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THE NATIONAL GEOGRAPHIC MAGAZINE

On Australia's Coral Ramparts

An American Naturalist Explores the Wonders of the Great Barrier Reef and Meets Its Denizens—Some Friendly, Some Not, but All Fascinating

BY PAUL A. ZAHL, PH.D.

With Illustrations from Photographs by the Author

WE had never expected to find waterfalls on a coral reef. But there they were, only a few steps from where we stood, a series of beautiful cascades plunging seaward off the reef's outer edge. With each incoming swell the falls would vanish, only to reappear as the sea drew back.

There was enchantment, not just in the spectacle of the sea tumbling into itself but also in the rich, vast acreage of coral formations over which we had cautiously made our way to the edge of the tide-exposed reef, and upon which we were now precariously balanced (page 14).

At our feet and extending to the far horizon lay a fabulous platform of fingers, platters, fans, and clumps—living corals glowing in every wave length of the spectrum. We were on the Great Barrier Reef of Australia, mightiest coral structure on earth.*

Beauties Lost on Captain Cook

I doubt that our enthusiasm was shared by the reef's discoverer. He was the great British navigator Capt. James Cook, and the first that he—or the world—knew of its existence was a splintering crash as his bark H.M.S. *Endeavour* smashed into a submerged coral reef near what is now Cooktown on a dark June night in 1770.

Good seamanship and a quick patching afloat enabled the crew to beach the ship, where she was repaired. Neither then nor later, as he sailed past "most terrible surf" and through "Islands and shoals," was Captain Cook in a mood to appreciate the beauties of any reef.

Today lighthouses and marker buoys show ships the way through those hazardous waters. Planes wing above the marbled shallows and myriad island dots. Australians from Melbourne and Sydney, fleeing the south's wintry cold, come to resorts on a few of the more accessible isles. In increasing numbers, skin divers with Aqualungs, spear guns, and underwater cameras drift among spectacular coral gardens.

Tiny Polyps Built 1,250-mile Reef

But this 1,250-mile-long labyrinth is far too vast to have been appreciably affected by such human encroachment (map, page 7). Untold miles of sandy shore have yet to feel the imprint of a Crusoe's foot, and a million coral grottoes have never been disturbed by diving men.

Five hundred of the reef's cays and islands are still unpeopled. Some seem as little touched by man as when God, through the miracle of countless trillions of limestone-depositing sea organisms, began the reef's unending creation. On others—well off the

* See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Where Nature Runs Riot," by T. C. Roughley, June, 1940; and "Great Barrier Reef and Its Isles," by Charles Barrett, September, 1930.

← Low Tide on Australia's Barrier Reef Drops the *Snow Goose* and Reveals a Profusion of Sea Life

A loose chain of shoals, reefs, and islands along Australia's northeast coast forms the Great Barrier Reef, world's largest coral structure.

One of the planet's most extraordinary natural wonders, the Barrier is little known and not commonly visited. The author and his wife, working under the auspices of the National Geographic Society, spent five months of 1955 studying and photographing the reef's formations and teeming marine life.

Here, shin-deep on a sand flat at the beginning of Heron Island's reef, Eda Zahl examines a live bailer shell picked up by E. M. Grant, Queensland State Marine Biologist.

The *Snow Goose*, auxiliary sloop used by the author, careens as the tide ebbs. The distant hulk was deliberately sunk on the reef in the hope that currents eddying around it would create a channel to the island. Today it shelters nesting sea birds. Pages 10-11 show the over-all view.

↓ Native sailors for ages have used the bailer shell, *Cymbium amphora*, to bail out canoes. *Cymbium* can spread its foot twice the shell's diameter when snailing along under the sand. Disturbed, the mollusk withdraws into its house (foreground).

3

← Big Coral Dish Makes a Sandy Wading Pool

Coral, the aggregation of limy skeletons of untold numbers of tiny sea animals, takes a multitude of forms. Formations grow upward as each new generation adds a tiny layer to the deposits of past ages. When they reach low-tide level, they may begin to spread horizontally, forming an ever-widening structure with a living edge, as in this Porites formation off Heron Island. Eroded interior leaves a ring that captures the water of each outgoing tide.

Because the visible reef is essentially flat, it never drains completely dry between tides. Here all but the tops of the coral heads are still submerged.

Ten-year-old Virginia Hasting became the Zahls' constant guide and companion on Heron.

brochured paths and seldom visited by city folk—live native islanders who know the reef only as a source of pearl shell and trochus, of bêche-de-mer and fish, of turtle and dugong.

The reef is the world's most extensive hunting ground for the coral fancier, the shell collector, the underwater explorer, and the student of marine biology.

My wife Eda and I fall into the last category. For nearly ten years we have been studying and photographing in color the infinitely varied inhabitants of the sea—in the Gulf Stream off Florida, in the Mediterranean's Strait of Messina, and in the tide pools of the New England coast.*

Always the Great Barrier Reef had beckoned as the habitat of the widest variety of marine life found anywhere. The National Geographic lent its assistance, and one day a little more than a year ago we closed the shutters of our New York City apartment and set out by plane for the fabulous coral realm on the other side of the globe.

Adventures Start at Heron Island

In Brisbane we consulted members of the Great Barrier Reef Committee, an academic group that advises on scientific and technical matters relating to the reef.

"Mast Head, Wilson, Lady Musgrave, Green, Low—any of these islands would interest you," mused E. M. Grant, Secretary of the Committee, "but I would suggest Heron as the place to start."

He explained that few of the reef's islands have more perfect coral formations or a greater diversity of sea life than this tiny heap of sand and coral lying almost on the Tropic of Capricorn, about fifty miles off the Queensland coast. Heron Island's fringing reef would in many ways be representative of the entire Great Barrier.

"Besides, there are some facilities on Heron which might be useful," Mr. Grant continued. "We are setting up a marine station there. I'm sure that our man, Eric Hasting, will be glad of your company.

"Don't expect too much," he added, noting my enthusiastic reaction. "There is no electricity yet, and no running sea water for keeping specimens alive. Kerosene lanterns are our present source of light; there is rain water for drinking. As for bathing, the sea is the best we can offer now."

His smile vanished as he added a warning: "But do not swim on a rising tide—sharks, you know. That's when the big hungry ones come into the reef shallows to feed."

Nevertheless, it sounded fascinating. Heron Island of the Capricorn Group would be our introduction to the Great Barrier Reef.

Thus one day in mid-September we boarded the sixty-foot open-deck *Capre* and headed out to sea from the little harbor town of Gladstone, 270 miles north of Brisbane. It was about noon, and our course lay northeast.

By five o'clock we had crossed the Tropic of Capricorn into the Torrid Zone, had sighted half a dozen whales on their annual migration north, and, hanging over the prow of the *Capre*, had watched two porpoises testing their speed against that of the ship. The gray of Gladstone harbor had early given way to the clean, clear, deep-blue water of the Coral Sea.

Nearly at sundown, the skipper, pointing to a line of sand and low foliage rising on the eastern horizon, announced: "That's Heron!"

Had we been in a low-flying aircraft instead of in a surface vessel, Heron Island would have materialized as a flat oval of some fifty acres encircled by a majestic beach and covered by a dense matting of Pisonia trees and pandanus. Ringing the island would have appeared a crystalline expanse of coral-mottled shallows at whose scalloped edges a white surf fumed (pages 10-11).

We started shoreward in a dinghy and then, in the manner of buccaneers, pants legs rolled high or skirts drawn up, we waded through the remaining several hundred yards of shallows. My eyes opened wide as we splashed

* See, in the National Geographic Magazine: "Night Life in the Gulf Stream," March, 1954; "Fishing in the Whirlpool of Charybdis," November, 1953; and "Glass Menageries of the Sea," June, 1955; all by Paul A. Zahl.

Page 5

Collectors Upend a Coral "Bush" and Find a Tiger Cowrie →

Hands gloved against the sharp coral, James Lynch (left), a Sydney businessman, holds an intricately branched coral, while Ted Johnston seizes the prized mollusk. He uses his knife for prying and cleaning. An underwater viewing tube lies at left.

Branching corals, chiefly staghorn, fill the foreground. The delicate pinks and purples depend in large part on the presence of minute plants—algae—in the tissues of the coral polyps. Colors fluctuate from hour to hour, depending on the coral tentacles' being exposed or withdrawn (page 6). So evanescent are these hues that a fairyland of soft color at close range seems a drab wasteland a few feet distant.

among half-exposed patches of vivid purple coral, side-stepped chartreuse-tinted sea cucumbers, and avoided open, brightly mantled valves of clams the size of large cantaloupes.

In all there were some twenty disembarking passengers, for Heron Island is not only the site of an incipient marine biology station but also something of a tourist mecca.

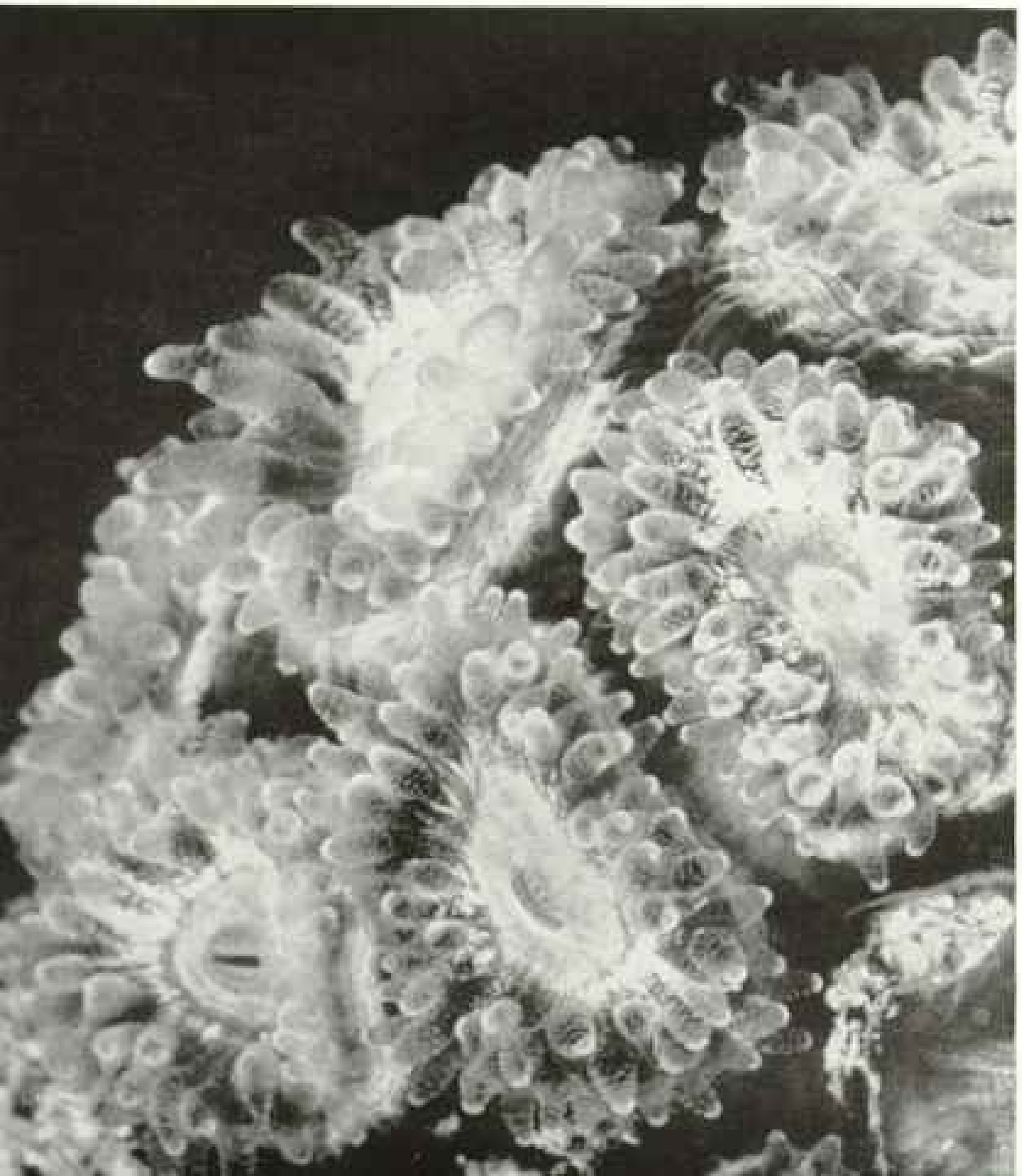
Welcomed to "Virginia's Island"

The other arrivals made for a row of small beach cabins on the north side of the island. We were welcomed by the irresistible smile of a pert little Aussie lass, who led us in the opposite direction. She was Virginia, ten-year-old daughter of Eric and Glenice Hasting, sole residents of Heron save for the Poulsons who ran the tourist establishment. Their bungalow, with one wall made of glass louvers, enjoys a marvelous view over the reef to the southwest. We were to eat at Mrs. Hasting's table and sleep on cots in the laboratory.

During six weeks on Heron Island, we saw not a single heron, though terns and shearwaters abounded. In retrospect, I prefer to think of it as Virginia's Island, for this golden-haired youngster—perhaps a bit lonely—joined us almost every day in patrolling the island's soft beaches, snorkeling and diving in the transparent waters, exploring the reef, and wandering through the luxuriant jungle of Pisonia trees (pages 2 and 38).

Virginia Hasting knew the secrets of Heron Island. In early evening she would sometimes take us to a sand bluff overlooking the sea and point out the Southern Cross lying on its side near the horizon; later she would sit with us on the darkened beach, hoping to sight the outlines of a giant turtle coming ashore to lay its eggs in the sand.

But this was September, and the loggerheads and greens were not due until late October; so after watching for perhaps half an hour, seeing the black shapes of sharks and rays but no turtles, we would get up and chase ghost crabs along the beach with an electric torch. Caught in the beam of light, they would skitter to the water's edge and vanish by digging themselves into the wet sand.



Petal-like Tentacles of Coral Polyps Reach for Food

Coral lives in all seas, even as far north as Norway's fjords, but the reef-building varieties thrive in tropic shallows.

These primitive animals, long mistaken for plants, are cousins of the jellyfish. Corals are free-swimming only as embryos. Early in life the tube-like polyps imprison themselves in limestone castles secreted, as a rule, on their ancestors' skeletons.

Ultimately the coral catacombs are cemented into dense masses by rock-hard coralline algae (page 8).

These cups, magnified five diameters, are the building stones of the reef. Others like them have erected enormous atolls.

By day most corals shrink into their stone houses. At night, when the tide is up, they extend tentacles to catch and poison plankton and carry it to their mouths.

Each day, usually under a sky of brilliant blue and a sun of incandescent white, Eda, Virginia, and I went "fossicking"—as Australians call searching the reef—and photographing a wide variety of its inhabitants.

These daily expeditions involved the transfer of needed gear from our lab workroom to places far out on Heron's reef. Field items included a crowbar for prying into hard coral, gloves for lifting stinging or other noxious creatures, a snorkel, face masks, both a surface and an underwater camera, tripod, buckets, jars, nets, and forceps. All these had to be carried in hand or knapsack over an obstacle course unique in the world.

By starting when the tide was well on its way out, we assured ourselves of a good two hours before rapidly rising water would drive us ashore again.

Always first to catch our eyes as we entered the coral belt, not more than fifty feet from the edge of the beach, were the colorful giant clams.

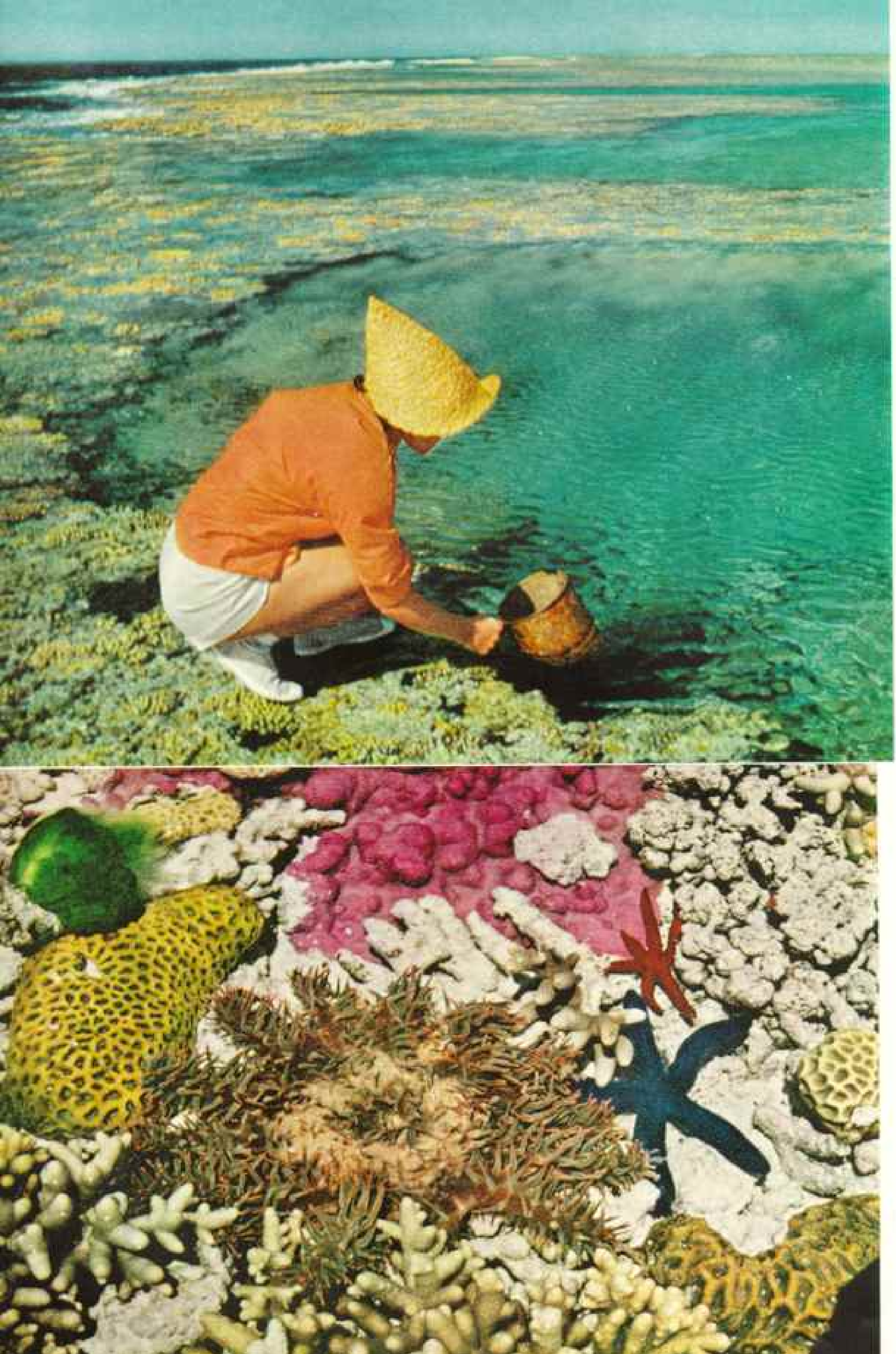
These were not the famous supergiant clams of the Great Barrier Reef's northern waters, where they may grow to be a yard or

(Continued on page 13)

Gilbert H. Emerson

Queensland's Submarine Buttress Stretches 1,250 Tide-swept Miles

Mainland and Barrier Reef enclose Australia's "Grand Canal," a shoal-studded lagoon. Captain Cook in 1770 blundered in but miraculously navigated H.M.S. *Endeavour* through uncharted channels.



Tide Pools Stain the Reef with Brilliant Green

A kaleidoscope of sea life flourishes in every pool. As the visitor watches through his glass-bottom bucket, gaudy coral fishes streak in and out of sheltering crevices. Tube worms lazily wave plumed gills like peacock fans. Bêche-de-mer and sea star, spiny urchin and cowrie cling to cavern walls or creep sluggishly along the bottom.

So utterly transparent is the water of this ten-foot-deep pool that the viewer imagines he could easily wade across.

A foaming line of surf (upper left) marks the reef's edge, here nearly a mile from Heron's shore.

←Page 8, below: Nature becomes its most bizarre in a coral tide pool, where animals resemble plants and plants take on the aspect of stone.

Here amid a bed of staghorn corals lie a clump of green algae, a tiger-colored lump of coral, a many-rayed sea star armed with spines, and red and blue sea stars (¼ natural size). Hard coralline algae splash the rock like lavender cement.

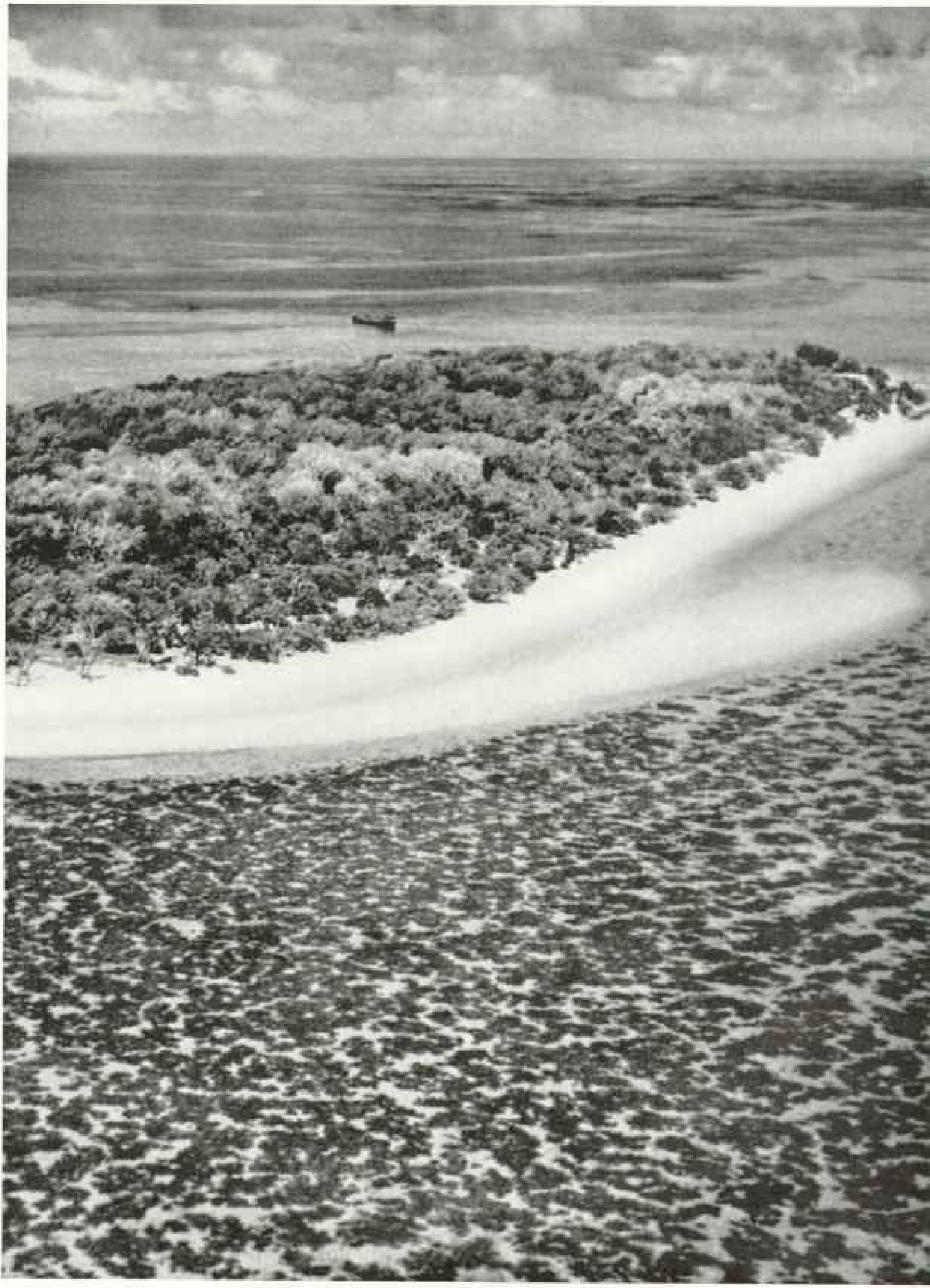
↓Searching the reef is known to Australians as "fossicking." These fossickers look for specimens off Heron.

Marbled Shallows ➔ Lay a Mosaic About Wooded Heron Island

Like an iceberg, most of the Great Barrier lies underwater. Only reefs and jungled heaps of coral sand betray the stupendous mountain of coral beneath. Borings on Heron have disclosed antique coral 450 feet thick.

The Barrier covers some 80,000 square miles (map, page 7). Twelve miles across at the narrowest, the platform extends about 150 miles at its widest point before plunging thousands of feet to the abyss. Between mainland and outer reef, the lagoon is cluttered with hundreds of islands and outcroppings, and threaded by tortuous channels. This waterway, seldom more than 150 feet deep, sits on top of the reef.

Most of the islands are uninhabited save by occasional pearlers, fishermen, and lighthouse keepers. Heron supports a marine laboratory and accommodations for holiday visitors. ➔ Blankets thrown over heads shut out the glaring sun as sightseers study Heron's reef through a glass-bottom boat.



more in length and hundreds of pounds in weight; such giants are not found in the Barrier's southern waters. Clams of the genus *Tridacna* seen on the Heron reef range up to the size of an American football and are so abundant that if one were to count all he saw during the course of an hour's fossicking, the figure might run into hundreds.

Clams Blaze in Brilliant Hues

But what the tridacnids here lacked in size, they made up for in color. With "mouth" and mantle facing upwards and with the hinge and base of jagged valves half or wholly embedded in the coral, each clam sits on the reef in a fixed position.

At low tide many protrude above water, their valves shut and all their tissues withdrawn into the locked interior. Thus closed they display no color whatever.

But when observed through several inches of the reef's window-clear water, valves gaping and mantle tissues exposed, they are one of nature's loveliest sights and a dye mixer's dream. No two are the same. The mantle of one will be electric blue, another just as intensely green, or yellow, mauve, or orange, with these colors in infinite combination, and mottled, striped, and speckled in every conceivable design (page 15).

Although clams have no eyes like those of the vertebrates, they do have light-sensitive organs that can detect the moving shadow of a man. As we made our way across the reef we frequently heard the sound of alarmed clams snapping shut, their action so rapid that water from their siphons often shot several feet into the air.

If we stood very still for a few seconds after such a demonstration, we were rewarded by seeing the clam slowly opening again, its gorgeous mantle creeping out over the toothed edges of the valves.

Adding to the scene set by the brilliant clam mantles were colors of a different order—those of the coral, perhaps more subdued but covering as wide a range as the flowers and vegetables in a spring garden.

There are numerous species of reef-building coral, and each one may assume a variety of hues and forms—from a forest of bristling staghorns acres in extent to a bed of sprouting asparagus.

Page 12

← Stonefish's Arsenal of Terror: Loathsome Face and Lethal Sting

Amid the delicate loveliness of the reef lurk several of the world's most fearsome hazards. As venomous as a cobra is the stonefish (page 16).

Rarely does the visitor see a stonefish, for it lies motionless in the sand, a perfect counterpart of a piece of weathered coral. If prodded, it moves sluggishly. But should an unwary wader step on the fish, thirteen needle-sharp spines bristle erect to inject virulent poison. The victim suffers immediate and unspeakable agony; he may become demented from pain. Death can easily follow.

Warty skin, which sheaths the bluish spines even when erect, has been pushed back in this view. The eyes, hard to spot among the many folds and excrescences, are dark dots beneath the pearl-like knobs (magnified 2½ times).

→ The author saw two stonefish during five months on the reef; other scientists on longer stays have never spotted one.

Dr. Zahl displays one of his finds still alive. Mounted, it now glowers from a shelf in his New York home.

Water, Rushing to Catch the Tide, Cascades from the Reef's Outer Edge

These visitors gather coral on Wistari, one of the reefs where the Queensland government permits collecting. Tide is unusually low; the author was able to land here only twice in six weeks. Waterfalls along the entire reef edge fill the air with continuous roar. A ten-foot coral boulder (extreme upper right), washed up by storm, breaks the flat monotony. The Tropic of Capricorn cuts between Wistari and wooded Heron Island (center).

15

Clam's Emerald Mantle Suggests Writhing Snakes

Cantaloupe-sized clams litter the reef, their open valves exposing brilliant tissues, their siphons sucking in currents of food-filled water. When intruders approach, the shells clap shut and waterspouts may shoot several feet into the air.

Another species may appear as an enormous purple-fringed disk lying flat on the bottom, elsewhere as a head of cauliflower or an incrustation of cabbage. Other corals resemble the convolutions of the human brain, the underside of a mushroom, the pipes of an organ, or a dainty gathering of lace.

Diversity of form within the same species reflects the varying physical conditions of the tide-washed environment. The crashing surf at the outer edge of the reef encourages corals to grow into forms of tremendous mechanical strength. The quiet of deep waters or protected pools stimulates delicate growth. Corals living on the walls of channels are modeled by yet other forces.

Fringed Polyps Resemble Flowers

Here and there we saw tentacle-fringed polyps—the true coral animals—each like a minute flower blossom. Their primary food is microscopic plankton, captured by myriad stinging cells that line the delicate tentacles (page 6).*

The masses of coral we were observing were built up by infinite numbers of polyps, each one living in its own tiny limestone chamber and continually adding to it.

Soft corals, most of which differ from the hard variety in their lack of a limestone exterior and in details of anatomy, grow chiefly in the more placid waters. Found throughout the reef's shallows, soft corals are of leathery texture, slimy to the touch, usually somber in color, and often of great size.

Another type of "coral" comprises the lime-forming algae, which are especially noticeable on the slightly elevated "pavement" near the edge of the reef. These are usually of some pink or rose hue and, although hard as rock, give the impression of having been poured like gravy into cracks and crevices and over the surfaces of old or dead coral.

At the time of the very lowest spring tides, Heron reef appears as acre upon acre of high-and-dry coral—some living and some the dead limestone remains—suggestive of a plowed field, rather desolate and a bit forbidding.

The farther out from the beach one presses, the larger and denser become the coral areas, and the more difficult it is to gain a foothold, until at last the growth fuses to form a more or less continuous crust, labyrinthed underneath, but nevertheless solid enough to walk upon. However, one must ever be mindful that coral is slippery and fragile, aware also of holes and crevices.

In Brisbane I had talked with a well-known Australian ichthyologist who, on this very reef, had gone through the crust, painfully lacerating one leg nearly to the hip. All official advice had been never to walk offshore without heavy shin-high rubber boots and puttees or leggings reaching to the knees.

Agile Girl Braves Reef's Dangers

Thus I suppose I should have considered more seriously the matter of taking a ten-year-old child half a mile out on a remote Pacific reef where any misstep on the brittle and abrasive coral could have been serious.

Yet, day after day, Virginia—with bare legs and nothing on her feet but a pair of thin tennis sneakers—bounded from one coral lump to the next with a most dainty indifference not only to the coral's sharp edges but to the deadly stonefish or the stinging cone shell and the sea wasp. Even my wife, instead of honoring my example in the use of protective armor, chose to follow Virginia's precedent (page 19).

The ladies' impressively practical argument was that the lighter the footwear the less encumbered the fossicker and the more adroitly she could negotiate the reef. During the weeks of day-in, day-out reef work on Heron Island, none of us ever had even the slightest fall or mishap. The issue of armor versus grace, therefore, stands unresolved, at least in our experience.

Deadly Stonefish Lies in Wait

As to what one *may* encounter on the reef:

The stonefish, a member of the scorpion fish family, is one of the ugliest monstrosities on earth. Gnarled, wrinkled, and warted so as to resemble a piece of dead coral or a disintegrating stone, the creature lies motionless in reef sand or alongside fragments of coral. If a foot approaches, thirteen deadly, needle-sharp spines bristle vertically from the fish's back (pages 12, 13).

Each spine has a pair of poison sacs near its middle and two grooves through which toxic fluid passes upward when pressure is applied. A bare or a lightly clad foot, pierced from its own weight by these hypodermics,

(Continued on page 25)

* See "Strange Babies of the Sea [Plankton]," by Hilary B. Moore, National Geographic Magazine, July, 1952.

Shark's High Fin and Saw Teeth Lose Their Dread Prospect out of Water

More than 100 species of sharks frequent Australian waters; at least eight of them are considered man-eaters. Although the menace of these nearsighted, wary creatures is sometimes exaggerated, visitors to the reef are advised to stay out of the water during rising tide, when hungry sharks venture into the shallows to feed. This six-foot bronze whaler shark was caught off Heron Island on a rope-and-chain setline.

Shark teeth grow in rows, moving forward to replace those lost or damaged. This kingfisher, resting in a tiger shark's jaw hung up to dry, is a cousin of Australia's famed kookaburra, or laughing jackass bird.

Coral Lily Pads Block an Underwater Shot by the Photographer

Despite the apparent sturdiness of the coral pavement, it is often a treacherous ceiling for a labyrinth beneath. These fragile shelf corals cover a deep grotto. One careless step would send a man plunging through. Glass-sharp edges would inflict severe and slow-to-heal wounds. Dr. Zahl wears heavy rubber boots against stonefish and coral; his wife finds tennis shoes less cumbersome.

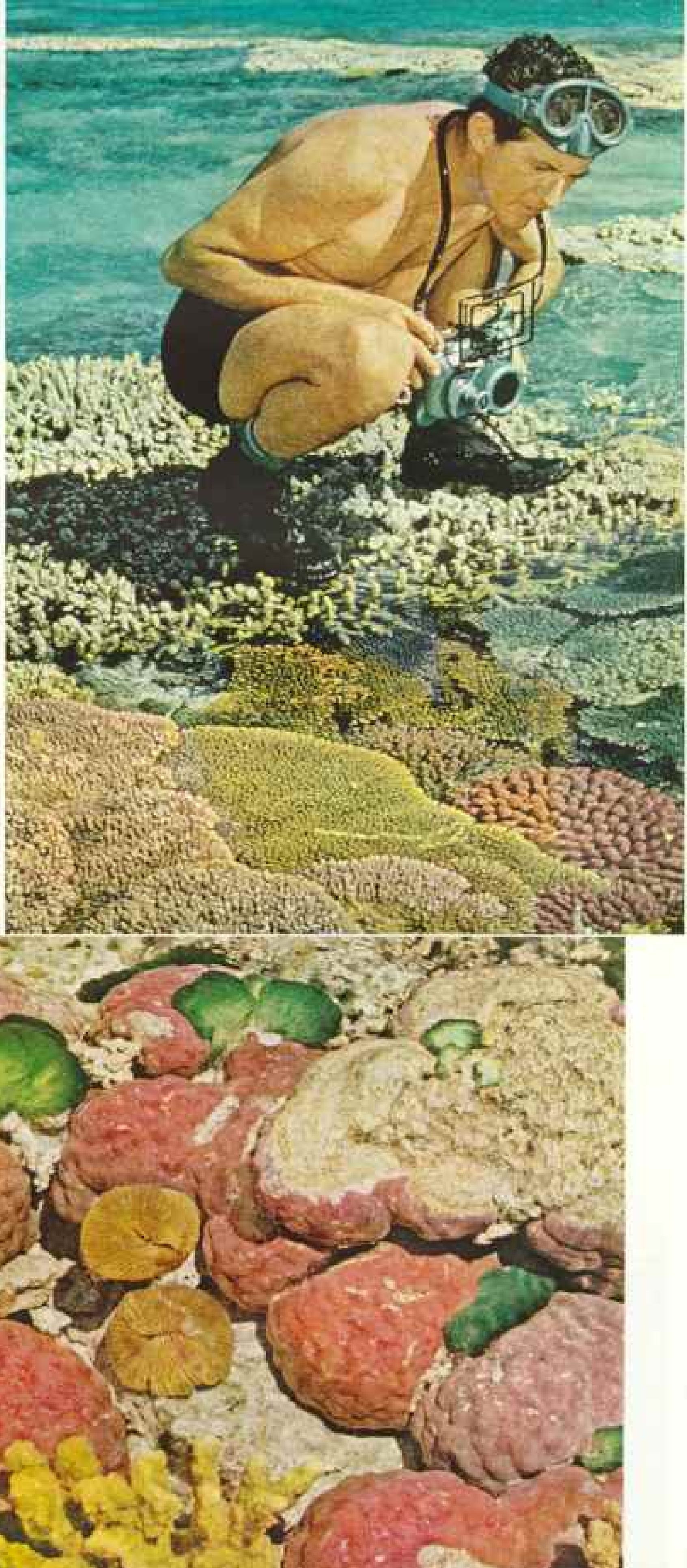
➔ Page 19, lower: Coral's diversity depends in part on its environment. Crashing surf encourages sturdy, massive structures. Protected waters permit branching formations like this lovely staghorn (½ natural size).

As a sculptor, the coral is slow but brilliant. Fastest growth is about eight inches a year.

↓ Coral Seems to Imitate Objects on Dry Land

Various species bear a striking resemblance to cauliflower, asparagus, cabbage, the human brain, dainty fans, and lace.

Intricate partitions of the mushroom corals (center) look like the underside of the fungus (⅛ natural size). Some corals are soft and leathery instead of stony.



↓ Pity the Diver Who Steps into Giant Clam's Stony Vise

This mollusk, the world's largest bivalve, inhabits the northern reef. What *Tridacna gigas* lacks in color it makes up in size. Known specimens measure four feet in length and weigh as much as 600 pounds.

Countless yarns along the coral coast recite the fate of divers imprisoned by giant clams, but firsthand evidence is scarce. The subject is a favorite with fiction writers.

Could a clam hold and drown a man? Dr. Zahl photographed this experiment off Green Island. An eighty-pound specimen, prodded while open, quickly closed its valves and held on to the pole even out of water.

20

↑ Marine Prospectors Search the Coral Shelf

More than 500 islands lie within the ramparts of the Barrier Reef. Most are true coral cays, like Green Island (shown), with a steep beach of dazzling white sand and a dense central jungle. Green Island lies some 600 miles north of the Tropic of Capricorn.

Porcupine of the Sea: → the Prickly Sea Urchin

Page 21: Most sea urchins wear armor densely covered with spines, but none is so well protected as *Diadema setosum*. Mrs. Zahl demonstrates what *not* to do: the needle-spined urchin's long thorns are exquisitely sharp and brittle, and at the slightest touch break off in the skin, causing a festering wound.

Two rusting mines recall World War II's naval battles in the Coral Sea, which washes the length of the reef.

↑ Star and Pincushion Are Cousins Under the Skin

Apparently dissimilar, these two varieties of starfishes are closely related. The bulky pincushion reveals on its underside (right) the same five rays characterizing most members of the class. A few starfishes have six, ten, or even fifty arms.

Tube Feet Protrude → From a Zipperlike Slot

Starfishes move with hundreds of suckered feet fixed in the grooves along each arm. Sea water pumped into the tubes stretches the feet forward. When the suckers take hold of some firm object, the feet contract by muscular action, and the star inches along.

