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NATIONAL GEOGRAPHIC

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OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

Organized "for the increase and diffusion of geographic knowledge"

THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D.C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization for increasing and diffusing geographic knowledge and promoting research and exploration. Since 1890 the Society has supported 475 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; more than 24 million maps distributed each year; its books, globes, atlases, and filmstrips; 30 School Bulletins a year in color; information services to press, radio, and television; technical reports; exhibits from around the world in Explorers Hall; and a nationwide series of programs on television.

Articles and photographs of travel, natural history, and expeditions to far places are desired. For material used, generous remuneration is made.

COVER: Solitary sailor on a globe-girdling voyage, Robin Lee Graham takes his own picture as he cools off with a bucket bath in the warm South Atlantic (pages 476-7).

NATIONAL GEOGRAPHIC MAGAZINE

No floor show just a working girl working

This is for real. No model. No put-on smiles. Her name is Carol Koberlein. But it could be Virginia White. Or Linda Epping. Or any one of the other 1724 stewardesses who work for Delta. In her new chic outfit, she looks like anything but a stewardess working. But work she does. Hard, too. And you hardly know it. Even when she spreads Delta's new eight-course, 1200-mile first-class meal before you. Or a Tourist meal that seems anything but economical. Next trip, come see our working girls work. It's no floor show. But it's funny how you get to feel like a leading man.

DELTA

Delta is ready when you are!

Firestone's new Tirepower gives you double mileage with new Radial Wide Oval.

Write in your usual tire mileage.

Now double it.

Announcing the all-new Firestone Supreme . . . combines radial tire performance with Wide Oval looks and ride.

Radial tires aren't new. But the new Firestone Supreme Radial is. That's because it's a Wide Oval.

We started by making a six-ply tire. Four belt plies that circle the tire. Two more that run from bead to bead. Then we put on an extra-wide tread. Result:

Much better ride than conventional radials. Even better control and steadiness than our original Wide Oval. Fantastic adhesion, wet or dry.

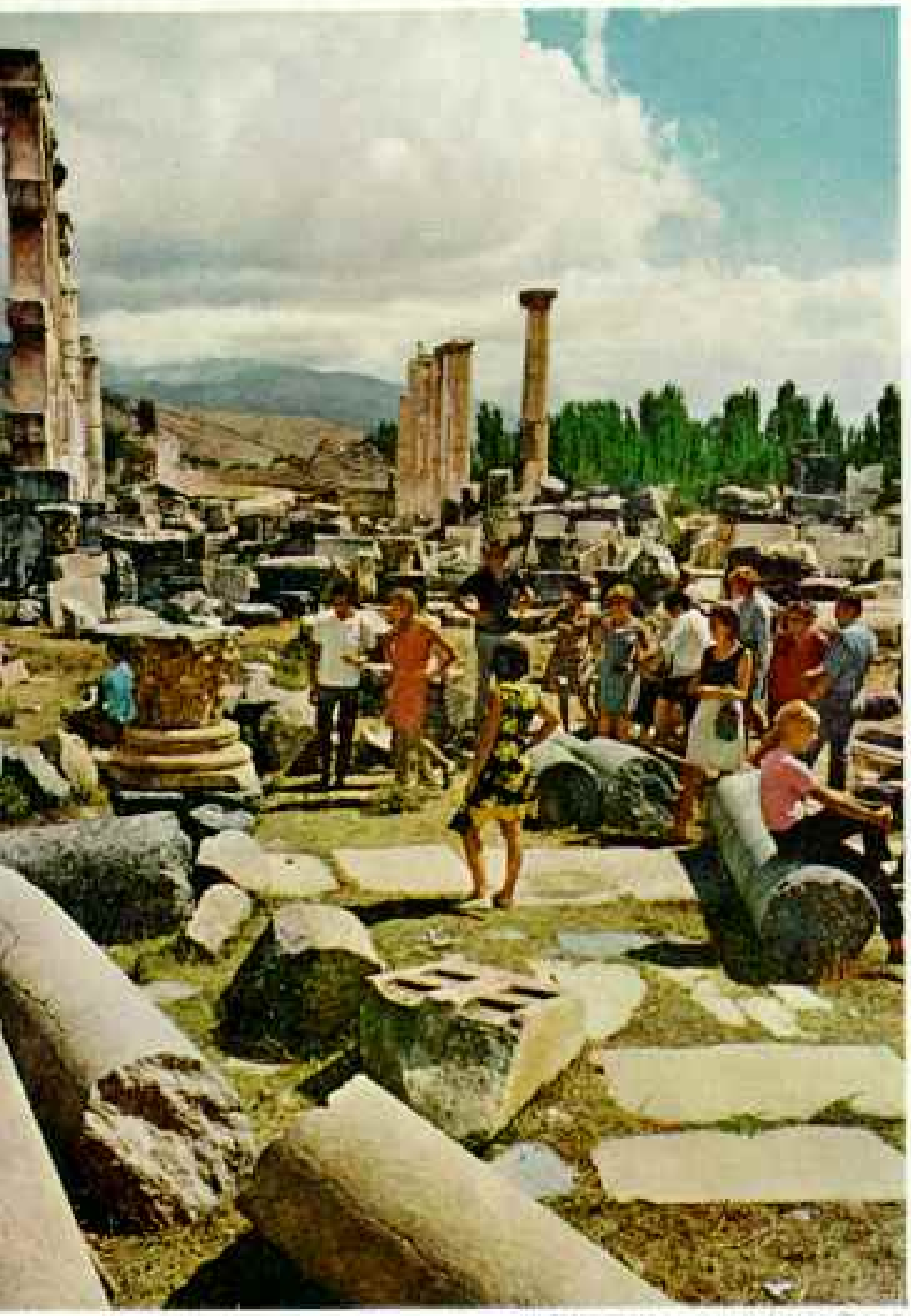
Plus double the mileage of our best-selling tire. Right! Double!

