jagged edge of a continent, Aden sprawls beneath sterile mountains. The Great Rift system created the sawtoothed ramparts when it parted Asia and Africa, forming the Gulf of Aden and the Red Sea. Chief city of the strife-torn Federation of South Arabia, Aden commands an approach to the Suez Canal. British forces have been battling anti-federation terrorists in the former crown colony, due to receive full independence on January 9 of next year.

One result of the weather program, Dr. Ramage predicted, may be a future ability to forecast local effects of the monsoons—just how much rain the winds from the ocean may bring to the land, where, and when.

A rakish little white-hulled ship, her buff-colored funnel bearing the stylized double-arrow emblem of the IIOE, sailed the Indian Ocean for two years. This was the U.S. research vessel *Anton Bruun*, formerly the Presidential yacht *Williamsburg*, refitted as a floating laboratory and renamed for a Danish marine biologist who had helped plan the Indian Ocean Expedition (pages 560-61).

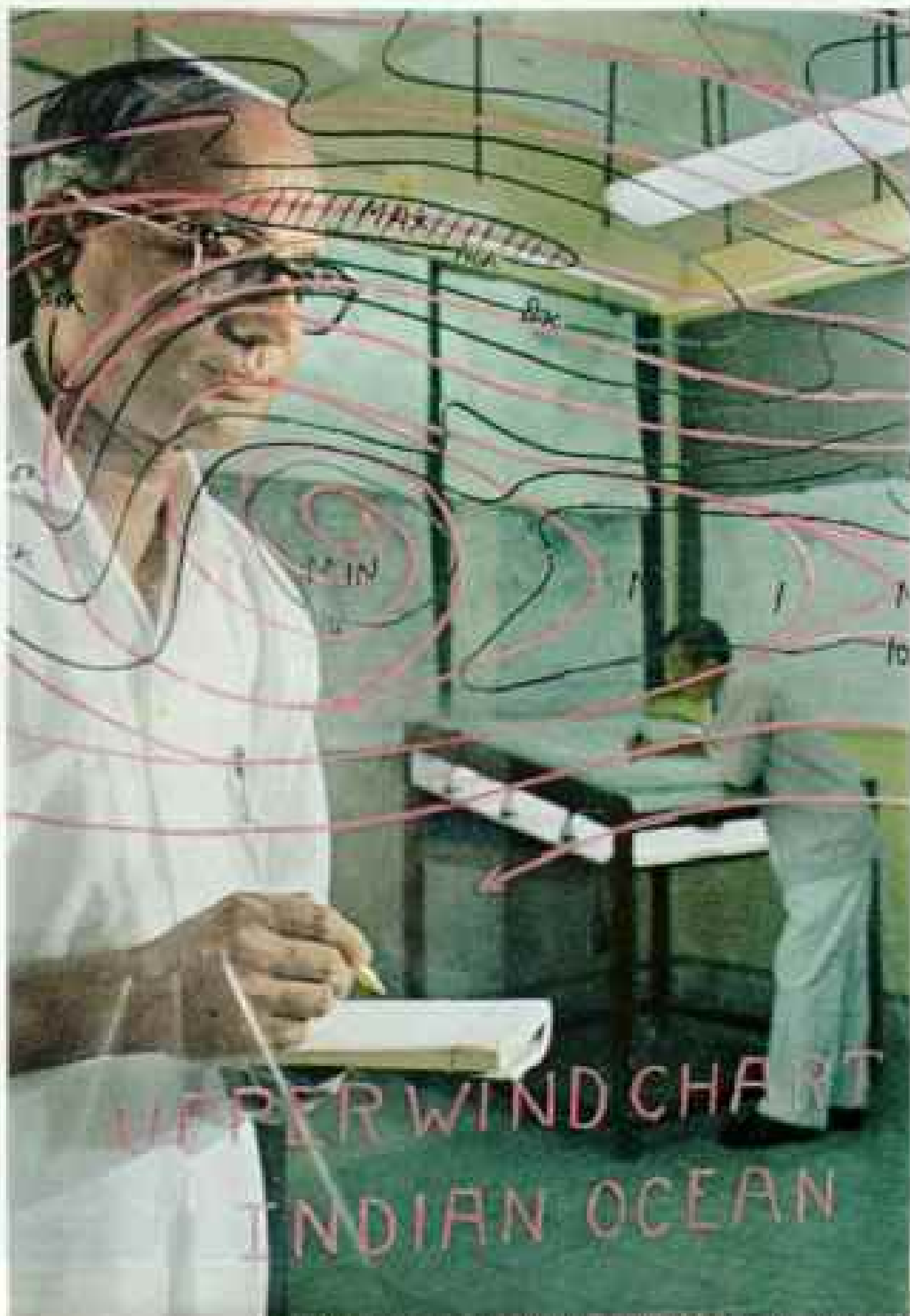
Successive teams of marine biologists from the United States and 15 other countries manned the *Bruun* on her months-long voyages. I joined her on a leg from Bombay around Ceylon and across the Bay of Bengal.

Heading south along India's Malabar Coast, we passed Kozhikode—ancient Calicut, where Vasco da Gama's three weather-beaten ships, their pennants bravely fluttering, made landfall on India in 1498. They had rounded all Africa, and with an Arab pilot had crossed from Malindi on the Kenya coast.

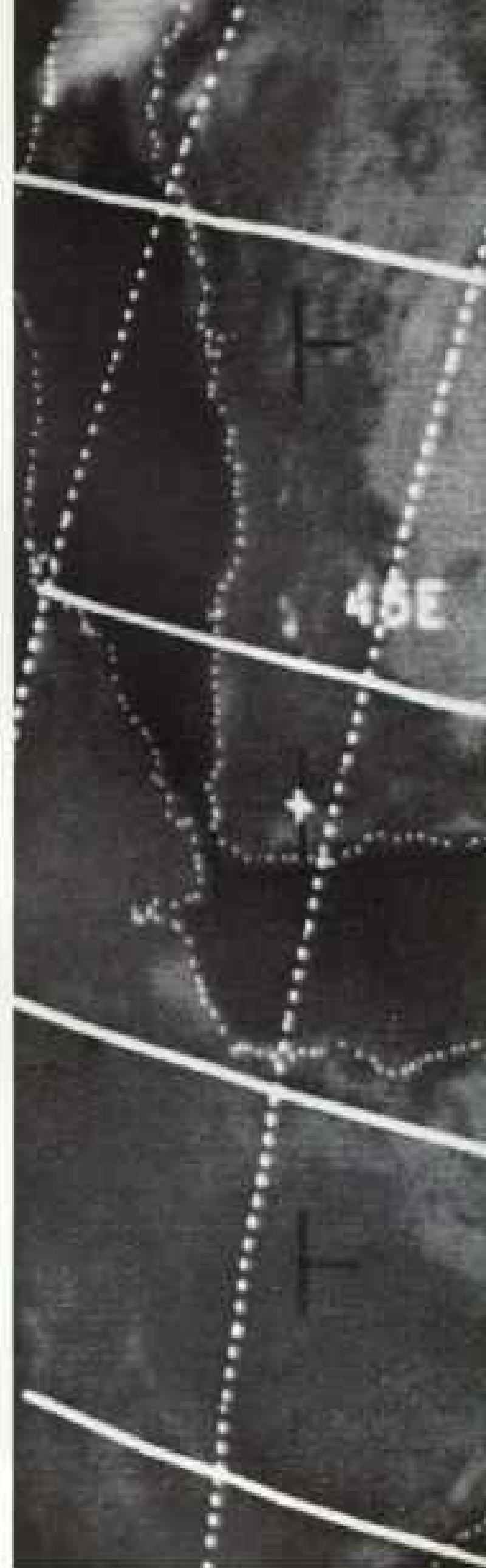
At regular intervals the *Bruun's* engines stopped, and she rolled quietly on the swell

Swirling cyclone, revealed by a TV camera aboard the ESSA 5 weather satellite last November, rakes Arabia's southeast coast.

Monsoon rain forecasts, an IOOE goal, are aided by weather studies of the International Meteorological Center in Bombay. Director C.R.V. Raman records a wind pattern.

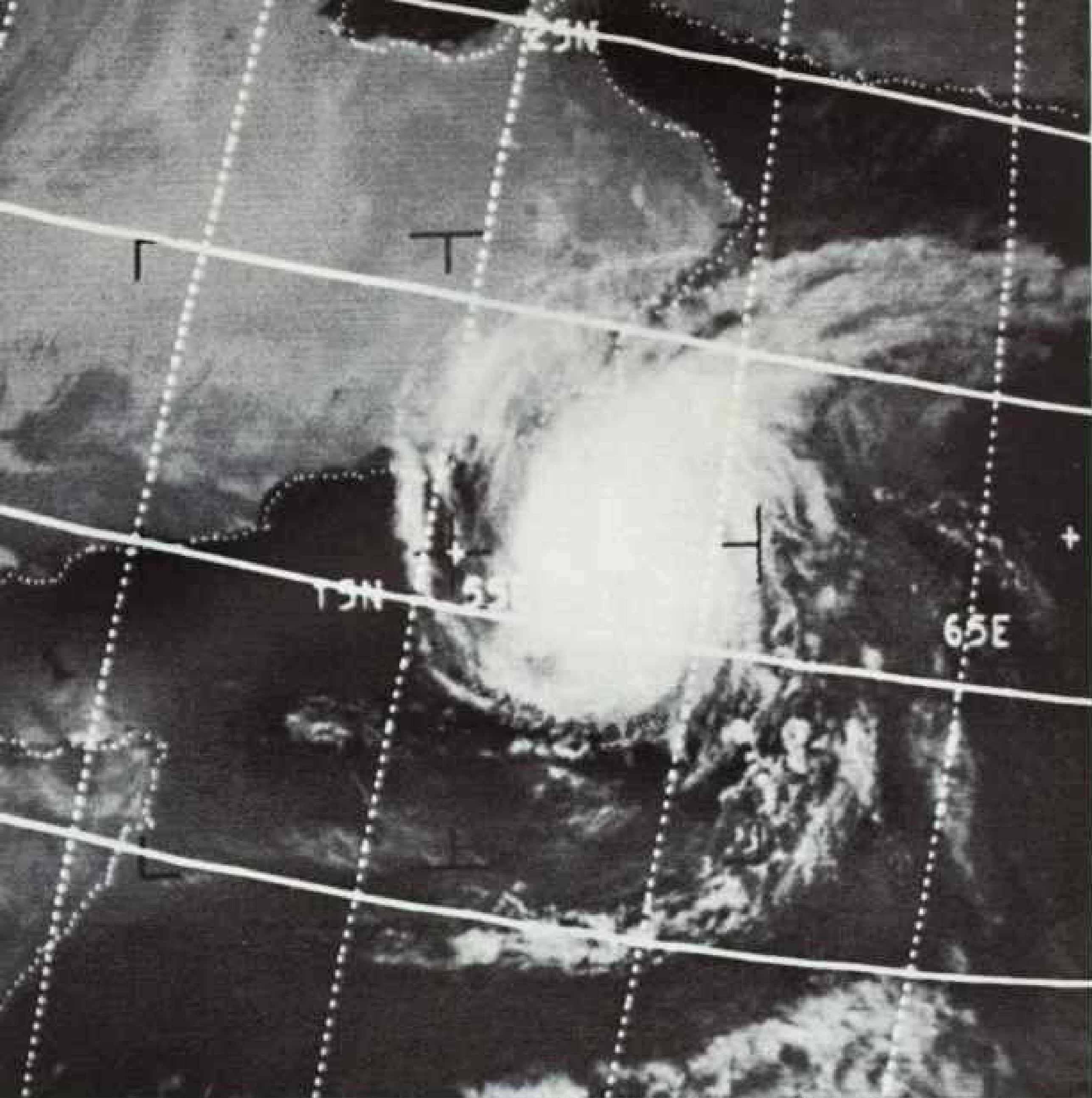


ENTACHROME (ABOVE) AND KODACHROME BY ROBERT F. SIEDON © N.G.S.