Sharp, stubby projections covering this pincushion (magnified three times) give the skin a harsh feel and explain the starfish's scientific name—echinoderm (spiny skin).

← Fantastic Tide Pools Stretch to the Horizon

Page 22. A living star graces this pool on Heron Island. Coral heads stud the flat expanse.

↑ Hermit Crab Surveys the World from a Borrowed Shell

A crab in name only, the hermit carries his unarmored body in abandoned mollusk shells. This specimen lives in a smooth spider shell known as *Lambis lambis*. Australian aborigines hang household objects on the long spines (natural size).

↓ Cowrie Spreads a Red Mantle Across Porcelain-white Shell

No shells have been so widely used for trade and decoration as the brilliant cowries. Melward's cowrie (left) rests its foot on organ-pipe coral while the breathing tissues creep over its shell. Shy pustulose cowrie hides within its abode (magnified five times).

forces the poison to be injected. Agonizing pain and even death may result. We encountered only two stonefish during our stay on Heron, but in view of their effective camouflage they are no doubt more abundant here than this would imply.

Cone shells belong to the mollusk suborder Toxoglossa (poison-tongue). Many species of this group are found throughout tropical waters, and their spectacularly patterned shells are prized by collectors. The animal within, however, is extremely poisonous in some species (page 39). In 1935 a tourist fossicking on the Great Barrier Reef picked up a cone shell to examine it. The animal's venom-depositing stiletto pierced the palm, and within hours the man was dead. No experienced collector picks up a living cone shell without gloves or a pair of forceps.

Sea wasps, appearing seasonally, are jellyfish. They can be extremely dangerous. In 1938, off Darwin, Australia, a boy was stung by a sea wasp and died a few minutes later.

Hazards of this sort are ever-present on coral reefs throughout the South Pacific. But a little knowledge and some common sense protect most people who venture onto a reef, just as they safeguard those who cross a busy city street.

Tide Bares Pools of Liquid Beauty

As one nears Heron reef's outer edge, large and deep cavities are sometimes encountered. At low tide they remain full of trapped water and thus become crystalline pools of exquisite beauty. With their surfaces reflecting hues of green or turquoise, these pools are jewel cases for those most decorative of all reef dwellers, the coral fishes. Here swim damselfish, butterflies, wrasses, surgeons, and parrots, as well as a host of immature oceanic forms—flecks of color and dazzling design almost beyond belief.

Bêche-de-mer and sea stars are to be seen on the clean sand bottoms, and less conspicuous on the irregular sides are an infinite variety of clams, tube-building worms, cowries, urchins, sponges, crustaceans, tunicates. In such sun-warmed tide pools the kaleidoscope of life turns as perhaps in no other of nature's half acres (pages 8 and 22).

After more than an hour of carefully picking our way through this wonderland of bizarre form and glowing color, with stops here and there to collect or to photograph a particularly interesting scene or specimen, we would come to the edge of the outer fringe, fully exposed now and being pounded and washed intermittently by the mighty rollers of the sea.

Walking was relatively easy here. On the other hand, the peace and quiet of the inner reef area was replaced by the roar of the surf, with often the whistle of a stout wind and the sound of waterfalls.

We could not stay here long, for on such fringing reefs the tide may come in suddenly with astonishing force. Heron, as well as every other Barrier Reef island we later visited, has its gruesome tales of fossickers trapped by rising water. So we would turn in good time and make our way back to the beach as painstakingly as we had come.

Collectors Find Rare Cowrie

One day, far out in the shallows, we saw two men coming in our direction. We recognized them as acquaintances living at the island guesthouse. One was Ted Johnston, a picturesque Queenslander from Magnetic Island farther north and a professional shell collector who knew of Eda's growing interest in conchology. The other, also an avid collector, was James Lynch, a young Sydney businessman who periodically found freedom on Heron Island from big-city bustle.

Several times I had watched these two as they waded slowly through the shallows on the lookout for good cowrie terrain. Whenever they came upon a likely looking coral head, neither too big nor too firmly fixed to the bottom, they would stop, seize its under edge with gloved hands, and heave it over. There on the bottom side, the natural habitat of many cowrie species, they would search as with a fine-tooth comb (page 5).

"Eda," Johnston shouted in our direction, "I've got a beaut here to show you."

Soon, like football players in a huddle, we were poring over what Ted Johnston held in his cupped hand—a cowrie, to be sure, but a pure white one, like a bit of porcelain, not much larger than an almond kernel.

"*Melwardi*, one of the rarest cowries on the reef," Ted said.

As he turned this specimen of *Nivigena melwardi* over in his palm, we glimpsed the animal within, which had withdrawn almost completely. It was bright red.

Eda and Virginia had now discovered the bag of larger tiger cowries, castor-bean shells, volutes, augers, and others which the collec-

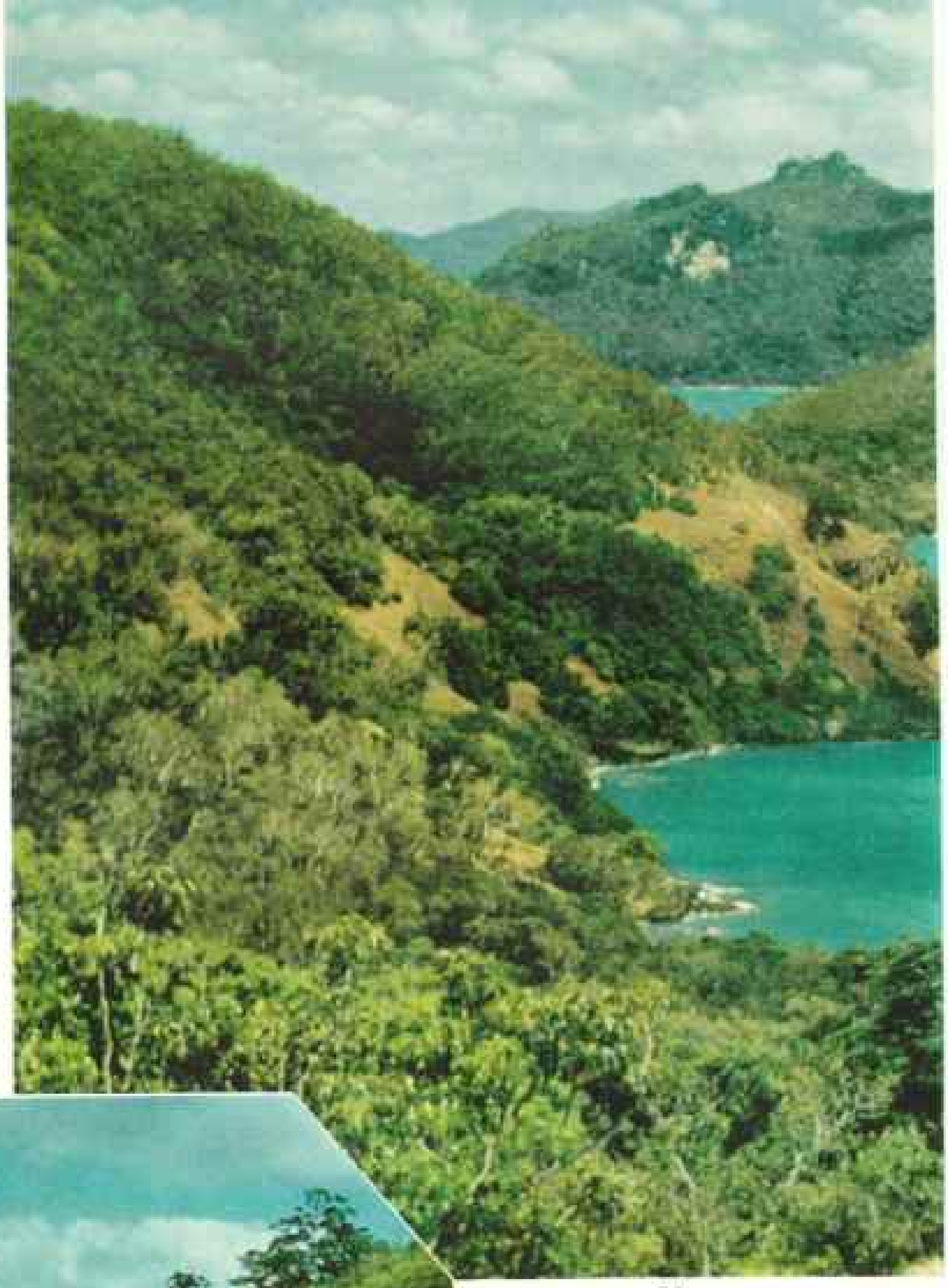
The Cumberland Islands: Robinson Crusoe Would Have Felt at Home Here

A subsiding sea bottom ages ago allowed the ocean to cut off a strip of the Queensland coast. The summits of this drowned coastal range today form a group of high granite islands, fringed with coral, that contrast sharply with the low cays made entirely of coral.

Wild vegetation and precipitous peaks, thrusting as much as 3,500 feet above the lagoon, provide some of Australia's finest scenery.

Pentecost Island, seen from this grassy slope on Lindeman Island, appears to crouch like the Sphinx of Giza. Both islands belong to the Cumberland group, discovered by Capt. James Cook in 1770.

Lindeman fits the average man's idea of the perfect tropical island, neither too large nor too small, with a jungle dotted with wild orchids, a fresh-water spring, a reef for turtling and fishing, and a pleasant guest-house. Goats were once released here by the government to feed possible castaways.



26

← An Australian Gathers a Galaxy of Sea Stars

Most starfishes are voracious carnivores, eating any small animal coming within reach of their arms. Often the echinoderm everts its stomach outside its body to envelop and digest a morsel.

This technique comes in handy when a starfish attacks an oyster or clam. Pulling with tiny feet on both sides of the shell, the starfish wearies the mollusk until its muscle relaxes. The inside-out stomach then enters the shell and dines on the flesh.

Protoreaster nodosus, the large red-and-black sea star shown here, spends winters deep in the barrier channel. In summer, when it migrates to tidal shores for spawning, it may be found in great numbers off Lindeman Island.

27

Salt-water Dragon ➔ Is a Man-eater

Of all the saurians infesting the streams of tropical Australia, the salt-water crocodile holds the evilest reputation. Fiercely aggressive, it will go out of its way to attack. Even if these monsters had not killed and eaten many men in Australia and the East Indies, their size and fearsome dentition would set them apart as objects of dread.

Crocodilus porosus is the bulkiest of living reptiles. Its maximum known length spans thirty-three feet.

This species lurks in estuaries, mangrove swamps, and coastal mud flats. It is often sighted far out at sea; sometimes it ventures well inland.

Lloyd Grigg holds this trophy of earlier hunting days.

tor carried tied to his belt. For their benefit, he emptied these, his afternoon's haul, onto a bared coral rock.*

"Ted," I ventured, while the others were examining these more or less routine specimens, "will you lend me that *mcheardi?* I'd like to put it in my laboratory aquarium. Maybe the red mantle will come out and I can photograph it."

Mr. Johnston placed his treasure in my hand.

Later that night we saw deep-red mantle tissue rise from the creature's under opening, slowly enveloping the sides and finally covering the entire surface of the shell. Then a red foot spread out underneath. Tiny eyes mounted on delicate stalks peered in all directions as the mollusk began moving about in exploration of its new aquarium environment (page 24).

What a difference between living shells and those found in the collector's cabinet! Or, as Emerson once observed:

I wiped away the weeds and foam,
I fetched my sea-born treasures home;
But the poor, unsightly, noisome things
Had left their beauty on the shore,
With the sun and the sand and the wild uproar.

Ernie Grant, with whom we had consulted in Brisbane, joined us on Heron Island during the last two weeks of our stay there. In addition to his position with the Great Barrier Reef Committee, he is Queensland State Marine Biologist.

Catching Parrot Fish Barehanded

For weeks before his arrival I had been trying with only a modicum of success to obtain specimens of various species of parrot fish often seen in the reef shallows. During our discussion of angling methods, Ernie said in what I thought was a humorous boast:

"Easiest way to catch parrots is with your bare hands."

My eyebrows went up. "All right," was his rejoinder, "come out on the reef this afternoon and I'll show you."

Three hours later we were knee-deep in the ebbing tide. Ernie peered into the distance toward somewhat deeper water. Abruptly he pointed: "There's a school. Now watch...."

He hurried toward the spot, explaining on the way that he aimed to drive the school from coral head to coral head, into ever shallower water, until the fish would practically expire from exhaustion.

"And how about you?" I asked.

"Oh, the parrots get tired long before I do," he replied.

Soon he was a hundred yards ahead of me, stepping high through the shallows and around coral patches. Whenever any of the fish, still invisible to me, would try to escape to deeper water, Ernie would yell and charge ahead in a wild effort to head them off.

At length I could see that he was gradually closing in. Suddenly he stopped near a large half-submerged coral head and beckoned to me.

As neatly as a man picking a blossom off a potted plant, Ernie reached down into a crevice of the coral and came out with a five-pound fish, so fatigued that it had hardly enough resistance left for a final flop. The fish was pink with mottlings of pale green, and its bony parrotlike "beak" was bright green. Needless to say, I was impressed by the specimen, but more so with the method by which it had been taken.

Sting Rays Lurk in Shallows

At dusk Ernie and I sometimes went to the east end of the island where sting rays, seen from the beach as dark and ominous patches, lay in the shallows feeding. He was studying the habits of these dangerous creatures and periodically needed to examine a series of sting rays for size and sex. His collecting equipment consisted of a conventional casting rod with a cluster of unbaited hooks at the end of the line.

With exquisite deftness he would cast and drop the hook cluster just beyond one of the black patches, give the line a quick jerk, and then wind the reel at maximum speed. He might have to play the snagged and furiously struggling ray for several minutes. But eventually the creature would be beached; Ernie would make his measurements and observations, then get ready for the next cast. The man was a real wizard with that line.

Sometimes on such ray-fishing expeditions Eda and Virginia came along. When the show was over, we would all return to the inhabited end of the island by following a short cut through the jungle of Pisonia and pandanus. This was indeed another world from that of beach or reef (page 47).

If it was after dark and we were using the electric torch, the gnarled white Pisonia

* See "Shells Take You Over World Horizons," by Rutherford Platt, National Geographic Magazine, July, 1949.

29

Baroque Pearls May Be Worth a Song or a Fortune

Thursday Island is a center of Australia's pearling grounds, which produce most of the world's mother-of-pearl (page 33). Gem pearls, by-product of the industry, are often irregular, or baroque, and comparatively worthless. However, the double Chalice Pearl (right and below) grows in value as its fame increases. Both halves of the gem were found in a single shell in 1949. Two rare black pearls stand out in the collection above.

30
Legions of Soldier Crabs, Each the Size of a Quarter, Deploy on Queensland Mudflats

trunks would suddenly have swaying arms and clutching fingers; and a high-pitched chittering of terns, nesting by the thousands in the trees of this oceanic jungle, would fill the soft night air.

Wedge-tailed shearwaters, locally called muttonbirds, appear on Heron late in October. Now, toward the end of our stay, they were momentarily expected. We had been aware of their existence, for often during our walks through the jungle the ground had collapsed, plunging us knee-deep into the sand.

Muttonbirds are burrowers and build their nests underground. So numerous and active are they from late October until they depart in April that 90 percent of Heron's central terrain is honeycombed and undermined as a result of their tunnelings.

Perhaps one of the most dramatic episodes of our Heron visit occurred only a few hours before our departure. We had often read and heard about the strange voices of muttonbirds but were unprepared for the reality.

The *Capre* was due to leave for the main-

31

If Frightened, They Vanish in the Muck

land at six in the morning, so we set our alarm for four-thirty. When that hour came, I jumped up from my cot, scared half out of my wits, not by the buzz of the alarm but by a most unearthly series of howls, groans, moans, and sighs in the near-by jungle.

The muttonbirds had chosen this very night for their annual arrival. The island had suddenly become one vast mournful moan. I knew that at dawn the birds would head out to sea for a day of feeding, and that for fourteen hours the island would be quiet. But with the coming of dusk, they would return for another night of digging, egg laying, and moaning. This goes on for six months out of every year on Heron.

"Lucky to be leaving," was Eric Hasting's comment as he helped us carry our luggage through the early morning darkness. "From now on every night it will be this way; those blasted birds could drive a man crazy with their everlasting noise."

Personally, we did not feel at all lucky to be leaving as we waded across the reef, hopped into a waiting dinghy, and were rowed away to where the *Capre* lay.

A day or two of reorganization on the mainland, and we were in a northbound Australian National Airways plane high above the Queensland coast, leaving Heron Island and the Tropic of Capricorn far behind. Out to sea we could occasionally discern dark patches —the outer Barrier's shoal labyrinth running parallel to our course. It would continue for more than a thousand miles.

Nearer the coast, here and there, were clusters of mainland islands, some of which we were to visit on our return journey. Directly below, in the vicinity of Mackay, Bowen, and then Townsville (all jumping-off ports for various reef islands), stretched vast fields of ripening sugar cane, an economic mainstay of north Queensland.

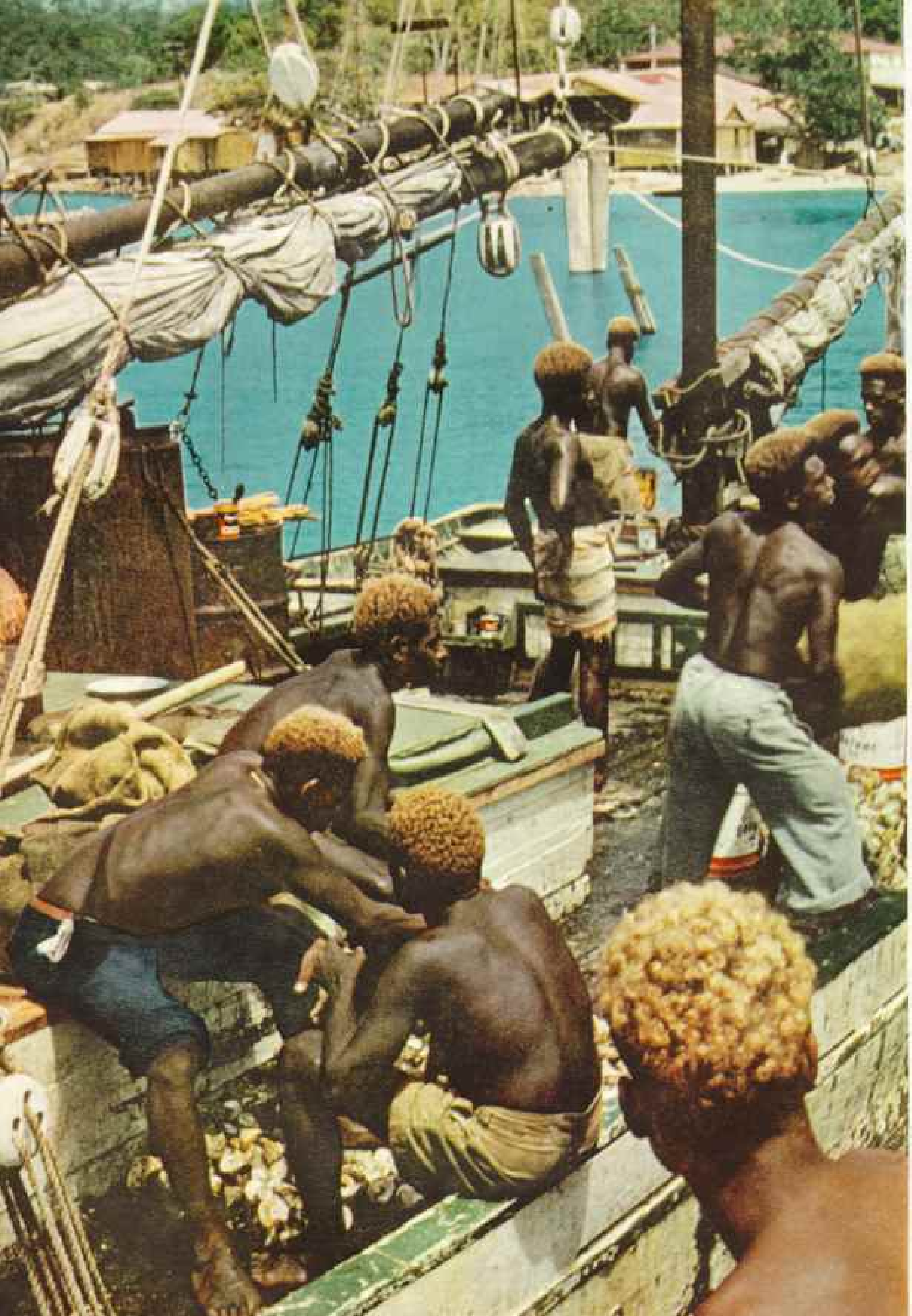
Crocodiles Go to Sea

As we passed over Innisfail and neared Cairns, the scene became as botanically profuse as anything I had ever seen. Here the world is smothered in an emerald blanket of creeper-covered jungle rated among the densest and wildest anywhere. In its gloomy and sweltering depths live giant pythons and countless other tropical creatures. And in mangrove estuaries, also visible from the plane, loll enormous man-eating crocodiles, as much at home in salt water as in fresh. They forage far out to sea, even beyond the outer reefs (page 27).

Yet for all this lush tropical setting, there was little evidence of the "steaming tropics" when we disembarked at Cairns, some 600 miles north of Heron Island. The air was temperate, and the people of this bustling port of 21,000 were anything but languorous. Here, off Cairns, the Barrier Reef comes almost within sight of the mainland.

Our immediate objective was Green Island, sixteen miles offshore, a forested coral cay discovered and named by Captain Cook.

(Continued on page 37)



Thursday Island Trochus Divers Bleach Hair Blond as the Badge of Their Trade

Crewmen of a lugger, home after six weeks of diving, unload shells at Port Kennedy. They killed the living mollusks at sea in boiling pots. Trochus shells yield mother-of-pearl for buttons and knife handles.

34

Like Locusts, Echelons of Sooty Terns Take Wing over Michaelmas Cay

In spring, hosts of ocean birds converge on Barrier islands to mate and rear their young. So thickly do they congregate on this twenty-acre islet that scarcely a foot of sand is left untenanted.

35 Australian Information Bureau

Right Face! Terns Look Out to Sea as if Aligned by a Magnet

When visitors approach the roosts, an acrid odor assaults the nostrils and a mighty clamor deafens the ear. Old-time sailors feared the Barrier isles, thinking the moaning of muttonbirds came from souls in torment (page 31).

Green Island may not have quite the primeval character of the Barrier Reef's more remote cays, but like Heron it retains a surprising degree of tropic-isle appeal (page 20).

The island has been visited by perhaps more people than all the others of the Great Barrier Reef combined. At 9:30 a.m. in good weather a boat leaves Cairns, often loaded with sightseers; it arrives at the island at about eleven and leaves on the return trip at three. During this four-hour interval visitors bask on the beach, ride in a glass-bottom boat, or do their best to escape the midday heat by sipping cool drinks under the island's coconut palms. If the tide is low, they may go onto the reef, or, for a less strenuous examination of undersea life, descend into Green Island's famous sunken chamber.

Sunken Room Reveals Reef Wonders

Two former crocodile hunters, Vince Vlasoff and Lloyd Grigg, designed and built this chamber on the mainland and towed it, pontooned, across the sixteen miles of sea to its present location on the reef about 200 yards off the island's west shore. After severe difficulties involving a hurricane, the compartment was bolted to the reef floor in 1954 and a superstructure added.

One might think that the presence of a man-made observation room submerged on the reef would drive all fish away and discourage further coral growth. Actually it appears to have had the opposite effect.

To be sure, chunks of living coral were initially transported from elsewhere on the reef and planted in front of the chamber's glass portholes. These coral transplants thrived and now are growing in normal profusion. But fish cannot be so planted or restrained. Voluntarily they moved in until now untold numbers, including scores of different species, inhabit the area, somewhat as fish take over the hulk of a sunken ship.

Perhaps one of the most remarkable sights the chamber offers is an enormous school of densely packed, fourteen-inch trevally, which every morning slowly drifts round and round, so close that some of the fish actually brush the ports. Suddenly a grouper, a shark, or some other enemy may intrude, and the entire pack will vanish in one monstrous and thunderous movement. Yes, thunderous, for here in this unique observatory one may hear to some extent, as well as see, what takes place beyond the glass (page 44).

Also observed are many types of hard and soft coral, butterfly fish, disappearing worms, squirrelfish, parrots, sardines, and a whole galaxy of other reef forms—all playing the game of life as if not a soul were watching. The view from any of the chamber's glass windows, which are actually only a few feet beneath low-tide water, is the finest submarine sight I have seen.

Giant Clam a Man-killer?

Within a few inches of one of the ports lay a clam that must have weighed hundreds of pounds and been close to three feet long. There it sat with great jagged valves open, undisturbed by the iron and concrete of its environment and emitting a steady stream of water from a siphon about the size of a fire hose. This was a true giant clam, *Tridacna gigas*, one of the so-called man-killers. Compared with the highly colored smaller tridacnids of southern reef waters, its mantle was drab.

The question of whether such a creature will clamp and hold the leg of, say, a pearl diver who has inadvertently stepped into its gaping jaws is classic all along the coral coast. For every affirmative opinion there seems to be a negative one.

During our stay on Green Island we came upon a giant clam living on the reef about a hundred yards offshore. It was not as large as the one seen from the observatory, being only about twenty inches long and weighing perhaps eighty pounds. Unlike the

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Page 36

←To Confound Enemies, the Sea Cucumber Ejects Gluey Threads of Slime

Every few yards of tide pool are likely to expose an ugly sausage-shaped animal known as the sea cucumber, or lolly fish. Ranging up to three feet in length, the caterpillarlike creatures crawl sluggishly by body contractions and use tiny tube feet like those of their relatives, the starfishes (page 23).

A common name for the sea cucumber is bêche-de-mer, from a Portuguese word meaning sea worm. The name is apt; like the earthworm, the bêche-de-mer continually swallows mud and sand from which it extracts organic matter.

When irritated, some sea cucumbers eject strands of extraordinary stickiness. Irritated further, they often throw out all their internal organs, growing a new set within a matter of days.

Chinese taste for bêche-de-mer, or trepang, once supported lively diving activity along Australia's coast. The skins, dried to leather toughness, are made into soup.

Heron Island's Only Child Finds a Treasure-trove in Her Back-yard Reefs

Virginia Hasting holds a spider shell; two cones stand below her knuckles. A large baler shell forms the lamp's chimney; trumpet and cowrie lie near its base. Spiral ramps identify two trochus shells (left center). The pagodalike Heron Island volute at bottom right is rarely found elsewhere.

↑ Periscope Eyes Pop Out Below the Mossy Shell of Red-mouthed Stromb

A conspicuous denizen of the reef, the red-mouth, or luhu, owns a porcelaneous shell marbled in white and red-brown. However, the lovely outer shell is hidden by a brown skin and often by hairy growths of algae. South Pacific natives use the mollusk's brilliant red lip for decoration. This view looks into luhu's door (magnified eight times).

Elegant Cloth-of-gold Cone → Can Sting a Man to Death

Shell collectors covet the handsome cones but fear the venomous mollusks within. A tonguelike organ with a barbed tooth at the end has caused many casualties and even deaths among persons who handled the living shell without gloves.

Scientists classify all cones in the suborder Toxoglossa, meaning poison-tongue. Hundreds of widely distributed species are easily identified by their conical caps. Cones prey on mollusks and small fishes, using the barbed teeth as harpoons and swallowing the animals whole.

Cloth-of-gold shell *(Conus textile)* is the best known and one of the most dangerous of the poison-tongues. It attains a length of four inches.

40

Flying Foxes, Asleep by Day, Hang Upside Down in a Queensland Forest

These fruit bats, known as flying foxes because of their three-foot wingspread and foxlike muzzle, live by the hundreds of thousands in mainland rain forests and on some Barrier Reef islands. They can take off only by releasing their hold on a high branch and dropping until wings catch the air. A grounded bat must crawl to the nearest tree, climb up with powerful foot and wingtip claws, and drop off for another try.

smaller clams of the southern reef, it was not rigidly fixed to the bottom.

One morning when the tide was low I conducted an experiment. I asked a muscular young Queenslander, Herbert Hussey of Gordonvale, a visitor on the island, to obtain a two-inch-thick wooden pole and then wade out with us to where the clam lay, its valves agape. Next I requested our friend to lower, rather abruptly, one end of the long pole between the clam's "jaws" and to touch the inner tissues with it. This was a "human foot" stepping into the clam.

We watched carefully as Hussey carried out the instructions. Down went the pole, and in a matter of a second the valves had clamped shut. I emphasize the speed because some have reported that such clams close sluggishly and therefore constitute no undersea hazard.

"Now pull out the pole," I said.

The more Hussey tugged, the tighter the valves gripped. At last he was pulling so hard that he lifted the entire clam, dripping, out of the water, where it clung to the pole by the sheer strength of its bite (page 20).

Another day on the Green Island reef Eda and I came upon a giant anemone. The creature, clinging to the side of a small pool, was a full twenty inches across, with its surface comprising a veritable forest of olive-green tentacles all writhing, swaying, expanding, and contracting like the serpents on the head of a Gorgon.

As in the case of coral polyps, I knew that hundreds of tiny crustaceans and other plankton organisms invisible to me were every moment being paralyzed by the poison cells which lined the surface of those "fingers," then devoured in the creature's central maw.

41

Flashbulb Surprises a Fruit Bat Dining on Mango

At dusk the flying foxes break camp and swirl off in dense clouds, seeking blossoms and ripe fruit. Though a plague to orchardists, they do not molest humans. Eyes of this Thursday Island bat glow like a cat's in a headlight.

Dainty Fish Live Dangerously

A fish no longer than my little finger seemed to be resting there among the deadly tentacles. It was one of the loveliest I had ever seen, with three separate bands of stark white that shone like luminous paint running vertically through its orange body.

Now and then the fish would dart away from the tentacles as though in pursuit of something, then flash back, plunging into the anemone again like a child diving into a deep feather bed (page 45).

How and why this fish can cavort in closest possible proximity to tentacles whose poisonous sting will stun other small creatures that dare come close is an old and intriguing problem in marine biology. Is such a fish immune to the anemone's poison, or is it somehow able to prevent the poison cells from discharging? Who benefits from this camaraderie, the fish, the anemone, or both?

I recalled the case of the Portuguese man-of-war, among whose lethal tentacles another species of small fish lives in just such a fashion.* Biologists have as yet no satisfactory explanation for these delicately balanced relationships between coelenterates and fish.

One day about dusk, as I returned from a solo collecting trip, Eda greeted me ex-

* See "Man-of-War Fleet Attacks Bimini," by Paul A. Zahl, National Geographic Magazine, February, 1952.

↑ Hammer and Chisel Shatter the Hideout of Myriad Reef Dwellers

Each of the countless coral heads is a labyrinth, its crevices filled with tiny fishes, mollusks, worms, crabs, and other animals. Most of them, disliking intense sunlight, take refuge in the dark coral maze during daylight hours, especially at low tide.

To collect the reef's smaller denizens takes hard work—usually by a team. Turning over coral heads flushes out some of the quarry; breaking open the formations is more successful.

Here Eric Hasting, of the marine laboratory on Heron Island, chisels away at a branching coral held by E. M. Grant. Mrs. Zahl waits with collecting bucket for specimens caught on the screen.

← Tiny Damselfish Takes Refuge Behind a Pink Shield

Clearly visible on each knob and projection are the minute cuplike homes of the coral polyps. Here they are withdrawn, leaving only a stony exterior. When the tentacle-fringed tubes come out, usually under cover of darkness, the limestone seems covered with fuzz.

If this lovely bit of coral were exposed to air and sunlight, the living creatures would soon die and the colors fade away.

citedly. In a mango tree not far from our cabin she had spotted a black, devilish-looking creature with a furred muzzle, glinting eyes, and pointed ears. As we watched it rasp away at a mango fruit, others began arriving, their wings spreading more than three feet.

These eerie animals were flying foxes, the huge fruit-eating bats of the Pacific tropics. Later, on the mainland, we saw them by the thousands, hanging by their feet in trees by day and darkening the sky at dusk as they scattered in search of fruit (pages 40, 41).

To Australia's Northeast Tip

From Cairns we continued our aerial journey northward, stopping briefly at the sleepy village of Cooktown. Then on we flew, over desolate uninhabited stretches of coastal swamp and jungle—the reef's shoals always discernible out to sea.

Finally, many hundreds of miles north of Green Island, we put down at land's end on the very northeast tip of the great Australian Continent. Here, in the Torres Strait, lying between Cape York and the jungled shores of New Guinea, the Barrier Reef fans out broadly before being terminated by the New Guinea land mass.

In this historic strait, through which Cook,* Bligh, and Flinders all sailed, are scattered such romance-conjuring islands as Mulgrave (Badu), the Murrays, Saibai, Darnley, and, of course, Thursday. Some still attract anthropologists in search of primitive cultures; others are barren and devoid of human life. Thursday Island falls into neither class.

The day we arrived on Thursday Island the first rains of the wet season soaked parched soil and flowed into nearly depleted water tanks. As one would expect only 11 degrees from the Equator, the atmosphere was hot and humid.

On a hilltop behind the town of Port Kennedy, like a ghost of the past, lay the remains of an old fort overlooking the strait; on another hill stood the remnants of more recent installations, for during World War II this area was of high strategic significance.

Pearl and trochus shell provide the economic basis for the settlement on Thursday Island. Picturesque pearling luggers often lie at anchor in the harbor, their crews of native divers swarming over the decks unloading shell or coming ashore in crowded dinghies for a look at the town (page 33).

Sharing our dining table were Vince Daly, the magistrate; Arthur Kirk, of the Department of Native Affairs; Tom Weeks, the wireless station manager; and our friend Charlie Peverell, the local contractor. At dinner on the night of our arrival, I noticed Mr. Kirk's eyes upon us in a puzzled, scrutinizing way. Next day at luncheon he continued to study us and then, abruptly, in a flood of apparent recognition, he asked: "But where are the two children?"

How could this man know that we had two children on the other side of the world? Then Kirk explained that he was a member of the National Geographic Society and had recognized us from earlier articles in the NATIONAL GEOGRAPHIC involving our whole family.

I told him that during the present trip we had left the children with relatives in Michigan. It gave us a warm feeling to realize that no matter how remote an outpost one visits, friendly members of the National Geographic Society and readers of its Magazine are sure to be there.

"Come to my office in the morning," Kirk said, "and see the Chalice Pearl. We took it to Cairns to show the Queen when she visited last year."

Bizarre Pearl of Great Beauty

Tough-minded pearl buyers call irregularly formed pearls baroque and do not place a high market value on them. When David Mosby, a native diver from York Island, came into port in 1949 with a double pearl, shaped somewhat like a chalice, some appraisers scoffed: "Baroque. No intrinsic value." Others said: "Most unusual. A collector's item. Might be worth thousands."

I know nothing of pearl values, but I do know that when Mr. Kirk took that little box out of the safe in the Native Affairs office, where the pearl is held in trust for its finder, and opened it, both my wife and I gasped at the gem's beauty (page 29).

The waters around Thursday Island lack the clean, crystalline character of those farther south or out to sea. Partly because of the strait's turbulent tides, the sea here tends to be murky, a condition apparently not discouraging to good pearl shell and trochus growth. I went out in a government research

*See "Columbus of the Pacific [Captain Cook]," by J. R. Hildebrand, NATIONAL GEOGRAPHIC MAGAZINE, January, 1927.

← **A Dense School of Trevally Drifts over a Giant Anemone**

Page 44: Dr. Zahl captured this remarkable view from a submarine observation chamber off Green Island. Voracious trevally ignore the gaudy clownfish above the anemone tentacles, knowing it requires but a split second to dart to safety.

↑ **Anemone's Poison Embrace Leaves Clownfish Mysteriously Unharmed**

↓ Minute stinging darts lining the sea anemone's tentacles paralyze most small creatures touching them. But the clownfish—for reasons no one knows—lives intimately with the anemone, even diving unscathed into its bed of tentacles.

vessel in quest of typical bottom specimens.

A native islander, wearing a diving helmet attached to an air hose, climbed overboard and disappeared in a cloud of bubbles. A little later he came up, his collecting basket cluttered with sea lilies, urchins, stars, coral . . . more specimens than I could have wished for from these waters here at world's end.

High Islands as Well as Low

Captain Cook, sailing northward across the Tropic of Capricorn, chose to hug the Queensland coast so closely as to be unaware that out of sight to the east lay the first of the Barrier Reef's string of coral shoals.

Several hundred miles farther north—but still long before he discovered the reef by crashing into it—Cook sighted islands to which he gave such names as the Northumberlands, the Cumberlands, Magnetical (now Magnetic), Palm, and Dunk.

Unlike true coral cays, made up of animal-deposited limestone, these mainland islands inside the Great Barrier Reef's lagoon were produced in the remote geologic past by the slow subsidence and partial flooding of a rugged mountain range. Some are more than 3,500 feet high, with heavy jungle and remnants of mainland flora and fauna.

The mainland islands are considered part of the Great Barrier Reef complex; many of them have extensive fringes of coral.

Tropical Island Paradise

Such an island is Lindeman, of the Cumberland group—the sort of place one would choose, preferably with Robinson Crusoe along, as *the* tropical island on which to be cast away (page 26). Not too large, not too small; a 700-foot-high summit for a lookout; a jungle; banks of wild orchids; a beautiful grove of white-trunked eucalypts; a good fresh-water spring; a reef for turtling and fishing; herds of wild goats; and—if one happens to be a Robinson Crusoe of the 1957 variety—a guesthouse run by the amiable Nicolson family.

Other mainland islands of special note are Hayman, Long, South Molle, Daydream, Hinchinbrook, and Pentecost. One—Seaforth, an islet about a mile from Lindeman—was visited by Queen Elizabeth and the Duke of Edinburgh in 1954 for a view of its magnificent coral gardens.

Goats were released on many of these islands years ago by the government to provide food for castaways whose ships may have piled up on near-by shoals. Coconut palms also were planted for the same purpose. Both have thrived and multiplied.

Large turtles live everywhere along the Great Barrier Reef, although they are ordinarily not conspicuous except during the egg-laying period of October through February. We saw no adults on Lindeman, but we heard many tales about how the aborigines from the mainland used to capture them.

The native method involved use of the so-called sucker fish as a "hook". This hitchhiking fish has the habit of clinging to a shark or turtle by means of a suction pad on the top of its head, to get a free ride and a share of the host's menu.

A Fish Goes Fishing

If a light line is tied to the sucker's tail and the fish is released in the shallows, it will swim about until it finds a turtle. Then it fastens itself to the shell. The angler gently reels in the line and lets it lead him to the turtle, which must eventually surface for air.

Aside from men, turtles face a horde of enemies. Hatching youngsters must run a gantlet of rapacious sea birds, ghost crabs, sharks, and fish. If only a few of the 100-odd hatchlings from each turtle nest survive, nature rests content.