Also, we built in greater resistance to punctures. With a safety-sealant innerliner.

Firestone Supreme Radial Wide Oval. Best tire we know how to make.

New Tirepower. Only at 60,000 Firestone High-Performance Tire Centers.

Uncovering the ancient city named for Aphrodite, goddess of love



"ONE of the most stunningly beautiful Greco-Roman ruins in the world is emerging from the earth before our eyes," declares Dr. Kenan T. Erim, who is excavating ancient Aphrodisias in southwestern Turkey with National Geographic Society support. In nine years the Turkish-born associate professor of classical archeology at New York University has unveiled a maze of marble sculptures, friezes, colonnades, baths, and temples—including the Temple of Aphrodite herself (left), patron goddess of a city whose elegance rivaled that of Imperial Rome. Its art work, like the priest's head above, spread around the Mediterranean.

Dr. Erim will report on his latest finds in a future GEOGRAPHIC. To enable your friends to aid such discoveries and share the results in the Society's color-filled magazine, nominate them by using the form below.

BOOKHOUSE BY JONATHAN E. BLAIR © N.G.S.

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An electronic flash makes it the most

Electronic flash, electronic timing, and the most sophisticated exposure control system ever conceived add up to the most remarkable 60-second camera yet.

You slide the electronic flash unit into place with a satisfying click, and flip on a tiny switch.

Instantly, a light in the camera body and a rising sound signal tell you the flash is building energy. A light starts flashing and the sound switches to a *boop...boop...*

You are now ready to shoot 40 flash pictures, without stopping once to put in a flashbulb.

As you focus, louvers in the flash unit automatically adjust to deliver the exact amount of light you need. You depress the shutter and zoing! the strobe releases a 1/1000th of a second burst of light, fast enough to freeze the action in a sizzling ping-pong game or capture the wildest dancer at the party.

You pull the film packet out of the camera. Automatically, an electronic timer is activated and the timer light goes on. The instant the print is perfectly developed, the light goes out and the timer goes *beeeeeep*.

Now: peel off your picture. Perfectly exposed. Perfectly developed. And all you did was

As you focus, louvers adjust automatically to insure correct light intensity.

aim and shoot!

Now keep shooting. After you've taken 5 film packs (40 shots), you place the electronic strobe in its charger unit and plug it into the wall. It recharges itself automatically.

Sound sort of James Bond? The 360 is no fantasy. It's real and it's here, to give you more excitement than you ever imagined you could get from picture-taking.

You'll take wonderfully spontaneous pictures. No more

POLAROID ®

self-sufficient camera in the world.

albums full of wooden friends and relatives. You'll never have to ask your subjects to stop doing what they're doing and pose. The film is exposed only for that millisecond of light. If your hand jiggles, you don't have to worry. The pictures are always razor-sharp.

You'll never have to use another flashbulb (so you'll never run out of them!). Let's say you're having a big party. You take 40 flash pictures. One last shot? Plug in for 10 minutes and you can shoot another pack.

Using The 360 tomorrow for a family get-together? Plug it in, and in an hour, it's fully recharged. When you're not using it, just keep the flash unit plugged in, like your electric toothbrush.

Best of all, The 360 gives you the freedom to shoot when the moment is right.

You'll get perfectly exposed shots, indoors or out. This remarkable strobe light is particularly kind to flesh tones. Outdoors, the sophisticated electric eye and electronic shutter system will read the light and set the exposure automatically.