**Combat of forces:** An offshore wind attacks incoming waves, and the sea turns white with froth near the flat Arabian coast west of Aden.

Such winds, blowing constantly away from land—like those of the winter monsoon (page 559)—can bestow a gift of life in the ocean. They create a vertical motion in the water called upwelling (diagram, right). Cold, dense water from the depths rises to replace the warm top layer pushed outward by the wind. The upwelling lifts mineral nutri-



SATELLITE PHOTOGRAPH COURTESY ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE; DIAGRAM (BELOW) BY GEOGRAPHIC ART DIVISION. © U.S.C.

ents, stimulating a rich bloom of microscopic plankton. The abundance of this key link in the sea's food chain attracts large concentrations of fish.\*

IOE ships found areas of upwelling in the Arabian Sea and the Bay of Bengal that were 10 to 20 times more nutritious than average surface sea water. The discovery promises rich new Indian Ocean fisheries.

\*See "How the Sun Gives Life to the Sea," by Paul A. Zahl, *GEOGRAPHIC*, February, 1961.







while her winches lowered water-sampling bottles, bathythermographs to record temperatures in the depths, and funnel-shaped nets of gauzelike mesh to sample tiny forms of sea life (page 555).

Using radioactive carbon 14 as a tracer, *Bruun* scientists measured the growth rate of microscopic plankton, upon which all other life in the oceans depends. They constantly analyzed the sea water for chemical make-up.

Late in March the northeast monsoon still blew out of Burma. Chief goal of this cruise was to test the eastern shores of the Bay of Bengal for regions of upwelling (diagram, page 573).

"When offshore winds steadily blow water away from a coast," explained Dr. Eugene C. LaFond of San Diego, chief scientist aboard the *Bruun*, "deeper waters come up, bringing dissolved phosphates and nitrates.

"These salts are the fertilizers of the sea. Where they reach surface sunlight, plankton blooms, and so does fish life."

The *Bruun* had found the center of the Bay of Bengal relatively lifeless, a biological desert. Yet along the eastern shores, off Thailand, Burma, and East Pakistan, just the opposite was true. Upwelling currents of cold, nutrient-rich water and the resulting high plankton growth here yielded heavy hauls of fish—great sting rays, 200-pound guitarfish, and noisy croakers—pointing to a huge new potential fishery for the nations of Southeast Asia.

#### Death in the Ocean—and Rich Promise

Later the *Anton Bruun*, whose work for the Indian Ocean Expedition was directed by Dr. John H. Ryther of Woods Hole Oceanographic Institution in Massachusetts, investigated other such upwelling regions off the southeastern shore of Arabia and the Somali coast. Here some of the coldest water anywhere in the tropics came welling to the surface. It carried ten to twenty times as much nutrient material as average surface water. Plankton bloomed so thickly here that the sea turned from blue to greenish-brown in soupy bands.

Such upwelling areas, paradoxically, sometimes are so thick with plankton as to turn deadly to fish; the blooms remove all available oxygen from the water. In 1957 a Russian merchantman crossing from Ceylon to Aden plowed for three days through a solid layer of dead fish floating on the surface. The Russians estimated that an area larger than the State of Florida, 100 miles wide by 600 miles long, was blanketed by millions of tons of decaying fish—equivalent to the entire world commercial catch for a year!

Fortunately, such massive kills are rare. In abundance of fish life, the upwelling regions plotted by IIOE ships rank among the richest ocean areas on earth. Just beginning to be tapped by deep-sea fishing fleets—the first included Japanese and Russian vessels—they offer the promise of new sources of food for all the burgeoning nations rimming the Indian Ocean—for Abdullah of the Gulf of Kutch, his sons, and their sons after them.

THE END

Sardines silver a South Arabian shore as villagers spread a rich haul to dry in the sun. Thanks to the cooperation of world scientists, the future will bring bigger catches for a fourth of earth's population, the chronically underfed peoples who dwell in countries bordering the Indian Ocean. And the perils of the seafarer's calling will lessen with the improved forecasting of storms and better navigational charts developed by the expedition. Thus by deepening man's understanding of his planet, science opens the door to new hope.

# National Geographic Society

**A**FTER TEN YEARS in which the National Geographic Society grew from 2,175,000 to 5,500,000 members, Dr. Melville Bell Grosvenor, on June 21, laid down the dual reins of President and Editor and was unanimously elected by the Board of Trustees as Chairman of the Board and Editor-in-Chief. His long-time associate,

Dr. Thomas W. McKnew, became Advisory Chairman of the Board.

Because of the Society's growth in membership and in the scope of its educational services, Dr. Grosvenor recommended separating the positions of President and Editor, combined since 1920. Besides providing greater efficiency, he said, this action "will give



Headquarters of the National Geographic Society houses the expanded editorial activities envisioned and developed by Dr. Melville Bell Grosvenor, President and Editor from 1957 to 1967.

Newly elected executives combine more than a century of experience. The Society's new President, Dr. Melvin M. Payne, second from right; its Editor, Vice President Frederick G. Vosburgh, second from left; and its Secretary, Vice President Robert E. Doyle, far right, joined the staff in successive years—1932, 1933, and 1934. Former President-Editor Melville Bell Grosvenor, center, a veteran of 43 years with the Society, becomes Chairman of the Board and Editor-in-Chief. Choosing to stand, he said with a smile, "I'll always be looking over your shoulder!" From a portrait on the wall of the Board Room, the late Dr. Gilbert H. Grosvenor, master builder of the Society and its magazine from 1899 to 1954, looks over the shoulders of his son, the new executives, and his grandson, Vice President Gilbert M. Grosvenor, left, promoted to Associate Editor.



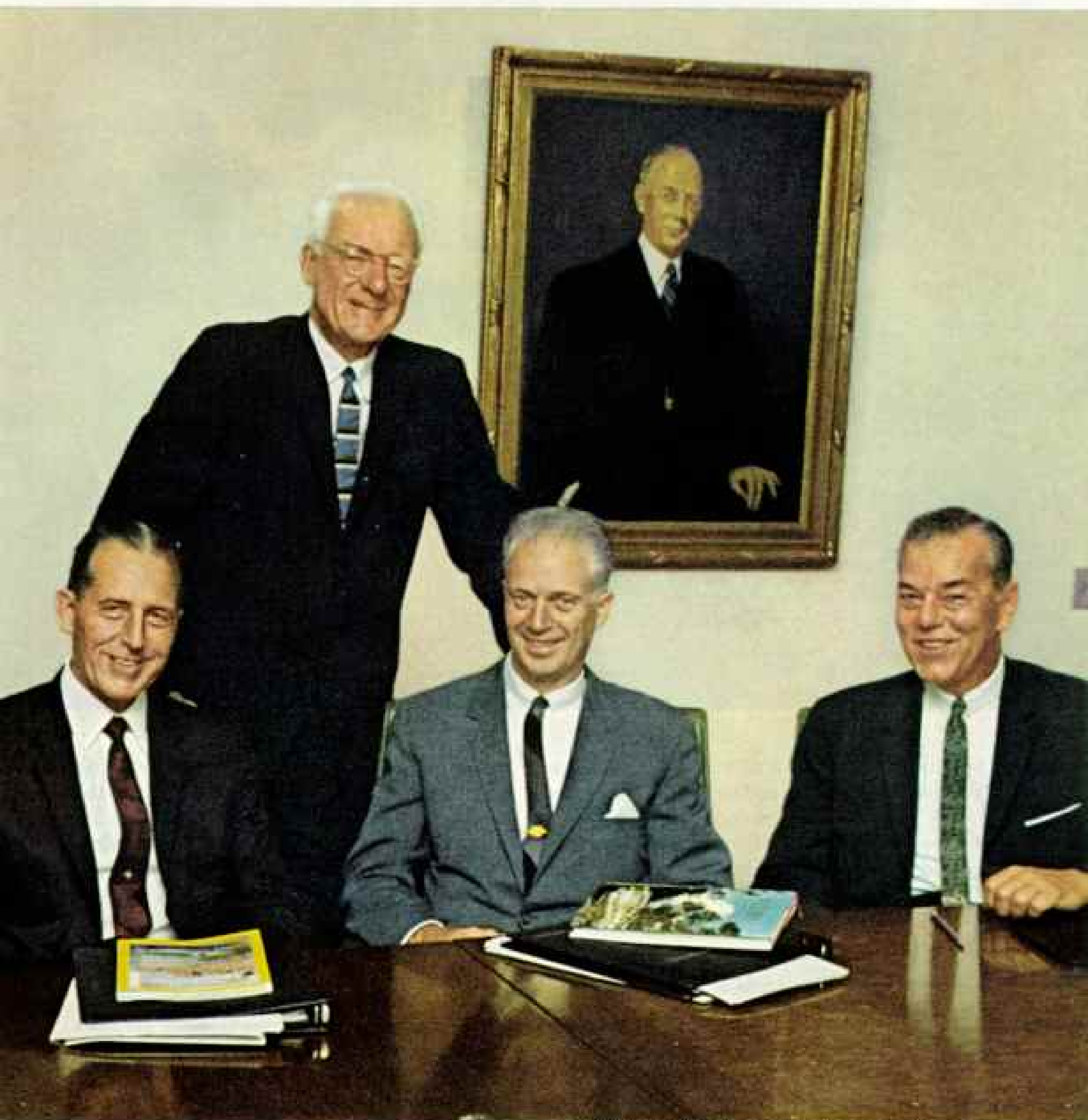
# Trustees Elect Key Executives

others up and down the line a chance to grow and develop, and will help keep the Society alive and vibrant and in the hands of young, imaginative people, as it should be."

Upon Dr. Grosvenor's recommendation, the Board elected Executive Vice President and Secretary Melvin M. Payne as President; Vice President and Associate Editor Frederick

G. Vosburgh as Editor; Vice President and Associate Secretary Robert E. Doyle as Secretary. All elections were voted unanimously by the Board, which adopted resolutions honoring Dr. Grosvenor and Dr. McKnew for their leadership and their many contributions to the Society's growth and progress.

Dr. Payne, the new President, joined the







Society's staff in 1932 as a 21-year-old secretary to Dr. McKnew, and earned a law degree from Southeastern University by attending early-morning classes. Over the years he has played an increasingly important role in the growth of the Society to its present position as the world's largest scientific and educational organization.

#### Has Aided Hundreds of Expeditions

From the time of his first field assignment—helping handle the complex logistics for the history-making balloon flights of *Explorer I* and *Explorer II* in 1934 and 1935—

Dr. Payne has been closely associated with Geographic expeditions throughout the world. As Secretary of the Committee for Research and Exploration, he was a prime force in the support of such projects as Capt. Jacques-Yves Cousteau's underwater explorations, the first American ascent of Mount Everest, the dredging of the *cenote*—sacred well of the Maya—at Chichén Itzá in Yucatán, Dr. Louis S. B. Leakey's search for early man in East Africa, and Jane Goodall's studies of wild chimpanzees.