One morning at two there was a rap at our cabin door. "Up and out," someone called. "The *Shangri-la* is leaving for the outer reef in twenty minutes."

Half an hour later, in total darkness, the Lindeman Island vessel with the intriguing name was easing its way through the channel, then heading northeast. The hour of departure was dictated by the tide.

We were bound to where Queensland's sea-washed coral ramparts slant steeply into the abyss. There reef growth stops, for these corals are all shallow-water creatures that rarely live at depths below 150 feet. Shoals here at the drop-off are referred to as the outer reefs, as distinguished from those which

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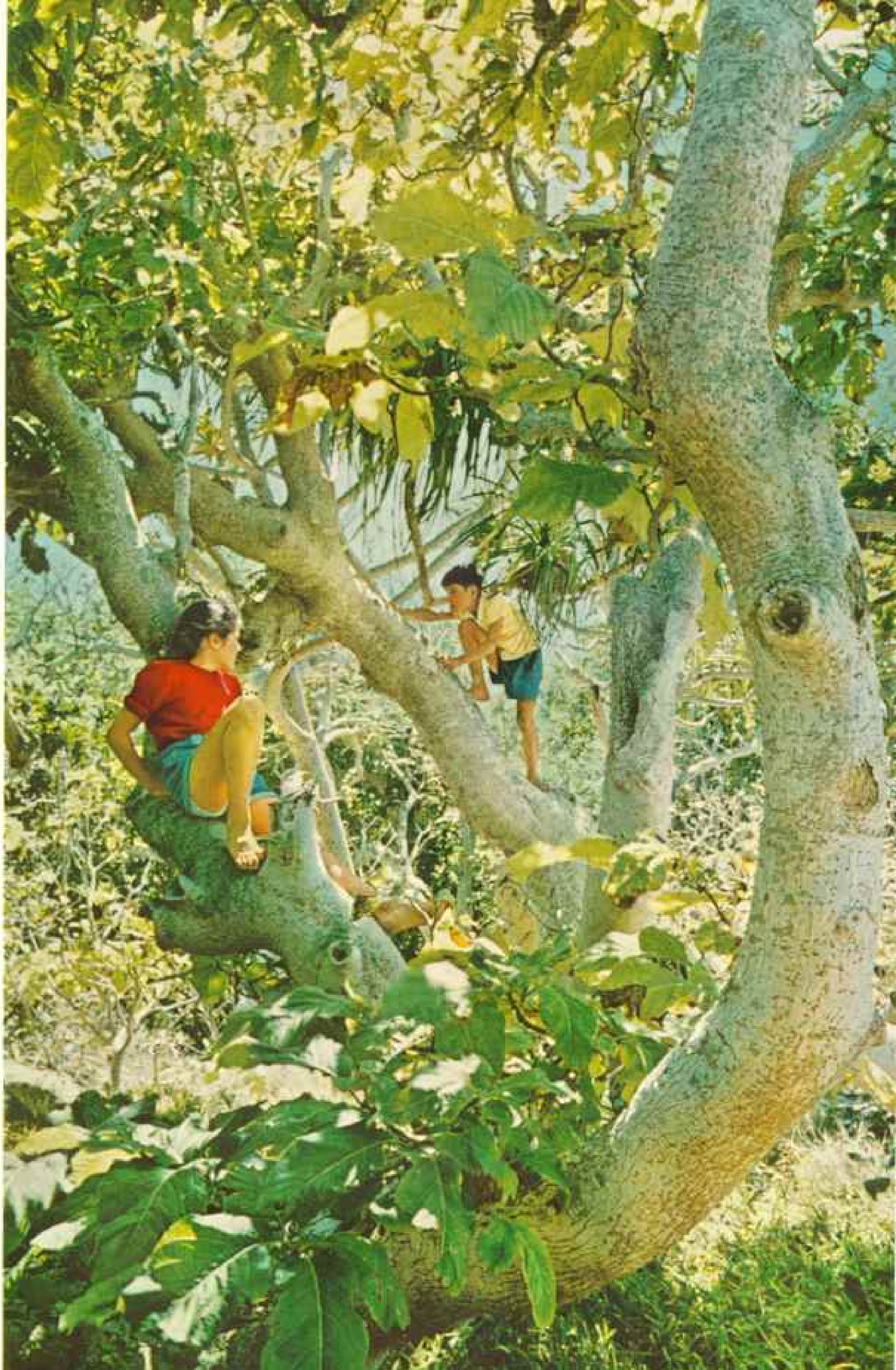
Page 47

Pisonia Trees on Many a Cay Weave ➔ Green-and-silver Tapestries

Massive big-leafed Pisonia trees rise as much as 60 feet above Heron's dazzling beach. These children cannot safely climb much higher in their search for tern nests, for the Pisonia wood is exceedingly brittle. Even large trunks snap under moderate weights.



48

Feather Star Bemuses a Mainland Aborigine

The many-rayed feather star, a crinoid, is a survivor from fossil times. Some 300,000,000 years ago its ancestors were among the most abundant of marine animals. Some crinoids live in deep waters, permanently attached to the sea bottom by long stalks. This specimen moves freely on the bottom of shallow waters. Feathery gills crowd each arm.

rise in various sections of the inner channel.

No land was in sight as the sun rose. At eight o'clock Archie Nicolson at the helm of the *Shangri-la* announced that we were now approaching the outer reefs. Our eyes strained eastward but as yet could see only blue white-capped ocean.

Creamy Surf Marks Sea Walls

"Tide's just beginning to slack," Archie said, checking his watch. "The outer reefs are still covered, but they'll show soon."

He throttled back the boat to its slowest pace and stationed a man on the bow for signs of shallowing bottom or coral heads.

Half a mile ahead a line of creamy white suddenly began to develop on an otherwise featureless sea.

"There's the inner edge breaking," confirmed Archie, "and if you look on beyond you'll see the ocean pounding at the outer wall." Yes, there was another white surf line developing farther out.

Gradually, coral-strewn bottom rose to fill the space between the two lines. Beyond lay the deep, boundless ocean. At this hour of low tide, such great shoals, as well as countless smaller ones, separated by channels, inlets, and even long stretches of sea, were forming all the way from Thursday Island to Heron. Sea birds began dropping from the sky to rest and forage.

Few Really Know the Reef

We dinghied to the coral's edge and for a while walked on the reef's surface. As with many another such coral surface on which we had wandered, here was fabulous color—coral, clams, sea stars, urchins, cowries.

But this day we did no collecting, attempted no long hikes, took few pictures. Our mood was to contemplate the vastness of the forest rather than the intricacy of the trees. This was to be our last visit to the reef, and indeed a very brief one, for because of tide and brewing weather the *Shangri-la* tarried only an hour or so before starting engines and weighing anchor.

The Great Barrier Reef is different things to different people, it occurred to me as we set a course due west toward the mainland. There are people who have spent their lives among the Capricorn group; others along the Whitsunday or Hinchinbrook passages, or on the islands off Townsville or Cairns, Cooktown or Cape York.

Many a ship's pilot has spent his entire lifetime navigating the reef's inner waters. Many an aviator has sped through its sky canopy. Many a native islander knows only the life of diving for pearl and trochus. Tourists from the great cities come to Barrier Reef islands for fossicking, fishing, and sun. And now and then throughout the years, individuals or teams of scientists have come to conduct research or to collect specimens.

But who other than its Creator can ever know the sum of the Great Barrier Reef?

The Great St. Bernard Hospice Today

High in the Swiss Alps, Devoted Monks Carry On Labors of Mercy amid Snow and Silence, Still Helped by Lifesaving Dogs

By George Pickow

As the mail bus wound up the slippery mountain road, taking me closer to the Great St. Bernard Pass, I marveled at the terrible whiteness of the glacial slopes and the dazzle of the canyons and ice walls ranging as far as the eye could see.

I also wondered whether I wouldn't soon find a beloved myth exploded.

Since childhood I had been fascinated by tales of the heroic St. Bernard dogs. I had heard that some of these huge animals would lie down in the snow next to an exhausted traveler and keep him warm, while others raced for help; that a dog named Lion had saved thirty-five people; and that another named Barry saved forty, including an unconscious child he pulled from an icy ledge which no human could reach.

Now I was invited to visit and photograph the dogs at the famous hospice nestling 8,115 feet up in the strategic pass, one of the highest spots in Europe to be inhabited all year round. How would the present compare with the storied past?

Once there had been a real need for this refuge on the main road from Italy to northern Europe. Since the Middle Ages thousands of wandering tradesmen, artisans, and laborers, couriers, beggars, emperors, popes, and pilgrims bound for Rome had found shelter there, especially during the wintry months of the year when all traces of a road are obliterated by snow falling on snow.

Dogs Saved Hundreds from Icy Death

Over the years, I knew, the monks and their brave dogs had plucked hundreds from death's brink. But now people use highways that hug the valleys or burrow through nearby mountains in long tunnels; much Alpine rescue work, too, is done with aircraft.*

Did the monks still defy blizzards to search for lost travelers? And had their dogs ever really carried little casks of brandy around their necks?

I got off the bus in the square of Bourg St. Pierre, a quiet French-Swiss village that is snowbound a good part of the year, and carried my bags along the main street to a food store. While I bought oranges and chocolate bars for my uphill journey on foot, the storekeeper warned me not to go alone. Although this was a bright January day, the weather could change abruptly, he said. Precipices and deep fissures threatened on the very edges of ski paths, endangering even experienced climbers. But fortunately a hospice employee named Anselme was expected soon, to fetch food for the monks. If I cared to wait, I could go up with him.

Anselme, a short, wiry Italian, turned up just before noon. The storekeeper kindly lent me skis fitted with skins for uphill walking. He sewed Anselme's purchases into a burlap sack, making a bundle about five by two by two feet, and Anselme casually hoisted it to his shoulder.

Grueling Eight-hour Climb on Skis

I had consolidated my camera equipment and clothing into a knapsack weighing about fifty pounds. This seemed quite heavy to me, but I didn't complain as we set out. My companion's unwieldy pack looked at least twice as heavy.

Six or eight houses from the village square the road disappeared under the snow. From then on only a few ski tracks indicated the way to the pass, which was to take me eight increasingly painful hours.

I was fresh at first, the crisp air was exhilarating, and the slopes rose gently. Even so, our progress on the clumsy skis slowed as it became more difficult to find a footing in ever-hardening snow. My breath came shorter as the air thinned. My load felt heavier all the time. I barely managed to keep putting one ski above the other until we reached a small stone shed marking the climb's halfway point.

When I stumbled into the next shelter, two-thirds of the way up, I fell exhausted, desperately yearning for sleep. But Anselme kept shaking me, and dragged me out into the fading light within a few thousand feet of the hospice. I gasped for breath. I thought I could not possibly go on. Then, mercifully, an enormous St. Bernard dog bounded up to me.

* See "Surprising Switzerland," by Jean and Franc Shor, National Geographic Magazine, October, 1956.

Father Formaz, on Skis, Beams Approval on Barry, His 150-pound Friend

St. Bernards bear the name of St. Bernard de Menthon, who in the 11th century founded a hospice that has sheltered untold thousands caught in Alpine snows. The handsomest dog in the kennel always takes the name Barry, honoring a famous animal that rescued some 40 persons. Various bloodstrains blend in the breed.

He wore no cask of brandy, but after him came a monk carrying a canteen of hot tea mixed with wine. He made me drink this and took my pack. While the two men pulled me over the steepest places, the dog frisked ahead as if this were a summer stroll.

We reached the hospice well after dark. The last 2,000 feet seemed to lead straight upward. The snow crust was sheer ice now. The howling wind had numbed me when at last the lights of the hospice reached welcoming fingers to us across the snow. Above the bright doorway a great outline of buildings loomed in the cold starlight, as if part of this landscape of icy cliffs.

Since snow was piled three feet above ground level, we had to slide down a ramp of snow and stoop to enter the building. I was too exhausted to start asking about the dogs just then.

Downstairs in a cavernous kitchen, next to a great stove going full blast, I hungrily ate hot soup, bread, and cheese. Then a novice took me to my room, through arched stone corridors dimly lit at long intervals.

"Tonight you are our only guest," he said. "Sleep well and God keep you."

I shivered while his footsteps died away, accompanied by eerie echoes and a series of clicks as he turned off the lights on his way down the hall. The room was a clammy cell with a hard bed, two blankets, and no heat at all.

Here I spent the coldest, loneliest night of my life, with not a monk, a caretaker, or even a dog within calling distance. The dank little room was cold and silent as a tomb in the snow.

Dedicated Woman Cooks for Monks

The morning dawned brilliantly clear and I felt much better. At breakfast I was presented to the prior, Father Quaglia, who welcomed me and introduced me to Father Clivaz, the master of novices; Father Marquis, the sacristan; Father Emery, the bursar; and Father Pellouchoud, the almoner. They were all Canons Regular of St. Augustine, and under them, I learned, served five other canons and novices. Two male lay employees and a woman cook rounded out the hospice family of thirteen. Among themselves, the monks spoke French.

I asked eagerly to see the dogs. The prior replied that I could spend as much time with them as I wanted, but first we would see one of the canons off to a snowbound Italian village. He was to visit the sick and conduct services there.

We all stood with him before the great outer door while the prior gave him his blessing. In the kennel the dogs barked furiously, sensing an expedition.

"Isn't he taking a dog?" I asked one of the monks, as the canon skimmed away down the mountainside, carrying prayer books and medicines.

"No, my friend. A dog could not keep up with a man on skis." He scanned the heavens and frowned. "It would be better if a dog could accompany him, that is sure."

"Why?" I asked.

Dread South Wind Starts Avalanches

The young man looked grave. "We learned that we can never trust the weather," he said. "On a day like this in November, 1951, Father Droz set out to guide six Italian mountaineers. The day was so favorable, and Father Droz knew the mountains so well, that he thought he wouldn't need any dogs.

"Soon we began to worry. The wind became stronger, but the air remained mild, and we recognized the foehn. The foehn is a treacherous south wind, and we fear it more than a snowstorm. It plays havoc with the barometric pressure, and it loosens and melts masses of snow.

"Soon one of the Italians telephoned from a shelter. Father Droz had been covered by an avalanche. He had walked ahead of the party to test the ground and was trapped in the sliding snow. It took us hours to dig him out. It was too late."

I asked how the dogs could have helped if they had been along in the first place.

"The dogs would have warned him. Some say they have a sort of sixth sense, but more likely it is their hearing. Several times they have pulled one of us out of the path of an avalanche before we could hear it coming.

"They are also trained to draw sleds with supplies. And if a canon has been in the hospital in Bourg St. Pierre, the dogs may bring him back up to the hospice on a sled.

"But here is the keeper of the dogs, Father Emery. He will take you along to let the animals get a look at those cameras!"

I followed Father Emery to a long, low stone building about a hundred yards from the main hospice. A few small rooms in the back of this building are used for storage of

53

← **Monks and Dogs Demonstrate a Rescue**

For about two centuries the booming barks of gentle St. Bernards have promised help and compassion for Alpinists imperiled by fog, avalanche, and storm in the Great St. Bernard Pass between Switzerland and Italy.

Here Father Gratien Vollut, Father Jean-Louis Formaz, and attendant Anselme Ronc trudge past a granite cross toward the St. Bernard hospice. The sled-borne man simulates an injured skier. All the dogs show keen interest in the operation.

Snow-streaked Grand Combin (left) and Mount Velan (center) reflect the hardships borne by monks and dogs in the November-to-May winters.

Above: According to monks at the hospice, the dogs have never carried brandy kegs in rescue work. They often pose with the traditional casks for the benefit of visitors.

↓Six-month-old Almira displays her efficient paws, enormous aids in "swimming" through snow.

George Pickow, Three Lions

apples and other fruit. But the front part houses the twelve to twenty St. Bernards now kept at the hospice.*

As we approached this kennel by way of a long ramp, the dogs began barking. Father Emery opened the door and quieted them with a word.

We entered a large room, empty except for beds of straw near the walls. Here the dogs sleep as huskies do, huddled together for warmth. The rest of the space is kept clear to give them room for exercise.

Father Emery spoke again, and suddenly we were surrounded by the powerful beasts, yelping with delight at seeing their master.

The dogs weigh from 140 to 160 pounds. Their dense white-and-fawn-colored coats make them look even bigger. In contrast to their puppylike exuberance, their mournful faces make a comic effect. But this is offset by their great strength and friendliness. One can sense their dependability at once.

Barry Welcomes a Stranger

They regarded me soberly for a moment. Then the largest dog planted two great paws on my chest and licked my face.

"Well! You are honored!" Father Emery said. "This is Barry."

"Barry! Not the one that saved forty people? I thought he lived long ago."

"Forty-one people it was. You mean Barry the First, Barry 'the Lifesaver.' He served here about 150 years ago, and he was the bravest of them all."

I began snapping pictures. An attendant working with the dogs took one look at my cameras and ran off. He returned with a small cask and fastened it around Barry's neck.

I glanced at Father Emery. He smiled. No, he said, the dogs had never carried casks on their missions, not once, so far as anyone at the hospice knew.

This legend, he explained, probably dates back to an artist who drew the original Barry with a cask simply because he thought it would add interest. If so, that artist was right. The public loved the idea and would not be told otherwise.

I couldn't resist and took a picture of a dog with a cask (page 53).

Later at lunch I asked for details of the great Barry's exploits.

"There's a story that the forty-first man he found in the snow was a soldier," Father Emery said. "He was freezing and befuddled. When he saw Barry leaping toward him, he thought he was a wolf and killed him with his sword.

"But as far as we know, Barry didn't really meet such a sad end. He worked faithfully for twelve years, and when he seemed near the end of his strength the prior sent him to Bern. He was well cared for and lived another two years. He can still be seen in a museum there, stuffed."

Monk Vouches for Famous Tale

I wondered about Barry's famous rescue of the little boy from the icy ledge. How had the dog managed to carry him down?

Father Emery's face lit up with enthusiasm. "Barry kept him warm and licked his face. That woke him up, and he threw his arms around Barry's neck. Barry began to drag him, but gently, you understand. The boy saw Barry needed his help, so he got himself on the animal's back and clasped his hands under his neck."

"Are you sure this really happened?" I persisted.

"The story has been told too often by too many good men to be false," my friend replied. "Details of rescues were rarely written down here, so we have no complete record of the dogs' work. But we all believe that these things are true."

After lunch I returned to the kennels and watched the attendant feed the dogs their daily rations of horsemeat mixed with dog meal, in tremendous amounts.

"They're good eaters," he laughed. "So would you be if you raced about in the bitter cold as much as they do. Five pounds of food a day down every one of them, and they lick their chops for more. Their food comes up by car when the road is open in summer, and we store enough for the winter."

Dogs Scent Man Buried in Snow

The feeding over, the dogs sniffed the air and milled about. The keeper said that after eating they usually went out for a run in the snow. Today, to show me what the dogs could do, the monks would enact a rescue.

I waited near the hospice with the prior and the other canons while one of the novices skied away. He halted some distance from us and buried himself in the snow.

* See "Working Dogs of the World," by Freeman Lloyd, NATIONAL GEOGRAPHIC MAGAZINE, December, 1941.

55

↑ Mail and Supplies Arrive on Skis

St. Bernards' alertness often shows in faces and stance. Their keen noses can follow hours-old scents and detect victims buried in snow. Some members of the breed have yanked men from the paths of avalanches before human ears detected the sound. Twelve to twenty dogs are now kept at the hospice.

Here the novice Lönne (back to camera) skis in from Bourg St. Pierre with letters and provisions for the hospice.

→Barry's melancholy eyes examine a man simulating an accident. St. Bernards can arouse a drowsing man and prevent his freezing. They lick the victim's face and bark to attract attention.

George Pickow, Three Lions

St. Bernard Fathers Meditate and Exercise on Their Private Road

These monks own the hotel (left) for paying guests. A covered passage connects the inn with their monastery. Spring thaws have unlocked Great St. Bernard Lake, which straddles the Swiss-Italian border.

"Now," the prior said, "you are about to see the rescue dogs of the Great St. Bernard Hospice find a person trapped beneath an avalanche.

"Because of their fine sense of smell, they are marvelous at this job. They'll follow a scent that's hours old. And they can smell a man under a snowdrift, whether he's dead or alive.

"The dogs save precious time by discovering exactly where the person is buried. They begin to dig, and they howl to direct us to the spot. Then the men help them, and together they get the victim out quickly. Watch, here come the dogs!"

The great animals poured out of the kennel and immediately fanned out, bounding through the snow. Sometimes they stayed on the top crust, sniffing. Sometimes they sank and "swam" along, covering an amazing amount

of ground without seeming to miss a single square foot. They worked in concert, as a pack, and in a very short time one of them had found the buried novice.

At once the dog dug the snow from the man and lay down, covering the body with his own. He began to bark and lick the man's face (page 55).

The other dogs came and began barking, too, setting up a dreadful din until the monks arrived with a mixture of hot tea and wine. They forced this down the throat of the "unconscious" man, then carried him to the hospice on a stretcher (page 52).

Amid these operations, several Italian border patrol officers on skis swooped down on us from the mountainside. When they had satisfied themselves that no smuggling was involved, they became very friendly.

Rugged Life Demands Vigor

That evening one of the worst storms of the winter whipped the pass. Wind-driven snow seemed to bite through the walls despite their three-foot thickness. I remarked to the prior that all the monks looked surprisingly young.

"It is the pass," he smiled. "It demands youth and vigor. In winter the temperature often goes to zero or even below. Sometimes the snowdrifts are sixty feet high. We have often skied right out of the second-story windows. Most of us are under thirty-five."

"But doesn't anyone grow old here?"

"Rarely, my friend. The altitude affects the strongest heart. We are supposed to stay only about eight years, although sometimes exceptions are made."

57 Photo, Three Lions

St. Bernard, in Iron, Points the Way to His Hospice

A chain in the right hand binds a dragon at the saint's feet, dramatizing a legend that he conquered a demon in the pass (page 59). "You who climb the Alps in safety under my guidance," says the plaque, "continue with me to the House of Heaven."

After dinner the monks invited me to their prayers in the little chapel, and I felt lost in time as medieval chants rang out with unbelievable clarity up there in the snowy wastes.

During the monks' recreation period, Prior Quaglia and several canons took me through the whole building. They showed me rich vestments and jeweled chalices and crosses of silver, gold, and enamel. They told me of the beginnings of the hospice.

In ancient times, the prior said, many roads led over these mountains, but this one was probably the most traveled after the Romans improved it in the first century A.D. On the summit, not far from where the hospice now stands, they put a temple to Jupiter.

Tribesmen from the north captured the pass

Paul Popper

A Stuffed Barry, Rescue Hero of Half a Century Ago, Stands Watch over the Stairs

Disregarding orders, this dog plunged into snows and found a band of exhausted travelers. His barks summoned help. A fall into a gully cost his life in 1910. Taxidermy lost the breed's characteristic sagging jowls.

from the Romans. After them came Huns, Vandals, and Saracens. Charlemagne passed through to be crowned in Rome. Priests established chapels along the route, but ruthless marauders looted and burned them as often as they were built.

The pass became a haunt of thieves and robbers, who tortured and killed pilgrims and wayfaring tradesmen.

St. Bernard Spurned Worldly Glory

The prior continued: "Into these troubled times, so the legend goes, Bernard de Menthon was born in Savoy at the end of the 10th century, the son of the great feudal baron Richard de Menthon. He grew into a tall and strong young man, the pride of his parents and the whole countryside. It was a great calamity for his father when Bernard came back from his studies in Paris and announced that he intended to become a monk.

"His father arranged a marriage with an heiress for him and tried to force him to accept his position as a lord of Savoy. But Bernard tore the bars from his window on the night before the wedding and escaped.

"Bernard became an outstanding churchman, a true Christian; soon his fame spread hundreds of miles. He was gentle as a dove but strong as a lion. He feared nothing.

"A handful of pilgrims stumbled into his church one night with a tale of horror. They had been attacked in the pass by the giant devil Procus, who worshiped at the statue of Jupiter. At once Bernard rallied the reluctant villagers and led them praying and singing through a terrible storm up to the Plain of Jupiter.

"Procus turned himself into a dragon and was about to swallow Bernard. But Bernard threw his stole around the devil's neck, and the stole became a chain, which held down the devil while Bernard killed him (page 57). The villagers demolished the image of Jupiter, and the pass was cleansed.

"Bernard told the villagers to build a hospice in the pass for travelers. 'There were many rocks on the plain; more rock was hauled great distances over icy trails."

Bernard also founded a hospice to the southwest, now known as the Little St. Bernard.

I asked just when Bernard had built the hospice on the Plain of Jupiter.

"Sometime in the 11th century," replied the prior, adding that it was not named for St. Bernard until about a hundred years later.

"First it was dedicated to St. Nicholas, the patron of children, sailors, captives, bankers, and pawnbrokers. A fire destroyed nearly everything in 1555. But the need for the

Four-year-old Junon Drowsily Suckles Her Second Litter

The usual brood numbers six; one dog mothered twelve. All of these seven pups were sold. At the height of the breed's popularity about sixty years ago, an English St. Bernard brought $6,500.

Three Lions

60 Kodak, Three Lions

Athletic Monks in Sturdy Ski Boots Welcome a Visitor

Given Norwegian skis in 1878, the fathers made additional pairs and introduced the sport to Switzerland. They ski and climb to keep fit.

hospice was so great that it was rebuilt within three or four years."

I also learned that when Napoleon crossed the Great St. Bernard Pass in the spring of 1800, on his way to crush the Austrians at Marengo, he brought not only 40,000 soldiers but 5,000 horses and 58 cannon as well. Each cannon was disassembled, enclosed in a hollow log, and dragged by scores of men.

Napoleon Dined at Hospice

Napoleon was then simply General Bonaparte, First Consul of the French Republic, and he didn't ride a white charger as depicted later, but a mule. He dined at the prior's table; during that year, the monks gave his troops 1,758 pounds of meat, 3,498 pounds of cheese, and 21,724 bottles of wine.

I was told that by Napoleon's time the monks of the hospice had been using dogs as lifesavers for about fifty years.

It had not occurred to me that these animals hadn't always been there, and I asked about their ancestors.

"No one knows for sure," explained Father Emery, "but probably they were the large short-haired mastiffs that appear in reliefs found in Assyria, dating from some 2,500 years ago. Wars and trade brought descendants of these animals from Asia to Greece and Rome. Then the Romans used them as watch dogs at their military posts.

"The Newfoundland was crossed in after Barry's time. Some say the Great Dane and sheep dog were too.

"Our St. Bernards combine the best traits of the mixture. Their hair is thick to protect against cold, and short to shed snow. They are tremendous fellows, strong as oxen, but gentle, affectionate, and wise."

From research the monks have done lately, I learned that the dogs first came to the pass toward the end of the 17th century. In those days the canons went about the countryside asking for gifts. Nobles in the neighboring valleys had been keeping dogs that looked much like today's St. Bernards—the head of one appears in a 14th-century coat of arms—and they probably assumed that the monks would find them useful.

They did, in the kitchen. With hungry travelers to be fed at all hours of the day and night, meat was almost constantly roasting on a revolving spit. Prior Ballalu, who provided the first written mention of the dogs at the hospice, in 1708, credits Canon Vincent Camos with making "the wheel in which a dog is placed to turn the spit."

Before long the dogs also proved themselves valued protectors against dangerous guests. A band of robbers, having eaten and slept well, demanded that the prior guide

them to the vault where valuables were kept. He took them to the dogs instead.

They left at once, quietly.

Just how useful, I asked, are the dogs today? I pointed out that many people think their heroic lifesaving days are over, that now they are kept only to please summer visitors.

Dogs Symbolize Heroic Tradition

Father Emery replied after some thought. "It is true," he said, "the need for them is not so great now. But who can say that the saving of even one life would not be a worthy thing? We believe that in the eyes of God service is service whether to the many or to the few.

"Having the dogs here is an honored tradition, and most of our visitors wish to see them. But dogs can still do valuable work as well.

"In the frozen months there are generally a few skiers and still some occasional pilgrims on foot. And of course, there are always the smugglers of cigarettes and scarce foodstuffs. We care for everyone alike. Our task is to give help without condemnation, just as the storm makes no distinctions among its victims.

"Sometimes the storm brings only wind and cold, and leaves the air clear so that the traveler can make his way supported by one of us. But the driven snow can cover the road and obscure the vision, and then an animal's instinct can best point the way to the hospice."

By now I was so impressed with the St. Bernards, these massive and noble but playful creatures, that I asked if I might buy a puppy to take home with me.

Father Emery said none were of the right age just then. They are usually sold when they are two or three months old.

Monks and Friends in the Refectory Converse over Bread and Wine

Carved in stone, the hospice's shield shows a flaming heart, symbol of St. Augustine and charity.

62 Three Lions

"Allez-y!" A Keeper's Command Sends Dogs Avalanching down a Powdery Slope

"We ship puppies to the United States to people who want them as pets. Would you like one sent later?"

Cold reason forced me to think of my frequent traveling and the formidable amounts of meat my pet would soon require. Above all, there came to me a mental picture of myself taking the furry giant for his daily airing, joining the ranks of apartment doormen walking miniature poodles. I withdrew my request.

I had hoped to make the descent the following morning, but the dawn came cloudy and cold. The monks advised me not to go. However, they said that if I had to leave they would guide me.

I decided to wait, and spent the morning with Father Emery in the cobbler's shop off the kitchen, photographing a mother dog with her litter. It was hard to imagine her tiny, wriggling puppies turning into huge furry beasts bounding over the snow (page 59).

For the rest of the day I relaxed, enjoying the company of the good men and their friendly animals. I was learning to distinguish between Bella and Edda, Almira and Stella, Alma and Ella and Horsa. In the recent past, dogs at the hospice have also been named Rex, Turc, Myrra, Pallas, Alpina, and Diane.

Early the next morning I watched Anselme get ready to go for provisions into Bourg St. Pierre. We packed hurriedly, put on our skis, and were on our way in the twilight before sunrise.

Back to "Noisy" Village Life

Going down was much easier than coming up: scarcely three hours after leaving the hospice we skimmed into Bourg St. Pierre, which gave me quite a surprise.

It was no longer a quiet little village. After my stay in the lonely, snowed-in pass, it seemed to me a large town, unbearably astir with every kind of noise except the cheerful barking of the St. Bernard dogs.

Pennsylvania Avenue, Route of Presidents

Landmarks and Shrines of United States History Line the Path of Inaugural Parades from Capitol to White House

By Dorothea and Stuart E. Jones

63

With Illustrations by National Geographic Photographer Volkmar Wentzel

THE MAIN STREET of the Nation this month casts aside its workaday look and sits for its portrait in red, white, and blue. As happens every four years in Washington, D. C., the inaugural parade makes its way down Pennsylvania Avenue from the Capitol to the White House.

Along this ceremonial mile and a half—about one-quarter of the Avenue's whole length—massed thousands have paid homage to returning heroes and cheered incoming and outgoing Presidents. Here they have welcomed royalty and soberly watched the funeral processions of warriors and statesmen.

Focus of a Nation's Hopes and Fears

In the Avenue's 165-year existence as the focal point of a Nation's hopes and fears, its dust has settled on musket and atomic cannon, on Civil War soldier, on rumbling coach-and-four, on Stanley Steamer and Cadillac, on silk topper and homburg.

Not all of its events have been solemn affairs of state. Men now living remember seeing on the Avenue the Nation's first commercially produced automobile—a Duryea that clattered along in 1896, scaring horses and causing onlookers to shake their heads in disbelief.

In 1801 "a vast concourse of people, numbering upward of 1,200 souls," ushered in the new Capital's first inauguration. Crowds now run into hundreds of thousands. Before and after every inaugural parade many visitors find time to explore the city's shrines and monuments, many of which lie within sight of Pennsylvania Avenue.

Under the myriad flags and beyond the grandstands, what do they see? The best way to find out, we decided, was to walk the historic Avenue. Thus, in a sense, we became an advance guard of two for the 1957 inauguration, making our way on foot and quite unheralded by police whistle or drumbeat (map, page 70).

Just as Washington was a planned Capital, fixed on a ten-mile square along the Potomac River by President George Washington, the Avenue did not just happen. It appeared on the plan of Maj. Pierre Charles L'Enfant, the gifted French engineer employed by Washington to lay out the new city. L'Enfant directed that the "grand avenue" should be 160 feet wide.

The nineteen local farmers and landowners who had agreed to "convey, in Trust," their land for establishment of the Federal City, saw this size as wild extravagance. Many grumbled, and one David Burnes delayed the opening of Pennsylvania Avenue by insisting on bringing in his corn crop before the workmen moved in.

Burnes's farm was part of Beall's Levels, a grant dating from 1703 and the colonial government of Lord Baltimore. Ninian Beall received the patent as a gift for valor in protecting the Crown's interests. A much larger tract of land into which the Avenue sliced was Duddington, also called Cerne Abbey Manor. What is now Capitol Hill lay within it. The owners were the Carrolls of Maryland, among whom was a signer of the Declaration of Independence.

Name Honored a Disappointed State

Presumably the Avenue was given the name Pennsylvania as a special honor to that key State among the original Thirteen—and perhaps also to soften her disappointment when the Founding Fathers decided against making Philadelphia the permanent Capital.

Of all the landmarks in this city of vistas, the one that draws men's eyes most compellingly is the great dome of the Capitol, serene against the sky. Even on close inspection the imposing building appears to have been there always—and in terms of the Federal City that is almost true.

The Authors

Dorothea Jones, a former member of the National Geographic Magazine staff, is the author of the recent book *Washington Is Wonderful* (Harper & Brothers, New York). Her enthusiastic interest in the Nation's Capital, past and present, is shared by her husband, Stuart E. Jones, a member of the Magazine's editorial staff.

John Pritchett

From Mud to Marble, Washington Fulfills Pierre L'Enfant's Dream of Grandeur

Surveying a wilderness, the French architect selected an eminence called Jenkins Hill for the Capitol and placed the White House a mile and a half distant. To link the two he laid out a highway. "The grand avenue," he wrote to President George Washington, "... will be most magnificent and most convenient."

Actually, the Avenue of Pennsylvania began as a footpath. Later, logs reinforced muck, making a crude road. Charles Dickens, a visitor in 1842, saw it as one of Washington's "spacious avenues that begin in nothing and lead nowhere."

Here, like a broken arrow, Pennsylvania Avenue shoots from the Capitol past the White House and on to distant Georgetown. Capital Airlines British-built turboprop Viscount flies over the city.

For seventy years the Capitol struggled toward completion. From the laying of the cornerstone by President Washington on September 18, 1793, to the raising of the Statue of Freedom above the dome on December 2, 1863, its construction was a prime concern of the Congress and the city.*

Indeed, under the heavy burden of their responsibility, the Capitol's architects and superintendents were often leading and controversial figures on the local scene. Four architects gave their minds and hands to its construction; countless workmen spent their adult lives on it. The briefest visit today reaffirms that the same sense of dedicated thinking that prompted L'Enfant to select this 88-foot knoll for the Capitol site also inspired the men who designed and laboriously raised the stately building, stone on stone.

"It's pure Americana," we heard someone say as we followed along behind one of the professional guides.

Here in the dim light Benjamin Henry Latrobe's corncob designs crown the cornstalk columns in the ground-floor vestibule of the old Senate Chamber. This north wing was finished to accommodate the second session of the 6th Congress in 1800 and was the first section of the Capitol to be completed.

Even the story of the acceptance of the original design for the Capitol is as American as today's quiz contests. The prize was rather generous for those days, but still considerably short of $64,000.

A national competition inviting "persons" to submit a plan for the Capitol had brought disappointing results. The deadline was July 15, 1792, yet, three months later, an obscure physician wrote from his home in the Virgin Islands for permission to send in his plan. It was granted, and Dr. William Thornton, gentleman and amateur architect, won "a lot in the city . . . and $500, or a medal of that value."

Becoming the original Architect of the Capitol, Thornton lived in Washington more than a quarter of a century. His accomplishments ranged from writing in 1793 the first American publication on the teaching of the deaf—read 123 years later by Alexander Graham Bell to a meeting of the Columbia Historical Society—to contributing ideas that led to the invention of the steamboat.

Thornton, who wielded additional power as a Commissioner, was a man of explosive temperament and would brook no tinkering with his Capitol plan. Superintendents and assistants led miserable lives, and their tenure was usually short.

The good doctor would rub his eyes today at the three and a half acres of lawmaking chambers, halls, and offices that sprang from his inspiration.

Where Candidates Become Presidents

We hurried down the great east entrance steps, where most of our Presidents-elect have taken the oath of office, and paused to contemplate the classic grace of the near-by Supreme Court Building, the gray pile of the Library of Congress, and the gemlike Folger Shakespeare Library.† Our way led westward, following the arrow of Pennsylvania Avenue. For the most part we would keep to the sunny south side, where promenading was the fashion 100 years ago. Shops, restaurants, and office buildings line the north side.

At the foot of Capitol Hill's western slope we stopped at the General Grant Memorial, a dramatic composition whose sculptor, Henry M. Shrady, captured men and horses in straining attitudes of the 1861-65 brand of warfare. It is one of the largest equestrian groups in the world; its dedication by Vice President Calvin Coolidge in 1922 signaled the start of a rousing Pennsylvania Avenue parade.

Well within sight of the Avenue, but not on it, rises the glass dome of the United States Botanic Garden. Members of Congress may draw on the conservatory for free floral decorations on official occasions. For

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Page 66

←"Look Sharp and You'll See It Move!" A Guide Points to the Capitol Dome

Tests conducted by the Smithsonian Institution in 1865 revealed that solar heat causes the cast-iron dome to move three or four inches out of line. The action follows the sun like a sunflower. Children watch vainly to catch sight of the motion.

A bronze Statue of Freedom by Thomas Crawford surmounts the 4,455-ton dome. Workmen paint the metal shell at least once every four years, usually just before a Presidential inauguration. Color must conform with the building's darkening marble.

House Chamber is to left of the dome, Senate to the right.

* See "U. S. Capitol, Citadel of Democracy," by Lonnelle Aikman, NATIONAL GEOGRAPHIC MAGAZINE, August, 1952.

† See, in the NATIONAL GEOGRAPHIC MAGAZINE: "Folger: Biggest Little Library in the World," by Joseph T. Foster, September, 1951; and "The Nation's Library," by Albert W. Atwood, May, 1950.

National Archives Exhibition Hall Enshrines Birth Records of the United States

Declaration of Independence (in shuttered frame), Constitution, and Bill of Rights are protected against damage in helium-filled glass cases. Each night electric mechanisms transfer them to a bombproof vault.

From the Marble Wall, Fathers of the Constitution Look Down upon the Rotunda

Artist Barry Faulkner's 14-by-35-foot canvas shows James Madison presenting the Constitution to George Washington (in cape) at Philadelphia in 1787. Benjamin Franklin stands on Washington's left.

the public there are seasonal displays—azaleas in spring, poinsettias at yuletide, dahlias and chrysanthemums in autumn.

Our arrival at the National Gallery of Art—not on the Avenue but close enough to be a part of it—presented us with a dilemma. Here were enough riches to consume days, even weeks, yet we could spare scarcely an hour on our one-day stroll.*

Inside the vast rotunda, under a soaring bronze Mercury, we were surrounded by a group about to start a guided tour past some of the gallery's 27,000 works of art. Knowing our own favorites, we savored the serene beauty of Giorgione's "Adoration of the Shepherds" and Donatello's life-size sculpture of David.

A guard in a room devoted to sculpture strolled over as we contemplated Verrocchio's bust of Lorenzo de' Medici, its most notable feature a prominent, spatulate nose.

"I always enjoy watching visitors when they see that," he told us. "Nine out of ten remark that it looks exactly like Bob Hope."

At the ground-floor sales desk we paused to buy a color reproduction of Winslow Homer's "Breezing Up" for our living room.

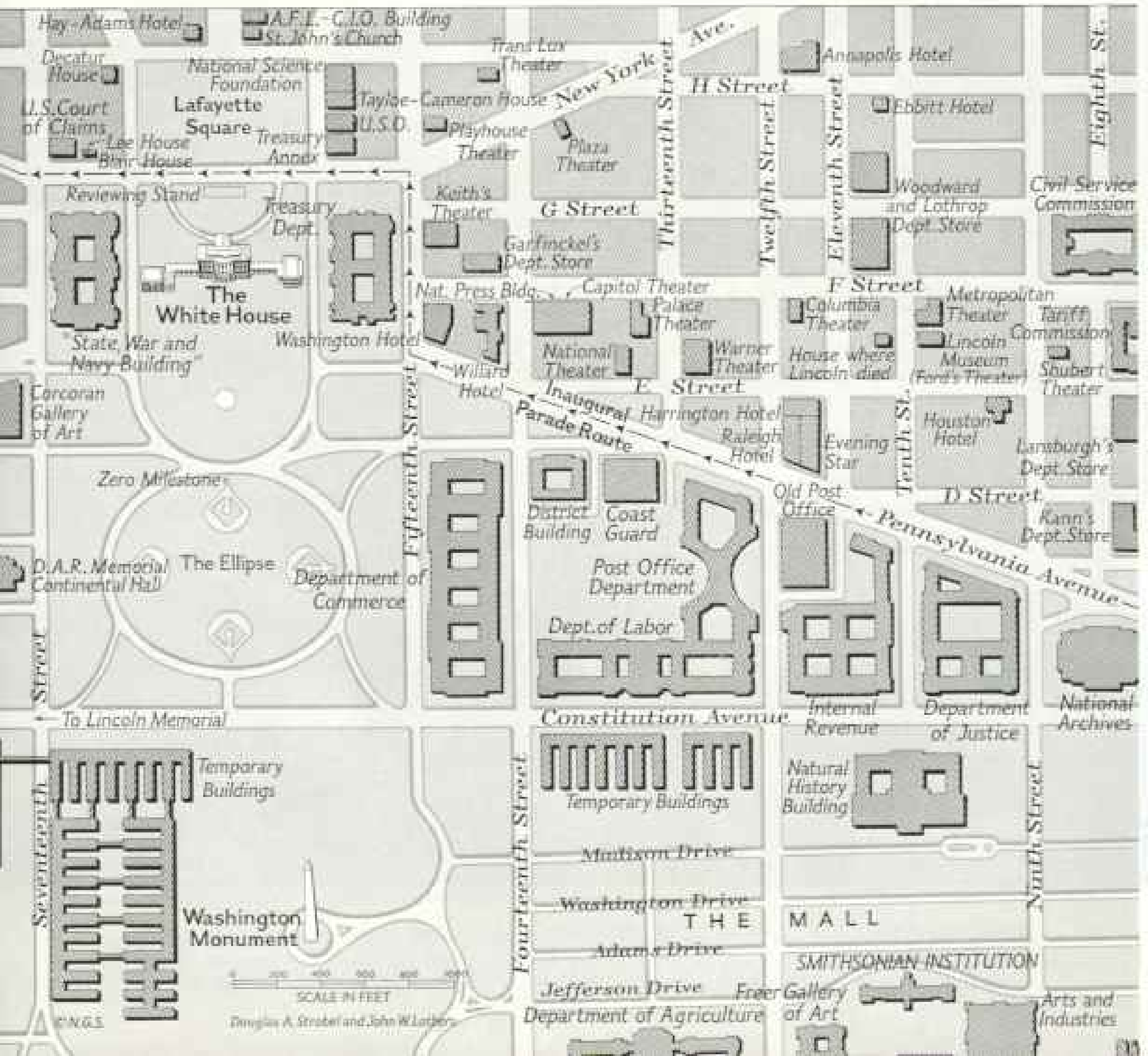
"One of our best sellers," said the girl who was helping purchasers select prints for framing from a dozen fat albums.

"Funny thing," she added, "and you can

* See "The Nation's Newest Old Masters," by John Walker, NATIONAL GEOGRAPHIC MAGAZINE, November, 1956.

↓ Washington Began near the Capitol and Grew West Past the White House

Pennsylvania Avenue's Ribbony Lights → Lead to the Floodlit Home of Congress




Hecht Co. Dept. Store One Block
Selective Service Headquarters
Indiana Ave.
Sixth Street
Municipal Center
C Street
U.S. Courthouse
Federal Trade Commission
Seventh Street
National Gallery of Art
Madison Drive
Washington Drive
THE MALL
Adams Drive
Jefferson Drive
Temporary Buildings
Fourth Street
Pennsylvania Avenue
Constitution Avenue
Third Street
Union Square
General Grant Memorial
U.S. Botanic Garden
Second Street
Securities and Exchange Commission
Indiana Ave. N.W.
Federal Home Loan Bank
Continental Hotel
Teamsters Bldg.
Louisiana Ave.
1st St. N.W.
Senate Office Building
Inaugural Parade Route
U.S. Capitol
Union Station One Block
Plaza Hotel
Delaware Ave.
Carroll Arms Hotel
1st St. N.E.
New Senate Office Building (Under Construction)
Supreme Court
Folger Shakespeare Library
Inaugural Stand
Library of Congress

David R. Boyer, National Geographic Staff

The 1953 Inaugural Parade Streams Past 15th Street Throngs in a Rain of Confetti

This street interrupts Pennsylvania Avenue's flow from Capitol to White House. Infantrymen wheel into the Avenue as distant column leaves it. Dwight D. Eisenhower, in white convertible, rides past the Treasury (right).

read a trend into it if you like, but until recently our best seller was Auguste Renoir's 'A Girl with a Watering Can.' Then Mr. Chester Dale loaned the gallery Salvador Dali's 'Sacrament of the Last Supper,' and now we're selling more copies of that than anything else."

Outside we saw a scene that might have been conceived by Dali himself. The water in a fountain across the street had turned bright green. A breeze fanned the froth until bubbles drifted toward the gallery and hung there against the rose-white Tennessee marble façade, which glowed pink under a sudden drizzle. Some prankster had dumped a bubble-bath mixture into the fountain.

Parklike Circles Confuse Motorists

Because the Avenue strikes diagonally across the city to Georgetown, it shears whole blocks in two, leaving bits and pieces of streets strewn on either side. The same is true of other main thoroughfares, also named for various States.

L'Enfant planned it that way. At frequent intervals he established areas where important streets would meet and sort themselves out. Though now a trial to motorists, L'Enfant's scheme created many small parks and circles, cheerful oases among overpowering expanses of marble, granite, and sandstone.

Where Pennsylvania and Constitution Avenues come together at such an angle, the Apex Building commands the eastern end of a planned geometric development called the Federal Triangle. Twelve Government buildings, some a block long and all about seven stories high, make up the Triangle.

The Federal Trade Commission occupies the Apex Building. Commission employees, lunching in the seventh-floor cafeteria, look through enormous curved windows upon a matchless view of the Capitol's west front.

Most of the Triangle buildings, of classic design, were put up between 1930 and 1937. They came as a belated result of a report issued in 1902 by the McMillan Commission, which found Washington drifting away from the L'Enfant plan toward architectural disorder. The commission recommended a reasonable return to L'Enfant's first principles.

Soon we stood outside the National Archives Building, raised on a truly historic site. Sounds of barter no longer ring out as when the old Center Market occupied this ground. But many Washingtonians remember coming here as children to help their mothers fill a basket on market day.

73

First Secretary Alexander Hamilton Still Guards the Treasury

A native of the island of Nevis, British West Indies, Hamilton began writing and speaking for patriot causes as a student in King's College, later Columbia University, New York. During the Revolution he organized and fought with an artillery company until called to be George Washington's secretary and aide. Following the war he wrote most of "The Federalist" essays in support of the Constitution. Hamilton led the faction favoring a strong central government.

When Washington assumed the Presidency, Hamilton became the first Secretary of the Treasury. As his crowning achievements, he established the credit of the infant Republic and founded the Bank of the United States. Death in a pistol duel with Vice President Aaron Burr ended his career July 12, 1804.

This year the United States observes the 200th anniversary of Hamilton's traditional birth date. Recently his exact age came into question. Historians, digging into the colonial archives of St. Croix, Virgin Islands, where Hamilton's mother died, found court records showing he was born in 1755, not 1757, the generally accepted date.

The bronze statue by James Earle Fraser stands at the south entrance to the Treasury Building.

More often it was nicknamed "Ma'sh Market," for Tiber Creek and tidal streams turned this low-lying area into marshland. L'Enfant hoped to create a "grand canal and cascades" from part of the old Tiber Creek, but it only came to be the evil-smelling Washington City Canal, which was finally covered over. Before the National Archives could be erected, more than 8,500 piles were driven to a depth of 21 feet to create a solid foundation.

Until the National Archives was occupied in 1935, there was no permanent depository for important and rapidly accumulating Federal documents. Today it contains nearly 800,000 cubic feet of the Nation's most valuable records.

But the visitors who come here are little concerned with the myriad official papers that fill this space. An average of 35,000—Boy Scouts, men in well-tailored business suits, shy honeymooners, retired couples on their way to Florida—enter the imposing building every month. They make the pilgrimage in curiosity and in reverence to gaze on an intensely personal heritage—the originals of the Constitution, the Declaration of Independence, and the Bill of Rights.

We strolled in and up the east stairway, although most visitors prefer the Constitution Avenue steps. But both lead to the exhibition hall, where the priceless parchments, preserved in helium-filled cases and protected against dust, light, and other hazards, are displayed. Who can stand before these great charters and not have "the murmur of beginnings come through"? Here was the beginning of the Nation, we told ourselves, the very essence of American history.

Guarded through the day, the documents disappear each evening at the flick of a switch, to be shielded by tons of steel and thick walls in an unseen vault below (page 68).

Enshrined side by side with these three relics are some fifty other documents that also knew the touch of great men. There are George Washington's own working copy of the Constitution, his first inaugural address, and the Lee resolution for independence.

As we turned into the corridor, a young mother just ahead of us told her daughter in braids, "This is something you will never forget—I know *I'm* going to be a better citizen for it."

In the hall we stopped before an automatic miniature of the remarkable safe-deposit chamber. The replica was presented to the people of the United States by the Mosler Safe Company, builders of the vault.

Behind the scenes at National Archives, and invisible to the casual sightseer, are 196 stack areas, search rooms where researchers and others may examine Federal papers, storage rooms containing 60,000,000 feet of movie film, and more than 250,000 sound recordings. In addition, there is a theater where historic films may be studied, and a modern photo-science laboratory.

Avenue Remembers Stirring Events

Like the National Archives, the Avenue itself recalls great moments in history. No month in the old street's long annals will ever quite top the days and nights in April, 1865, at the close of the Civil War, when it reached a climax of rejoicing only to plunge into deep sorrow.

In the spring dusk of April 4, a "great illumination" began on Pennsylvania Avenue, celebrating the fall of Richmond. The *National Intelligencer* reported "that popular thoroughfare became blocked up with promenaders, who crowded every sidewalk. . . ." Lights blazed, and bands played from the Capitol to the White House.

Nine days later another, and even greater, "illumination" hailed the end of the war. The Avenue throbbed as thousands danced, cheered, and celebrated. The Capitol dome, finished that same year, now was a dazzle of lights. Few noticed a dandified actor named John Wilkes Booth, mingling with the crowd but not partaking of the night's gay mood.

The next day, never to be forgotten, was Good Friday, April 14. Bunting still decked store fronts. Sounds of gaiety filled the air, only to be swept away tragically in a few hours. President Lincoln was assassinated

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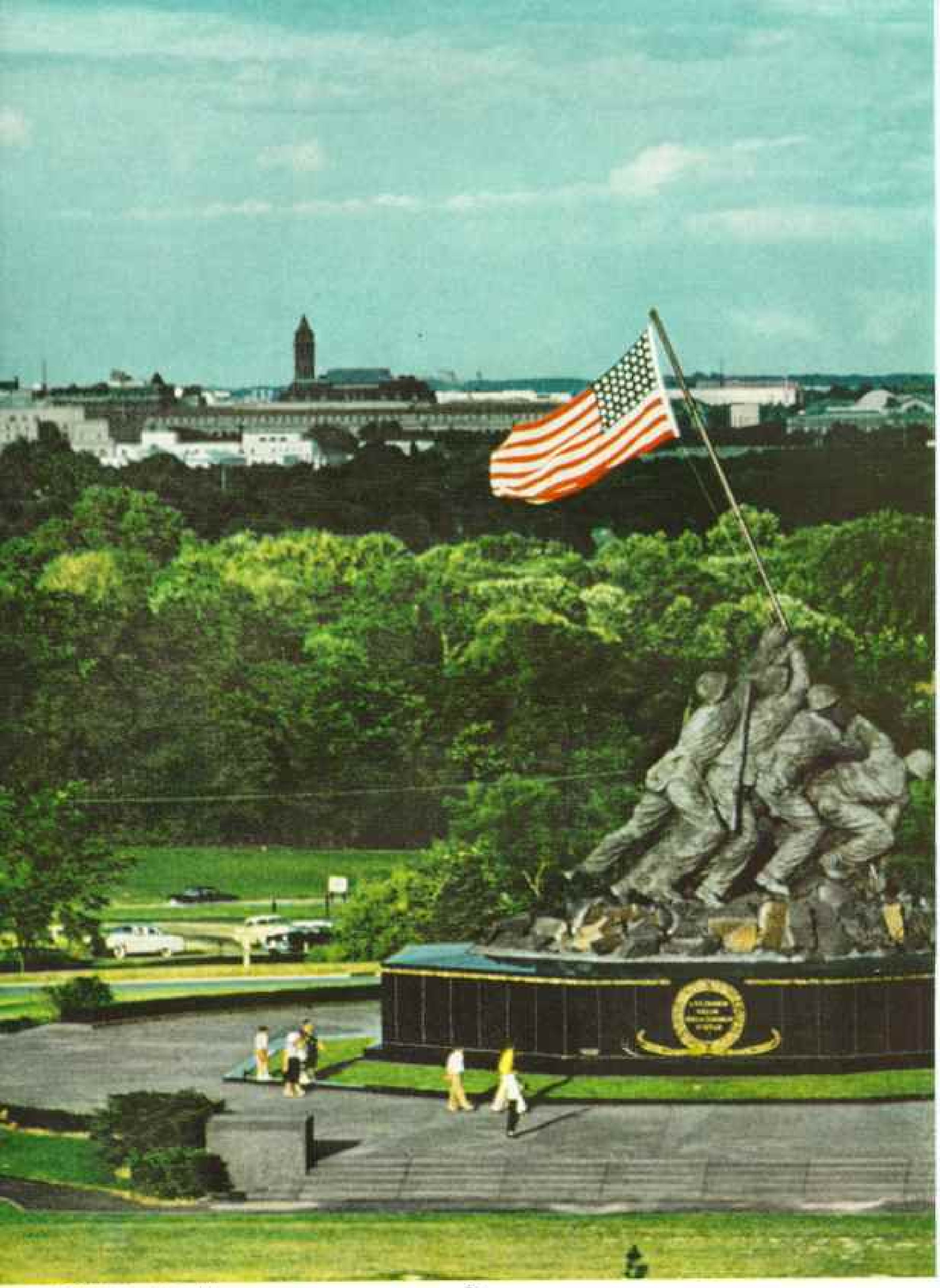
Page 74

← Fireworks Burst Like Star Shells Above the Nation's Capital

Every Fourth of July some 300,000 spectators gather near the Washington Monument and White House (foreground) for Washington's brightest and noisiest celebration. Pyrotechnicians in protective jackets use mortarlike tubes to send displays rocketing nearly as high as the 555-foot monument.

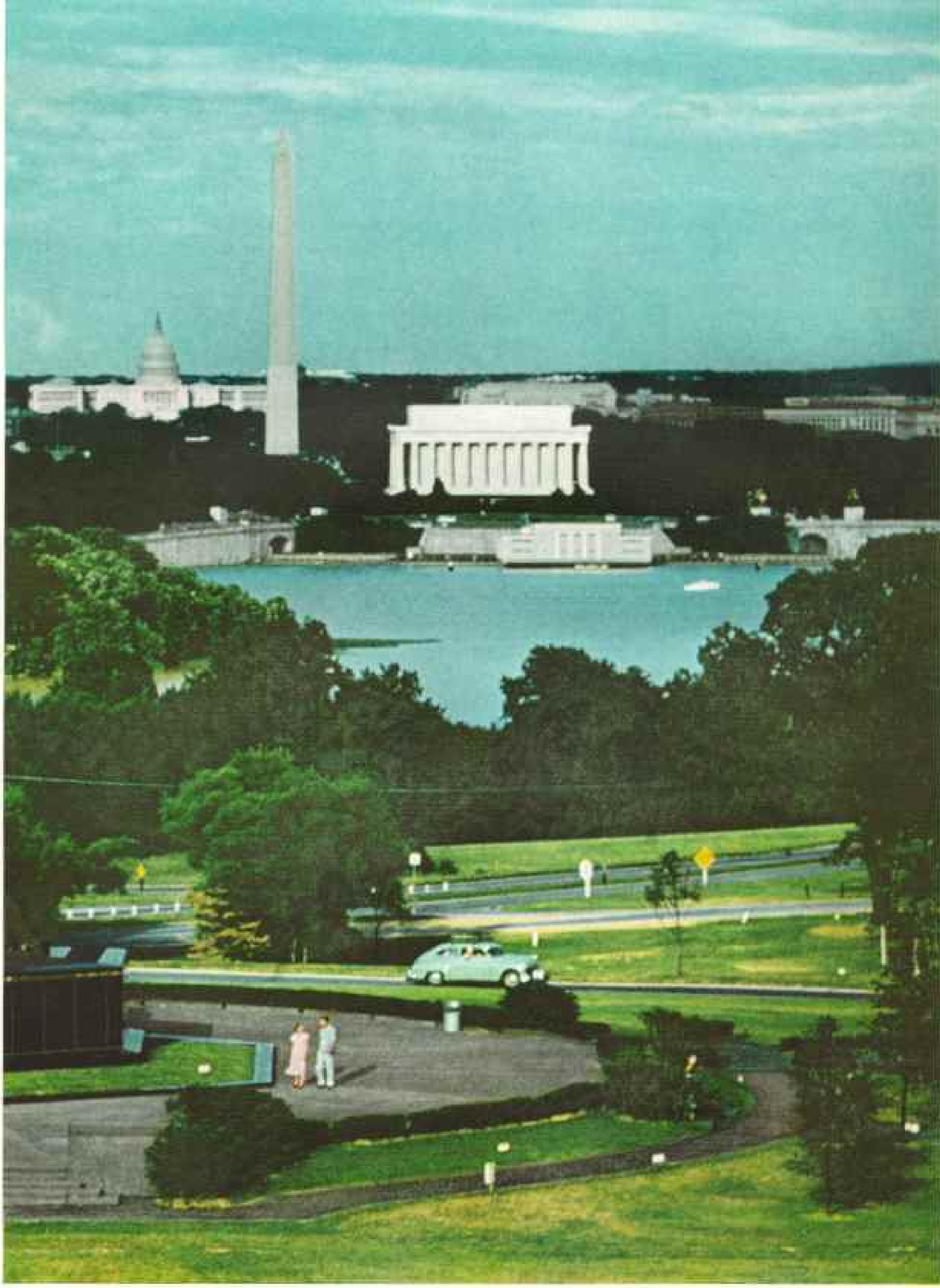
Floodlights here reveal a horizontal line about one-quarter way up the obelisk. Work halted at this point in 1854. Army engineers finished the job 30 years later with a different shade of marble (page 77).

Red beacons in observation windows serve as a warning to low-flying aircraft.



Marines Raise the Flag on Iwo Jima, Where "Uncommon Valor Was a Common Virtue"

Fleet Admiral Chester W. Nimitz provided the inscription for this monument on the Virginia bank of the Potomac. The 78-foot-high memorial depicts a World War II feat by five marines and a sailor. The flag is cloth.



77

Washington Monument Punctuates the Skyline Between Lincoln Memorial and Capitol

Service bands use the floating stage in distance for summer concerts. Music lovers sit on the Water Gate's granite steps or cluster around in canoes. Arlington Memorial Bridge (right) serves Virginia suburbs.

that night by Booth at Ford's Theater, and from a note of frenzied triumph the street froze to shocked and muffled silence. Five days later, in the heavily draped East Room of the White House, noonday funeral services for Lincoln were held.

"Soon after ten o'clock the whole of Pennsylvania Avenue from 15th to 17th Streets was crowded, and locomotion was difficult," wrote one observer. "Large numbers of people sought the grateful shade of the trees in Lafayette Square."

The sky was blue and cloudless as the cortege followed the famous route to the Capitol, where the body lay in state until Friday morning. Then the eight o'clock train bore the remains of both Lincoln and his son Willie on the slow ride to Springfield, Illinois. (The twelve-year-old boy had died three years before in the White House and had been interred in Georgetown's Oak Hill Cemetery.)

Suffragettes Cheered and Jeered

Still another day of days was March 3, 1913, when the Avenue watched 5,000 women march in a parade that had a cause—the right to vote. From early afternoon to late evening of the day before Woodrow Wilson's inauguration, the suffragettes trudged doggedly along. A crowd of 400,000 persons looked on, some cheering, some jeering and crying "Old hens!"

Soon unruly throngs broke through the lines, swarmed over the Avenue, and disrupted the parade. Scores were injured. That night, at the DAR Memorial Continental Hall, what was to have been a victory rally turned into a protest meeting; the ladies angrily denounced city officials for "inefficient policing."

"They should have stayed at home," one Congressman remarked. But an aftermath of the parade was a Congressional investigation, brought on by public outcry at this behavior toward the marchers. Seven years later the Nineteenth Amendment to the Constitution was ratified just in time for women to vote in the presidential election of November, 1920.

Entering the Department of Justice Building, we brushed shoulders with vacationing newlyweds and eager youngsters, as well as G-men intent on their own and FBI Director J. Edgar Hoover's business. A tour was forming, one that would introduce visitors to such items as a death mask of gangster John Dillinger and the straw hat that flew off his head when FBI agents shot him down in Chicago. A dramatic demonstration of submachine-gun marksmanship in a basement target range rounds out the FBI tour, one of the most popular in Washington.

After passing the Internal Revenue Service's big headquarters, we saw street repair crews at work on the Avenue, doing a bit of needed pre-parade smoothing. It brought to mind a lively exchange of letters in November, 1801, between a discouraged householder and the District of Columbia Commissioners.

"I find the communication to and from my house intercepted by a ditch, adjoining the pavement on the Pennsylvania Avenue; and by a marsh, which fronts me on the East," wrote the irate citizen. "A carriage, a cart, or a single horse, cannot pass from the Avenue to my house. It is even difficult for a person on foot."

But the Commissioners were adamant: "...neither the Season of the year, nor our funds will admit of any new undertaking on the streets." The same month, however, they directed James Hoban, Irish-born architect of the White House who had a hand in many endeavors, "to cause lamps to be placed" in four places, including "one on a Tree near the turn from the Capitol into Pennsylvania Avenue."

Up ahead we could see the clock tower of the Old Post Office. This 58-year-old landmark will be razed after the 1961 inauguration, if present plans for the Federal Triangle are followed.

A few steps brought us to the District Building, Washington's "city hall," also due for demolition after 1960. Here are the offices of the three District Commissioners who, acting in concert with Congressional committees that function collectively as "mayor," could be described as our voteless town's city council.

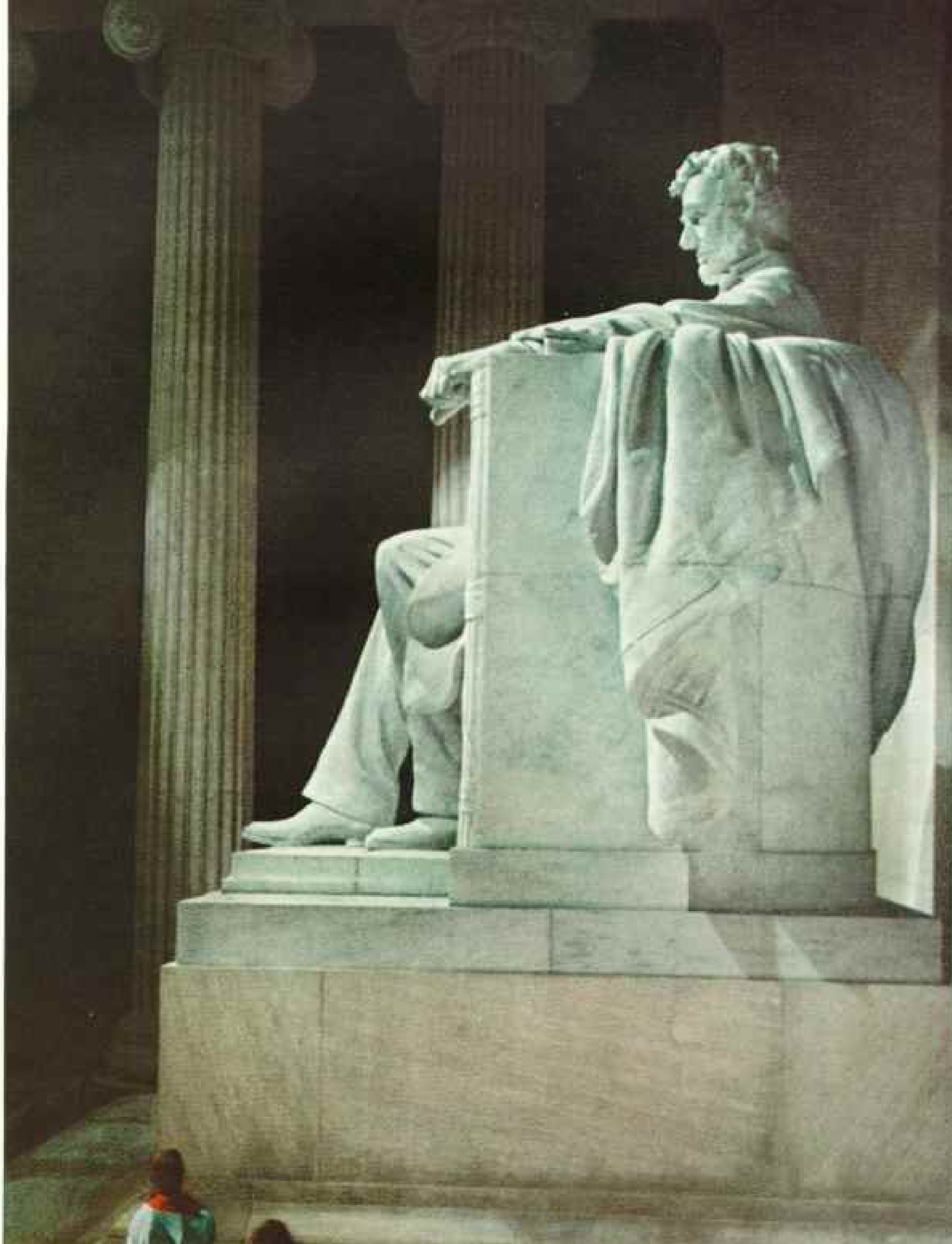
Page 79

"The World Will Little Note nor Long Remember . . ." Lincoln Was Wrong

Abraham Lincoln at Gettysburg in 1863 predicted that his words would soon be forgotten. Now some 2,000,000 people a year enter this memorial and read his Gettysburg Address carved on the wall. No other national shrine (or park) attracts so large an audience.

Architects, fearing the colonnaded chamber would dwarf Daniel Chester French's statue of Lincoln, increased the figure's height from a planned 10 feet to 19.

To avoid streaking of the Georgia marble, custodians usually wash the statue when weather turns suddenly from cold to warm. At such times the stone perspires, bringing grime to the surface for quick removal.



Pakistanis in Saris Give Washington a Cosmopolitan Air

In this world capital, people from every part of the globe rub elbows yet remain distinctively themselves.

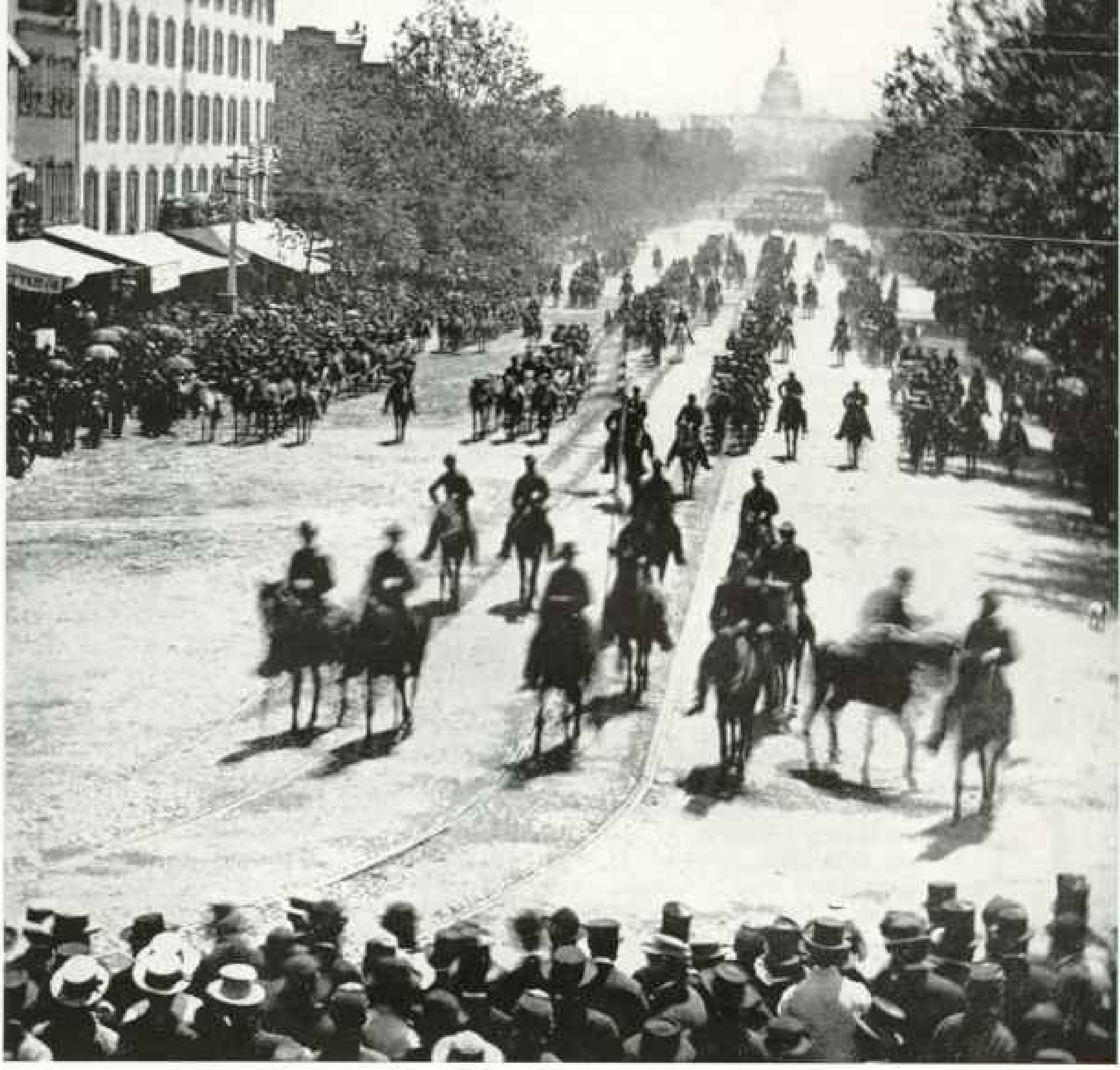
These young women, relatives of embassy officials, wear the flowing gowns of their homeland but carry purses of United States manufacture. Their destination is the National Gallery of Art in background.

Like all streetcar platforms along the inaugural route, this wooden safety island can be removed for parades.

Nation and World Drop In for News from Home

↓This Pennsylvania Avenue dealer stocks more than 350 newspapers, 22 of them printed abroad. French, Hebrew, Argentine, and Greek journals hang from the eaves of his kiosk.

Claude van Muyden (right), Swiss press and cultural attaché, reads the *Neue Zürcher Zeitung*, of Zürich.



81 Library of Congress

44 Days After Appomattox, the Victorious Union Army Parades on Pennsylvania Avenue

In May, 1865, hundreds of thousands of soldiers and visitors gathered for the two-day Grand Review, a welcome home to heroes. "Such a concourse never assembled before in Washington," said the *Evening Star*. On the 23d, firemen watered the dusty Avenue, and President Andrew Johnson and Gen. U. S. Grant mounted the reviewing stand. The Army of the Potomac led the march. "Roses bloomed in the muzzles of the guns," one reporter wrote. Here on the 24th, artillerymen of the Army of the Tennessee pass before Willard's Hotel (left), which was torn down in 1900-01. The final survivor of the Union Army died only last year. Photograph is from the Mathew Brady collection. Shutter speed of the wet-plate camera was too slow to stop motion.

Always a busy place, the District Building fairly seethes with activity in the weeks just before a Presidential inauguration. The three Commissioners must authorize a booklet of special regulations concerning traffic, parking, public buildings, and quartering of troops who take part in the celebration. They issue an official proclamation calling on all residents of the District to display flags and properly observe the inauguration of the President.

Busiest of all, and working with the Commissioners, is the chairman of the inaugural committee, chosen after the November election. He appoints dozens of subcommittee chairmen and they, in turn, name thousands of members. A group representing both Houses of Congress also has a powerful voice in the preparations.

Chairman of the committee appointed by President Eisenhower for his second inauguration ceremonies is the distinguished Washington banker and civic leader, Robert V. Fleming, Treasurer and Life Trustee of the National Geographic Society.

For 1957 Congress set aside $215,000 as inaugural expense funds, earmarking it only for

the ceremonies on the east steps of the Capitol. Another grant took care of certain municipal services, including the salaries of extra policemen imported from neighboring cities.

Since inaugurations are expensive, additional thousands are poured into a "guaranty fund" by business firms, individuals, and organizations. Such contributors get their money back through the sale of inaugural ball tickets, street grandstand seats, souvenir programs, and other enterprises.

Everybody worries about inaugural weather, and especially the dread possibility of a last-minute snowstorm. So elaborate are the preparations that the fall of a single flake would alert the entire Division of Sanitation to stand by for action with sand, shovels, and trucks. The Armed Services, if necessary, would be ready to pitch in and help.

Mr. Hoover Wanted No Parade

In a corridor of the District Building we had the good fortune to encounter our friend Maj. Gen. Ulysses S. Grant III, USA (Ret.), distinguished Washingtonian and, as we discovered, a leading authority on inaugurations. He recalled serving as general chairman for the Herbert Hoover ceremonies of 1929.

"We had an unusual problem," he said. "Mr. Hoover didn't want a parade. But there was such a demand that he agreed to a procession limited to two hours. Our parade just managed to keep within this time, and I have always regarded that as an ideal arrangement."

"March 4 of that year was a very bad day, cold and rainy," General Grant told us, "but we were always proud that we had an inauguration in which the committee, for the first time, paid back all the money that was put up. In addition, we gave $25,000 to the Community Chest—a big sum in those days."

Even then, inaugurations were not new to this grandson and namesake of the Civil War general and 18th President of the United States.

"William McKinley's inauguration in 1897 was the first one I took part in," he said. "Gen. Horace Porter was Grand Marshal. He was one of grandfather's staff officers during the last years of the Civil War. It was his idea to have the living descendants of Presidents ride in the procession—wearing red sashes—as special aides.

"I was only sixteen at the time, and the youngest. It was my first high hat and frock coat. I had a hard time keeping the hat from flying off."

The other red-sashed special aides who rode on Pennsylvania Avenue that windy March 4 were sons of Rutherford B. Hayes, James A. Garfield, and Benjamin Harrison.

"Four years later," General Grant continued, "I came down from West Point with the Corps of Cadets to take part. That was at McKinley's second inaugural."

Riding four abreast with young Grant in the parade, in a special group set apart because of illustrious family connections, were West Pointers Douglas MacArthur, son of Lt. Gen. Arthur MacArthur; Julian Larcomb Schley, cousin of Adm. Winfield Scott Schley, and Philip Henry Sheridan, son of the dashing cavalryman, "Little Phil," who helped

Jaywalkers Amble Among Buggies and Trolleys at Dawn of the Horseless-carriage Age

Gibson Girls in high collars and veils contemplate the Pennsylvania Avenue of 1905 from the Treasury Building's terrace. The twelve-story Willard Hotel at left is Washington's exciting new "skyscraper." Southern Railway Building on right has just added two floors and a tower; its façade is gone today, but a rear wing remains. Long lens brings Capitol close. Pages 71 and 81 show this view of the Avenue in different eras.

Grant win the campaign that brought victory at Appomattox.

Leaving the District Building, we passed the Willard Hotel, built in 1901. An earlier "Willard's Hotel" on the same site was where Abraham Lincoln awaited his inauguration in 1861 and where Julia Ward Howe, in that same year, wrote "The Battle Hymn of the Republic" in a room above the Avenue.

The Willard's southern windows now look upon a fresh patch of green; here, until recently, stood one of the Government's wooden temporary buildings, some of which date from World War I. All over the downtown area the "tempos" and other eyesores are coming down, to a chorus of "Good riddance!"

On many newly cleared lots, on and off the Avenue, rise edifices that mark Washington not only as the seat of Government, but as headquarters of science, education, organized labor, and many other interests that exert powerful influences upon national affairs.

West of the Willard, at the corner of Pennsylvania Avenue and Fifteenth Street, we came upon a familiar scene—a young tourist couple armed with a map and wearing expressions of bewilderment.

"We'll never get to the White House by noon if we fool around here," we heard the girl say. "Let's ask that policeman what happened to Pennsylvania Avenue. It just seems to have disappeared."

We knew they would have to turn sharp right at Fifteenth and proceed a block north. L'Enfant had planned for Pennsylvania to take a straight course through what is now the Treasury site. Now the Avenue seems to end abruptly at the massive, columned Treasury Building.