Equally at home in a board meeting or a parley with an African tribe, Dr. Payne has



Rapt school children in the Society's Explorers Hall see for themselves that Columbus followed ocean currents to the New World. At the console of the world's largest free-moving globe, Curator T. Keilor Bentley projects an image of a ship while maneuvering the sphere. He compares geographic features by superimposing Texas on Alaska, for example, or the Amazon River on the United States.

Dr. Thomas W. McKnew, former Chairman of the Board and now Advisory Chairman, stands by the gondola of the stratosphere balloon *Explorer II* in Explorers Hall. One of his early assignments was to serve as project director for the record-breaking flights of 1934 and 1935, sponsored by the Society and the U. S. Army Air Corps.

ESTABLISHED BY BRUCE WALKER (LEFT) AND JAMES F. RUSSELL © N.G.S.



long been admired by his colleagues for administrative brilliance, tireless devotion to duty, rare judgment, and quiet humor.

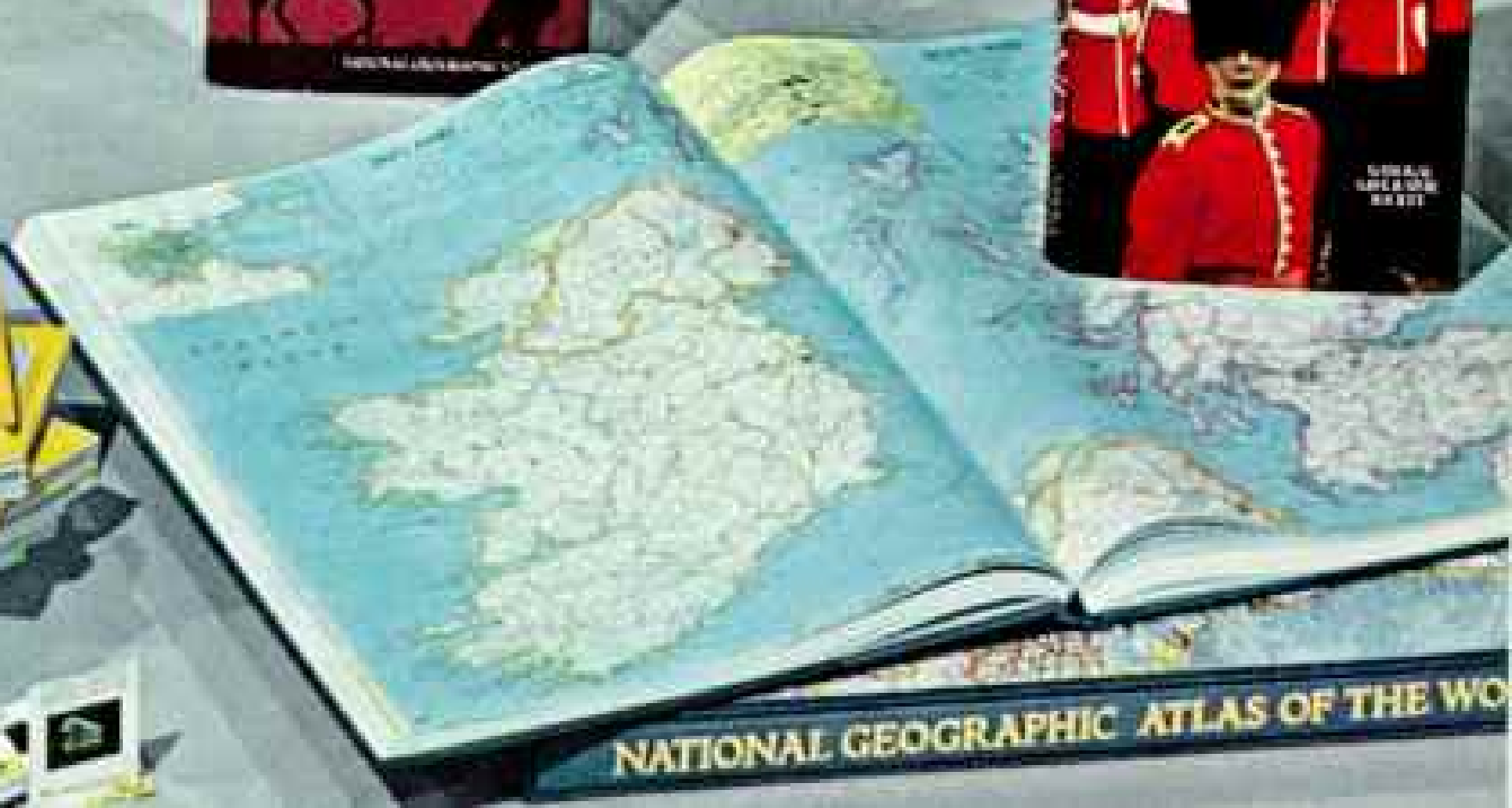
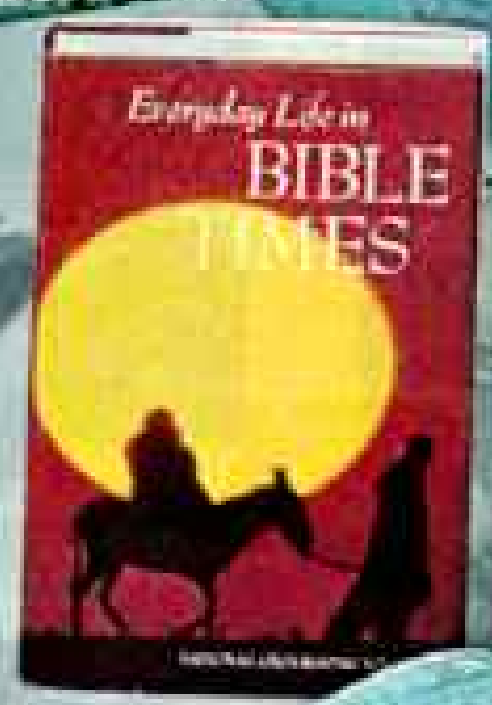
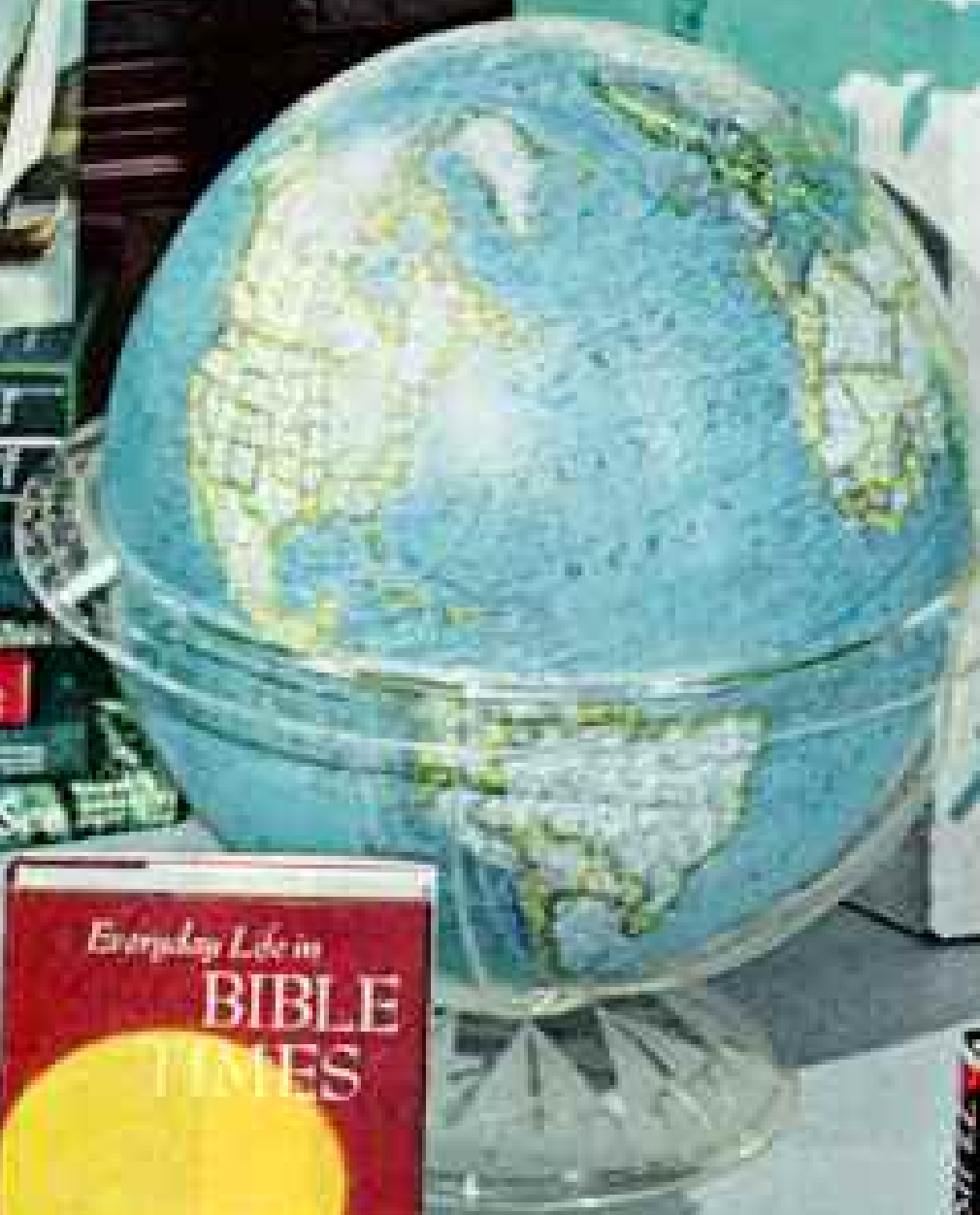
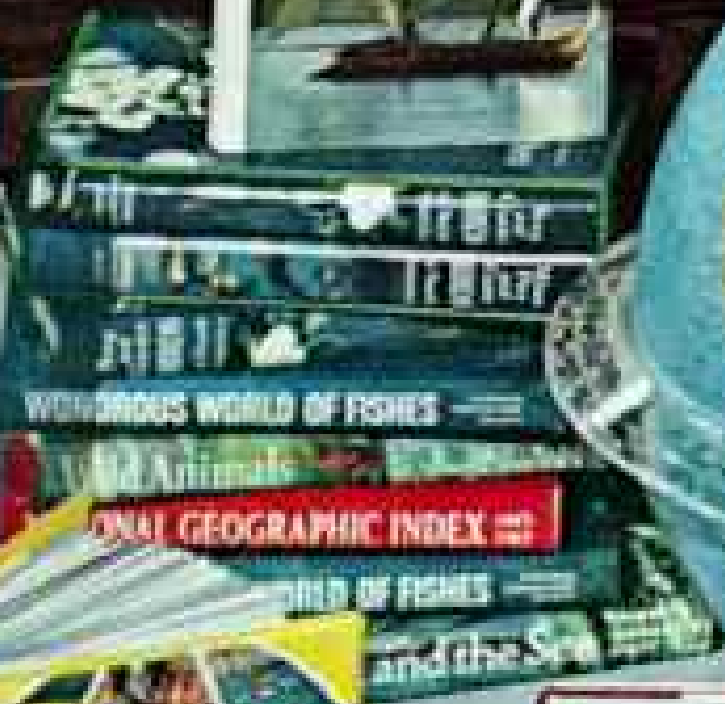
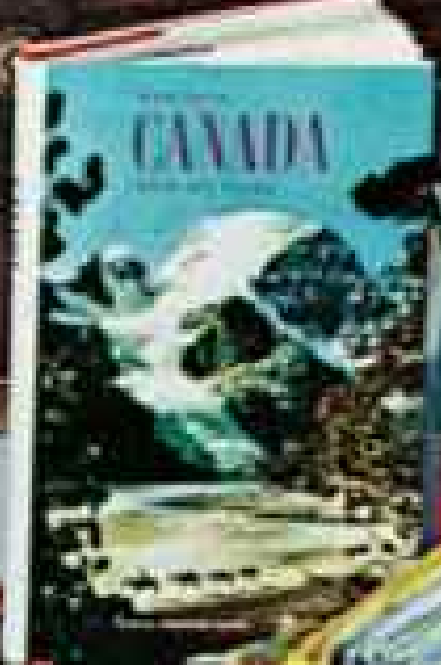
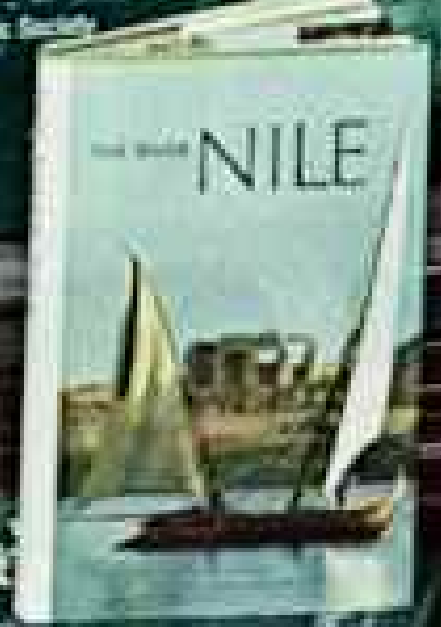
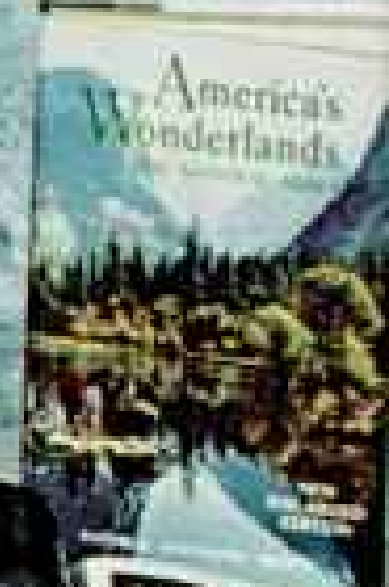
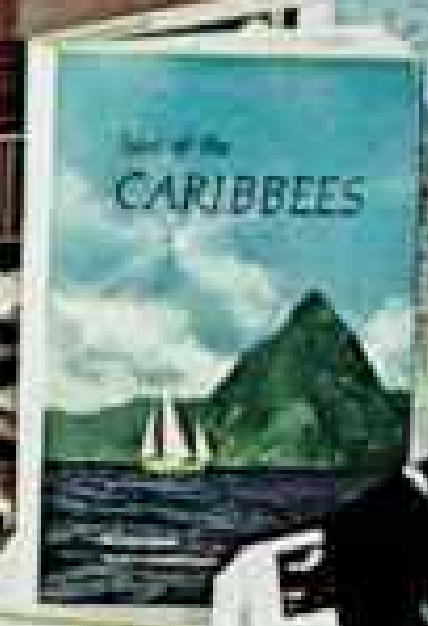
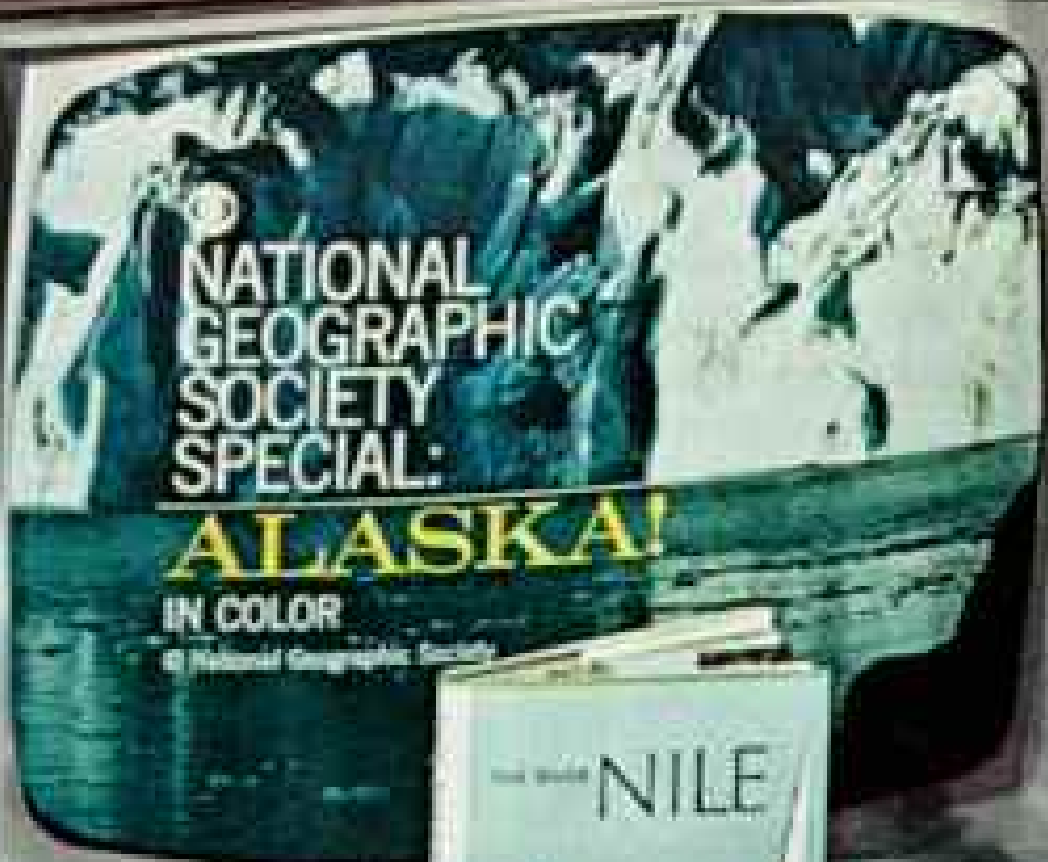
Mr. Vosburgh, the new Editor, has worked closely with Dr. Grosvenor and Dr. Payne for 34 years. When he joined the NATIONAL GEOGRAPHIC staff at the age of 29, he was already a veteran of nearly seven years as a reporter for the Associated Press in New York and Washington.