The confusing dogleg is there, so the story goes, because President Andrew Jackson, irked by delay in choosing a spot for the Treasury, thrust his cane in the ground at the northeast corner of the block and shouted, "Put the cornerstone here!"

Custer's Charger Ran Away

On this Fifteenth Street section of the inaugural route occurred one of our favorite happenings in the long history of Washington parades. Leading his 3d Cavalry Division in the victorious two-day march past of Union forces in May, 1865, Maj. Gen. George Armstrong Custer thrilled the crowds with a magnificent, if involuntary, display of horsemanship (see Brady photograph, page 81).

As an observer of that day put it:

"Among the incidents . . . was the dashing passage of Gen. Custer past the reviewing stand. . . . The General had no hat on and his golden locks were displayed to great advantage as the frightened war-steed glided by to the amazement of all beholders. It turned out that some fair lady, as the General was passing the corner of 15th Street, threw a beautiful wreath of flowers to him.

"The animal, not having been trained to such gallantry upon the field of battle, took fright and attempted to run, but the General soon curbed the spirit of the war-horse, but not until he had been carried nearly opposite the War Department."

Luckily we reached the east gate of the White House in time to beat the noon deadline for public tours. Outer walls and columns of the Executive Mansion bore a sparkling coat of pre-inaugural white paint.

We followed a knot of sightseers to the public stairs. The China Room, opposite the stairs, was closed, but on occasion it is open to special groups. Then visitors move in quiet admiration from one illuminated cabinet to the next, from gold service plate to historic heirlooms of the Washington family.

Gifts from Princess Elizabeth

Upstairs a White House policeman doubling as guide pointed out the overmantel on the State Dining Room's north wall and the candelabra on a serving table below.

"They were presented by Queen Elizabeth in 1951," he explained. "Of course, she was Princess Elizabeth then and acted for her father, King George VI of England."

Other policemen told of receptions in the Red Room, singled out the French Minerva clock in the Blue Room as an example of James Monroe's good taste, and explained the President's impressive seal woven into the rug on the floor of the Green Room.

A mahogany concert piano, presented to the Nation by the Steinway family in 1938, stood in the East Room, largest room in the White House and scene of Presidential receptions, balls, and funerals.

Near by, against the gold and white of wall and drape, Martha Washington stood out in life-size brilliance, as painted by Eliphalet F. Andrews in 1878. The portrait was copied from the unfinished "Athenaeum head" of Martha, painted from life by Gilbert Stuart and hanging in the Boston Museum of Fine Arts. It is believed that Andrews's first wife modeled the hands and arms, while other models posed for the figure itself.

A thicket of fact and fancy surrounds a near-by companion portrait of George Washington

(Continued on page 93)

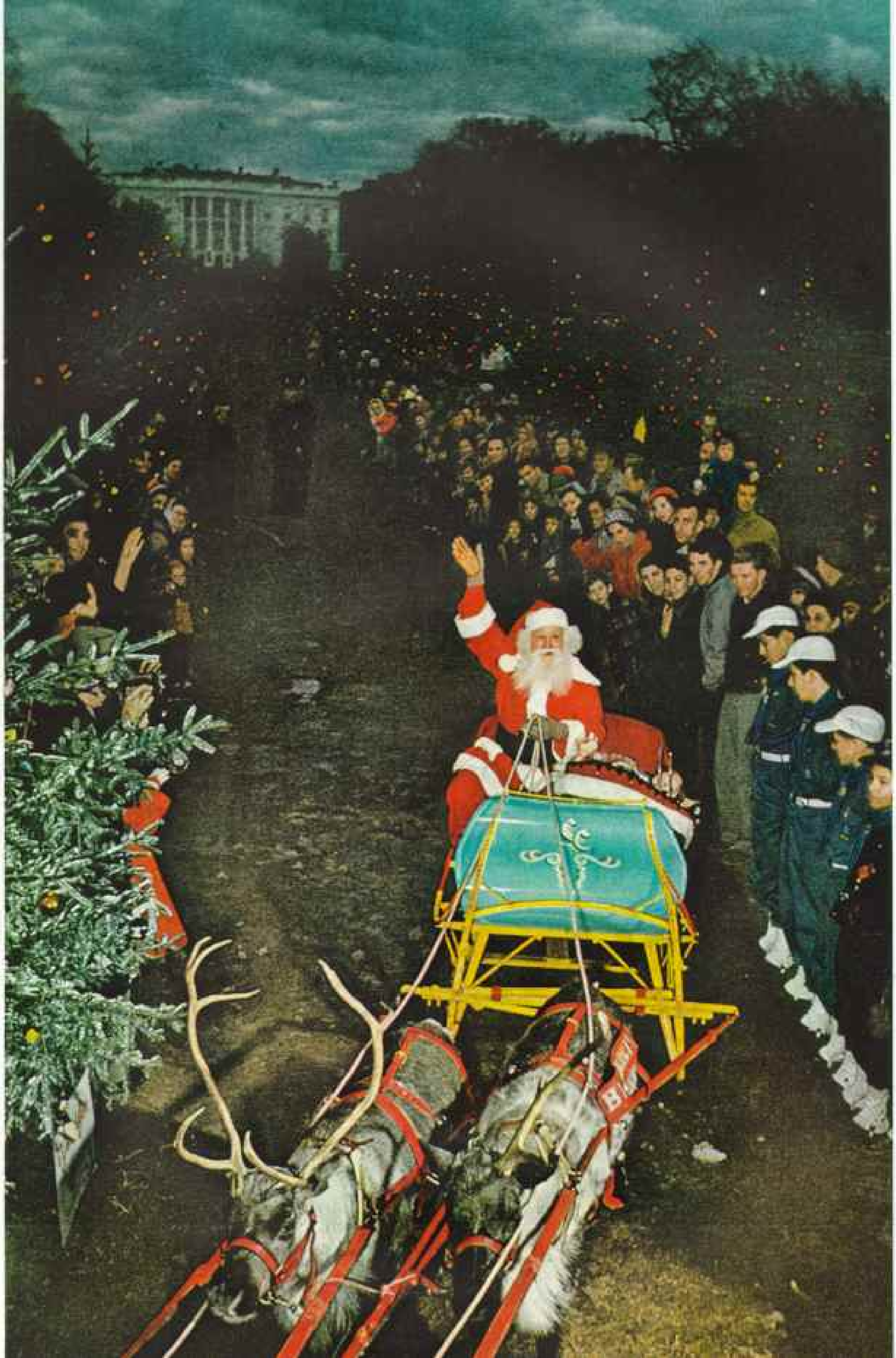
Page 85

Alaskan Reindeer Draw Santa's Sled ➔ in Washington's Pageant of Peace

Christmas occasions a two-week celebration in the Ellipse, a park south of the White House (background). Washingtonians, often snowless in December, sometimes pave Santa's route with crushed ice or paint withered grass bright green.

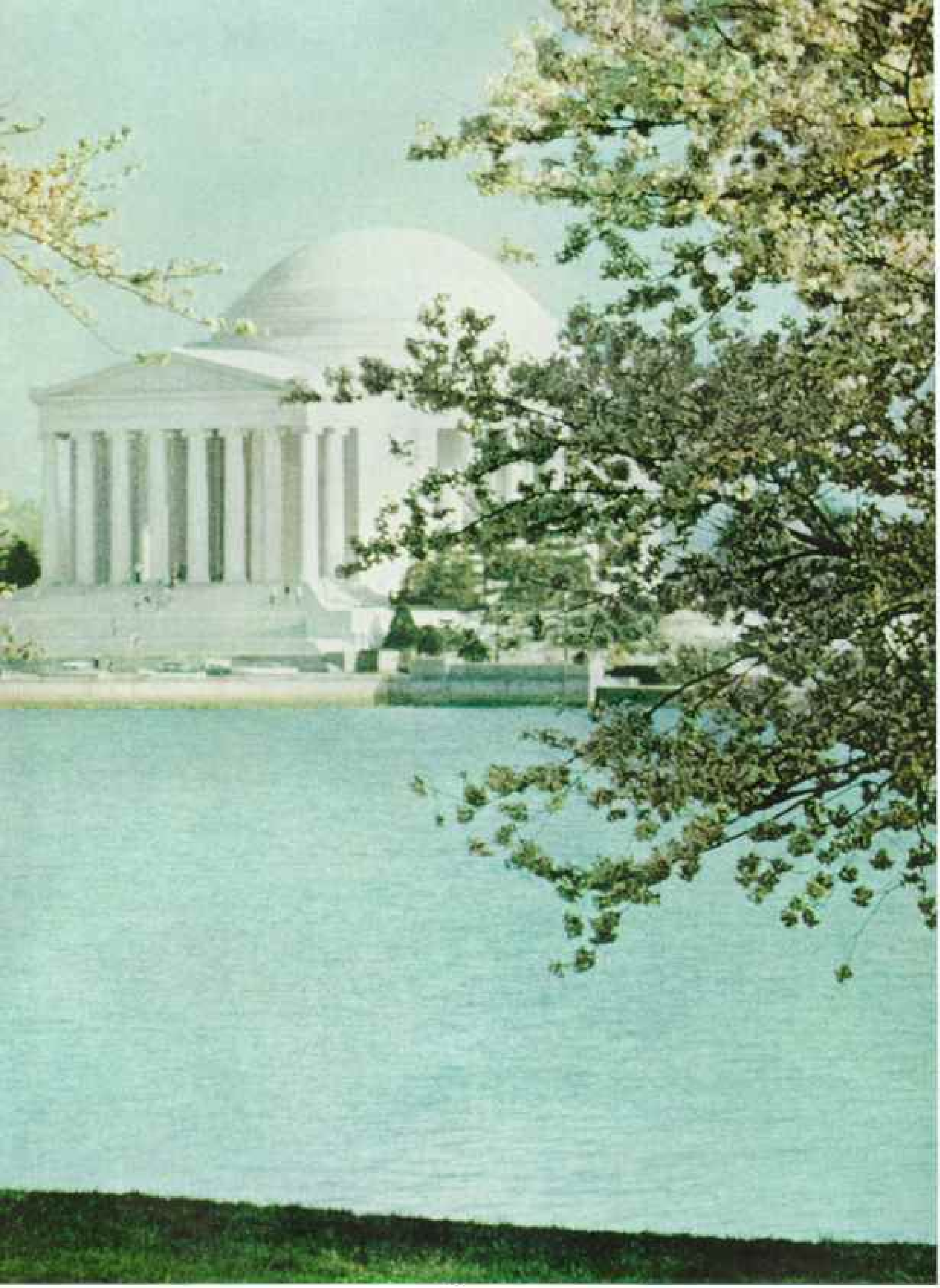
The President delivers a message and lights a giant tree. School choirs sing carols. Foreign embassies contribute decorations from children of their countries. Such a gift is the small mosque from Pakistan, a blob of light in the background.

Trees bordering this path are gifts of the 48 States. Air Explorers and Cub Scouts form Santa's honor guard. Reindeer came from Alaska by way of North Pole, a children's toy town in northern New York State.



Cherry Blossoms, Stone Lantern, and Gay Kimonos Bring Japan to the Tidal Basin

Cherry trees were Tokyo's gift in 1912. Washington in 1952 returned cuttings to rejuvenate war-ravaged nurseries. Japanese Embassy girls will light the old temple lantern (left) to open the Cherry Blossom Festival.



87

Thomas Jefferson Memorial Fills a Vacant Point in the Geometry of Washington

White House, Capitol, Lincoln Memorial, and this marble dome form four arms of a cross intersecting at Washington Monument. Ground breakers in 1938 removed cherry trees; replacing them when work was finished.

Spanish Embassy Guests Glide Through a Brilliant New Year's Eve Quadrille

Gentlemen clasp dress swords and lead partners through the *rigodón*. At midnight guests make wishes come true by eating 12 grapes, one at each clock stroke. A knight of the Order of Malta wears the red tunic (center).

89 Volkmar Wentzel and Donald McBain, National Geographic Staff

Diplomatic Braid and Rustling Silk Swirl Below Glittering Chandeliers

Spanish Ambassador Señor Don José María de Areilza, Count of Motrico, dances with his daughter Mercedes next to a Flemish tapestry representing a victory by King Charles I of Spain. Bust at right portrays Philip II.

Volkmar Wentzel and Donald McBain, National Geographic Staff

Four First Ladies, Widely Different in the Flesh, Are Look-alikes in Effigy

A popular Smithsonian Institution exhibit pictures wives and hostesses of the Presidents in gowns they wore in life. To avoid controversy, the Smithsonian gave to all its 37 figures an identical face, that of Shakespeare's Cordelia as idealized by a sculptor. Varying hair styles help conceal uniformity. Mrs. U. S. Grant (right) wears an inaugural gown of silk given by a Chinese emperor. Salon copies the White House Blue Room of 1870.

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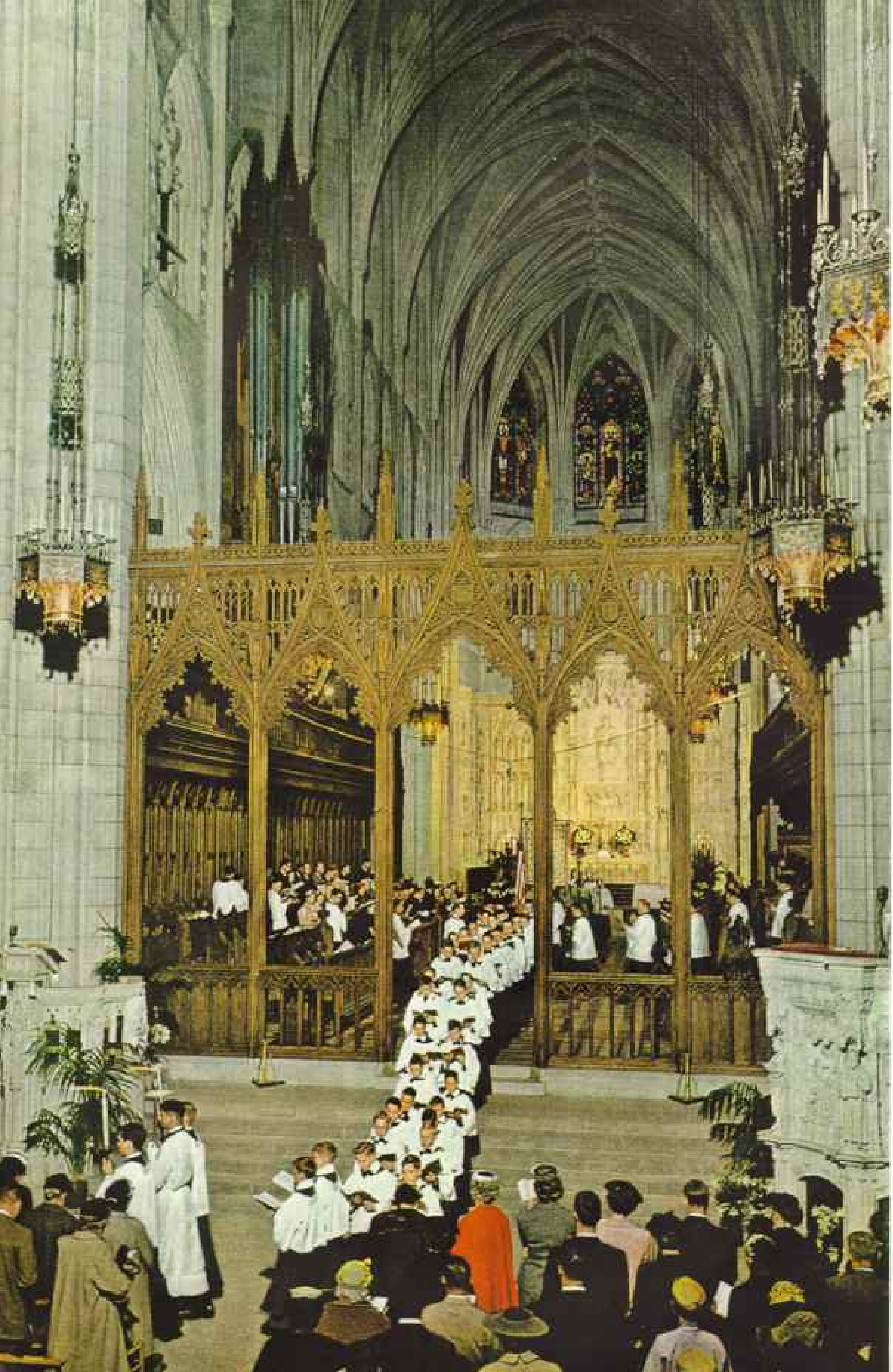
↑ National Geographic Visitors Tour the World in Explorers Hall

The Society maintains a permanent exhibit in its Washington headquarters. Trophies document more than 100 scientific expeditions. Totem masks on left and right come from New Guinea. Pictures by staff photographers change every 12 seconds on screen. These actors sit before the Acropolis in Athens.

↓ Picasso's "The Lovers" Draws Admirers at the National Gallery of Art

Congress in 1937 established the gallery as a bureau of the Smithsonian Institution. Gifts and loans comprise a collection now ranked among the world's best. An educational program interprets the gallery's treasures to visitors. Here a lecturer (in turquoise dress) leads one of many public tours.



in a black velvet suit. Some choose to believe that Gilbert Stuart was the artist. Many more throw up their hands and hope for decisive evidence.

Others think that this portrait is a copy of a Stuart, perhaps by the English-born artist William Winstanley. One thing is sure: Government records for July 9, 1800, show that a warrant was issued for $800 for "a portrait full length of the late General Washington . . . for the President's House."

There is more certainty that this is the Washington portrait that Dolley Madison had removed from the frame and delivered into safe hands during the War of 1812. One frantic day in August, 1814, she wrote that she was "within sound of the cannon" that presaged the invasion of the Capital and burning of the White House by the British.*

Leaving by way of the stately north portico, we headed across the Avenue to Lafayette Square where, despite a chill wind from the Potomac, people idled on benches and fed squirrels and pigeons.

Everyone who hears about the plan proposed some years ago to replace the old structures on the square with Government buildings gives a sigh of thanks that it failed. What would the historic old park do without its first private dwelling, Decatur House, and its church, little St. John's? Both are revered and preserved as prime examples of the skill of Benjamin Henry Latrobe, the Nation's first outstanding professional architect.

Decatur House, facing the northwest corner and built for Stephen Decatur only a year before he was killed in a duel, wears a proud tradition. Among those who have lived here were Henry Clay, Secretary of State under John Quincy Adams, and Martin Van Buren while Secretary of State under Andrew Jackson. Recently the house with its furnishings was bequeathed by the late Mrs. Truxtun Beale to the care of the National Trust for Historic Preservation, and the use of its rooms offered the United States Navy for official entertaining.

Opposite the square's northeast corner stands the old home of the Cosmos Club, which moved a few years ago into the Townsend mansion on Massachusetts Avenue. The club's former quarters consist of several buildings joined and connected, and are now used as headquarters by the National Science Foundation.

One of the buildings in the group is the house Dolley Madison occupied during her last years and in which she died. It is considerably changed since then. Another is the Tayloe-Cameron House, known as the "Little White House" during the McKinley administration. A few yards away, toward the Avenue, a USO club entertains service men and women in the old Belasco Theater.

Cows Grazed in Lafayette Square

Not so many years ago the square was a grazing ground for livestock that wandered in from neighboring farms. Today it comes close to being Washington's "village green," shaded by giant elms, beeches, cypresses, magnolias, and many kinds of evergreen. Its squirrels and pigeons live extremely well, fattening on the peanuts and popcorn handed out by casual passers-by and "regulars" who come daily to the park for just that purpose.

Oddly enough, Lafayette Square's central and most prominent piece of statuary honors Andrew Jackson rather than the Frenchnobleman for whom the park was named. The heroic figure of Old Hickory on a rearing, short-coupled charger was erected in 1853—the work of Clark Mills, a plasterer with no formal art training.

The Lafayette bronze, which came later, stands in relative obscurity at the southeast corner. Statues of Count Rochambeau, Baron von Steuben, and Gen. Thaddeus Kosciusko, who also came from Europe to help the American cause in the Revolution, adorn the other corners.

A buff-colored house, with dark-green shutters and burnished brass knocker, stands near

* The first name of President James Madison's wife is correctly spelled with an "e". She was baptized Dolley and spelled her given name this way whenever she wrote it. Usually she signed herself "D. P. Madison."

Page 92

← Boys Choir Leads Easter Recessional in Unfinished Washington Cathedral

President Theodore Roosevelt in 1907 helped break ground for this Episcopal cathedral. Today the Gothic edifice is more than half completed.

Stone for the pulpit (right) came from England's Canterbury Cathedral. Altar blocks were hewn from the quarry that supplied King Solomon's Temple. Columns 19 feet thick at left and right will support a 288-foot tower still to be erected.

Before appointment to the choir, boys undergo six months of auditions. Successful candidates get scholarships to St. Albans School, close by.

Volkmar Wentzel and Donald McBain, National Geographic Staff

by on the Avenue, diagonally opposite the White House. This is stately Blair House, its brick covered with stucco. Through the years since it was built in the mid-1820's, its occupants have had a front-row seat for the Avenue's biggest events. The Montgomery Blair family sold it to the Government in 1942; now it serves as the Department of State's official shelter for Very Important Persons from abroad.

Just before the Truman family's stay there, while the White House was being restored, doorways were cut to connect Blair House with adjoining Lee House, also used for official guests.

The old residence has known terror as well as glamor. It was here that President Harry Truman, aroused from his nap one afternoon in 1950, appeared briefly at an upstairs window while guards and would-be assassins shot it out at the front door.

Where VIP's Raid the Refrigerator

We knocked at the English basement door and were greeted by Mrs. Victoria Geaney, the State Department's hostess-manager. She showed us the pleasant third-floor suite once used by Margaret Truman, cabinets of early American Sandwich and Stiegel glass, a safe full of gleaming silver, and the drawing room where international conferences are held.

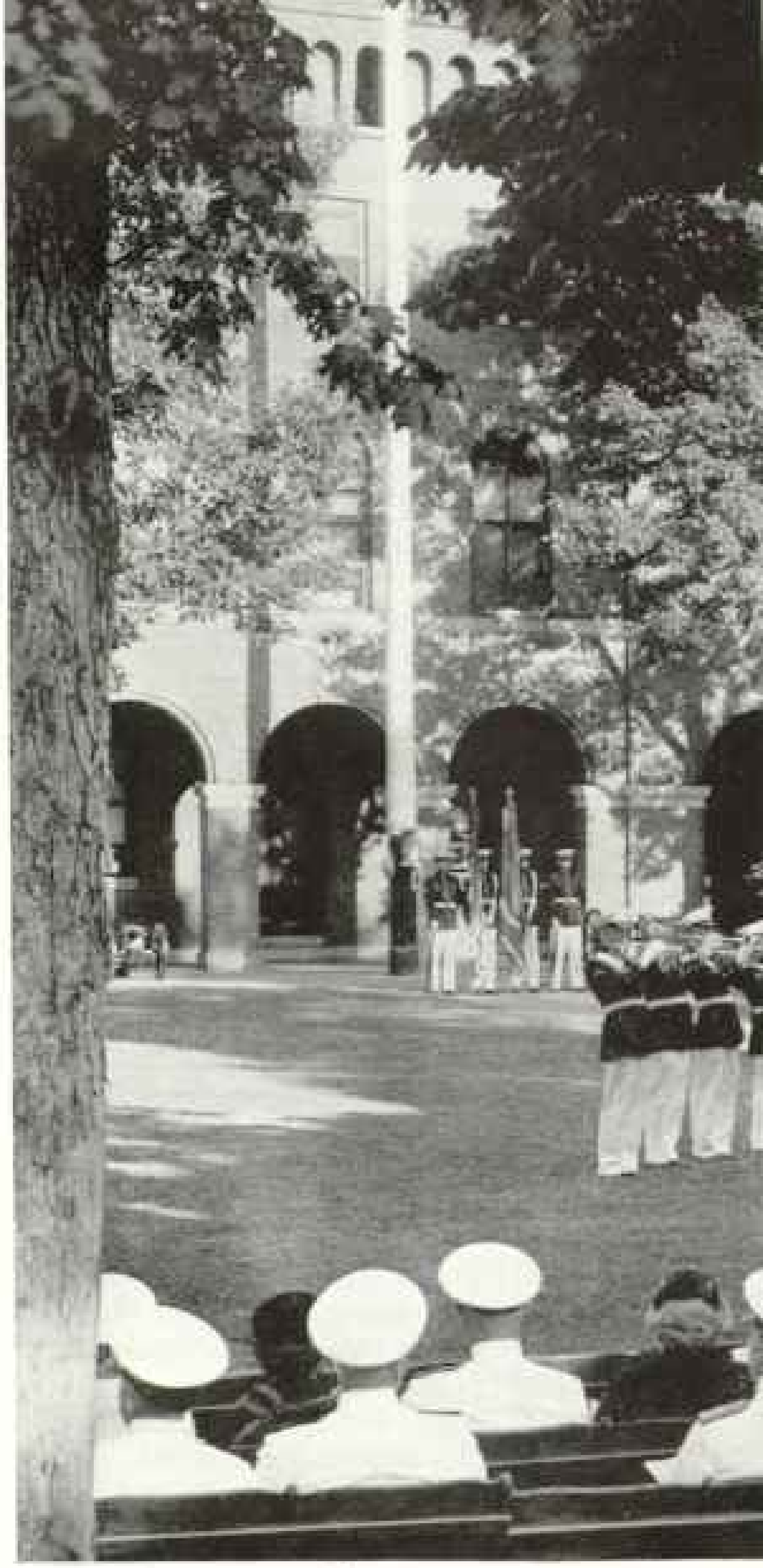
Mrs. Geaney operates Blair-Lee House in a comfortable manner that breaks down the stiff formalities of protocol. Premiers and presidents staying there have been known to enter into the great American pastime of foraging in the refrigerator for late snacks.

"We try to make our guests feel at home," she said, "and most of them seem to welcome an opportunity to relax. I remember particularly the Italian Prime Minister, Mario Scelba. He and Signora Scelba were wonderful, so warm and friendly.

"After the Scelbas came in from a reception or a dinner, members of the party would come down to my basement apartment and watch television with me, and we would have refreshments."

Sometimes Mrs. Geaney is hard pressed to pack up and bid one set of guests farewell in time to say hello to new arrivals.

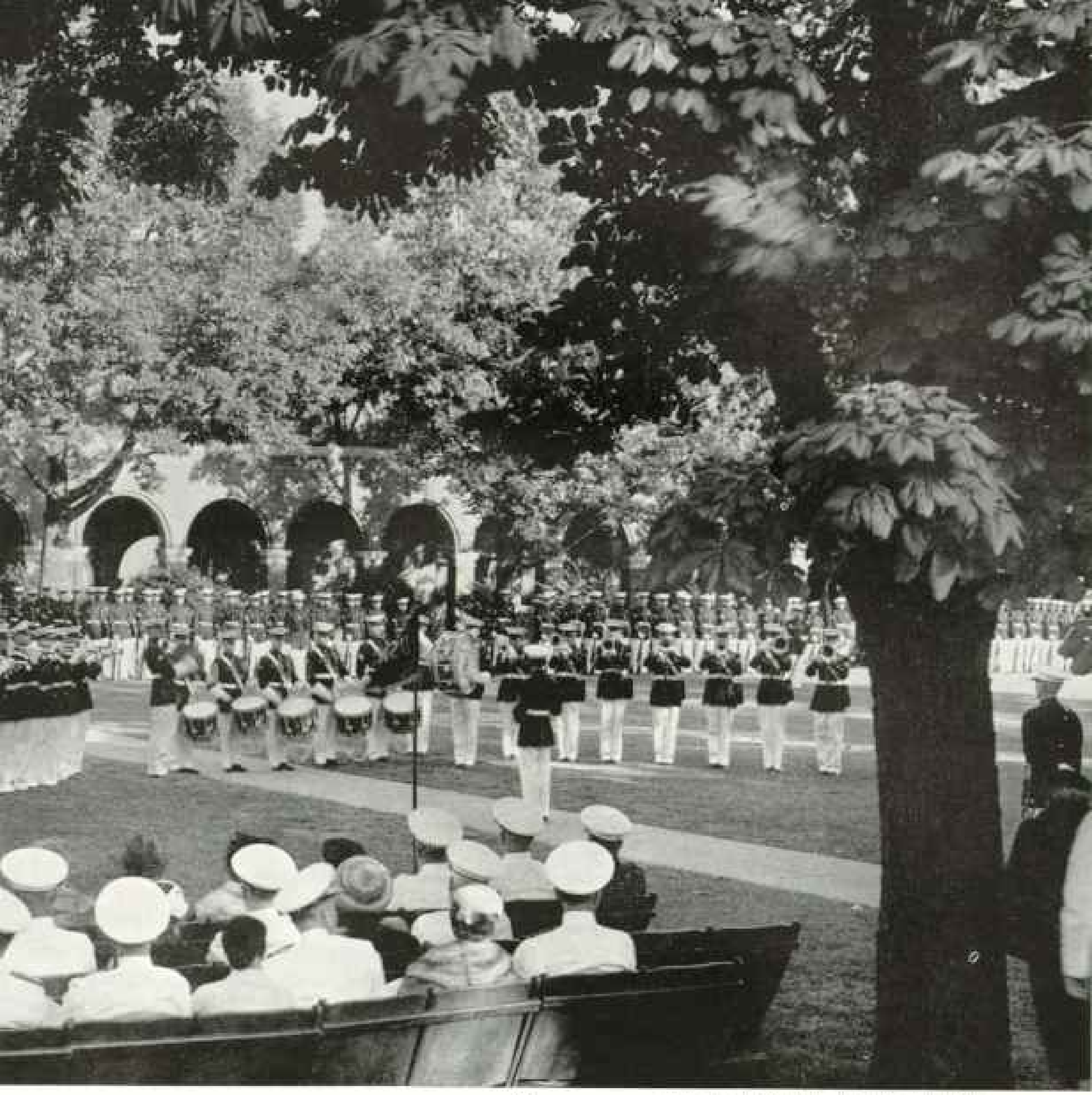
While such visitors constantly come and go, other foreign emissaries who represent their governments in a more lasting way underscore Washington's place as a world capital. Even as we left 152-year-old Blair House, passers-by included two sari-clad ladies, probably from one of Washington's eighty embassies



and legations, bound for F Street shopping. Saris and turbans no longer cause heads to turn here, nor does the sight of a girl in pink Punjabi pantaloons loading supermarket purchases into a chartreuse convertible.

In December, 1945, there were only fifty-seven diplomatic missions in the United States. Since World War II, more new nations have come into being and now occupy additional patches of foreign territory in the Capital. In a recent week three representatives presented credentials to the President of the United States. They were the Ambassadors from Morocco, Tunisia, and the Sudan.

Until August, 1947, the State Department, in handy juxtaposition, occupied the great rococo pile of stone across the street from



Henry Ruthstad, Washington Post and Times Herald

Bugles Peal and Drums Roll at Marine Barracks, the Leathernecks' Oldest Post

Established in 1801 on a site selected by President Jefferson, the post was Corps headquarters for a century. Today it is used largely by Marines on ceremonial duty. John Philip Sousa, a leader of the Marine Band, wrote some of his marches at the post. Here the Drum and Bugle Corps plays at a sunset parade.

Blair House, in what old-timers still call the State, War, and Navy Building. Now the White House executive offices have overflowed into the rambling structure, and the State Department does most of its business in its new home at Twenty-first Street and Virginia Avenue in Foggy Bottom.

State, War, and Navy was completed in 1888, but even older is the square red-brick building just west of Blair-Lee House where the United States Court of Claims holds forth. This structure was erected in 1859 by philanthropist William W. Corcoran to house an art collection which he presented to the city. The Corcoran Gallery of Art later moved a few blocks south on Seventeenth Street.

At Seventeenth Street and the Avenue we stood on the corner taking the long view east. In 1791, after Secretary of State Thomas Jefferson saw L'Enfant's plan, he wrote: "The street most desirable to be built up at once, we suppose to be the broad one (the avenue) leading from the President's house to the Capitol."

Mr. Jefferson, then and later, had a way of being right.

Norway's Fjords Pit Men Against Mountains

Proud and Steadfast People Cherish Hard-won Living Space Where the Sea Thrusts Arms Deep into a Rugged Land

By Andrew H. Brown

Senior Editorial Staff, National Geographic Magazine

With Illustrations from Photographs by the Author

ONLY the gurgle of water and swish of dripping oars broke the morning stillness as we glided across Geiranger Fjord in southwest Norway. Sverre Mjelva, hotel manager playing booky from all his guests but me, trailed a fishing line and idly inspected the almost perpendicular scenery.

"*Se opp!*" he exclaimed—and instinctively I ducked, for I had been long enough in fjordland to know that those words meaning "Look up!" often carry an urgent warning. People who live in this vertical world must keep one eye on the heights above, alert for the thundering fury of avalanche or rockslide.

Gravity Helps with the Haying

But this time there was no sign of fjordland's sword of Damocles, *fare ovenfra*—"danger from above." My friend was pointing up to distant figures on the mountainside.

"They are bringing in the high-field hay," he said.

As we drew closer I saw that from posts in the lower fields eight or ten cables fanned out skyward. Their upper ends were secured to posts in hay patches so far above that people working there seemed mere black slivers moving through the golden grass. Down these wires, as we watched, big bundles of hay came shooting (page 115).

"You see, gravity can be a friend as well as an enemy," said Sverre in his careful word-by-word English. "It helps the farmer get in his hay, and it also makes our country rich in water power."

Suddenly he gave his line a tug, pulled it in, hand over hand, lifted aboard a flapping mackerel, held it up for my approval, then continued as if there had been no interruption.

"But gravity means danger too. Sometimes there comes tragedy."

All around us towering cliffs gave emphasis to his words. Pull as I might on the thick-shafted oars, we seemed not to move through that colossal landscape (pages 99, 100).

In inner Nord Fjord I already had come upon the scars of twice-repeated tragedy (page 114). From the face of Ravnefjell—Mountain of the Raven—on January 14, 1905, huge masses of rock fell into Loen Lake.

Displaced water swept in a monstrous wave over the farms of Nesdal and Bødal. The flood killed 61 people, mostly by drowning, crushed buildings like paper cups, and threw a lake steamer 500 yards inland.

Families cleared debris and rebuilt homes and barns. Then, on September 13, 1936, the face of Ravnefjell collapsed again, and 74 people died—two-thirds of the population of the upper valley. A third rockfall in 1950 fortunately caused no loss of life.

The experience of centuries, of course, has taught the fjord people which sites are substantially immune from snowslide and rockfall. Yet on many a farm in southwest Norway living will always be a bit precarious.

Glacier-gouged Fjords Set Life's Tempo

Roving through fjordland, I slid effortlessly into cadence with the way of life of a friendly, resolute, ingenious people.

Fjords, the frame and theme of life in western Norway, are mighty grooves clawed out by glaciers and invaded by the sea when the ice withdrew. They slash the whole length of Norway's Atlantic shores. Those of greatest majesty and fame indent the southwest coast (map, page 106).*

Ponderous glaciers ground down the native rock not just to sea level but far below it. For coastal waters, the fjords are prodigiously deep: To plumb one spot in Sogne Fjord takes 3,966 feet of cable.

Sogne Fjord, Norway's longest, probes 120 miles inland. Narrowing walls of others squeeze them to nothing within a dozen miles.

Temperate ocean waters sideswipe Norway en route to arctic Europe. This relatively

(Continued on page 105)

* See "Stop-and-Go Sail Around South Norway," by Rear Adm. Edmund J. Moran, USNR, National Geographic Magazine, August, 1954.

Smiling Maids on a Fjord Outing Rest at the Outsize Oars of Their Spotless Dory

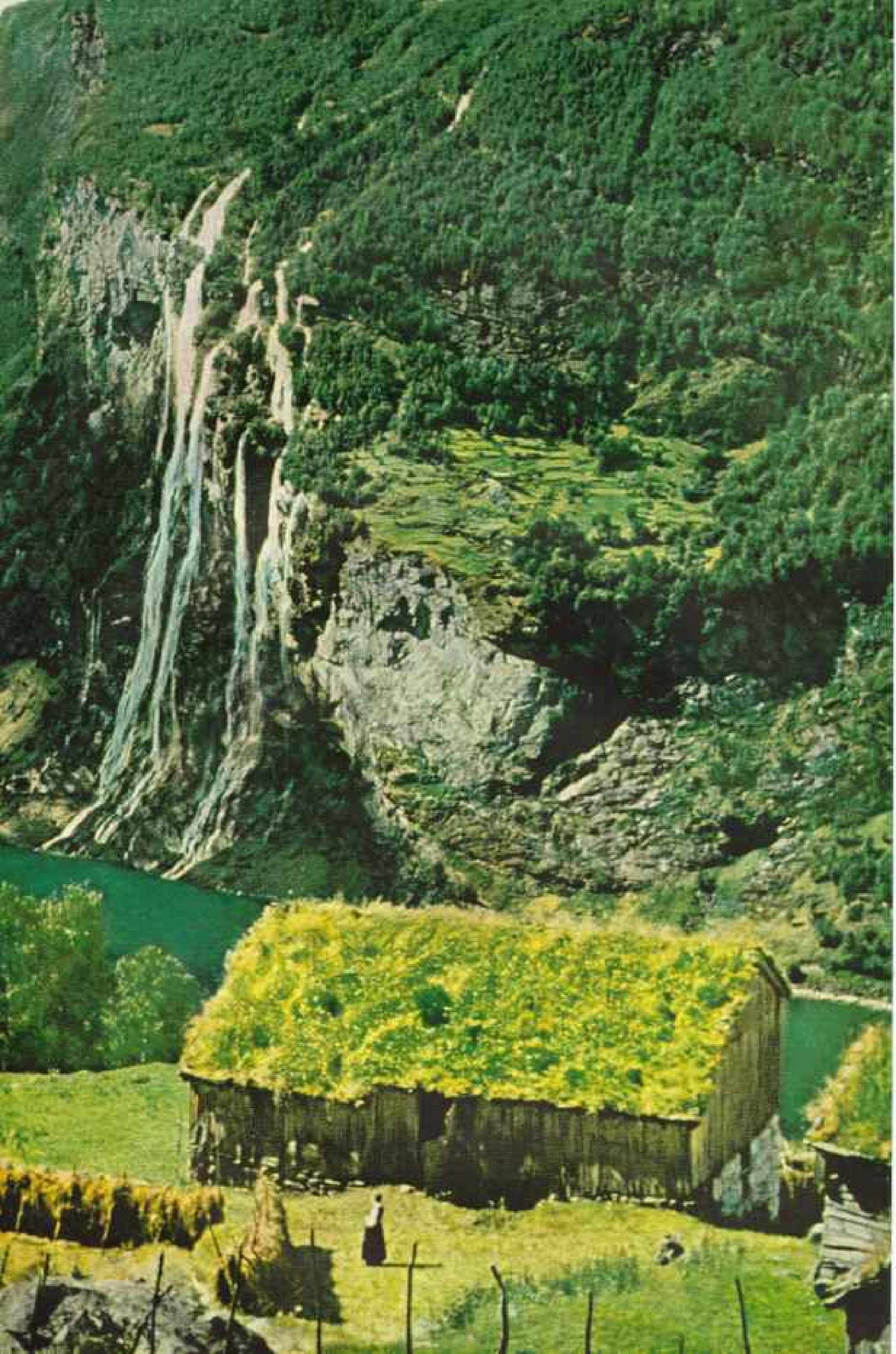
Shrouded peaks and verdant foothills ring the sunlit tip of Ulvik Fjord, an arm of Hardanger Fjord 100 miles from open sea. Immaculate aprons protect Voss district working dress (left) and beaded Hardanger costume.

A Gleaming Ferry, Work Horse of Norway, Comes to Rest in Balestrand Beside the Majestic Walls of Sogne Fjord

Passenger Steamer Spreads a Glittering Wake Between the Towering Cliffs of Geiranger Fjord

Seven Sisters Fall Tumbles 1,500 Feet, Almost Three Times the Height of Washington Monument, into Geiranger Fjord

Families living on the brink sometimes tether toddlers at play lest they drop down a sheer precipice. Landslide is a constant threat. Here at Skagaflå hay dries on strands of wire beside sod-roofed house and barn.



102

Hjelle Valley's Switchback Road Tells a Winding Story of Norway's Up-and-down Travel

←Dropping Their Packs, Campers Take a Mountainside Coffee Break

Scientists believe deep cracks in the earth's crust laid the basis for Norway's fjords. Later, during the glacial period, ice masses thrusting down from the mountains gouged the faults into wide canyons, some of them much deeper than the neighboring sea. When the ice retreated, ocean waters invaded the fjords far into the mountainous interior. These sawtooth indentations give Norway a coastline thousands of miles long.

Here the author (center) and Norwegian friends stop for lunch beside a rock formation known as Prekestolen.

↓Grandfather, boy, and dog live beside Geiranger Fjord (page 100).

↑ Tassel Caps Splash Color over Norway's Summer Landscape

These three pause by a rushing stream near Trollstegen.

←A young woman does her embroidery in the cabin of a *seter*, or mountain farm, common to the fjord country.

In summer farm women drive cows, sheep, and goats thousands of feet up the steep slopes to auxiliary pastures, remaining until autumn snows force a retreat. Each day finds them milking cows, churning butter, and making cheese. They live alone while husbands and brothers do the chores at home. Men make occasional visits to bring supplies and carry away cheese and butter.

Once the seter served as a refuge from sea rovers, who stole into quiet fjords to loot and burn. Many a victim was able to rebuild his home because he had his mountain farm to fall back on.

Norway's growing road system encroaches on this lonely life. Easy access by truck and bus lessens summer's isolation.

This girl in festive costume stitches by the light of a kerosene lamp because electricity has not reached the seter. Norwegians call the hand-painted sewing box a *tine*.

warm water, a Gulf Stream offshoot, bestows on the fjords—lying in the same latitudes as ice-draped south Greenland, Alaska, and bleak Bering Sea—a climate surprisingly mild for so far north. Except for inner fingertips, fjords stay ice-free the year round.

Summer warmth here ripens tobacco, walnuts, even grapes. Norwegian botanists find their nation's richest flora near the heads of western fjords. Lowlands are gay with roses and rhododendrons. Apple, pear, plum, and cherry orchards support the farmers of Hardanger and Sogne Fjords.

Western Norway's climate, furthermore, like much of the world's, is getting warmer. In recent times, climatic change has raised the upper limit of agriculture by 500 to 650 feet, extending the land fit for farming.

Farmers Row to Town

The fields of Humlung overlook Geiranger Fjord and the village of Geiranger with its shops, hotels, and street-corner gossip. Yet Humlung people, when they go to town, reach it only by goat path or boat. The cliffs are too high and the country too rugged for a road.

When we rowed to Humlung that July day, all hands were on the mountainside harvesting the high-field hay.

Landing, I joined two boys, perhaps eight and ten, at the receiving end of a cableway. Tugging and straining, the lads off-loaded the big bundles from the pulley hooks.

Between arrivals of hay, the boys rode the cable's last fifty feet, hooking on where it dipped close to the slope. Near the end they dropped and rolled in the grass like wind-blown tumbleweed, yelling with delight.

Later, with three new Norwegian friends, I traveled by motorboat to Skagaflå, a few miles down-fjord from Geiranger. We landed at the foot of a precipitous trail that climbed 1,500 feet, nearly straight up, to the narrow setback supporting Skagaflå's farms.

Sometimes we clung by our hands to roots and clumps of grass. Steps hewn from the living rock eased our ascent in places. Where the path was a thin lip between cliffs above and below, handrails of pipe gave support.

The climb not only gave us a grasp of the loneliness and isolation of high farms in fjordland; there also was the view. Skagaflå looks across Geiranger Fjord to the lacy loveliness of the Seven Sisters. Perhaps Norway's best-known cataract, its waters plunge some 1,500 feet into the fjord in seven streamers of shimmering white (page 100).

We sat on a stone wall, absorbing the spectacle. A fjord steamer, gliding along far below, was a dab of black, towing its herringbone wake. Only the lowing of cattle and the vibrant hiss of wires carrying hayloads from fields above broke the stillness.

Hanging Out the Hay

The women of Skagaflå, that sunny afternoon, were hanging out the hay to dry, much as the American housewife pins up her Monday wash on clotheslines. Since time immemorial almost all fjord country hay has been cured on *hesje*, the word for the whole process of drying hay by laying it on wire or cords strung between poles (page 116).

We watched wives and daughters, helped by the younger boys, rake up the scythed hay. They lifted the grass in armfuls and spread it evenly along the wires, loading the lower strands first.

Fjord agriculture is a never-ending battle, with the courage and persistence of proud and hardy people pitted against staggering physical obstacles. In this land "up" and "down" have overwhelming importance.

One farmer's daughter in Geiranger, until recently, went up and down 1,700 laid-stone steps each 24 hours to carry milk from the *seter*, or high-country pasture. Only plowing by cable makes some steep fields arable. An engine, secured at the top of the field, pulls plow and harrow straight uphill on a wire.

Over most of western Norway tillable soil is totally absent. Less than two percent of fjordland can be plowed.

Stony Fields Suggest New England

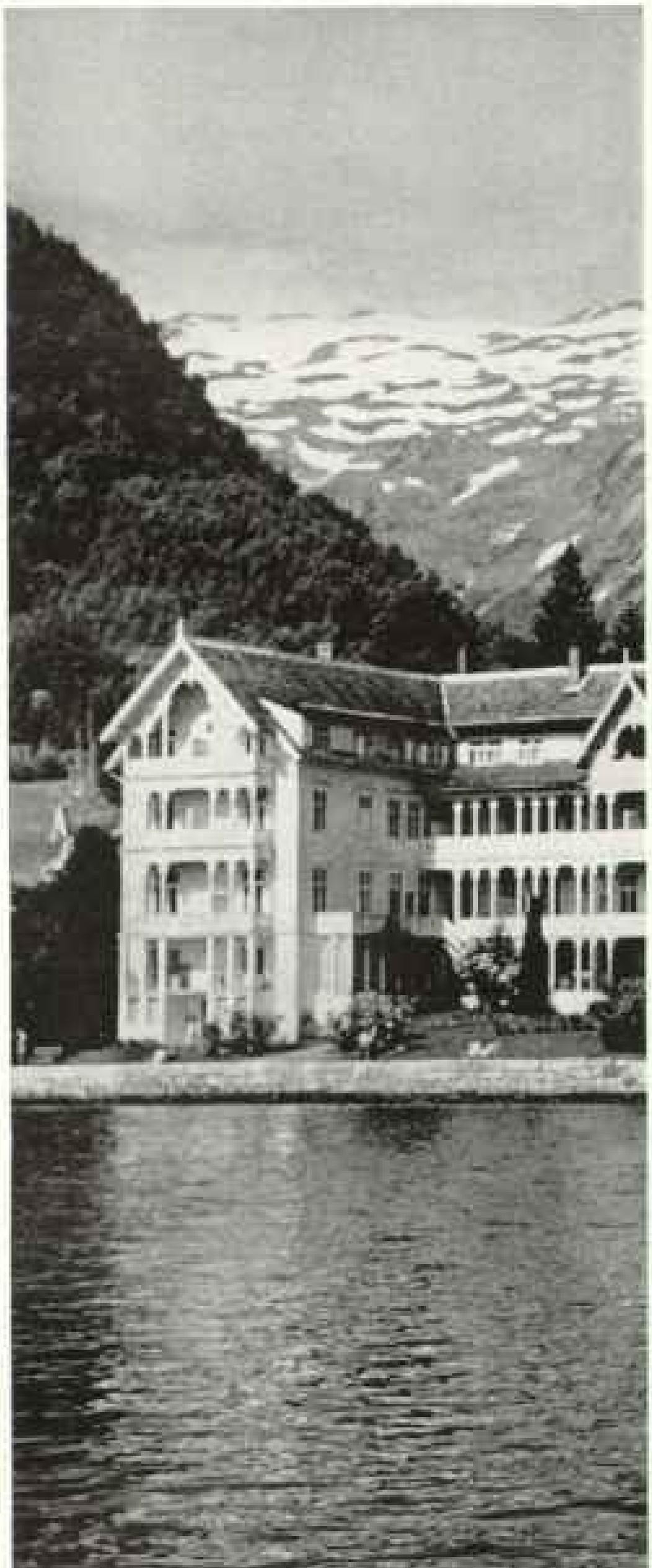
Ancient glaciers, depositing pockets of rich soil here and there, mixed in boulders and cobblestones by the million. A Nord Fjord farmer, showing off his best field, told me: "Grandfather used to say he could munch an apple in the middle of this field, spit out the seeds, and hit a stone with each one."

Laboriously, each surface stone had to be removed; work-calloused hands built miles of stone walls, as in New England. The effort paid off: these handmade fields today yield a per-acre output exceeding that of comparable crops in the midwest United States.

Settlers' trial and error over the centuries pinpointed spots of most favorable climate. Many old farms bask on sunny slopes,

Molde
Molde Fjord
Romsdalen
Is Fjord
Åndalsnes
Trollstegen
Ramsdalshorn
Alesund
Stor Fjord
Sunnmøre Alps
Hjørund Fjord
Sylte
Geiranger Fj.
Norang Fj.
Volda
Oye
Seven Sisters
Geiranger
Skagafla
Dalsnibba
Djupvasshytta
Vanylven
Maloy
Nordfjordeid
Lore Fjord
Lofjeld
Hjelle
Lyster Fjord
Lyster Lake
Alfot Glacier
Nesdal
Bodal
Flora
Jostedals Glacier
Aslevoll
Fjaler Fj.
Farnes
Ardal Lake
Ardal
Fjaler Fjord
Høvlandsdal
Høyanger
Balestrand
Sogndalsfjøra
Leikanger
Kaupanger
Sogne Fjord
Bø
Lavik
Lærdalsøyri
Solund
Nærøy Fj.
Aurland Fjord
Gudvangen
Mo
Stalheim
Flåm
Myrdal
Hallingskeid
Aastrheim
Upsete
Lønthorgi
Vossa
Tinje Lake
Lake of Vossa
Hendalsnut
Dale
Vang
Ulvik Fj.
Ulvik
Finse
To Oslo
Eide
Sælna
Fjaler Fjord
Ålvik
Oystese
Varinu Fall
Fossli
Bjerkreim
Bergen
Osle-Bergen R. of
Hardanger Fj.
Hardanger Plateau
Bjorna Fjord
Tyssedal
Odda
Folgefonn
Låtefoss
Seljestad
Breifonn
Baldal Lake
Brattlandsdal
Nesflaten
Sauda
Suldal Lake
Sand
Suldal
Haugesund
Subtaldhögen
Kopervik
Boknafjord
Skudenesshavn
Roads
Ryfylke
Lysefjord
Stavanger
Prekestolen
Hafrs Fj.
©N.G.S.
STATUTE MILES

Galdhøpiggen
Glitter Tind
Gudbrandsdal
Jotunheim Mts.



shielded by mountain spurs from cold air just around the corner. A dead calm often hangs over such sites, while out in mid-fjord a fresh breeze brushes up a lather of whitecaps.

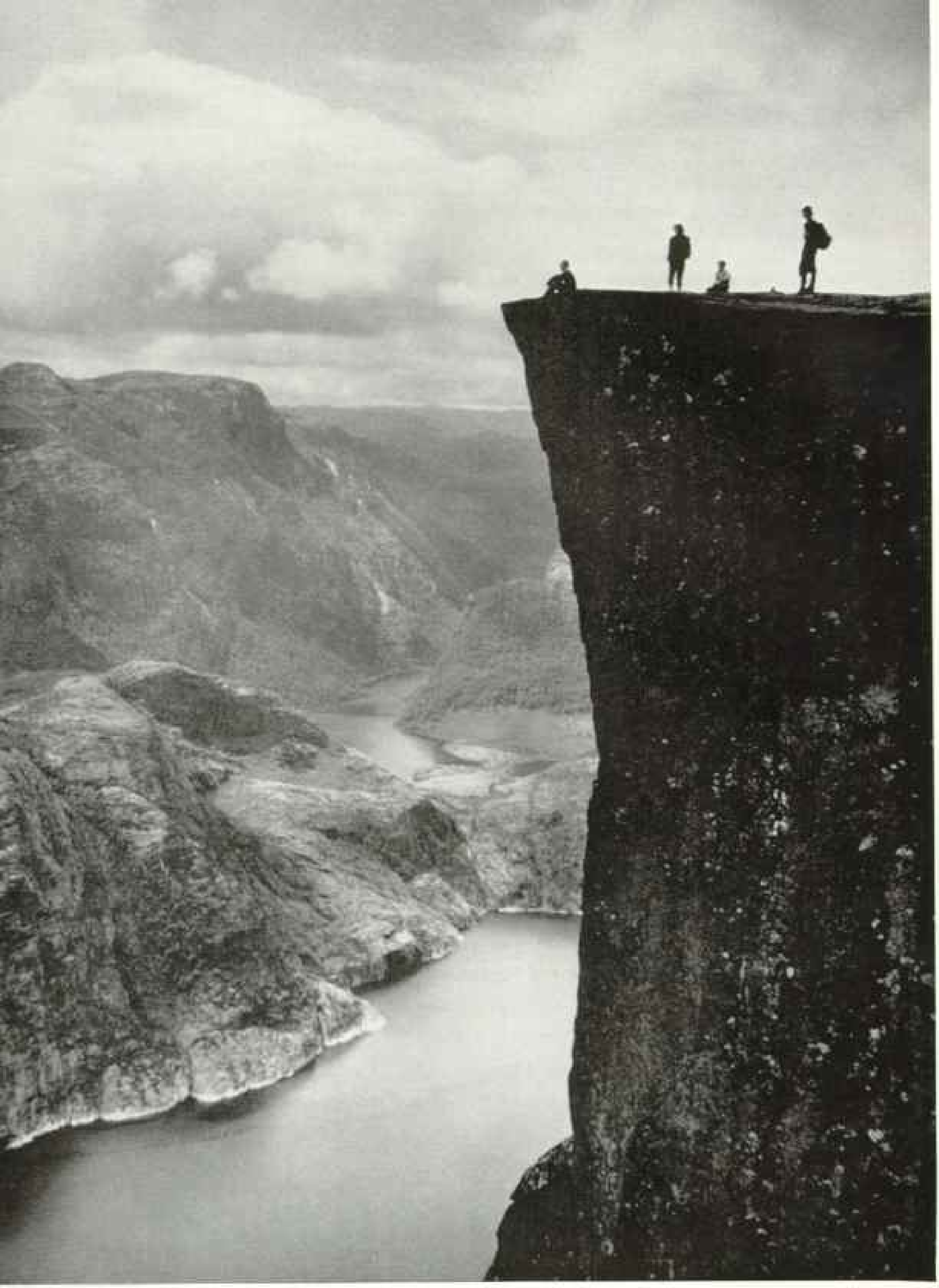
One coastal farm I saw lies, apparently exposed, at the foot of a high peak. Yet the master of these wide-open acres told me: "When winter's southwest gales rumble like thunder on the heights, I can carry a lighted candle across my yard and the flame won't even flicker."

From Stavanger at the bottom of my road map to Molde at the top, I traversed the inner reaches of half a dozen famous fjords. My route cut lengthwise through the region called Vestlandet—the West Country.

The first stage of my journey was by boat from Stavanger to Sand, and fifteen times, in ensuing weeks, I loaded my car on ferries that cross water breaks in the north-south roads. At least a dozen times highways lifted me above tree line, once nearly a vertical mile above the sea. On seven high passes I threw snowballs in July.

North from the wild Brattlandsdal, the highway climbs by tight switchbacks from Breifonn to Seljestad. Here was a dizzy introduction to the roads of western Norway, every

Snowy Summits and Sparkling Fjord Embrace Kvikne Hotel in Quiet Balestrand



108

Mighty Prekestolen (the Pulpit) Juts Out over Lyse Fjord Like a Ship's Prow

Norway's fjords thrust gnarled fingers far inland, connecting a mountainous interior with the ocean. Norwegians delight in climbing this 1,800-foot promontory for the view across the fjord.

one an engineering marvel. In fifteen minutes the highway lifted me from tidy farms and leafy orchards to barren moors and unbroken snow fields.

Despite the enormous obstacles of rough terrain, roads of a sort are an ancient Norse tradition. Today many of them betray antiquity with bridges built of great stone slabs supported on stone piers. For guard walls, modern engineers have emplaced thousands of squared-off monoliths a few feet apart.

Industry Booms Amid Orchards

Past the double cataract of Låtefoss and the gleaming Folge Fonn snow dome, I came to fruitful Hardanger Fjord, which knows the smoke of industry as well as the radiant beauty of blossomtime. At Alvik, Odda, Tyssedal, and near-by Eitrheim, corrugated-steel factory roofs overhang old homesteads topped with turf or heavy fish-scale slates.

Tremendous water power attracted great metal and electrochemical plants during the early decades of this century.

Ships deep-laden with machinery and raw materials come up the fjords to the front doors of hydroelectric and smelting plants. Snow-melt water from the heights plunges thousands of feet to power turbogenerators.

Smoke from carbide, ferro-silicon, and zinc plants contrasts with shores pastel-painted by the spring tide of apple blossoms.

Norway's biggest aluminum plants—both being enlarged—are at Sunndalsøra and at Årdals Vatn (Årdal Lake). Sunndalsøra made 40,000 metric tons of aluminum in 1955 and the Årdals plant 27,000, between them turning out nine-tenths of Norway's total output. At Årdals Vatn high-country waters have been diverted down a 3,000-foot drop to a generating station built inside a mountain, safe from bombs and avalanches.

Mountains Cradle Summer Pastures

Although Norway has the highest per-capita consumption of electricity of any nation, only a portion of her water power has yet been put to work. Since 1939, however, the use of electricity has leaped ahead by 150 percent. Industry today gobbles up two-thirds of it.

Above Ulvik on Hardanger Fjord we trekked up through rain to a seter, or summer pasture. Its huddle of huts, occupied only in season, was lost among the hills.

We found a mother and daughter, guardians of half a dozen cows, contentedly whiling the summer away in a one-window cabin furnished with a table, built-in bed, and two narrow chairs. There were candles, two lanterns, and a well-shined churn.

"On the seter" even summer nights are cold. The bed was piled high with homespun, farm-woven *ikle*. These look like carpets, with their hard weave and geometric patterns, but are used as blankets. The younger woman was busy with a piece of embroidery in blue and gold (page 104). The older passed out tumblers of milk.

"Sorry it isn't warm," she said, "but we haven't done the evening milking."

Every morning men and women from the farm below toiled up the long grade to carry down the yield of night and morning milkings.

Seter life, source of endless themes for Norwegian songs, tales, and paintings, is on the way out. Trucks now travel improved roads to upland pastures, and cowherds commute.

Rain still poured down next day as I drove up the Bjoreia River to booming, 535-foot Vøringfoss (Vøring Fall). The brink of the cliff at Fossli brought me face to face with one of Norway's major cataracts and also placed me athwart the line where the country parts its weather.

Peaks Strip Clouds of Rain

Westward, down the Bjoreia Valley, ravelings of rain wavered earthward from black clouds. Overhead, the sun dived in and out of scud. But to the east, over the barren Hardanger Plateau, blue skies were cloudless.

Western Norway has abundant rain, averaging sixty to eighty inches a year, because its high mountains rake moisture out of the Atlantic's wet west wind. Across the mountains, in eastern valleys, irrigation is not uncommon. Hovlandsdal, just north of Sogne Fjord's mouth, gets ten feet of rain a year; at Luster Fjord, in Inner Sogn, as little as thirteen inches fall.

Descending the Bjoreia River, I stopped to look at salmon traps blocking narrows in the stream. In the pocket at the upstream end of each V-shaped stone-and-wood trap, a farmer may catch three or four salmon a day during the summer spawning run. It's a profitable "money crop," however: Fresh salmon brings in the equivalent of at least a dollar a pound—too much to allow the farmer-fisherman to eat the catch himself. Besides, he prefers mountain trout.

Beside the Sør Fjord, near Bergen, and in

the Ese Fjord and others in Sogn, I visited the *sittjenoter*, meaning literally "sit nets." Their spidery lookout towers, built of poles and boards, are vanishing landmarks.

Fishermen Make Money Sitting Down

The sittjenot catches salmon—and promotes the contemplative life. The sit-seiner perches in a booth about fifteen feet above the water's edge. Diagonally below him, fifteen or twenty feet offshore in four or five fathoms of water, lies a white board, or piece of canvas, weighted to the bottom. This marker, five feet square, is called a *flake*—a name identical to that of the cod-drying flakes of Maine and eastern Canada.

Chin in hands, the fisherman-philosopher watches for a salmon to swim across the white flake. When the black shadow of his quarry comes in view, the netter pulls a rope that closes a purse seine laid around the flake. Two, three, or four fish is a good day's catch.

Hardanger folk cherish old-time customs and costumes more than their neighbors in adjacent fjords (pages 97 and 119).

Skirting the north shore of Hardanger Fjord one July evening, I drove into the pleasant town of Øystese. Three woman pedestrians, dressed in the red-white-and-black local costume, caught my eye. I trailed them into the yard of a new youth center.

The three ladies had joined 50 other women massed on tiered benches. I quailed before 106 inquiring feminine eyes, but marched forward. Groups of men in black suits stood around, chatting. One of them advanced and greeted me in English.

"Is this a wedding?" I asked.

Yes—and no! The assembled company were relatives and friends of a couple married earlier that day. Bride and bridegroom were expected momentarily. Refreshments and congratulatory speeches in the youth hall were on the schedule, to be followed by dancing, midnight supper, and more dancing.

"Who Are You?"—"Join the Party!"

My informant presented me to the groom's mother and brother. They promptly invited me to join the party (page 118).

The newlyweds appeared shortly, cheeks ripe with smiles. The surname of Lars, the

Goats Obligingly Line Up to Fill the Cheese Maker's Milk Pail

Norwegian National Travel Office

bridegroom, matched the name of the town—Øystese. He was a shoemaker and Alis, his new wife, a dressmaker.

The assemblage trooped into the hall. Long tables, laid out with snowy napery, creaked under cakes buried in whipped cream, plates of cookies and open-faced sandwiches, and bowls of candy.

When the company took their places, I moved toward a chair near the door; a hand gripped my elbow, however, and guided me to the head table. A place was laid for me between the groom's father and brother.

Now everyone picked up a song sheet that bore a drawing of a barometer opposite the verses. All present sang lustily . . . "Remember, feed your husband well, or there will be night frosts . . ."

At a signal, choraling, white-aproned youths paraded in from the pantry; each bore aloft a crockery pitcher full of steaming coffee. Within ten minutes my cup had been refilled three times.

Speeches, jokes, laughter. Then hosts and guests withdrew to the basement. A fiddler struck up. The bride and groom, holding joined hands high, shuffled around the floor at the head of a procession.

Presently the music caught fire with the lilt of old-time dance tunes, and couples whirled around the floor. The groom slipped out for a few moments to mop his brow.

I had to reach Voss that night: fifty road miles and a mountain range intervened. Unwillingly, I took my leave; it was hard to cut short the enjoyment of such hospitality.

Wooden House Survives 700 Years

Voss, a military center at the time of the German invasion of 1940, suffered heavy air attack. Rebuilding has healed the wounds.

The smoke-blackened Finneloft, a wooden structure built perhaps as early as the 13th century, fortunately was not damaged. A leading contender for rank as Norway's oldest wooden house, it now is a museum of old furniture, utensils, clothing, and footwear.

It was from Voss that Norway's special hero, the explorer-statesman Fridtjof Nansen, set out overland for distant Oslo in 1884. The young Nansen, then 23 and curator of the zoological collection in the Bergen Museum, had read a newspaper announcement: "Skiing Match at Huseby Hill [near Oslo] February 4." He took the new railway to Voss and headed cross-country by foot and ski over the mountains to eastern Norway. A dog was his only companion.

At Huseby Nansen won a prize, then backtracked over the wind-swept fells to complete a round trip of about 500 miles, mostly on skis. Never before had the journey been done in winter.

Helping me with pictures of haying on hills above Voss, Bjørg Lahlum, an attractive local daughter, named the peaks that flank Voss and its lovely Vangs Vatn (Lake of Vang).

"With my schoolmates, I've skied the crests of all those mountains," Bjørg said. "Some are more than 4,000 feet high."

No wonder this thinly peopled land has mothered leaders like explorer Nansen; composer Edvard Grieg; poet, novelist, and dramatist Bjørnstjerne Bjørnson; and aviator Bernt Balchen!

Rails Cracked Norway's Mountain Shell

At Voss my route crossed the scenic Oslo-Bergen Railway (map, page 106).

The *Bergensbane* (Bergen Railway), as it is popularly called, crowds most of its wonders into its western mileage. In 1909 it cracked the mountain shell of Norway and opened a year-round land route between the nation's west coast and eastern cities. Before the railroad, the roundabout sea route was the only avenue for commerce between Oslo and Bergen, the country's two chief cities.

Trains on the Oslo-Bergen Railway run hidden in tunnels—there are nearly 200—or timber snowsheds for almost a seventh of the total distance. The longest tunnel, between Myrdal and Upsete, measures 3¼ miles.

For about sixty miles Bergensbanen trains chuff along above tree line, crossing the broadest tract of open high plateau in Europe, the Hardanger Vidda. Here untamed reindeer sometimes block the track.

From Voss a short drive led me to Stalheim, perched on the brink of the Nærøydal gorge, whose tall waterfalls and rock domes give it scenic kinship with Yosemite. The riverlike Nærøy Fjord, to which the Nærøydal descends, is magnificent. Morning mists lifted from the heights as the S. S. *Sandøy* turned away from the Gudvangen wharf and swung down the steep-walled channel. From the hurricane deck I craned my neck at mountains crowding close together.

Waterfalls spouted from cliffs bearded with dripping grass and moss. Hardly a scrap of cultivable land softened the stern but splen-

did scene. White gulls, diving in the ship's wake, crashed their own reflections.

As the *Sandøy* swept out of Nærøy Fjord into broader Aurland Fjord two other ships converged on our course as if we were three rescue boats homing, full tilt, on a drowning sailor. Neatly the three vessels came together. When rails were a yard apart, deckhands threw lines across. Roped together, *Sandøy* and her two companion craft still kept slow headway.

The idea was to transfer passengers and cyclists bound for other destinations than those of the ships they embarked on. The exchange completed, the vessels drew apart.

Spawning Ground of Viking Raiders

Such a display of seamanship is hardly surprising hereabouts, for deep water, good harbors, and forests to furnish ship timber have fostered a seafaring folk in Norway since the days of the Vikings. Norse sea rovers from many parts of Scandinavia scourged Europe from the 8th to the 11th centuries.

Driven by craving for adventure and joyous lust for battle, Vikings set sail in the offshore winds of spring, pointing the tall prows of their long boats "west over sea." Their leaders went by such names as Erik Blodøks (Bloody-ax), Magnus Barfod (Barefoot), Sigurd Jorsalfar (Travelet-to-Jerusalem), Svein Tveskjegg (Fork-beard), and Ragnar Lodbrok (Hairy-breeches).

Some of these ruthless commandos settled the lands they invaded, merging with native populations. Others, pioneers at heart, occupied the Faeroes, the Shetland Islands, Iceland, and Greenland. A handful of even bolder spirits sailed on to reach the mainland of North America, about 500 years before Columbus landed in the West Indies.

The warning cry, "The Vikings are coming!" struck terror through western Europe. Church litanies dubbed in a new prayer: "*A furore Normannorum libera nos*"—"From the fury of the Northmen deliver us!"

The returning Viking was the schoolmaster of his times. He held young and old enthralled with tales of abbeys that were storehouses for the gold and precious stones he looted. He described teeming cities and told of graceful ladies decked with jewels, silks, and choicest furs.

The Vikings preferred to live along seaward reaches of the fjords and among the coastal skerries. But every habitable patch at the fjord heads, too, supported its *jarl*, or local king. Each competed with his neighbors in length of voyage, haul of loot, warlike triumphs.

The Ynglinge Saga sounded the scorn of hugging the parental hearth: "He only might with full truth be called a sea-king that never slept under a sooty rafter, and never drank in the chimney corner."

But today's fjordland dwellers hold no scorn for the family rafters and chimney corner. From a steamer plowing Geiranger Fjord, my friend Sverre Mjelva pointed out to me a weather-beaten farm, clinging to the mountainside like a last year's swallow's nest.

"Believe it or not, that little farm, with its mossy meadows and stony pasture, is paradise," he said. "So I was told on my last visit, at least, when I climbed up there to talk to an eighty-year-old grandmother, a long-time friend."

It was a fine day when he had sat down beside the old woman, Mjelva explained. The fjord sparkled and the grass shone. The aged hostess, eyes bright with pleasure, called her guest's attention to the singing of birds, the sun's warmth, the clumps of wild flowers.

Running Water Makes a Paradise

Puzzled and amused by the old lady's enthusiasm, the visitor looked around for a clue to her contentment. Slanting tin roofs merged with the slopes above, to carry avalanches and rockfalls over dwellings and sheds. The cow barn stood close to the dwelling, the cattle out at pasture. All the landmarks of desperately frugal farming were in place.

All at once, Sverre Mjelva became aware of the steady splash of water. Turning, he saw for the first time the clear stream pouring in from a new supply pipe projecting between house and cowshed. Scarcely had his glance alighted on it when the old woman chuckled and grinned.

"Ah! At last you see it!" she said to Mjelva. "Now you know why I am so happy. How different from the days gone by! I used to worry so much when the children went out to the spring.

"Once a slide rushed down between the house and spring just when the youngest girl was out there filling her pail. But now—now water is only a step away. There is no more need to worry. Now we have everything we want. Now we live in paradise."

(Continued on page 121)

Snow-specked Peaks and Red Barns Hang Upside Down in Tranquil Norang Fjord

Glacial ice scooped out this arm of Hjørund Fjord between peaks rising 4,000 to 6,000 feet. Mountains belong to the Sunnmøre Alps, whose jagged heights challenge climbers.

Rowboat Rests Suspended in Loen Lake's Turquoise Calm. Craggy Ravnefjell (Right) Breeds Giant Rockslides

Green Hay Cascades down a Cable near Geiranger Fjord

Young Norwegian farmers await a 60-pound load on the first leg of its journey from high pastures. A second cable will take it on the final lap down to fjord level.

Norwegian Ponies Specialize in Vertical Farm Work

Black markings on mane and legs indicate this sure-footed animal is a Norwegian Dun, believed to be one of the earliest breeds of horses. Here he hauls his own winter provender.

Tawny Rows of Drying Hay Stretch in the Sun Beside Nord Fjord

Cloudy days and frequent rains rule out ground-level windrows. Instead, fjord farmers use the *hesje* method, lifting hay off the ground on strands of wire supported by poles. Breezes, more than sun, cure the harvest.

117

Lofjeld's Wooded Slopes Give Hotel Alexandra a Green Back Yard

The large white structure was named for Danish-born Alexandra, queen consort of Edward VII of England. Many Norwegian hotels bear British names, a gesture to numerous English sightseers and anglers.

↑ Everyone's Welcome at a Hardanger Wedding; No One Leaves Hungry

Modern villagers have telescoped Hardanger Fjord's week-long wedding celebration into a day or two. On their wedding day yesteryear's young couple walked to church or rode white horses. Occasionally they rowed.

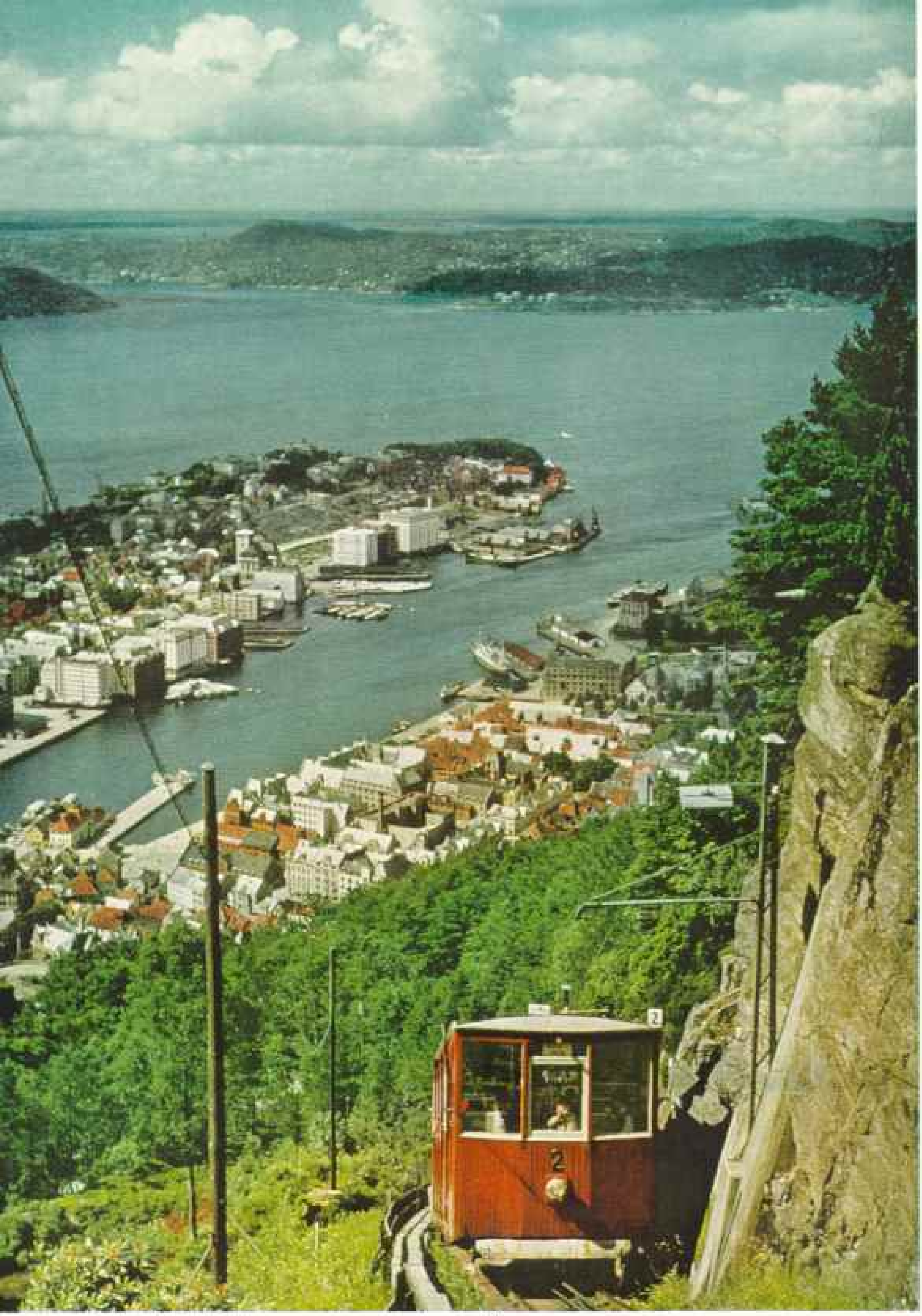
After six or seven days families of the bride and bridegroom announced the end of festivities by refusing to feed the guests. Merrymakers might seize the chef as hostage.

This evening party for newlyweds fills the new youth center at Øystese. Bride and groom, married earlier in the day, sit flanked by their parents at the head table. The master of ceremonies (head bowed at table, left) leads the songs, tells jokes, and calls on guests to speak.

After refreshments, guests adjourned to the basement for dancing. At midnight the celebrants returned to the tables for a wedding supper. Dancing later resumed and continued all night. The author, a total stranger, was received warmly.

→Bride and bridegroom wear traditional Hardanger dress. As a wife, the woman is now entitled to the matron's *skaut*, or starched linen headgear.

←Mothers of the bridal couple wear the skaut and red Hardanger vests.



Cable Car Passengers Get a Superb View of Bergen from 1,000-foot Fløyfjellet

Norway's second city began about 1070 as a trading and fishing center. Often burned and often rebuilt, it now has broad streets and spacious parks. Residents quip, "I don't want to boast, but I do come from Bergen."

In inner Sogne Fjord, I left my car for repairs and fell back on the local bus to get me to Leikanger and the Balestrand ferry.

On the ride to Leikanger I observed with awe our bus driver's energy and patience. He delivered mailbags at each wayside post office. He helped ladies, old and young, on and off the bus. He stopped at farmhouse gates and set down items that farm wives had ordered from town.

During a 45-minute run, I watched that driver unload—apart from passengers and small packages—trays of fragrant new-baked bread, two wooden "knees" to a shipyard, a case of margarine, a barrel of pork, a bag of wheat, two bicycles, and a sprocket wheel for a tractor.

Why Fjords Stay Ice-free

In Sogne Fjord and Nord Fjord ice and snow on the horizon grew commonplace. Yet lowland fields seemed as fertile as those farther south, and fruit hung just as heavy on orchard trees.

Strangely enough, the water temperature of the fjords remains almost constant all the year round. Why this is so was explained to me by Magne Oppedal, a fisheries expert.

"Every western fjord," Mr. Oppedal said, "though many hundreds of feet deep inside the coastline, has a 'doorsill'—a shallow shelf across its mouth that's a result of ancient glacial sculpturing."

During the long summer days, he explained, rapid melting of mountain snow and ice gluts every stream with chilly water. Inflowing masses of this water lower the temperature of the salty fjord.

In winter, by contrast, frost locks the upland snow and ice in place. Streams trickle instead of roar into the fjord. Then relatively warm surface water fed into the Norwegian Current from the Gulf Stream laps in over the fjord-mouth shoals, dominating the fjord in winter.

As a result, temperatures at the 300-foot depth in Sogne Fjord, for example, are 45.5° F., winter and summer. Shipping, unhampered by ice, goes on the year round.