For the magazine this Phi Beta Kappa graduate of Syracuse University has written many articles, ranging in subject from fireflies to jet airplanes and in distance from Formosa

and Japan to his native Mohawk Valley in New York State.

When Melville Grosvenor became President-Editor in 1957, he announced to the Board that his first official act was to appoint Mr. Vosburgh as the Associate Editor. He added: "He is one of the finest writers I know. He has a hawk's eye for error, and nothing is released for publication in the magazine without his approval. His deft touch improves and humanizes many articles, and he has helped the magazine immeasurably by training young writers."

As Associate Editor, Mr. Vosburgh has





helped Dr. Grosvenor bring about the many editorial advances of the past decade.

The Society's newly elected Secretary, Robert E. Doyle, has risen, like the others, up the ladder of merit. After attending George Washington University, he entered the Society's employ in 1934 as a helper in the duplicating division, and by his qualities of enterprise and leadership advanced rapidly to positions of great responsibility.

For 17 years Mr. Doyle has directed the work of the employees, now numbering 1,100, who receive the mail and keep the records of the mounting membership and assure prompt delivery of the magazine and the Society's other publications throughout the world. With membership growing by half a million a year, he played the leading role in establishing a modern computer system to handle circulation, and has been primarily responsible for the planning and construction of the new Membership Operations Building near Gaithersburg, Maryland (page 590).

As Secretary, Mr. Doyle becomes the official point of contact between the Society and its millions of members and serves as the administrative right hand of President Payne.

#### "Fine and Generous Thing to Do"

In thanking the Board for "a very happy culmination of a 35-year apprenticeship," Dr. Payne recalled the Society's achievements during Dr. Grosvenor's administration and said: "Acting in what he considers to be the Society's best interests, he has, entirely of his own volition, decided to let the ranks move up to new responsibilities and prestige. As I said, I have spent 35 years with the Society,

All these new ways of diffusing knowledge burgeoned during the decade under Editor Melville Grosvenor. The NATIONAL GEOGRAPHIC added a color photograph to its familiar yellow-bordered cover, became a fully color-illustrated magazine, and even gave its readers sound—a record of Winston Churchill's funeral and immortal words. Nationwide color-television specials diffused geographic knowledge to millions more. Cartographers, remapping the world, produced the Society's first atlases and globes. Book editors created such handsome volumes as *Men Ships and the Sea*, *This England*, *Our Country's Presidents*, and *The River Nile*. A redesigned School Bulletin, in five years, soared in circulation from 30,000 to 431,000 students and teachers, and plans were made for a film-strip service.

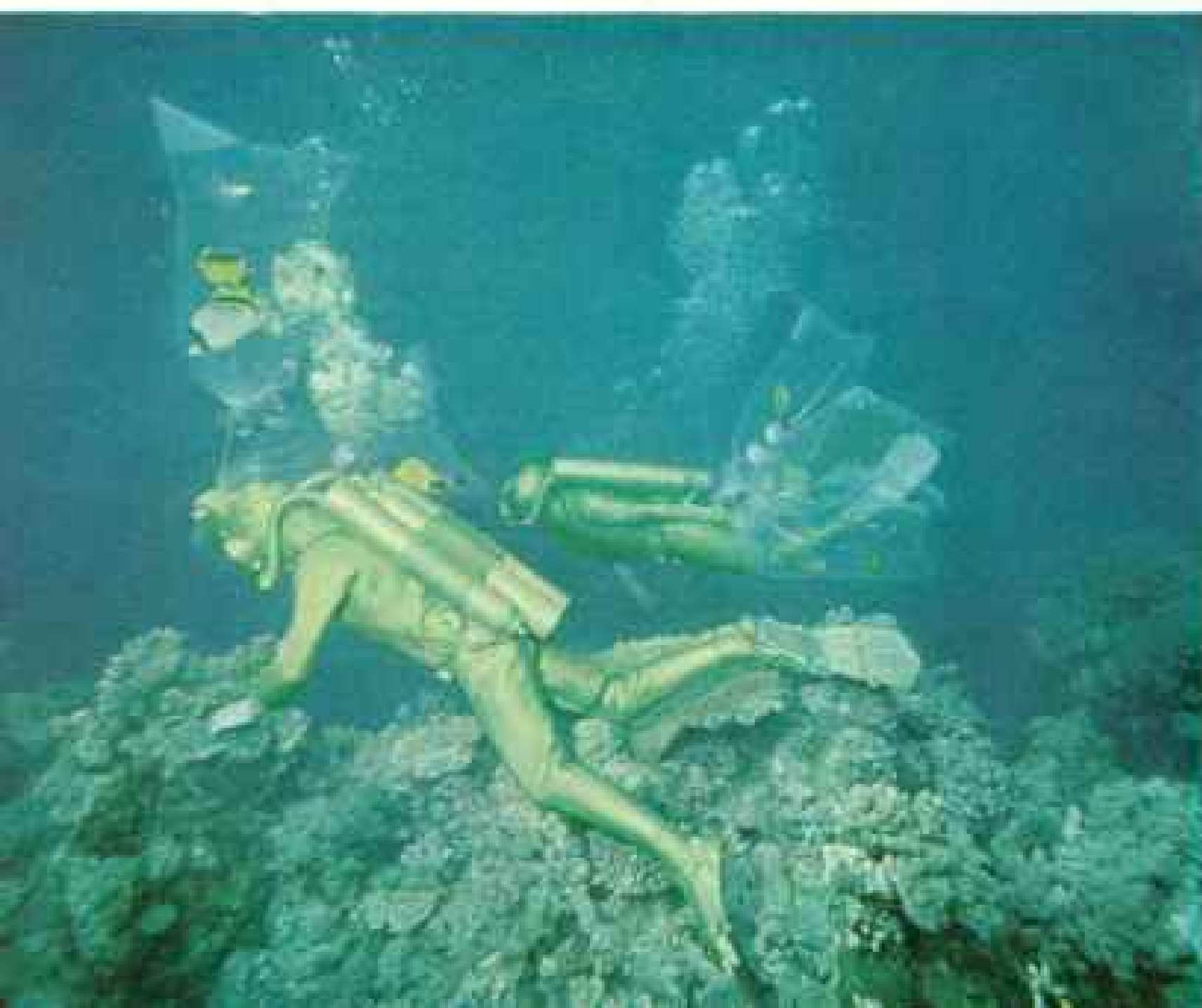
ILLUSTRATION BY ROBERT S. DAVIS (C) N.G.S.