"Speaking of the Gulf Stream," said Mr. Oppedal, "our herring go through it, but don't 'go for it'—to use a bit of Yankee slang."

Led in by instinct from far at sea to spawning grounds along the coast, myriad herring swim head-on into the Norwegian Current, he pointed out. The warm water is as distasteful to the finny migrants as a chinook thaw to a spring skier: in crossing the displaced tropic waters the herring lose two to three percent of their fat.

Spring herring, slimmed by the warmer water and by the ordeal of spawning, are the "lean herring" of commerce. Winter fish, netted after a summer of lush feeding in the fjords and bays, make up the bulk of the yearly catch and are a favored Norwegian delicacy.

On the way northward to Geiranger, I stopped at a lonely inn in the bleak pass of Djupvasshytta. From there, at 3,405 feet, a toll road loops upward 1,516 feet to the bald, rocky crown of Dalsnibba, which affords a tremendous view.

An Oslo teacher, vacationing in these chill uplands, rode with me up Dalsnibba. I asked about little wooden shelters spaced along the road. They were filled with earth in the fall, the man explained. When snow closes the road, tall stakes are placed to mark the right of way. Come springtime, workers shovel earth from these shelters on top of the snow along the road.

Dark earth absorbs the sun's heat, so the snow under it melts more quickly than the drifts alongside, and the road emerges from snow long before the rest of the ground.

Sightseers Ride Glass-roofed Buses

Next day, coasting down to Geiranger, I checked in at a hotel. My second-floor room faced the road and a rushing stream that plunged over a fall just below.

Each morning the roar of the cataract was matched by the excited chatter of sightseers setting out in buses—red, blue, green, or yellow—for fjordland destinations. Many buses came, tourist-packed, from Oslo. Others bore license plates from the Low Countries, France, Spain, and Italy. I even saw one Pullman-plush bus from Brazil.

In western Norway vertical scenery puts a premium on the latest glass-roofed bus models. To see up from my hired sedan, I had to stop and get out scores of times.

Still northbound, I drove on from Geiranger to Åndalsnes, at the mouth of the romantic Romsdal. The route climbs to the high pass of Trollstegen (Trolls' Way). There three craggy rock skyscrapers, the Bishop, King, and Queen, overlook the tortuous descent to the sparkling Rauma River, favorite beat of English and Norwegian salmon anglers.

Stones Anchor the Sod Roof and Bolster the Casements of a Geiranger Farmhouse

Timbered structures have endured for centuries in Norway's cool climate. Many are perfectly preserved.

Soaring nearly a vertical mile above the Rauma, the colossal Romsdalshorn suggests Rio de Janeiro's Sugar Loaf. Mountain climbers range up and down this whole region.

On the shore of Is Fjord in Romsdal rises a crag called Skotkleven, the Scots' Cliff. In 1612 two Scottish officers, Lt. Col. Alexander Ramsay and Capt. George Sinclair, landed near Andalsnes leading some 350 unenthusiastic mercenaries. They were bound up Romsdal and over the mountains to Sweden to support the young Swedish monarch, Gustavus Adolphus, in his war against Norway and Denmark. But Norwegian defenders killed most of the invading Scots and captured the rest.

Flowers Near the Arctic Circle

Pine forests clothe the gentler fjord slopes of this region. Andalsnes and near-by towns carry on an active lumber trade; small shipyards thrive.

From Andalsnes to Molde I dawdled across pastoral countryside reminiscent of an Inness landscape. Molde, a busy manufacturing and trading town, also suffered heavy war damage in 1940. The city has had to reconstruct a fifth of its total area, including most of the downtown section.

Facing south, Molde has a gardenlike richness of vegetation. Here, only 3 degrees and 49 minutes south of the Arctic Circle, beech and chestnut trees reach their northern limit, and flowers perfume dooryards.

From the hill park in the heart of Molde I scanned a broad expanse of fjord. Surely few cities in the world can match Molde's outlook. The panorama enfolds water, islands, and distant farmlands, backed up by serried mountain pinnacles that wall off the whole horizon to the south.

I added up 96 separate skyline peaks and summits, all far enough away not to encroach on the town's tranquillity. Perhaps the impact of majesty blurred vision and made me count some twice. If so, it was not the first time the witchery of Norway's fjordland had bedazzled me.

An Engineer's View of the Suez Canal

Without Constant Dredging, This Vital Waterway Would Fill with Sand and Be Reclaimed by the Desert

By Maj. Gen. Glen E. Edgerton, USA (Ret.)

THE SUEZ CANAL—all in all the most influential change man has yet imposed on geography—is many things to many people, quite a few of them surprising.

As the world well knows, the canal can cause international explosions. To Britain and western Europe it is a veritable life line, and to much of the world a short cut that makes countless products cheaper because they are more efficiently conveyed.*

President Eisenhower has called the canal vital to the economy of the United States—"indeed, to the economies of almost all of the countries of the world." You get an inkling of what this means when you see a 700-foot supertanker from Kuwait pumping out crude oil in Philadelphia; that one load, after refining, will fill up the gas tanks of about 300,000 automobiles.

American imports through the canal—less than one million metric tons in 1938 but more than 11 million in 1955—include rubber and much of the manganese we need to harden steel. Europe counts on the canal for half its oil supply, or about 50 million gallons a day.

Winds Sweep Desert Sand into Canal

Less widely known is the fact that even zoologists take a professional interest in Suez. Thanks to the canal, creatures once at home in the Red Sea—especially the delicious swimming crab *Portunus pelagicus*—migrated to the Mediterranean Sea and are now caught there in large numbers.

As if in repayment, Mediterranean sardines and sea horses swam the other way. The sea horses now abound in the Bitter Lakes, about two-thirds of the way to the Gulf of Suez.

But to me as a member of the Commission Consultative Internationale des Travaux, the Suez Canal Company's international board of engineering advisers, the most interesting thing about this much-discussed waterway is that it is still being dug. Without continual dredging the canal would become a dry ditch. Winds constantly try to fill it with sand.

Toward the end of November the wind is *nukneesa*, the "broom." Near the end of March comes *aiwa*, the "cat's noise," and then comes the violent *khamsin*, the "wind of fifty days." The khamsin usually lasts only a few hours at a time, but it has been known to take paint off cars and force fine sand into camera shutters and wrist watches.

During the worst week on record, in 1911, storms sprinkled into the canal 105 million cubic feet of sand, more than enough to make a pile the size of the Great Pyramid.

Waves and water currents vie with the winds in this work of destruction. Ships' wakes eat insidiously at those beautifully straight banks (map and diagram, page 127).

Dredges' Work Is Never Done

In short, the Suez Canal poses one of the toughest maintenance problems of the century. And, in addition to maintenance, there must be improvement—to widen and deepen the channel as ships increase in size.

Thus day in and day out, in normal times, dredges clank, men shovel muck, and engineers pore over blueprints. In the last eighty years more than a billion and a half cubic feet of sand and rock have been dug out of the canal, about six times as much as the original excavation.

An unceasing challenge to the engineer, the canal can provide an unforgettable first glimpse of a new world for the voyager on a cruise ship making a transit in tranquil times.

* See, in the National Geographic Magazine: "The Spotlight Swings to Suez," by W. Robert Moore, January, 1952; and "Suez Canal: Short Cut to Empires," by Maynard Owen Williams, November, 1935.

The Author

General Edgerton is the only American on the board of eighteen experts appointed by the Suez Canal Company to advise on canal maintenance and improvement. He has been a member since 1952.

Kansas-born Glen E. Edgerton was graduated from West Point at the head of his class in 1908 and became an assistant engineer of the Panama Canal during its construction. After brilliant service elsewhere, he returned to Panama in 1938 as engineer in charge of maintenance, and from 1940 to 1944 was Governor of the Panama Canal.

Besides serving with distinction in two world wars, the versatile general has directed UNRRA operations in China, supervised the renovation of the White House, and served in such varied posts as chief engineer of the Federal Power Commission and managing director and president of the Export-Import Bank. He is a director of the Panama Canal Company.

Less than a Century Old, Port Said Grew Up with the Canal

A collection of hovels in 1861, Port Said became the home of 250,000 people and one of the world's busiest harbors. Largely built on mud dredged by the canal builders, the city continued to expand across Nile River silt washed in by the sea.

This view, taken a few hundred feet from the canal's Mediterranean gate, looks south.

Waterfront avenue points to the Suez Canal Company's domed white building, which Egypt seized last July and French and British troops occupied last November. Square white building at near right served as a first-aid station during the fighting. Distant old town suffered most of the destruction.

Freighter (foreground), tanker, and liner tie up beneath a tall lighthouse with checkered sides. Cruise passengers cross a gangplank for sight-seeing expeditions steered by Port Said's multilingual guides. Freighters on left load supplies.

↓ Telephoning in the control tower of the canal building, this Egyptian kept convoys moving.

Charles E. Brown (right) and Burt L. Goss Magnum

After crossing the Mediterranean, he arrives at Port Said, the canal's northern entrance (page 124). When he reaches the Gulf of Suez at the other end, he will have traveled the 100 miles from Port Said lighthouse in about 13 hours, scarcely ever out of sight of seemingly endless sand plains or dunes. He will not pass through the town of Suez at all, but he will be able to see it from the canal's southern exit of Port Taufiq (page 137).

Port Said.... Here, wrote Rudyard Kipling, a little garden with hibiscus and poinsettia marks an exact division between East and West, where homesickness is smothered by "the smell of strange earth and the cadence of strange tongues."

In the harbor, amid huge signs advertising well-known Western products, chanting Arab roustabouts row out to the ship to catch a line and row it off to a mooring buoy. Now the ship is fast while she awaits the making up of her convoy.

Convoys are necessary because the canal is generally one-way. It looks wide enough for ships moving in opposite directions to pass, and it is—but it is not deep enough at the edges. Therefore ships must stay in the middle and travel in convoys to keep traffic tidy and make the best use of the bypasses.

So the passenger amuses himself until a convoy is ready, and then his ship casts off from buoys to take her place in line.

For the first 25 miles she moves in the channel dug through marshy Lake Manzala, next to a road, a railroad, and the fresh-water canal branch supplying Port Said.

Passengers May Glimpse Mirages

Then dry land appears on both sides, with palms and cultivated splotches on the African side to starboard. Here flocks of storks stand around in migration time. In early winter old canal hands tell passengers to look for blossoms in the trees. The trees are there all right, but the blossoms turn out to be white egrets.

Portside lies the grayish Sinai desert. Lucky passengers may see a mirage. A cadet-midshipman from the U. S. Merchant Marine Academy at Kings Point, New York, came by on a round-the-world cruise last year and says he saw a gabled house, upside down. Another recalls mountains, right side up.

Soon the canal seems to divide into two parallel canals, less than a mile apart. This is Ballah Bypass. It allows convoys moving in opposite directions to pass each other with the least possible delay. The convoy with the larger number of vessels has the right of way. Seen from the convoy, ships in the bypass seem to be drifting in the sands.

The channel continues through Lake Timsah, meaning "Lake of the Crocodiles"—there aren't any left—past the docks, beaches, villas, and gardens of Isma'iliya, "the emerald of the desert," on the right.

Then comes Great Bitter Lake, where convoys also pass each other; Little Bitter Lake, in which pelicans fish; and the final canal stretch to the Gulf of Suez, an arm of the Red Sea. In ordinary times khaki-clad Egyptian coast guard men on camels patrol the banks, alert for hashish smugglers from the Asian side.

With progress south comes a rise in temperature. It may have been 70° in the Mediterranean, but 100 miles south it can be 100°, making one think of T. E. Lawrence's impression: "the heat of Arabia came out like a drawn sword and struck us speechless."

Transit Requires Split-second Decisions

To the passenger, memory of the Suez Canal may recall an Arab on the bank spreading his prayer rug at sunset, or greenish rays shooting from the sun as it dips below the horizon. To the ship's captain, however, the canal brings recurrent problems.

A skipper always worries about his ship, of course, and even entering Hampton Roads or Philadelphia may force him into split-second decisions which, if unwise, could bring disaster. But in the narrow Suez Canal—"It really *is* a ditch, you know," says a captain who has been going through for 20 years—he faces split-second decisions all the way.

From the standpoint of the master accustomed to straight steaming in deep water, the most unnerving thing about a Suez transit is the sudden seeming insanity of his ship.

"The old gal forgets all she's ever learned," one master of a huge tanker told me. "She acts like a colt in a pasture. She's a different baby entirely."

The reason is the peculiar action of water confined between narrow banks. True, this sort of thing can occur in a dredged channel in a shallow bay or in any narrow canal. But from what the pilots and masters tell me, I gather that Suez waters play tricks all their own.

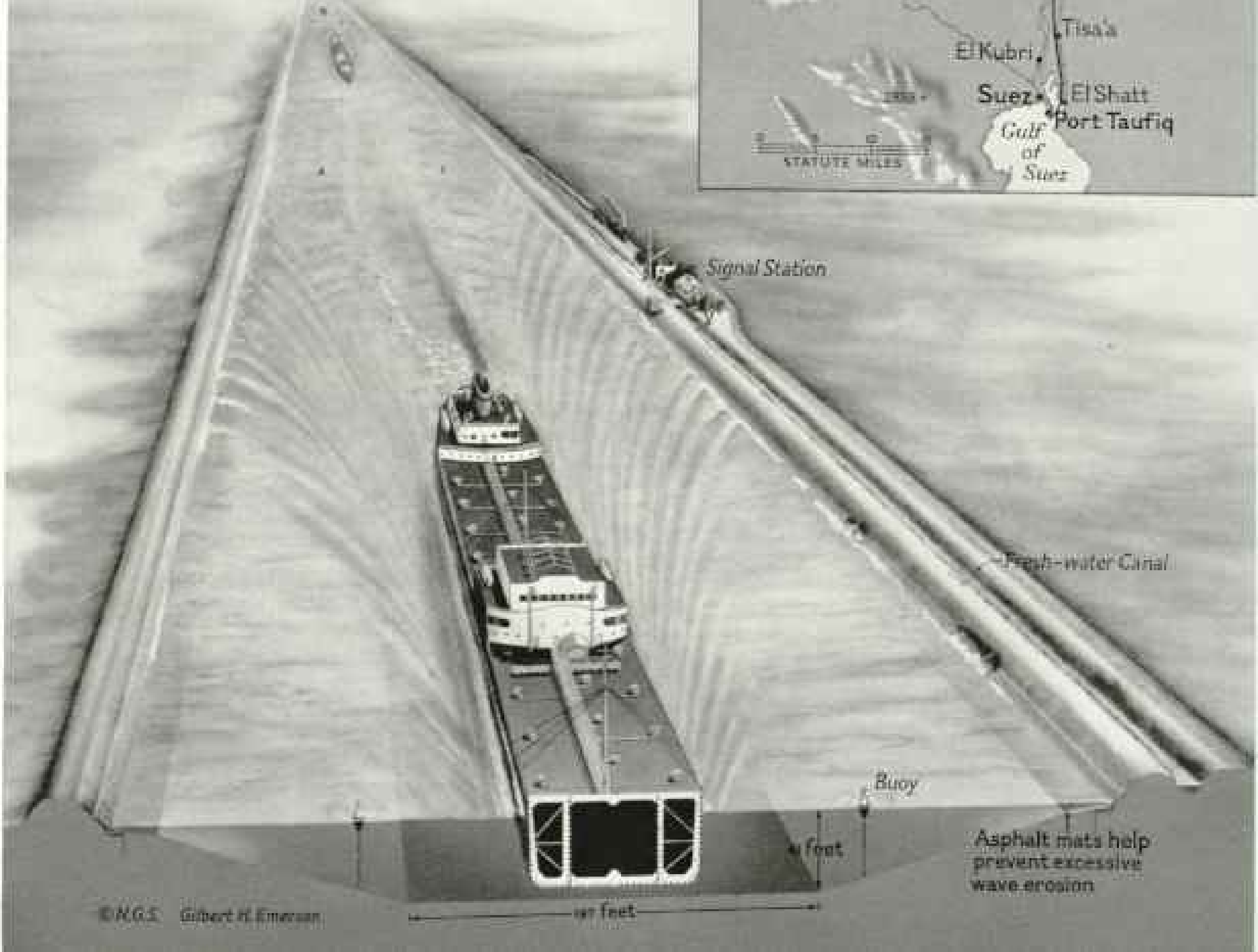
To cope with them, the shipmaster relies on

Suez Canal Brings Persian Gulf Oil 4,000 Miles Closer to the U. S.

Slicing Africa from Asia, the 100-mile canal links Mediterranean and Red Seas through the Bitter Lakes. Apparently a part of the Red Sea in Moses' time, the area dried up, leaving salty depressions until the canal filled them in.

Wide at the surface, the canal slopes down to a narrow channel. Ships must proceed in single file. Ballah Bypass, like a railroad siding, permits convoys to pass without slowdowns. Speed is limited to 7½ knots to control bank-eroding turbulence caused by moving ships.

A fresh-water canal dug from the Nile to Isma'iliya to supply Suez work gangs in the 1860's now irrigates some 70,000 sun-baked acres in cotton, wheat, and dates.



Burrl, Magnum

Seen from a Ship's Bridge, Africa's Sandy Shore Slips Past a Southbound Convoy

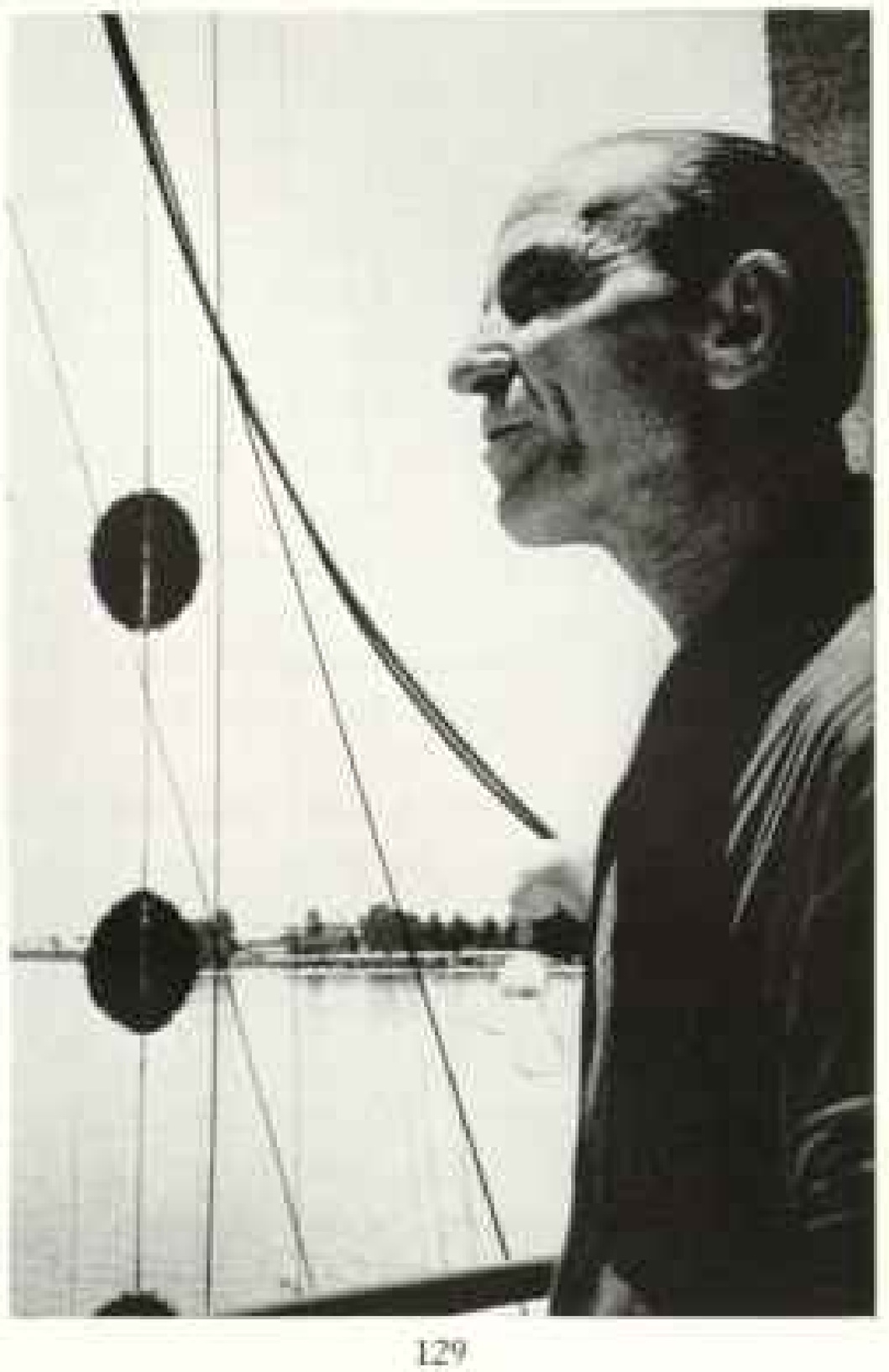
Concrete caissons on right will be sunk in Little Bitter Lake to hold mooring posts.

advice from his pilot; but he remains responsible for everything the ship does.

I am not a seafaring man myself, but it is easy to understand that there are not only the ordinary currents to be reckoned with, but also the vagrant pressures built up by the ship herself.

To explain: A big ship acts in the canal somewhat like a loose piston going forward in a cylinder of water. As she moves, she pushes water away from her—ahead and to the sides. This creates a depression right where the ship is. The water level drops as much as three feet, and the ship "squats" while the waves of the displaced water hit the banks and bounce back. When they reach the ship, the effects are often surprising.

Altogether, currents hit the hull from three directions. There is one current from stem to stern. Another, the reflection from the banks, strongly affects the aftermost third of the vessel, possibly making her veer sharply toward one bank in what the pilots call "bank suction." And finally, a powerful stern wave follows in the wake. This is simply a mass of water seeking to fill the "hole" the ship



129

↑ Three Canvas Balls Command Southbound Ships to Tie Up

The chief of this Isma'iliya signal station prepares to clear the channel for a northbound convoy.

↓ During a canal transit the pilot is virtually in command. Far better than the captain, he knows the tricky currents that can ground a vessel, given a few seconds' neglect. Gazing from the wheelhouse, this pilot continually instructs the helmsman. He strives to keep in mid-channel and maintain a two-mile clearance behind the vessel ahead, the distance usually required for a supertanker's full stop from 7½ knots.

Burri, Magnum

herself made. It produces a current in the direction of the ship's progress.

The pilot's main task is to give constant advice—in effect, orders for the helmsman—to keep the ship in the middle of the channel (page 129). In view of all these currents, this is more difficult than it looks at first sight.

When the ship is on a true course in the center of a straight channel, pressures are equal from both sides if the banks are alike; but if the ship swerves toward one bank, pressures are unbalanced unpredictably. They usually tend to push the ship toward the other bank.

Where the channel bends, these forces become something to be used, but skillfully and with caution. Entering a curve to the right, the pilot must ease his lumbering charge toward the left bank.

The bow meets increasing pressure from that side as distance to the land diminishes. It swings to the right without so much as a nudge from the helm—and that is all right, because that is the way the bow should go.

But a heavy ship may come right too fast. Then the landlubber on the bridge might get a shock: The pilot orders left rudder—and it is the only command he has given—to make a right turn!

Pilot Gives Orders in Seven Tongues

Pilots will tell you that steering must also take into account the ship's size, shape, and load, its speed and number of propellers, the irregularities of the banks and churned-up bottom, the wind, and probably other things. No wonder a pilot has a lot to learn.

Some senior pilots can give orders in any of seven languages, if necessary, but as a rule the pilot's language is English. His orders may come every few seconds:

"Left 10!"
"Ease to 5!"
"Midships!"
"Right 5!"
"Midships!"
"Steady as she goes!"

Some helmsmen understand blithely but not too well. A pilot once replied to a captain's question with "All right." The helmsman took this for an order, and put the helm hard right. He ran aground.

Another pilot stood out on the open bridge wing of a passenger ship around midnight and noticed the bow slowly swerving. He shouted an order to correct this. No response. He charged into the wheelhouse. Nobody there. The helmsman had left the wheelhouse at the end of his watch without waiting for his replacement.

Presumably no less aggrieved was the pilot who, boarding a freighter one night, was grabbed around the neck, lifted into the air, and dropped to the deck. The cargo, it seems, included elephants from India.

"Incidents" Come Thick and Fast

The pilot, to be sure, has a lot more worries from day to day. Whatever delays traffic is reported as an "incident," and these can come thick and fast.

For instance, in March, 1956, when 1,397 ships passed through, there were 114 incidents, including a line fouled in a propeller, groundings (2), bumping of banks (6), tying up because of engine breakdowns (3), steering-gear failure (8), and fog (19). The fog can come down like a blanket, and to make a big tanker fast to the bank the pilot may have to check the compass to find out how the bow points.

One tanker lost a rudder in the ditch. Such major mishaps are rare, but even minor mechanical troubles can result in blocking the entire waterway.

A tanker, for example, may develop a short circuit in her steering wiring. Although the helmsman puts the wheel over, she does not respond. In the open sea, this would hardly matter, since a second motor cuts in automatically within a minute or less.

In the canal, that swerve may mean trouble. If the ship is lucky, she will only "smell the bottom," barely touch where the channel begins to slope upward to the bank. But she may hit the bank and stick.

The current surges from astern. It may push her stern to the opposite bank, and that end will be stranded too. The traffic stoppage will be complete. It might last an hour, or five, or ten.

Veteran Suez Skippers Keep Calm

"Old hands at canal transits usually stay calm," a veteran pilot told me. "Skippers don't always let on when it's their first time through, but we generally can tell.

"If a master chain-smokes or cracks his knuckles or keeps clearing his throat, he's probably making his first trip through.

"Then there was a liner captain. We had a little trouble—nothing to worry about—and

Traffic Backs Up as a Loaded Oil Tanker Snags a Railroad Bridge near El Firdan

One hundred fifty ships stood idle, some for three-and-a-half days, when the *World Peace* struck the African arm of the swing bridge in December, 1954. Torchmen dismantled the steel span while firemen played streams of water as a precaution against sparks kindling an oil fire. During hostilities last November the railroad bridge in the distance was blown up, again blocking the canal. Many ships were sunk in other parts of the waterway. Shady oasis on right bank marks one of 12 signal stations that regulate traffic. Irrigated vineyard and gardens help make life endurable for the attendants.

he looked very calm. But he hopped up and ordered all watertight doors closed!"

Since ships may have to tie up in a hurry because of fog or sudden emergency, mooring posts are spaced about every 80 yards along the canal. Each ship must carry one or two boats and crews ready to be lowered and take a line ashore at once. Anchors must be ready to let go.

Special lights are prescribed for traveling in convoy at night. Usually rented for the trip and hung from the bow is an arc-light projector, in a box big enough to hold an operator. It casts a 15-degree beam which can be split so that there will be five degrees of darkness in the middle. Then it illuminates the banks and buoys but will not blind men on the ship ahead. (Cars on the road

Lacking Breeze, Egyptians Drag a Felucca Through the Canal

Small Egyptian boats pay no toll. Some are so overloaded that the slightest wave sinks them.

Collins, Pix

along the canal, incidentally, are requested to dim their lights when they meet a ship. Some don't, which upsets helmsmen.) To save time, a ship may dump the light box into the water at the end of the canal. It floats, and a launch will pick it up.

If the ship stops at night for any reason, a red light must be put on the stern immediately. If it does not show in time, the next ship in the convoy may even have to go aground voluntarily to avoid collision. To halt safely, a big tanker needs about fifteen minutes notice, and about two miles of canal.

Enough water, coal, or fuel oil must be ready for rapid unloading so the ship can be lightened and

Collins, Fix

Canal Officials' Children Romp in the Wake of a Tanker as if in Ocean Surf

Ship momentarily lowers the canal level, exposing sand along slopes (page 128). Waders, who ran after the ebbing water, rush to escape the tanker's wash. Buoy near Isma'iliya marks 27 feet; mid-channel is 42 feet.

her draft decreased at least a foot. This is to help refloat her if she goes aground. But if lines, tugs, skill, and luck should not suffice, canal authorities reserve the right to blow her up.

The pilot has still other worries, too. He knows that vessels are not supposed to enter the canal unless they hold an internationally recognized certificate of seaworthiness. But before boarding a ship he reads a confidential file of her record in the canal, sometimes an arm-long tale of poor steering, engine breakdowns, and groundings.

Staying in step with the convoy makes for more pilots' headaches. The usual transit speed is about seven knots (eight miles an hour). But there are ships with a vibration point at seven knots. The vibrations of engines and hull synchronize, and the entire vessel shudders and shakes. Passengers get soup splashed in their laps. The pilot cannot hold his binoculars steady, and the vibrations may damage a ship's wiring. Then the only thing he can do is ring alternately for eight knots, then six, and keep the right average.

A pilot can't be arrested for speeding in the Suez Canal, but he can, in a sense, be fined. For being as little as three minutes off schedule in passing one of the signal stations spaced six miles apart, pilots have lost part of the bonus they expect for each successful trip.

To the pilot, the canal means the daily pressure of exacting work at good pay. To the official in the complex canal administration, it means some 5,000 employees, scores of warehouses and workshops, dredges, tugs, barges, and harbor craft; modern housing for personnel, and medical centers. And for the entire Isthmus of Suez, the big ditch has meant a tremendous change.

Exploring here 102 years ago, Ferdinand de Lesseps found "there lived not even a fly in this appalling desert." To cross it, his party of four needed 25 camels just to carry water.

Today the Isthmus is one of Egypt's richest provinces, thanks to irrigation through a fresh-

134

British Naval Auxiliary (Left) and French Troops Guard Battle-torn Port Said

water canal from the Nile. That water can look anything but fresh, though, especially after a few water buffaloes have plunged in. Released from plows and water wheels, the animals submerge like hippos, leaving only their nostrils sticking out. They do this to cool off and escape the flies, of which there now seem to be millions, all annoyingly resistant to DDT.

More Than 500,000 Live in Canal Towns

Some 70,000 acres have been reclaimed from the desert, and the farming population normally numbers about 35,000. In peacetime more than half a million live in the five canal towns, where some 9,000 businesses offer work, most of it keyed to the canal.

The biggest business, of course, is the canal itself. Tolls yielded $93,000,000 in 1955. Half a million passengers passed through, along with 107,000,000 metric tons of freight, about five times as much as in 1946.

In the economist's long view, the canal's opening in 1869 sparked a commercial revolution in the wake of growing industrialization. Copra, tea, and grain came faster and cheaper to the markets of Europe, the journey from Bombay to Marseille, for example, being shortened from 12,000 miles to 5,300. Factories springing up in England, France, and Germany eagerly absorbed raw materials from the shortened route to the East and sent back machinery, textiles, and a flood of consumer goods.

The commercial advantages of the canal in turn forced drastic changes in shipbuilding, hastening the decline of sailing ships. Sailing by the perplexing winds of the Red Sea had

135 Joe Walhof, Illustrated

Scuttled Ships Clog the Canal Entrance

never been easy, and taking a windjammer through the canal proved too difficult and slow.

In the search for speed and profit, steam vessels were rapidly improved. Auxiliary sails soon disappeared, screw propellers became common, and high-pressure boilers were introduced.

Comfort followed, too. Englishmen commuting through the canal to India sought cabins away from the sun most of the way: "port out, starboard home." The first letters of these words, many British travelers will tell you, became the word "posh," meaning the best available.

British politicians at first bitterly opposed the building of a canal which would put "all the coasts of the Mediterranean and the Black Sea . . . nearer India than we are." But once it was there, it became, as Bismarck put it, the British Empire's spinal cord.

To historians a water route linking the Mediterranean and the Red Sea is a story older than the Trojan War. Aristotle, Pliny the Elder, and Strabo, who wrote the most important ancient geography text we have, all ascribe the linking of an arm of the Nile and the Red Sea to Sesostris, King of Egypt. He may actually be a compound of several rulers of 1300 to 1200 B.C.

Egyptians, Persians Dug Ancient Canal

Herodotus insists that the Pharaoh Necho (609-593 B.C.) was first to seek a canal to the Red Sea, and that 120,000 laborers died before the project was abandoned on advice from an oracle.

Necho's canal was finished by Darius the Great, and a stone tablet in a garden in Ismaʻiliya proclaims:

"I am a Persian; with the power of Persia I conquered Egypt. I ordered this canal to be dug from the river called Pirava [the Nile] which flows in Egypt to the sea . . . ."

The canal was probably silted up by the time of Cleopatra. But after defeat at Actium, Plutarch says, she wanted to escape into the Red Sea anyway and tried to have her fleet carried over the sand. Shakespeare makes her say that rather than face "the shouting varlotry of censoring Rome" she would prefer death in "a ditch in Egypt."

Roman sources mention a canal in use during the time of Trajan. Later the Moslem rulers of Egypt made Mecca and Medina more accessible by "the canal of the prince of the faithful," but about A.D. 770 the Caliph Abū Jaʻfar, the founder of Baghdad, had it filled in to blockade rebels in these holy cities. Depressions supposedly left by this canal can be seen today; in some of them grow beans and sweet potatoes.

Venetian merchants talked wistfully about cutting the Isthmus of Suez when the Mediterranean, "the center of the earth" of the ancient West, stagnated after being bypassed by new trade routes around the Cape of Good Hope and across the Atlantic. Cutting of the present canal at last revitalized the Mediterranean, but this geographical surgery was delayed by problems of politics, money, and engineering.

One was the question of water levels.

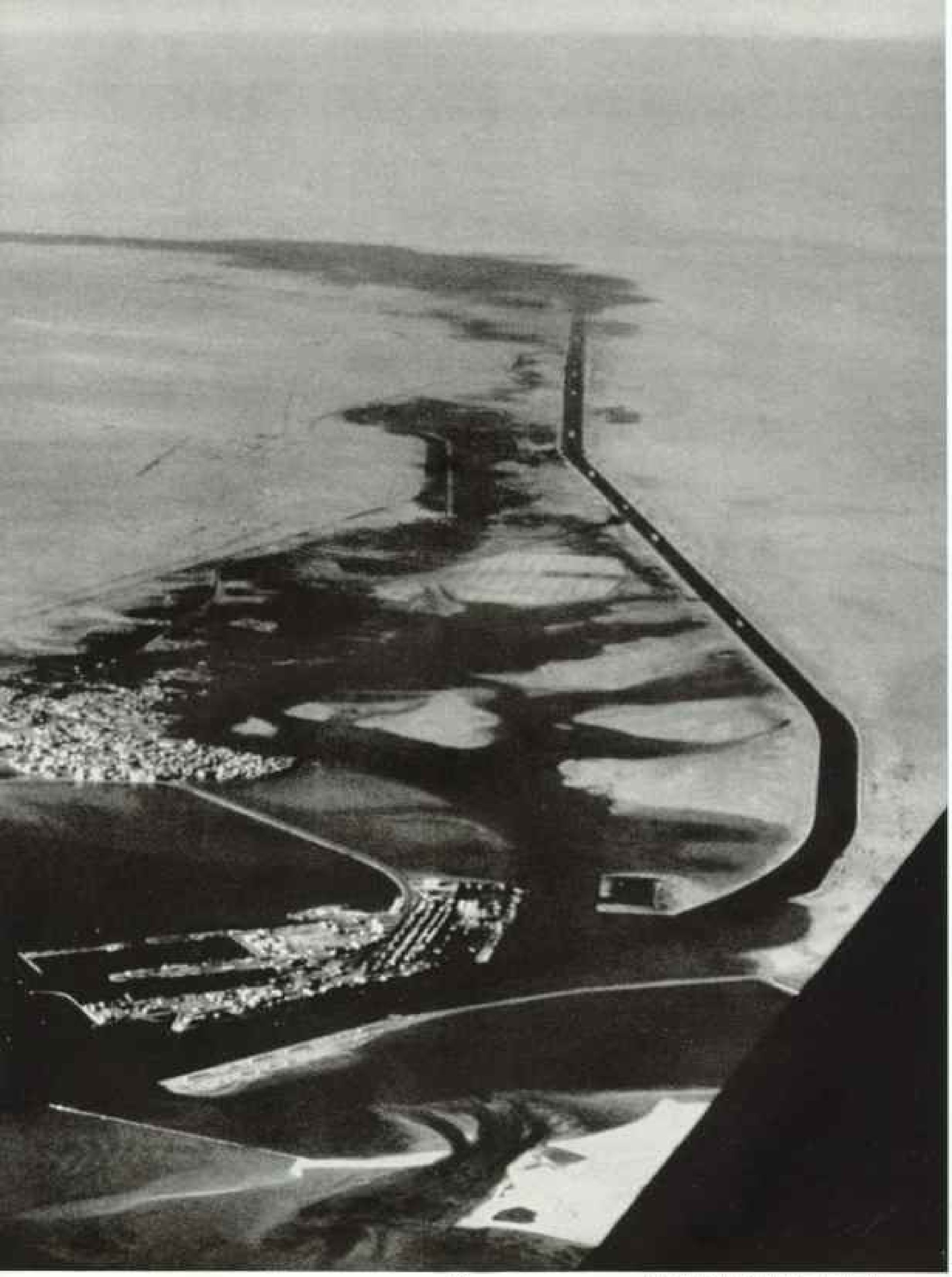
A cautious Pharaoh had built a lock for his canal to guard against the sea rushing into the Nile; and Napoleon Bonaparte, who came to Egypt in 1798 with secret orders to cut

136

Seen from a Plane Above Gulf of Suez, the Desert Flattens Out Like an Unrolled Map

White specks in the gulf are ships waiting to form a convoy. Road from Cairo skirts the coast beside an oil refinery, continues into the town of Suez, and leaps the causeway into Port Taufiq.

Great Bitter Lake, where convoys pass, lies 30 miles to the north. Beyond, the canal fades into the horizon.



137

J. Baylor Roberts, National Geographic Staff

Clinging to Mid-channel, Ships in Convoy Leave Little Bitter Lake for Port Taufiq

Africa lies on the left, Asia to the right of the canal. Sea turtles have ventured as far as Little Bitter Lake, where the canal widens out. Stagnant mud flats between canal and port are being reclaimed for agriculture. Black square beside canal is a coal depot. Repair docks for Red Sea shipping stand at the canal's southern gate.

right across the Suez Isthmus and grab the Red Sea for France, was led to believe that it was 32½ feet higher than the Mediterranean.

No wonder his surveyors erred. Bedouin marauders kept chasing them away from their instruments.