but Mel was a part of the Society practically from the moment of his birth, and only a few months ago completed 42 years of active and productive service. To give up these titles, which he worked so hard to earn and so richly deserved, is a fine and generous thing to do. . . .

"I am tremendously proud to succeed to the office held during my career by Dr. Gilbert Grosvenor, Dr. John Oliver La Gorce, and my contemporary and beloved friend, Melville Grosvenor, and for the future I dedicate myself without reservation to all that the Society has stood for in the past."

"This generous and forward-looking action," said Mr. Vosburgh, "is characteristic of Melville Grosvenor."

"During this century, only three men have been the Editor of the NATIONAL GEOGRAPHIC—Gilbert Grosvenor from 1899 to 1954, John Oliver La Gorce from 1954 to 1957, and Melville Bell Grosvenor from 1957 to 1967. I am proud indeed to follow them."



To the highest mountain and the depths of the sea: Expeditions sponsored by the Society in recent years include the first American ascent of Mount Everest in 1963 (upper left). "Conshelf" experiments of Capt. Jacques-Yves Cousteau proved that man can live and work on the continental shelf. With butterfly fish caught in plastic bags, French aquanauts paddle for home—a capsule moored 36 feet down in the Red Sea. This year Society grants have aided more than 40 scientific projects throughout the world.



BOGACHOWICZ (OPPOSITE PAGE) BY BARRY C. BISHOP; SYTACHROMES BY BARON HILLO VAN LAWICK (JACKET) AND ROBERT B. GOODMAN © N.C.S.

Inspecting research projects half a world away, President Payne, then Executive Vice President, center, visits Baroness Jane van Lawick-Goodall and her wild chimpanzee friends in Tanzania. With two members of the Committee for Research and Exploration, Chairman Leonard Carmichael, left, and Dr. T. Dale Stewart, he watches the famous field zoologist and a young chimpanzee that dropped in for a banana.

Dr. Grosvenor has built a splendid staff, and with his help and yours we shall do our utmost to make our magazine and the other publications of the Society a growing influence for knowledge and understanding in the world."

On the recommendation of the new Editor, approved by the new President and ratified by the Board, Senior Assistant Editor Gilbert M. Grosvenor joined Franc Shor as an Associate Editor, and Wilbur E. Garrett was promoted from Associate Illustrations Editor to Assistant Editor.

"For several years now," Editor Vosburgh said, "Gil has had responsibility for much of our long-range planning, and his knowledge of the entire editorial operation is unsurpassed by any of us."

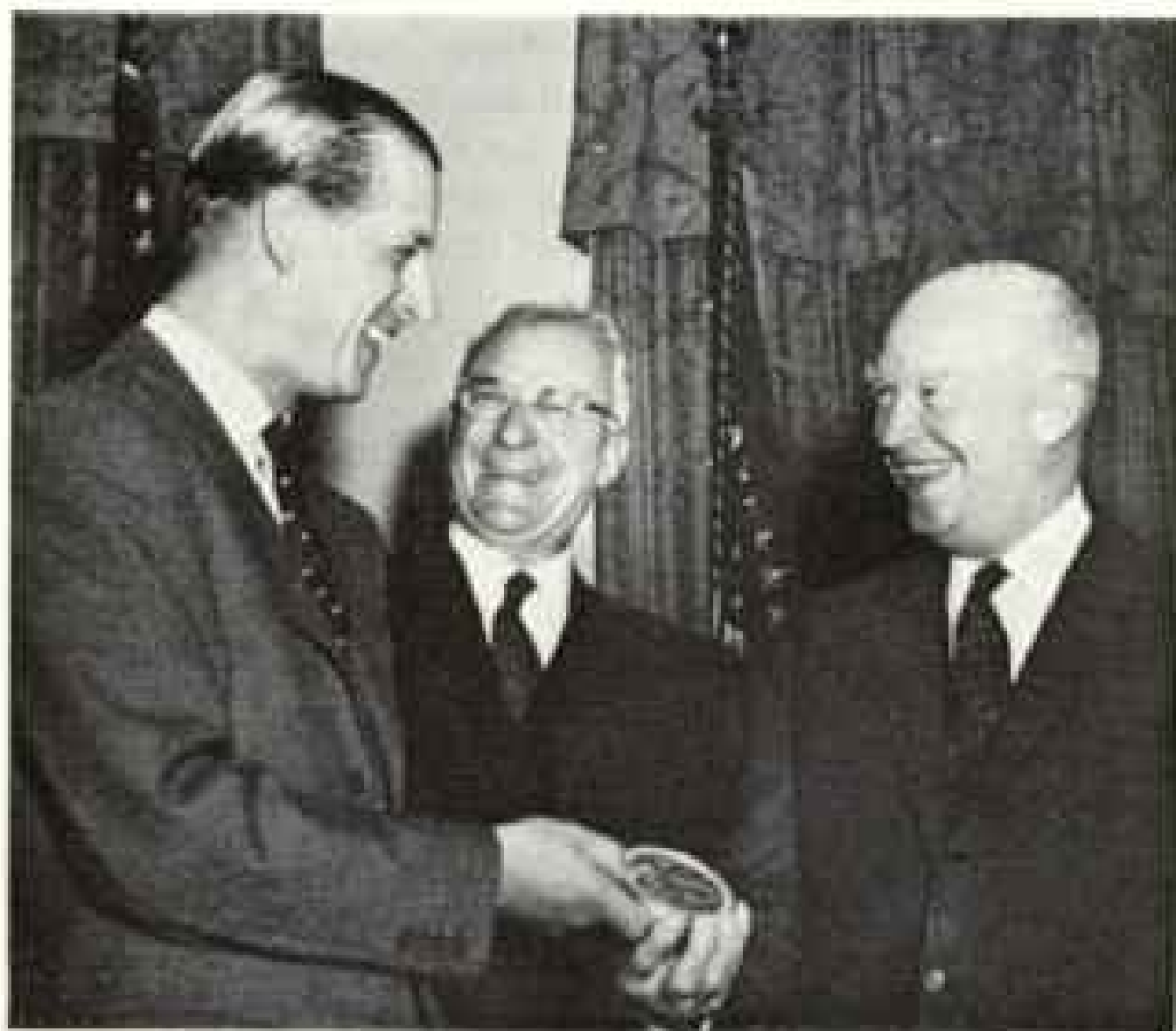
He pointed out that both Mr. Grosvenor and Mr. Garrett have contributed many outstanding articles and photographs, and have played major roles in the improvement of the magazine, especially its illustrations.

"Both joined the staff in 1954," he said. "It must have been a vintage year."



Diamond marks Johnson City, Texas, home of President and Mrs. Lyndon B. Johnson. Dr. Grosvenor presented the Geographic globe to the First Lady when the President dedicated the Society's new building (page 576) on January 18, 1964.

Between Prince and President, Dr. Grosvenor watches Dwight D. Eisenhower present the Society's Special Gold Medal to Britain's Prince Philip "whose questing spirit has . . . brought to millions a better understanding of our planet and its peoples."



A member of the Board and a Vice President of the Society, Mr. Grosvenor expressed appreciation of the recognition and encouragement given to the younger members of the staff.

"In my opinion," he said, "no magazine's top management recognizes the enthusiasm and new ideas of young people as this organization has."

The Board provided that all of the staff changes should become effective on August 1, 1967.

As Chairman of the Board, and in the new position of Editor-in-Chief, Dr. Grosvenor will continue to give the Society the benefit of his knowledge, experience, and ideas, while leaving the daily direction to others. The extraordinary achievements of his ten years as President-Editor were summarized in the resolution offered by a fellow editor on the Board, Benjamin M. McKelway of the *Washington Star*, long the President of the Associated Press:

"RESOLVED: That the Board of Trustees express its deep appreciation of the services of the National Geographic Society's President and Editor, Melville Bell Grosvenor, as he relinquishes those offices and becomes Chairman of the Board and Editor-in-Chief. In these capacities he will continue to bring to the life of the Society the bold and resourceful leadership that has distinguished his decade as President and Editor.

"The achievements of that decade are astonishing in scope, extraordinary in number, and enduring in consequence.

"Knowing change to be the order of life, Melville Grosvenor harnessed it rather than defied it. In part, this meant providing the finest and most efficient physical means for growth. Inadequate sheet-fed printing methods were replaced by high-speed web presses. New paper-manufacturing techniques provided higher quality pages at lower cost. A streamlined typesetting technique, the photo-electronic Linofilm, revolutionized production of Society publications.

"Turning aside from the temples of traditionalism, Dr. Grosvenor and his colleagues graced the landscape with a soaring structure that speaks directly



REPRODUCED BY THOMAS STUBBS © NATIONAL GEOGRAPHIC SOCIETY

President and Mrs. Kennedy receive from Dr. Grosvenor the first copies of the guidebook *The White House*. The Society produced it in 1962 as a public service for the White House Historical Association, headed by David E. Finley, center. Proceeds from sales, more than 1,800,000 copies thus far, buy furnishings for the Executive Mansion.

to the present, with an Explorers Hall that brings the romance of geography in exciting form to millions of visitors. Additionally, the Membership Operations Building now grows on a magnificent 100-acre site near Gaithersburg, Maryland.

"In July, 1959, a color photograph appeared on the cover of the NATIONAL GEOGRAPHIC for the first time. It was one of many improvements in a magazine that has long been a synonym for quality throughout the world. Both the face and the content have so continuously improved that to compare the magazines of 1957 and 1967 is demonstration in itself of Melville Grosvenor's genius as an editor.

"With the same uncompromising insistence upon quality, he transformed the School Bulletin into a highly readable color-illustrated magazine for students and teachers and increased its circulation from 30,000 to 431,000.

"Soon after he became President and Editor, Dr. Grosvenor undertook a program of complete remapping of the world by the Society's cartographers, and the resulting World Atlas Maps distributed as magazine supplements have totaled more than 169,000,000.

"He conceived and published the Society's first atlases—one of the United States and a World Atlas, now in its second edition.

"Under his guidance, a free-standing globe with a 'thinking cap'—a unique tool for geographic learning—took splendid form in 1961. National Geographic globes now bring the world into 265,000 homes, offices, and schoolrooms.

"Dr. Grosvenor greatly increased the number and quality of the Society's educational books by organizing its Book Service and Special Publications staff. The growing shelf includes the great saga of human seafaring, the rich wonderlands of our continent, the vast fields of our history, the beauties and





fascination of nature, all in editions in the hundreds of thousands. *America's Wonderlands* has sold 494,000 copies, and so great is the demand for the forthcoming *Everyday Life in Bible Times* that a first printing of 400,000 copies has been ordered.

"At the request of the White House Historical Association, the Society produced the first descriptive popular book on the President's home. Sales have grossed \$1,885,005, enabling the nonprofit association to proceed with additions to the historical furnishings of the White House. This contribution was followed by other public-service books, on the Capitol, the Supreme Court, and the Washington Monument, and a second on the Executive Mansion, *The Living White House*.

"Membership growth made possible greatly enlarged support for research and explora-

tion. It now amounts to a million dollars each year. Through this support and subsequent accounts of the results in the magazine, such names as Louis and Mary Leakey, Capt. Jacques-Yves Cousteau, and Jane Goodall have become household words.

"Important discoveries have flowed from the Society's grants. The horizons of man's knowledge have been pushed into the silent world beneath the sea, and backward to the dawn of man.

#### TV Series Wins Coveted Award

"In 1963, the American Mount Everest Expedition, with the Society as primary sponsor, placed six men on the summit of the world's highest peak. Later 26 million Americans witnessed the dangers of that hazardous and heroic enterprise through television.



In the Control Center, where future magazines are planned, the new Editor, Mr. Vosburgh, addresses the Executive Editorial Council, half of which is shown. From left, first row: President Melvin M. Payne, Senior Assistant Editor John Scofield, Associate Editor Gilbert M. Grosvenor, Editorial Assistant to the President Leonard J. Grant, Editor-in-Chief Grosvenor, and Associate Editor Franc Shor. Second row: Chief of Photo Lab Edwin L. Wisberd, Chief of School Service Ralph Gray, Associate Secretary Herbert T. Henderson, Assistant Editor Howell Walker, Assistant Editor Carolyn Bennett Patterson, Assistant Illustrations Editor Mary S. Griswold, and Illustrations Editor Herbert S. Wilburn, Jr. Third row: Chief of Television Service Robert C. Doyle, Vice President for Research and Exploration Leonard Carmichael, Chief of Geographic Research George Crossette, and Vice President and Secretary Robert E. Doyle.

Pointing out deadlines, Vice President and Associate Editor Gilbert M. Grosvenor briefs the council on the status of forthcoming issues.

KODACHROME BY JAMES L. YANFIELD © N.G.S.



"Just as the National Geographic had pioneered many of the major advances in the art and technique of publishing, so now Dr. Grosvenor saw the opportunity to diffuse and increase geographic knowledge through the television screen. At each showing, from 18½ to 33½ million Americans have adventured with the Geographic on television, and all four color documentaries of the 1966-67 season were rated among the top ten programs of their type, one of them, Alaska, leading all the rest. The Society's series won the coveted George Foster Peabody Award for excellence in documentary films.

"In Melville Grosvenor's decade as President and Editor, the Society grew from a membership of 2,175,000 to 5½ million today. Chiefly because of the constantly increasing circulation, it has not been necessary to

raise the annual dues of \$6.50 in the ten years of his stewardship. . . .

"In his first message to members as President of the Society, Melville Grosvenor said we should not be content to ruminate on past glories. 'How much more fitting it is to look beyond the horizon, upward at the skies, and forward to tomorrow.' In that conviction, he has made unprecedented contributions to the National Geographic Society. Now, as he prepares to exercise his unique talents in a yet larger dimension, the Board of Trustees wishes to convey to him, on behalf of the Society's millions of members, admiration, affection, and gratitude."

In response, Dr. Grosvenor said, "That is very thrilling and I appreciate it. But as I heard the words, I kept thinking of the wonderful Geographic team that made it all

possible. Each man and woman on the masthead [inside front cover of the magazine] and a thousand others won that accolade for me. I hope to continue to offer ideas and recommendations to the staff, but they will be just that—suggestions.

“Without the support and care of my lovely wife Anne Elizabeth Revis, who has accompanied me on my travels from Angkor in Cambodia to Olduvai Gorge in Tanzania, I could not have done these things. Mrs. Grosvenor’s on-the-spot notes reflecting the woman’s point of view, and her photographs in these pages, have embellished numerous articles credited to me.

“As we look to the future, the Society and its publications could not be in better hands, and I prophesy an even greater future for our far-reaching work—increasing geographic knowledge—thus helping people around the world to know each other better. Thank you again for that nice resolution.”

In the new post of Advisory Chairman, Dr. McKnew will continue to be a source of invaluable support, his wise counsel reflecting more than 35 years as an officer of the Society.

“Around the Geographic, the name Tom McKnew associates itself automatically with building and growth,” said the Board’s resolution, proposed and read by Gen. Curtis E. LeMay.

“As a construction company engineer and executive, Tom McKnew attracted the attention of Dr. Gilbert H. Grosvenor and Dr. John Oliver La Gorce with his skillful supervision of the enlargement of our 16th Street building in 1930-31. Invited to join the Geographic staff, Dr. McKnew became Assistant Secretary in 1932, Secretary in 1945, Life Trustee in 1949, Vice President in 1955, Executive Vice President in 1958, Vice Chairman of the Board in 1962, and Chairman in 1966. This splendid building is a monument to him, for as Chairman of the Building Committee he planned and followed through on every detail of its construction.

“Soon after joining the Geographic, Tom McKnew became project officer for the National Geographic-U. S. Army Air Corps Stratosphere Balloon Expedition flights of 1934-35 from the Stratobowl near Rapid City, South Dakota. His efforts and those of his



young assistant, Mel Payne, did much to assure the success of these history-making ventures to the threshold of space.

“In 1957 the Navy bestowed upon our able colleague its highest civilian honor, the Distinguished Public Service Award. He has also received the Air Force’s highest civilian honor, the Exceptional Service Award.

“As Chairman of the Printing Methods Committee, Dr. McKnew directed a two-year study culminating in 1958 in new methods of printing which assured production of issues of the magazine numbering in the multimillions on new high-speed rotary web presses purchased by the Society. Lifting the ceiling on printing capacity permitted membership growth that is now requiring purchase of a seventh press. . . .

“As a NATIONAL GEOGRAPHIC contributor, Dr. McKnew shares authorship with Dr. Gilbert Grosvenor of the article ‘We Followed Peary to the Pole,’ and he wrote two outstanding service stories, ‘Fledgling Wings of the Air Force,’ and ‘Four-Ocean Navy in the Nuclear Age.’ The latter won its author



ENTRUSTED BY ROBERT S. DUFFY © NATIONAL GEOGRAPHIC SOCIETY

## Twenty Trustees attend the meeting that elected the new executives

**N**ATIONAL GEOGRAPHIC Trustees, on far side of table from right, at the June 21 meeting: Curtis E. LeMay, former Chief of Staff, United States Air Force; Conrad L. Wirth, former Director, National Park Service; Alexander Wetmore, Research Associate, Smithsonian Institution; Leonard Carmichael, Vice President; Melvin M. Payne, President; Melville Bell Grosvenor, Chairman and Editor-in-Chief; Earl Warren, Chief Justice of the United States; Benjamin M. McKelway, Editorial Chairman, *Washington Star*; Caryl P. Haskins, President, Carnegie Institution of Washington; Louis B. Wright, Director, Folger Shakespeare Library; James H. Wakelin, Jr., former Assistant Secretary of the Navy for Research and Development; Gilbert M. Grosvenor, Society Vice President and Associate Editor.

On near side of table from left: William McChesney Martin, Jr., Chairman, Board of Governors, Federal Reserve System; Leo Otis

Colbert, Rear Admiral, U. S. Coast and Geodetic Survey, Ret.; Crawford H. Greenewalt, Chairman, E. I. du Pont de Nemours & Co.; Thomas W. McKnew, Advisory Chairman of the Society's Board; Laurance S. Rockefeller, President, Rockefeller Brothers Fund; Frederick G. Vosburgh, Society Vice President and Editor; Emory S. Land, Vice Admiral, U. S. Navy, Ret.; H. Randolph Maddox, Vice President, American Telephone & Telegraph Co., Ret.

Not present: Society Vice President and Treasurer Robert V. Fleming, Advisory Chairman of the Board of Riggs National Bank and Chairman of its Executive Committee; Arthur B. Hanson, Society's General Counsel; Juan T. Trippe, Chairman of the Board, Pan American World Airways; James E. Webb, Administrator, National Aeronautics and Space Administration; and Trustee Emeritus Lloyd B. Wilson, Honorary Chairman of the Board, Chesapeake & Potomac Telephone Co.



PHOTOGRAPH BY JAMES E. RUSSELL © R.S.A.

**Building for the future:** On a 100-acre sylvan site near Gaithersburg, Maryland, rises the Society's new Membership Operations Building—a project directed by Secretary Doyle, left. With Dr. Payne and Dr. Grosvenor he holds a painting of the completed building presented by Mr. Fred E. Jones, right, representative of the architects, Mills, Petticord and Mills. Containing 50 percent more floor space than the Society's Washington headquarters (page 576), the structure will accommodate the hundreds of employees needed to keep membership lists up to date, assure prompt delivery of the magazine and other Society publications, and deal annually with some seven million pieces of mail.

the George Washington Honor Medal of the Freedoms Foundation of Valley Forge.

"Unfailing in courtesy, unswerving in integrity, uncompromising in discharge of responsibility, Tom McKnew has made excellence with compassion the watchwords of his life. We know him to be sympathetic and forbearing, though never indulgent of half-hearted effort or shoddiness of work. . . . We salute Thomas Willson McKnew with all affection and esteem."

The eventful June meeting of the Board included election of a new Trustee, Washington attorney Arthur B. Hanson, who, like his father before him, serves as the Society's General Counsel. He also represents a number of other learned organizations, and in 1957 was elected to the American Law Institute. Three times awarded the Bronze Star for valor in World War II in the Pacific, Mr. Hanson is a brigadier general in the Active Marine Corps Reserve.

# NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

*Organized "for the increase and diffusion of geographic knowledge"*

GILBERT HOVEY GROSVENOR,  
President, 1907-1914; Editor, 1909-1934  
Chairman of the Board, 1934-1966



THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D. C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization for increasing and diffusing geographic knowledge and promoting research and exploration. Since 1890 the Society has supported 393 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; more than 26 million maps distributed each year; its books, globes, and atlases; 30 School Bulletins a year in color; information services to press, radio, and television; technical monographs; timely exhibits from around the world in Explorers Hall; and now a nationwide series of programs on television.

Articles and photographs of travel, natural history, and expeditions to far places are desired. For material used, generous remuneration is made.

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COVER: Wooden grave marker in Madagascar depicts a knife-wielding tribesman sacrificing a zebu (page 47).