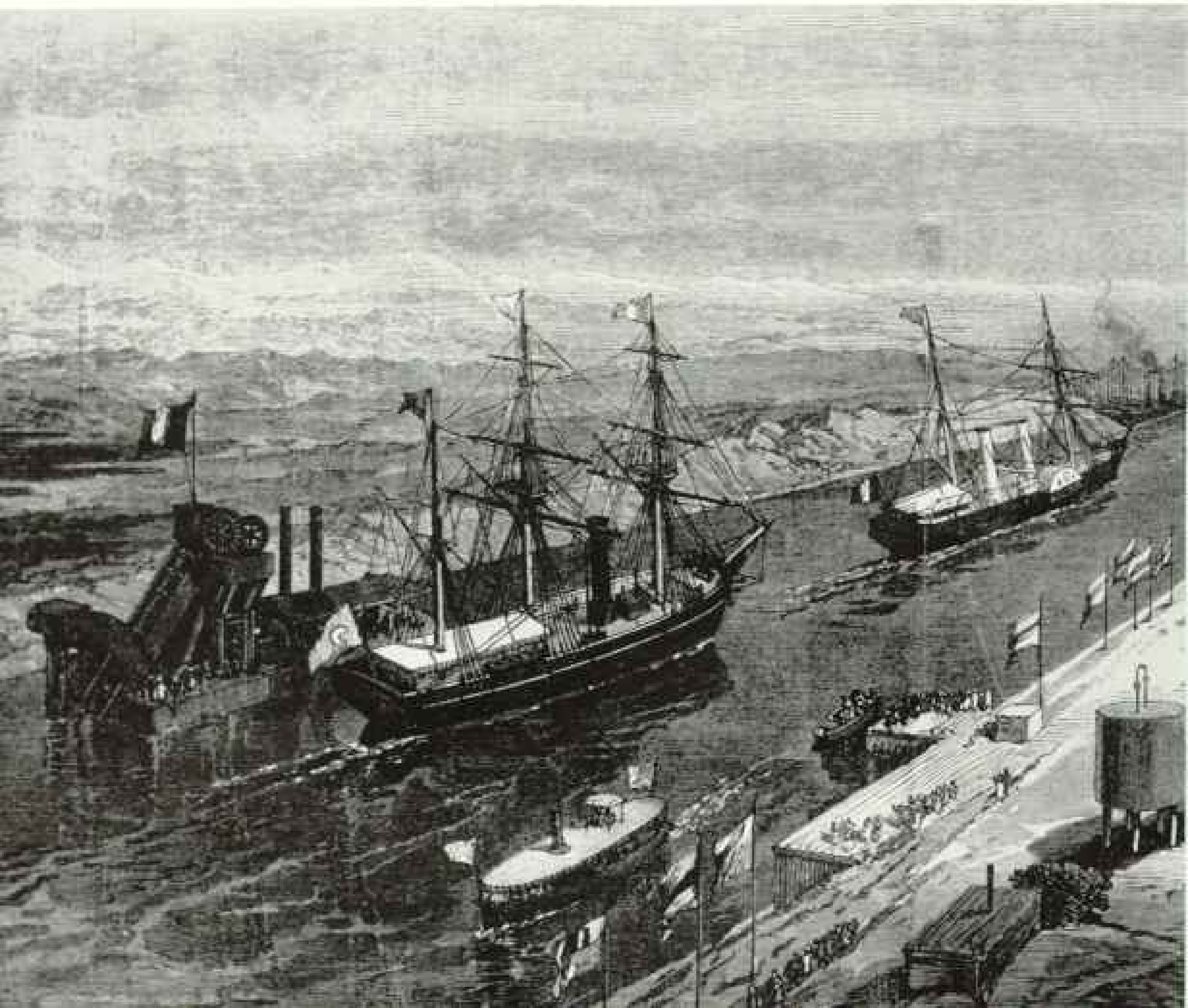
Surveying the Isthmus became a thoroughly international enterprise some forty years later, with engineers from Austria, Sardinia, Spain, Prussia, England, and France working under a Dutchman. They found a sea-level canal feasible because the water levels of the two seas are about equal. (Actually the Mediterranean is higher in summer, and the Red Sea is higher in winter, by about a foot.)

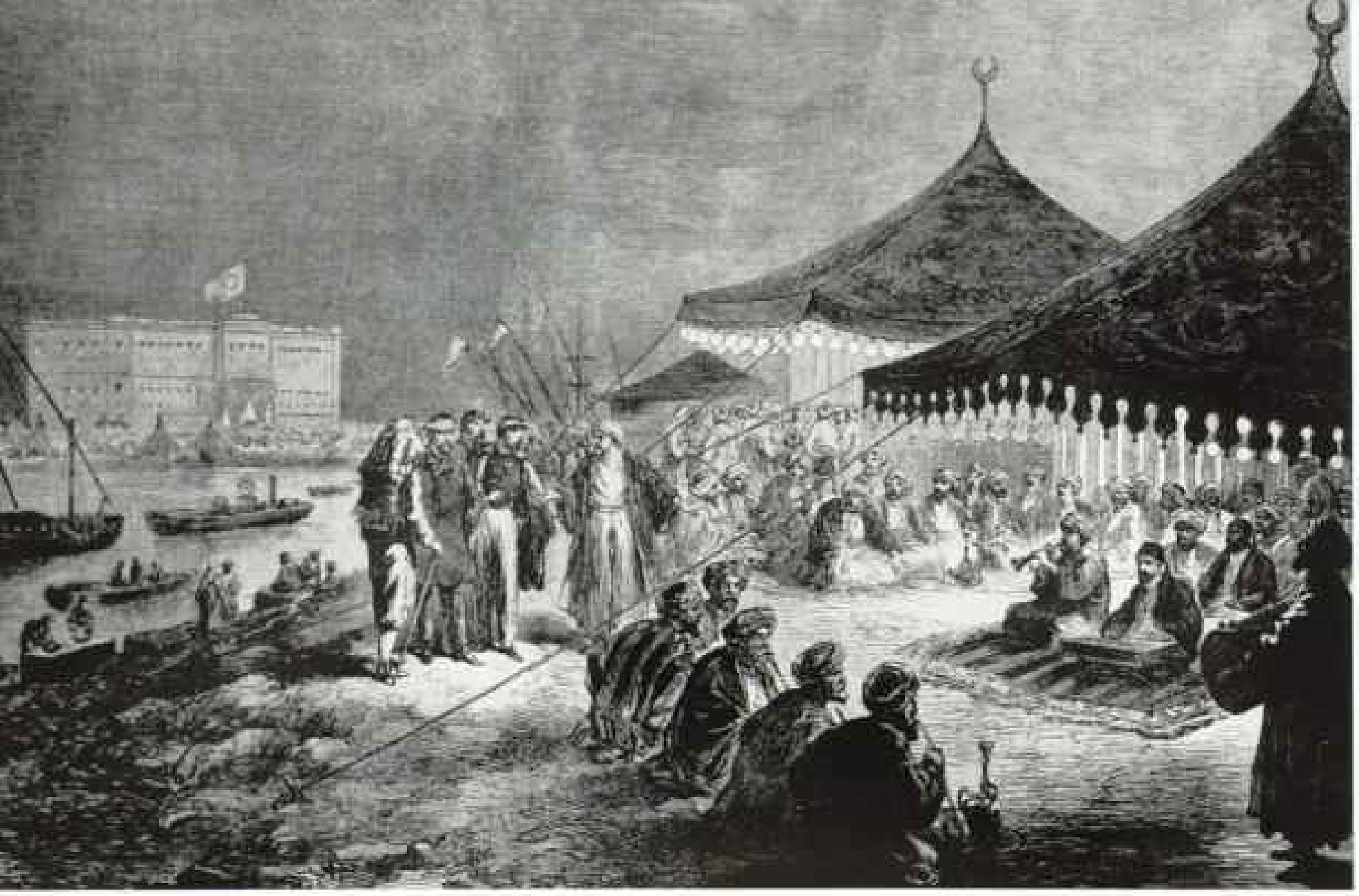
The engineers' reports were neglected, however, until they struck sparks in the brain of Ferdinand de Lesseps, a retired French diplomat who was actually no engineer but an irrepressible promoter.

De Lesseps had long known the Viceroy of Egypt, Mohammed Said, who as a child was too fat for his father's liking and suffered from enforced fasting and exercise, such as climbing a ship's mast for two hours every day. In the De Lesseps home the boy could fortify himself with macaroni. Later, when he had the power to oblige his friend, he gave him the canal concession in the hope of benefiting Egypt and world commerce.

After raising money from French investors and the viceroy, De Lesseps found that construction was not easy. A contemporary account claims that the laborers, conscripted by the viceroy but reasonably paid, didn't want to use wheelbarrows at first—"so much so, that some commenced by carrying them on their heads." Facing bankruptcy in the midst of building, De Lesseps had to badger the viceroy for more money, and conscripted labor had to be withdrawn because of political pressure.

But men rushed in from Italy, France, and the Balkans for "piecework," being paid by

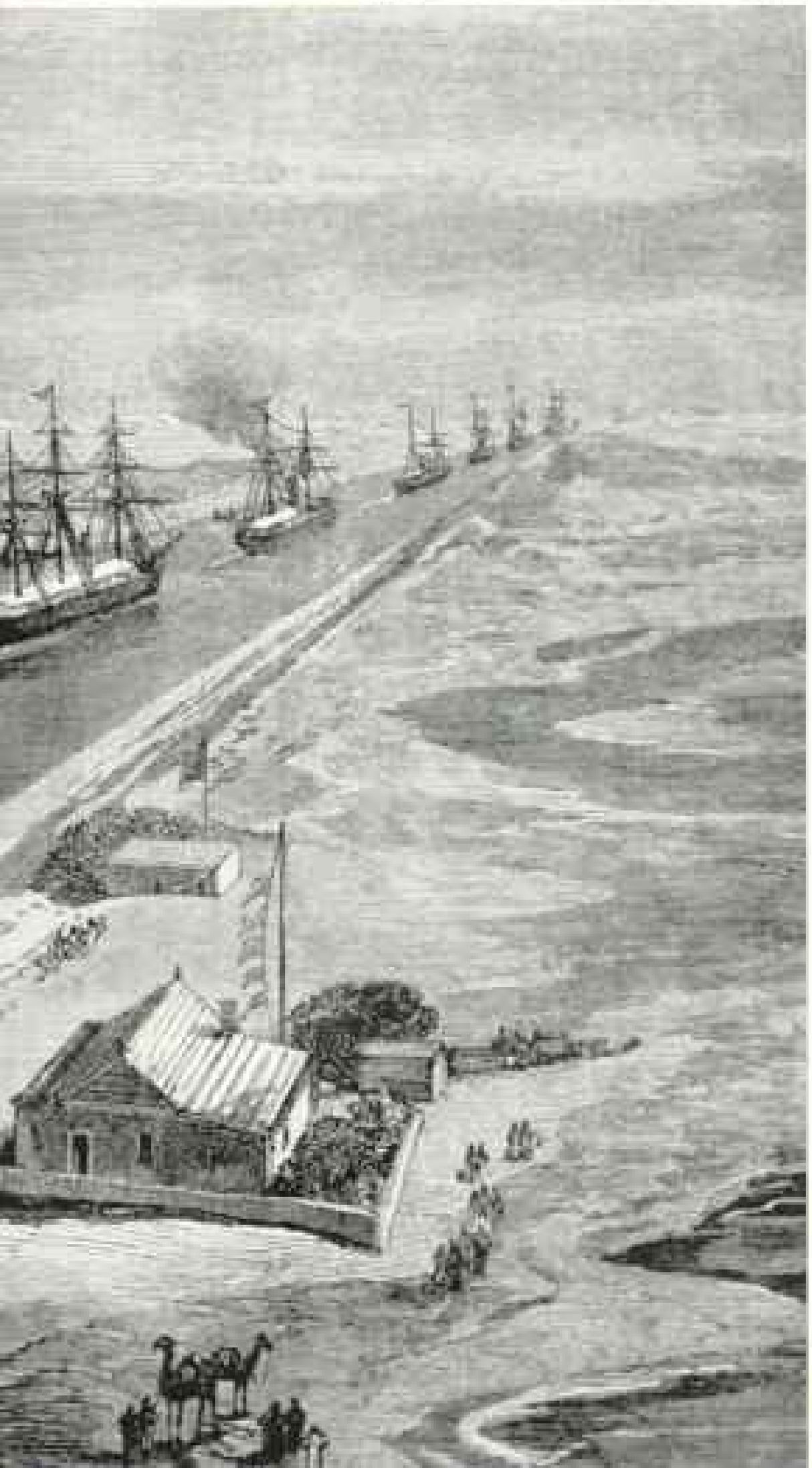




↑ Suez Opens in 1869: East Entertains West in an Arabian Nights Setting

Egypt's Khedive Ismail, a viceroy of the Sultan of Turkey, welcomed the Empress Eugénie of France, the Emperor Franz Josef of Austria, the crown princes of Prussia and the Netherlands, noblemen from Sweden and Russia, and some 6,000 other distinguished guests. To feed them, Ismail hired 300 European cooks and 1,000 servants. Egyptians arrived with wives, children, horses, camels, and gazelles.

In this old-time illustration Arab musicians play for Western visitors, while fellow Egyptians smoke water pipes. The scene is Isma'iliya, named for the khedive, who erected there a palace with a grand ballroom. Turkey's crescent flag flies overhead.



← Eugénie's Flotilla of Steam and Sail Makes the First Canal Transit

Sixty-eight ships, with the French empress's yacht *Aigle* in the lead, started from Port Said amid a thunderous cannonade. They reached the Red Sea in four days.

Cheering Arabs lined the parade route so densely that at one point they pushed front ranks into the canal.

Stopping at Isma'iliya, the halfway point, the empress rode a camel. Bedouin horsemen fired muskets as they galloped past her. Ismail gave a ball for 5,000 guests. The spectacle of royalty waltzing shocked Arab sheiks, who relegated dancing to entertainers and dervishes.

Canal builder Ferdinand de Lesseps was the lion of the hour. Within a week, in his 65th year, he married a woman of 21, who bore him 12 children. Trying to dig the Panama Canal, he was defeated by yellow fever and engineering and financial difficulties.

Keystone View Co.

the amount of earth they dug each day. Despite the claim of a tremendous toll among the workers, a recent study puts their mortality rates lower than those in their home areas.

Toward the end, 4,000 men dug more than 20,000 had dug before, thanks to new dredges and excavating machinery that developed a total of 10,000 horsepower. This doesn't sound like much today, but then it was a wonder of the world.

The opening, on November 17, 1869, was a spectacular affair, attracting royalty from all over Europe (page 139). More than 500 cooks and 1,000 servants were imported from Europe, and the pyramids were lighted up with magnesium flares.

But there were mishaps too. Fireworks went off prematurely and nearly blew up Port Said. The opera *Aida*, commissioned for the occasion, couldn't be produced until two years later. An Egyptian frigate stuck in the channel, and a thousand seamen were sent to pull her clear or dynamite her. She came loose at the last minute.

Noted Engineers Advise on Maintenance

Almost as soon as the canal was opened, it was found to be too snug. One in three ships ran aground the first year. When 416 out of 3,198 ships grounded in the thirteenth year, the canal was enlarged on pressure from shipowners. It grew from a width of 177 feet at water level and 72 feet on the bottom in 1875, to 500 and 197 feet respectively at present.

Maximum draft for vessels was increased from 22 feet in 1870 to 35 feet by 1955, allowing passage of everything afloat except a handful of transatlantic liners, battleships, and carriers.

Even so, some of the bigger tankers can pass the canal only when not fully loaded. The channel will have to be widened and deepened further as ships keep growing in size. New bypasses are needed—like railroad sidings—to avoid congestion as traffic continues to mount in the course of normal events.

These long-range improvements, as well as maintenance matters, are the prime concern of the Suez Canal Company's board of engineering advisers. They keep an eye on technical problems through reports, which are discussed at the annual meeting in Paris. The most recent one was held last November, despite all the fighting along the canal itself.

Among the 18 members are representatives of the Port of London Authority, the Ports of Norway, the Departments of Civil Engineering of Belgium and France, and the Italian Ministry of Public Works. Another member is a former Minister of Public Works of the Netherlands. Most of these men are well along in years. Since I am a member myself and no longer young, I think I may say that this is a very good idea. Young men are needed for action, but older men for judgment and advice.

One of our recurring problems is the safeguarding of the canal's banks, because even at the limited speed of 7½ knots the ships churn up destructively powerful waves. Once a sentry, presenting arms to the flag of a passing cruiser, was swept right into the canal by the cruiser's wash.

Higher speeds tend to multiply the water turbulence and endanger the banks. To find out precisely what pressures the banks must withstand, our board studied the results of tests run in a model of the canal in a hydraulic laboratory in Grenoble, France.

The scaled-down canal section was 210 feet long and 29½ feet wide. In it a self-propelled model of the hull of a tanker, scaled down from a length of 694 feet to 27 feet 9 inches, made hundreds of round trips until erosion of the banks reached the maximum. The results were checked when the full-scale ship passed through the full-scale canal.

Model Reveals Strange Findings

The findings were startling in several ways. What struck me most was this: To speed up from 7 to 7½ knots, a big tanker must develop twice as much engine power; and most of this power flows into the currents and whirls, causing them to damage the banks and channel slopes all the more.

We have tried a lot of tricks to save those banks. Here's the latest: Asphalt is poured on a framework of steel and wire mesh. The result is an asphalt mattress, to be slid over the canal slopes. Then the churning currents won't undermine the banks so quickly.

Improvements now planned look ahead all the way to 1970. Whether they will all be made, and just when they may actually be finished, cannot now be said for certain. But I am confident that men will keep digging the Suez Canal as long as ships sail the seas in peace, for the good of all the world.

NATIONAL GEOGRAPHIC SOCIETY

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ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded 68 years ago, the National Geographic Society publishes the National Geographic Magazine monthly. Receipts are invested in The Magazine or expended to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic surveys constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives. It has aided and encouraged exploration literally to the ends of the earth, having contributed to expeditions of Rear Admiral Robert E. Peary, discoverer of the North Pole, and Rear Admiral Richard E. Byrd, first man to fly over the North and South Poles.

Photomapping the heavens to a depth of a billion light-years from Palomar Observatory, the National Geographic Society and California Institute of Technology have expanded the known universe at least 25 times and discovered tens of thousands of giant star systems. This seven-year Sky Survey (1949–1956) has made available to observatories all over the world the most extensive sky atlas yet produced.

In Russell Cave, Alabama, in 1956, an archeological expedition of The Society and the Smithsonian Institution excavated the oldest material of human origin yet found east of the Mississippi—charcoal from cooking fires of 8,000 years ago. The site revealed a unique record of man's occupancy from 6,000 B.C. or earlier until about A.D. 1650. Finds included many artifacts, weapons, and the 4,000-year-old bones of a man and a dog.

National Geographic exploration and scientific study made known to the world the natural wonders now preserved as National Monument and Carlsbad Caverns National Park.

The Society's notable expeditions pushed back the historic horizons of the Southwest to a period nearly eight centuries before Columbus by dating the vast ruins of Pueblo Bonito.

In Mexico, The Society and the Smithsonian Institution, January 16, 1938, discovered the oldest dated work of man in the Americas. This stone is engraved, in Maya-like characters, November 4, 291 B.C. (Spinden correlation). It antedates by 200 years anything else dated in America and reveals a great center of early American culture, previously unknown.

On November 11, 1935, the stratosphere flight of the world's largest balloon, *Explorer II*, sponsored by The Society and the U. S. Army Air Corps, reached a world-record altitude of 72,395 feet. Capts. Albert W. Stevens and Orvil A. Anderson recorded scientific results of extraordinary value.

The Society and individual members contributed $100,000 to help preserve for the American people the finest of California's sequoias, the Giant Forest in Sequoia National Park.

Cadillac

Jewels by Harry Winston

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How to find your great-great-great-great-grandfather in Britain

First, go back to the village your ancestors came from. Talk to the oldest inhabitant. He'll be a gold mine of information on everybody's family history—yours included.

Or visit the Vicar. He can show you the Parish Register. Some contain four hundred years of news about marriages, baptisms, burials.

If the Parish Register doesn't help, don't give up. Rent rolls and hearth taxes, census returns, wills and deeds are all tenderly filed somewhere. The British adore old documents and never throw them out.

Whenever the trail grows cold, call on the curators of Britain's genealogical societies and great libraries (such as the British Museum).

If you consult the telephone book, you may discover a helpful great-aunt (or charming cousin). If you consult the College of Heralds in London, or the Lord Lyon in Edinburgh, you may come up with a Coat of Arms.

See your travel agent and write for free booklet, *Tracing your Ancestors*,* to the British Travel Assn., Box 121, 336 Madison Ave., New York 17, N. Y.; in Canada: 90 Adelaide Street, West, Toronto, Ont.

*If you don't have a British ancestor, why not invent one?

Take this list of useful addresses with you on your hunt!

England and Wales

Somerset House, Strand, London
(birth, marriage, death certificates)

Society of Genealogists,
37 Harrington Gardens, London

Public Record Office,
Chancery Lane, London

National Library of Wales, Aberystwyth

Northern Ireland

Public Record Office, Law Courts Building
May Street, Belfast

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Scots Ancestry Research Society,
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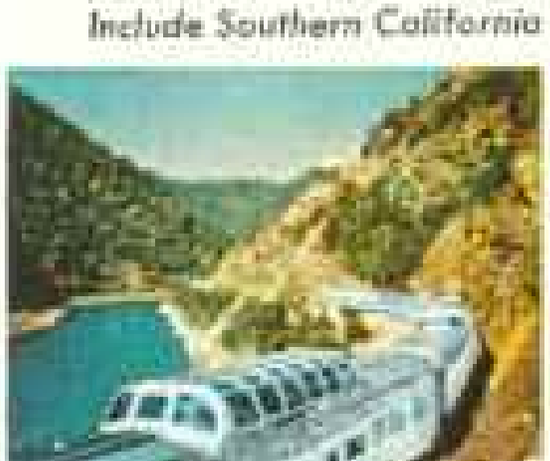

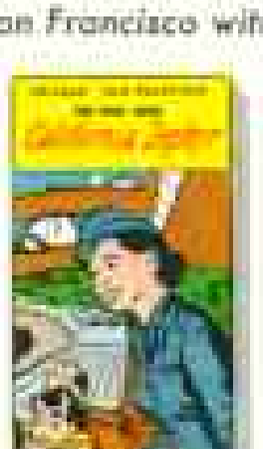

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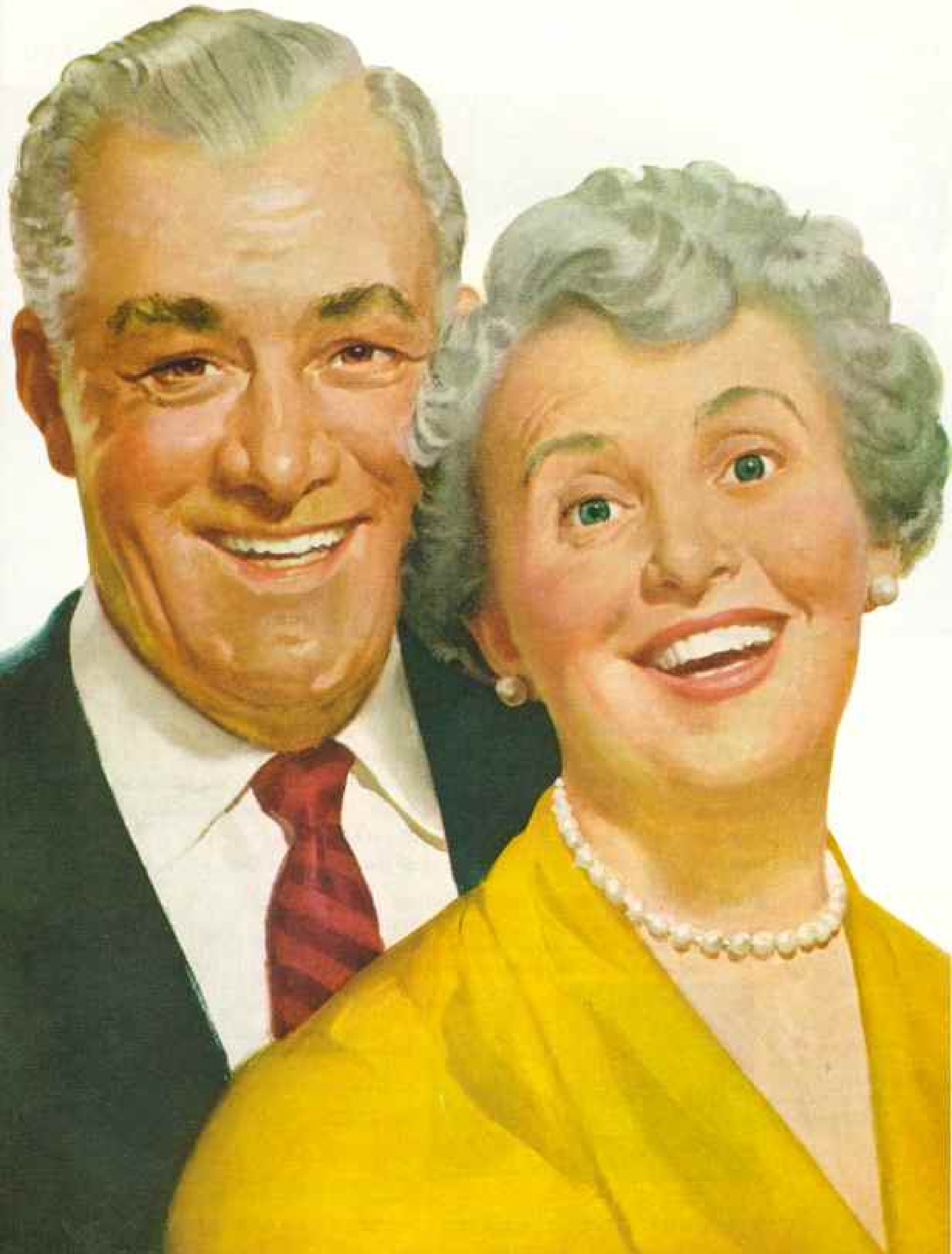

to your years

. . . *and years to your life!*

You've probably noticed it among your own acquaintances. Some people at 60 or even 70 seem to be doing more, and having more fun at it, than others who are 50—or even 40!

Chances are, if you could look closer into their lives you'd learn a few things. They chose the right parents. (Heredity has something to do with it.) They find joy in their work. (That has a *lot* to do with it.) And then you might find something else. You might discover that the people who live longest and enjoy life most are people who eat enough of the right kind of foods.

For a properly balanced diet, medical scientists tell us, can literally slow up the aging process. That means plenty of proteins—the building blocks that keep your body in a state of good repair. Vitamins and minerals—the protective foods which keep your eyes shining, your hair and skin in good condition . . . and your whole outlook on life brighter. Energy foods—the fuels your body has to burn to give you young vigor and enthusiasm.

This is not to say you have to eat a lot. In fact, as we grow older, we need less food. The important thing is to eat a *wide variety of the right foods.*

For instance—take a banana. Take it—peel it—eat it! It's satisfying and nourishing. Vitamins and minerals are there in well-balanced supply and wholesome natural sugars to give you energy. Slice a banana into a bowl and pour milk on it . . . you're adding proteins to keep your body in good repair, as well as riboflavin and bone-building calcium. There's a healthful bowlful! Easy to fix. Easy to eat. Easy to digest. In fact, doctors often recommend bananas in cases of severe digestive disturbances.

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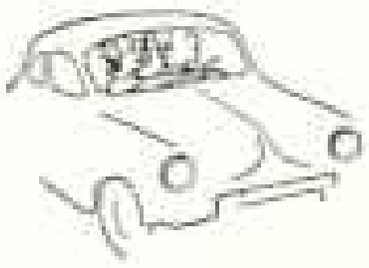

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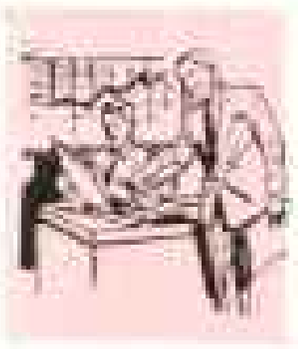

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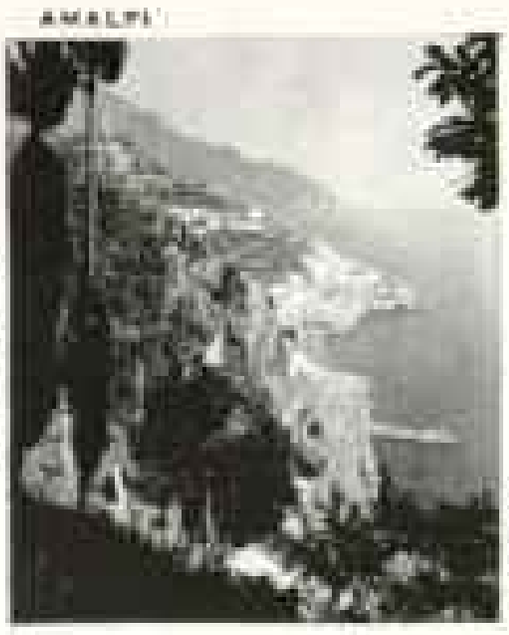

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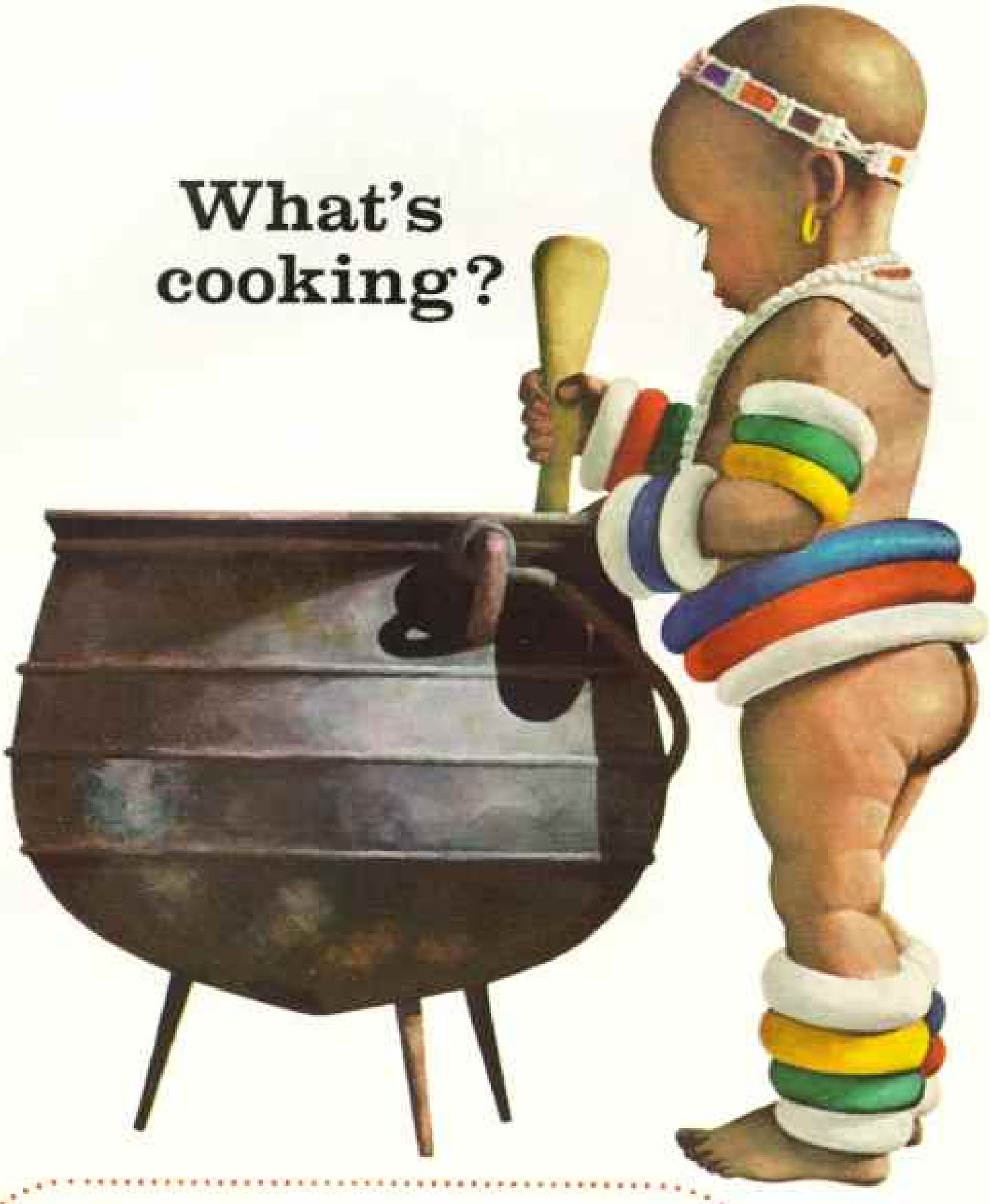

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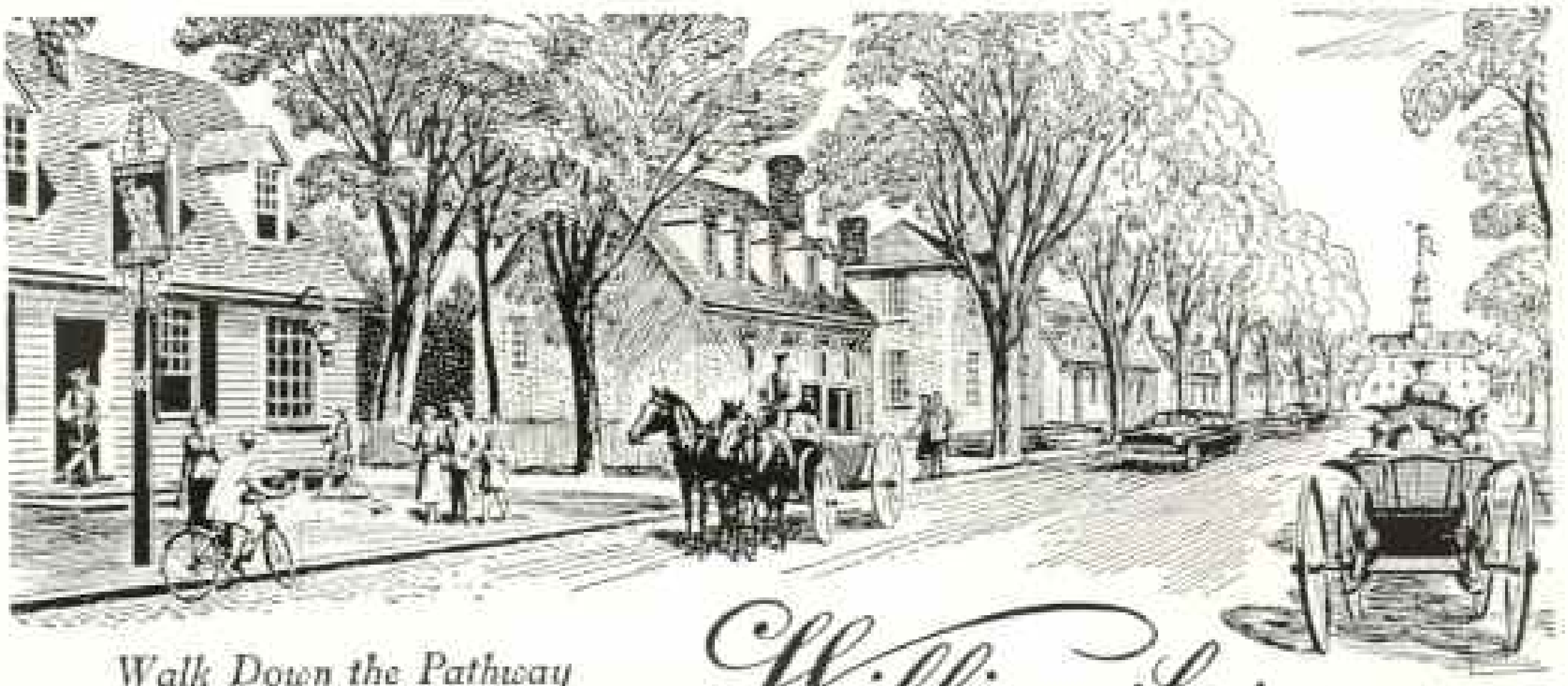

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(See National Geographic Magazine, November, 1955, page 630)

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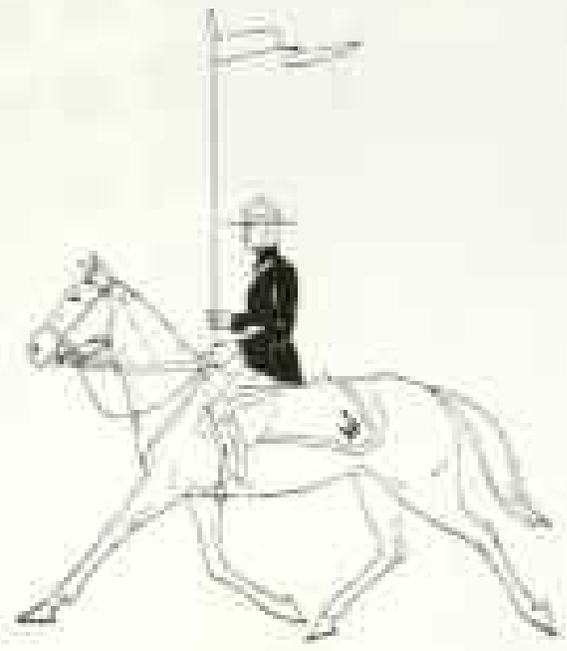

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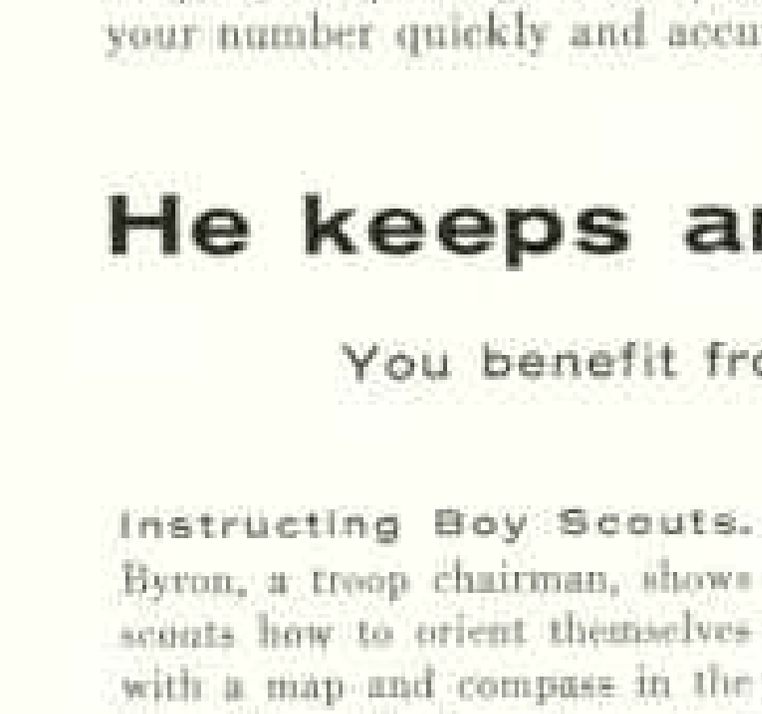

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