A black and white advertisement for a Hamilton watch. The background is a close-up of a man's face wearing a helmet, with a Hamilton watch on his wrist. The watch has a white dial with black hands and a metal link bracelet. The text is overlaid on the image.

Is there any excitement left  
to give a man who free falls  
from ten thousand feet?

Does he own a Hamilton?

He wears danger like an accessory; challenges the wind, and goes where few other men have been. There is only one watch for him. And Hamilton calls it the Dateline Automatic. Bold elegance in a stainless steel case. Weatherproof,\* shock-resistant, anti-magnetic, of course. With self-winding convenience and an automatic calendar. Accuracy and dependability he can count on.

If he takes his chances on the unexpected, Hamilton's Dateline Automatic is his kind of excitement... especially when it comes from you.

If you want to give more than time, give  
**HAMILTON**

\*Weatherproof (waterproof-dustproof with seals intact). Dateline A-392, \$85.

Hamilton Watches are available in Canada and more than 50 other countries.  
Hamilton Watch Co., Lancaster, Pennsylvania, U.S.A.

## Wide-Tracking is the way a Pontiac behaves. And no other car has Wide-Track.

Pontiac engineers have a happy faculty of bestowing upon their cars more good things than most cars have a right to. Like years-ahead styling. And disappearing windshield wipers. And a neat vinyl rub rail that's built into that thin stripe of molding along this Bonneville's flanks. And variable-ratio power steering you can order on Bonneville's, Grand Prix's and Executive's that up to now has been available only on a fine luxury car. But

Pontiac's engineers also insist on maintaining superiority in that most telling use of a car—on the road. Hence Wide-Track. And in '68, Wide-Tracking is even further removed from plain ordinary driving. Because the ride is quieter, more comfortable, more stable than ever before. And more secure. Two shoulder belts are standard in the front seat of every new 1968 Pontiac. Isn't it time you saw your Pontiac dealer and started Wide-Tracking?

Other Wide-Tracks: Grand Prix, Catalina, Brougham, Executive, Ventura, GTO, LeMans, Tempest and the Five Phobias. Pontiac Motor Division



MARK OF EXCELLENCE

Wide-Track



Pontiacs





## Quest for birds in high Bhutan

“SOME SHONE bright as jewels, but all seemed elusive as rainbows.” Thus Professor S. Dillon Ripley, Secretary of the Smithsonian Institution, describes the quarry he sought in the remote Himalayan kingdom of Bhutan. The ornithologist here sets a mist net to catch specimens in a tangled rain forest. One prize, the Assam roller (above), earned its name from the flying loops it performs during mating season.

Professor Ripley's account of his unusual journey will appear in a future *GEOGRAPHIC*. Simply by nominating your friends for membership on the form below, you can enable them to share such adventures.



### NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

CLICK  
ONE

Mail to: The Secretary, National Geographic Society  
Washington, D. C. 20036

**\$6<sup>50</sup> CALENDAR YEAR 1968 MEMBERSHIP DUES INCLUDE  
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Life membership for U.S. and its outlying areas, \$200 U.S. funds or equivalent; for Canada, \$216 Canadian funds (\$200 U.S. acceptable); for all other countries, \$250 U.S. funds or equivalent. Remittances should be sent direct to National Geographic Society.

1967

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 signed:

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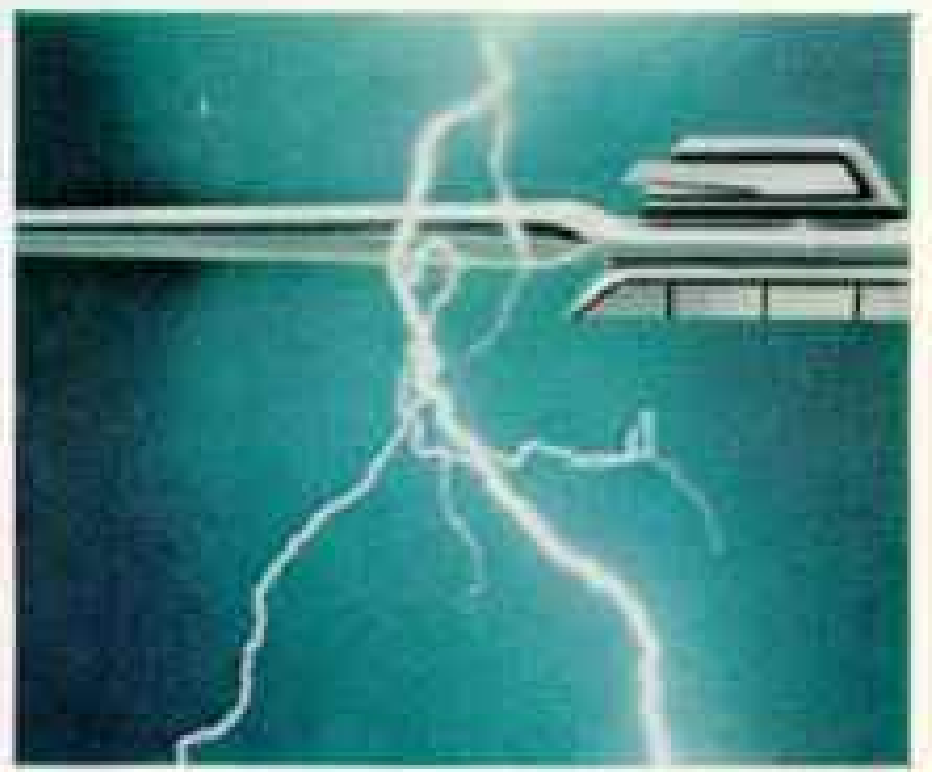
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New and bound to create a storm: 429 exciting cubic inches of new Thunder Jet V-8. More power than ever for the Bird, available now to people who can't wait to escape the ordinary. What else? A dazzling range of options, everything from Automatic Climate Control to AM/FM Stereo Radio (with lots of great etcetera in between!) Even the Bird has never been this well-built before! Up, up, and away!

# New thunder



1968 Thunderbird Hardtop

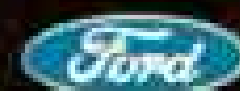


Any way you want to fly this year, the Bird is there, one step ahead. Standard this year: Flight Bench Seats, which mean 6 people can fly in total comfort. (A new engineering achievement gives the man in the middle unprecedented leg room.) You prefer buckets? You may have them. And 4 doors. Or 2 doors, if you wish. Don't wait. Fly Thunderbird . . . Unique in all the world.

from the bird.



1968 Thunderbird Four-Door Landau



# The only short-range jet with big-jet comfort.



That's the Boeing 737's big plus for passengers.

The new 737 is the smallest member of the Boeing family of jetliners. Yet it's as wide and roomy as the big 707 Intercontinentals. It's the only airliner that can bring passengers on short-range routes the same wide-cabin comfort travelers enjoy aboard transcontinental and over-ocean flights.

Equally important, the new 737 inherits all the benefits of Boeing's unmatched experience as builder of the world's most successful jetliners.

Newest, most advanced short-haul jet in the world, the 737 is currently undergoing an intensive flight test program. Pilots describe it as a delight to fly. The 737 takes

off quickly, quietly. It cruises at 580 miles an hour, and carries up to 113 passengers.

The superb new Boeing 737 goes into service early next year. It has already been ordered by: Avianca, Braathens, Britannia, Canadian Pacific, Irish, Lake Central, Lufthansa, Malaysia-Singapore, Mexicana, NAC-New Zealand, Nordair, Northern Consolidated, PSA, Pacific, Pacific Western, Piedmont, South African, United, Western, Wien Air Alaska.

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## Why Texans fought to give away their Treasure Island.



Padre Island is still giving up buried treasure from

Spanish Galleons. But its real treasure is its worth as a natural recreation area, to draw visitors and vacationers from all over the country. Texans were always pretty well agreed on that. What they disagreed on was how to go about it. The Great State chose up two sides.

One side wanted free enterprise with no fences. They promised that the island, all 117 miles of it, would be developed in a sort of commercial way, and wind up like some of the large resort cities. The opposing side said no, that idea would only build an overgrown seaside amusement park. This group believed that part of the island, at least, should remain natural and undeveloped;

that its big stretches of white sand, its exotic vegetation and its flourishing marine life should be preserved in its natural state for everybody, including future generations. The only way to carry out this plan was

to have Padre Island made a National Seashore.

Both sides went along fairly nip and tuck until Texas' Senator Yarborough succeeded in getting Washington to agree to its part in the National Seashore. This put more fight into the opponents back in Texas, who proposed that Padre should become a State, not a National Park, leaving about half of the Island out of the plan.

But Governor Connally had promised Texas a National Seashore, and he stuck by his guns. Support rallied. A newspaper, the Corpus Christi Caller-Times, carried the cause right into South Texas, the hotbed of opposition. Largely through the work of newspaperman Ed Harte, and a committee of private citizens in Corpus Christi, the tide finally turned. Now

America has a beautiful new National Seashore. The biggest yet!

Texans are proud to have you come and enjoy the near-tropic sun, the swimming, the surf-casting for man-size lunkers. You're even welcome to poke



around for bits of Spanish treasure. (The fun is yours, but any treasure goes to the government!)

What's true in Texas is true all over. Officials want and need the help of private citizens like Ed Harte and his neighbors. *This is why Sinclair, which has long been dedicated to conserving natural resources, encourages people to take an active part in preserving our natural heritage.* For a booklet describing what others have done and how you can help, write Sinclair Tour Bureau, 600 Fifth Avenue, New York, N.Y. 10020. Also include your request for information about touring any scenic landmarks you may wish to visit.



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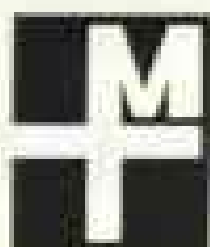
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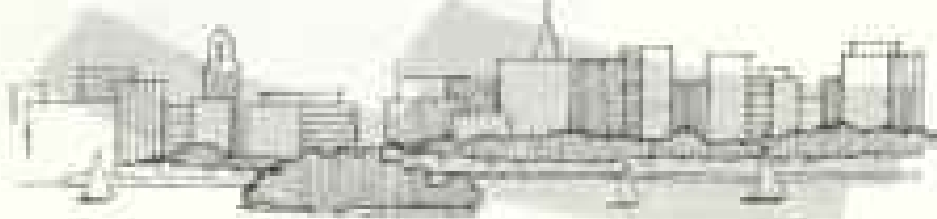
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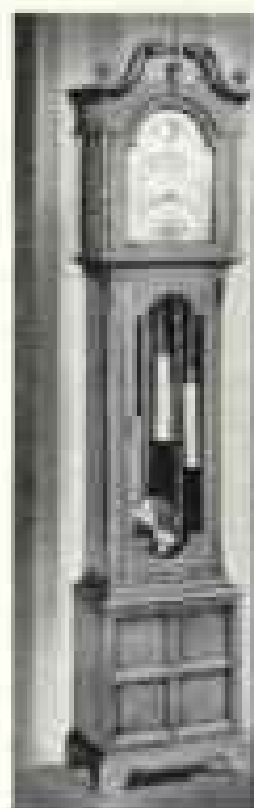


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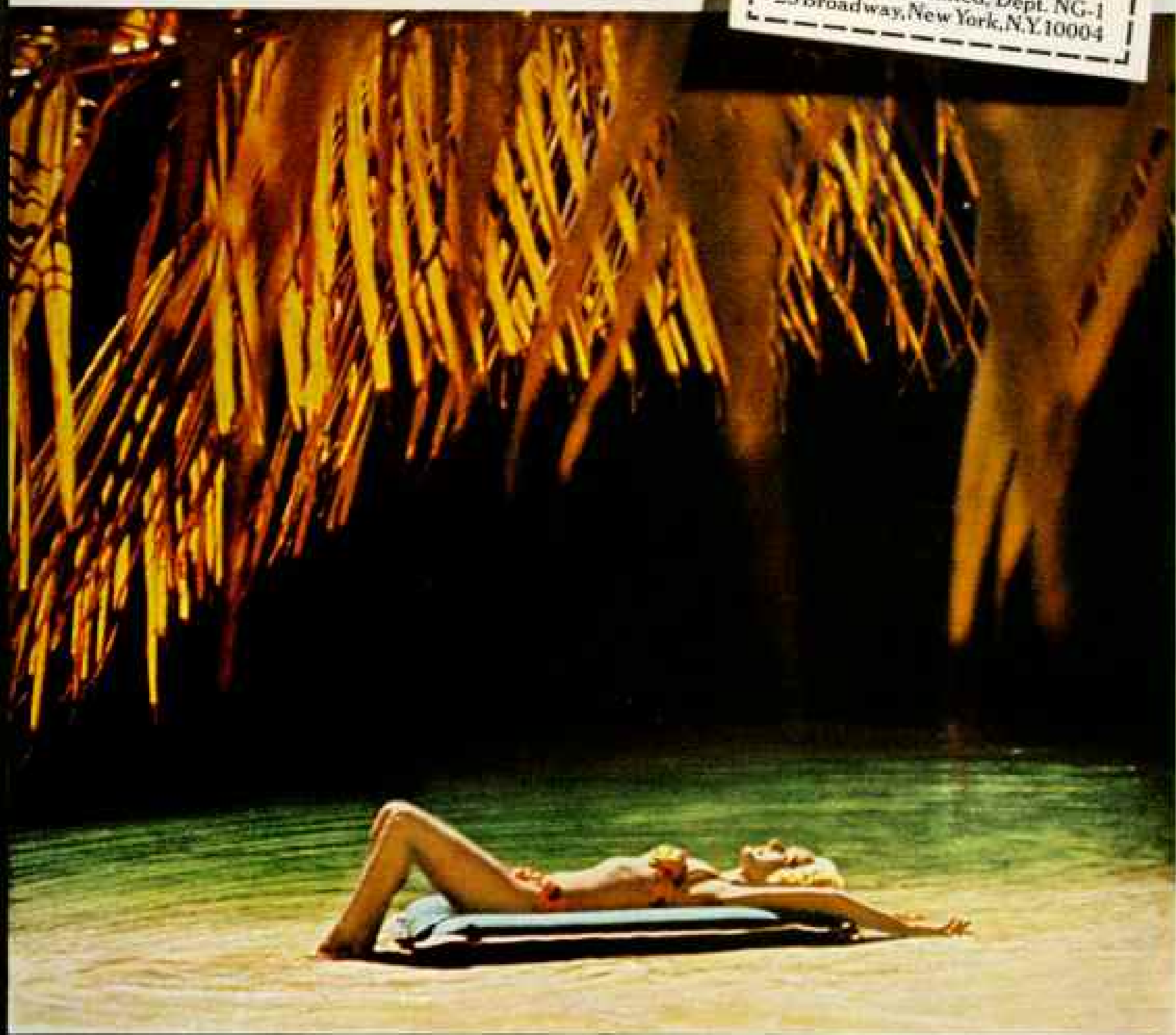
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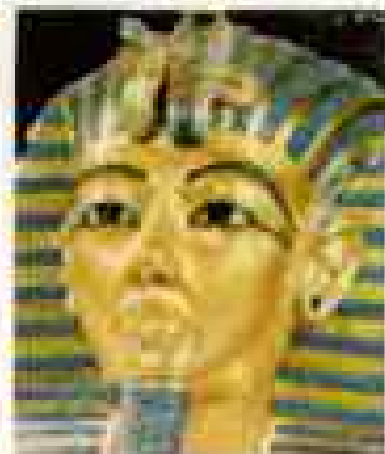
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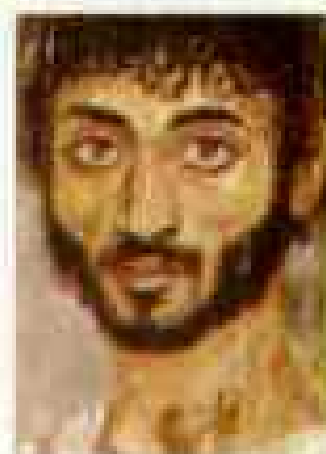
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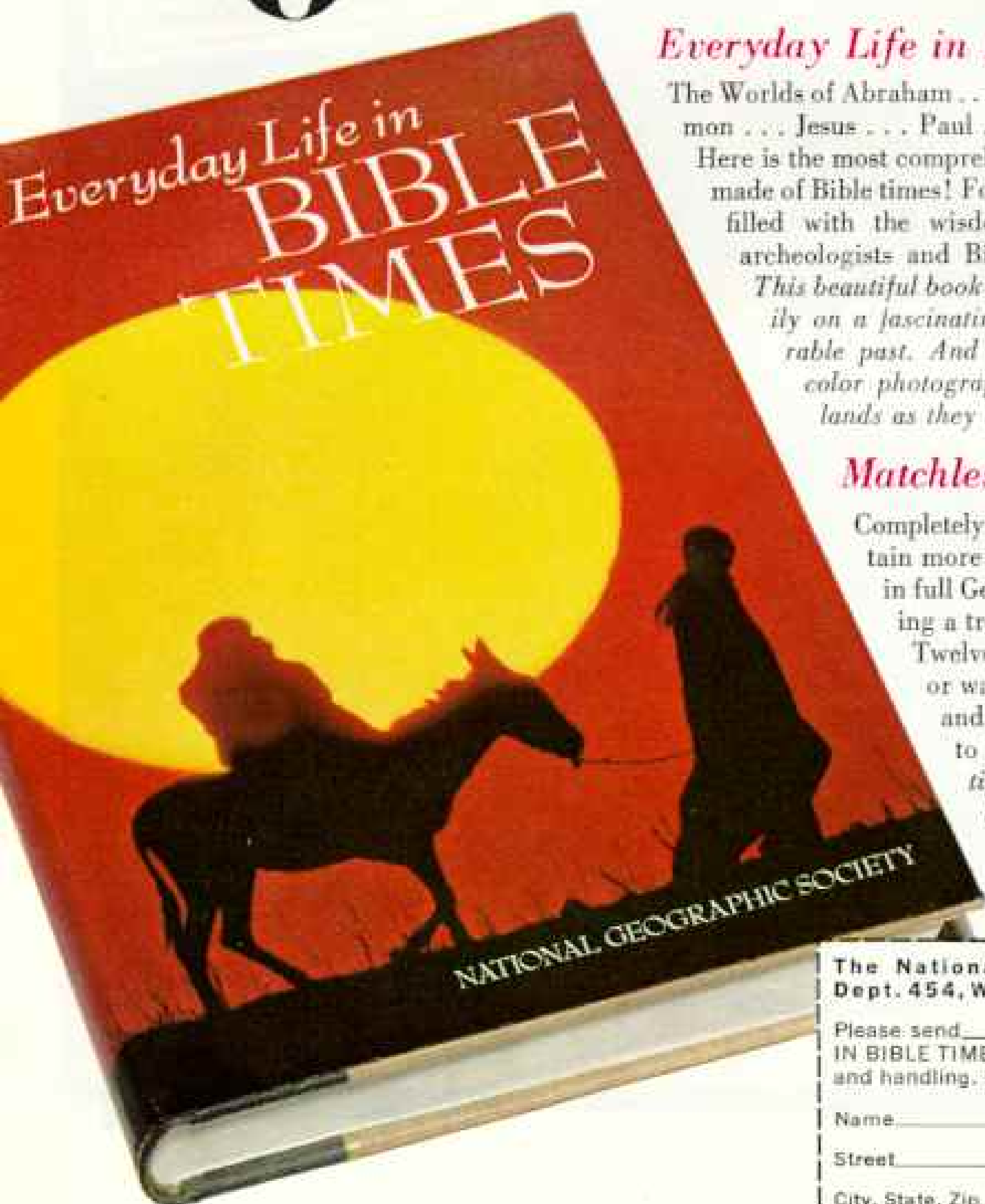
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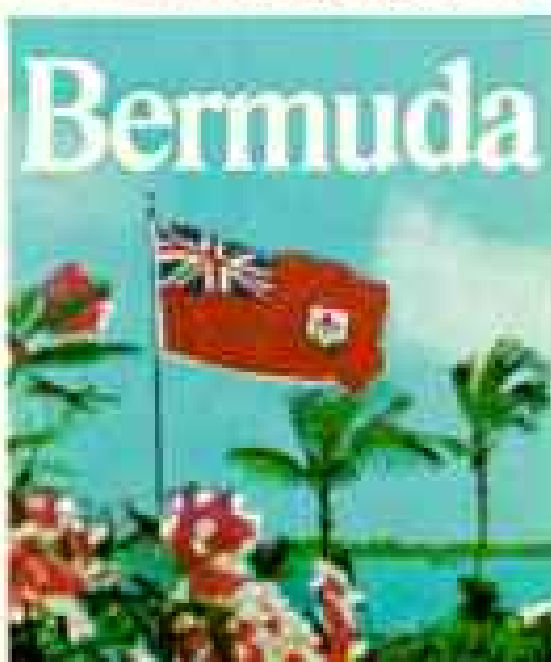
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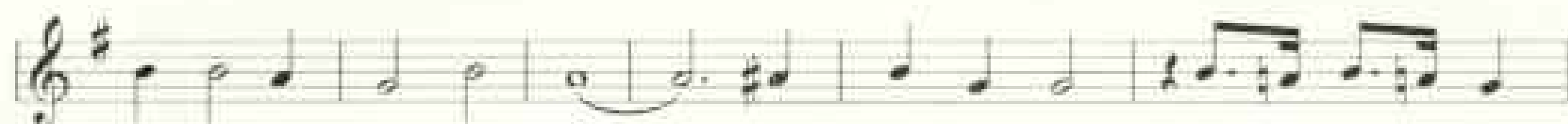


## Take Me Along

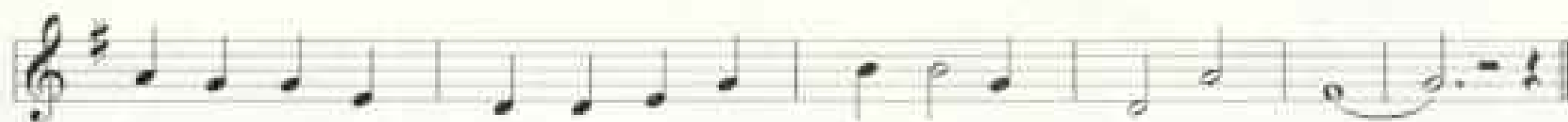
From the Broadway musical "Take Me Along"



*"Take me a - long if you love - a - me. Take me a - long if you love - a - me.*



*Take me a - long with you—. My heart will ride, sweet 'n glo - ri - ous*



*high a - bove the throng if you will Take me a - long with you—."*

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Vitamin B <sub>6</sub> (1.2 mg.)	*
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