You won't waste any more pictures because of poor timing. You set the timer correctly and let *it* worry.

One fascinating feature will give you an inkling of the ingenuity that went into this camera. In the timer, the shutter and the flash unit are circuits containing transistors, resistors, and other electronic components. Each would normally fill a space as large as a deck of cards. In The 360, they have been reduced to tiny chips of plastic-covered silicone less than 1/32 of an inch square, about the width of a pencil point.

The Polaroid Land Model 360 has a Zeiss Ikon range-and-viewfinder. Triplet lens. Four film speed settings. Two exposure ranges for color, two for black-and-white. It can take Polaroid attachments for close-ups and portraits. It has a tripod socket. And instant pack-film loading.

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No flashbulbs ever. Electronic flash shoots 40 pictures, recharges on house current.

Electronic circuits reduced from the size of a pack of cards to the size of a pencil point.

1/1000th of a second exposure makes possible spontaneous flash pictures.

"I've had a driver's license for 10 years. For 9 of those years I was a drunk."

Fewer than 4% of all drivers on the road are heavy drinkers.

Yet heavy drinkers are involved in nearly 50% of all traffic deaths.

The frightening truth is that drunks are the deadliest drivers ever let loose on the highways.

Knowing that, you'd think that our licensing officials would take extraordinary measures to hunt down this small gang of killers and get them off the road.

And save 25,000 lives a year.

Well, think again. The way things are now, there's no effective way to take a drunk's license away before he kills somebody.

With 25,000 lives at stake, there must be a better answer than that.

Maybe it's a thorough physical examination.

For instance, in Pennsylvania a doctor must certify that every new driving-license applicant is not an alcoholic.

Maybe there's a better way, but certainly what Pennsylvania does is better than nothing.

And nothing is what all but a handful of states do.

So if you're tired of being a target, write to your local legislators and demand that they get those drunken killers before they get you.

Not everyone should drive.

At 6:04 last night, Mrs. Walter Russell started Polyunsaturating her entire family

...with a big assist from Mazola.

For years, millions of Americans have been eating a diet that is improperly balanced in terms of fats. Mrs. Walter Russell is no exception.

Today, however, she's doing what medical authorities are suggesting. She's serving her family a balanced diet, one which includes cutting down on total calories and fat calories, and replacing solid fats with the more highly polyunsaturated vegetable oils.

Since Mazola® 100% Corn Oil is highest in polyunsaturates of all leading brands, Mazola is the only brand for Mrs. Russell. It's the logical choice for you, too, for all your cooking and salad making needs.

No matter how many generations there are in your home, there's one thing you can all enjoy doing together.

Polyunsaturating.

P. S. She's got Mazola® Margarine in on the act, too. It's made with liquid Mazola Corn Oil.

Come up for air.

Looks like you could use some about now.

Just across the border is about 4 million square miles you can stretch out in. Pick a lake. Ontario alone has 250,000 of them, so you might even get one all to yourself.

Hike to Georgian Bay, clear blue water and an absolute rash of islands. Scuba dive to a sunken ship. There are about thirty of these right around the Bruce Peninsula.

Drive east through la belle province de Québec. Take the leisurely and beautiful 3-day trip around the Gaspé into northern New Brunswick. Some of the finest fishing rivers in the world are waiting for you here.

Or go west. Prowl around a ghost town restored to its former grandeur. At Nelson, B.C. board the Nassokin, a retired paddle-wheel steamer now comfortably beached in a petunia bed. Its decks and salons have been transformed into a museum of Indian and wild west antiquities.

Or, go up to Banff, Alberta, sit in a 110 degree Fahrenheit mineral spring and just contemplate the view.

What do we do for excitement in Canada?

That's another story altogether. For when you're up to it.

Georgian Bay (above.) Where there isn't blue water, there's a green island (thousands of them!) Read all about Ontario's many resort areas...and don't forget Ontario is just one of ten provinces you can escape to! Plan your getaway now.

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For the location of the Bolens dealer in your area, phone **800-243-0355** any hour, any day, free. (In Connecticut call collect 853-3880.) Dial just as you normally dial long distance.

Sgt. William H. White, Air Force mechanic, Dover, Del. *"I looked at four or five of the leading brands and this Bolens 770 tractor beat them all. There was no comparison for the machine that had to do a tough job. The Bolens was the best built and the best engineered of them all, and I have never been sorry on my selection."*

Mr. Donald B. Lindsay, Milwaukee, Wis. *"I took in several garden and home shows to evaluate the different machines. After looking at many, I finally decided on Bolens 1250. I do appreciate the total flexibility and ease of operation. From forward to reverse in one smooth operation, and with one pedal, is excellent."*

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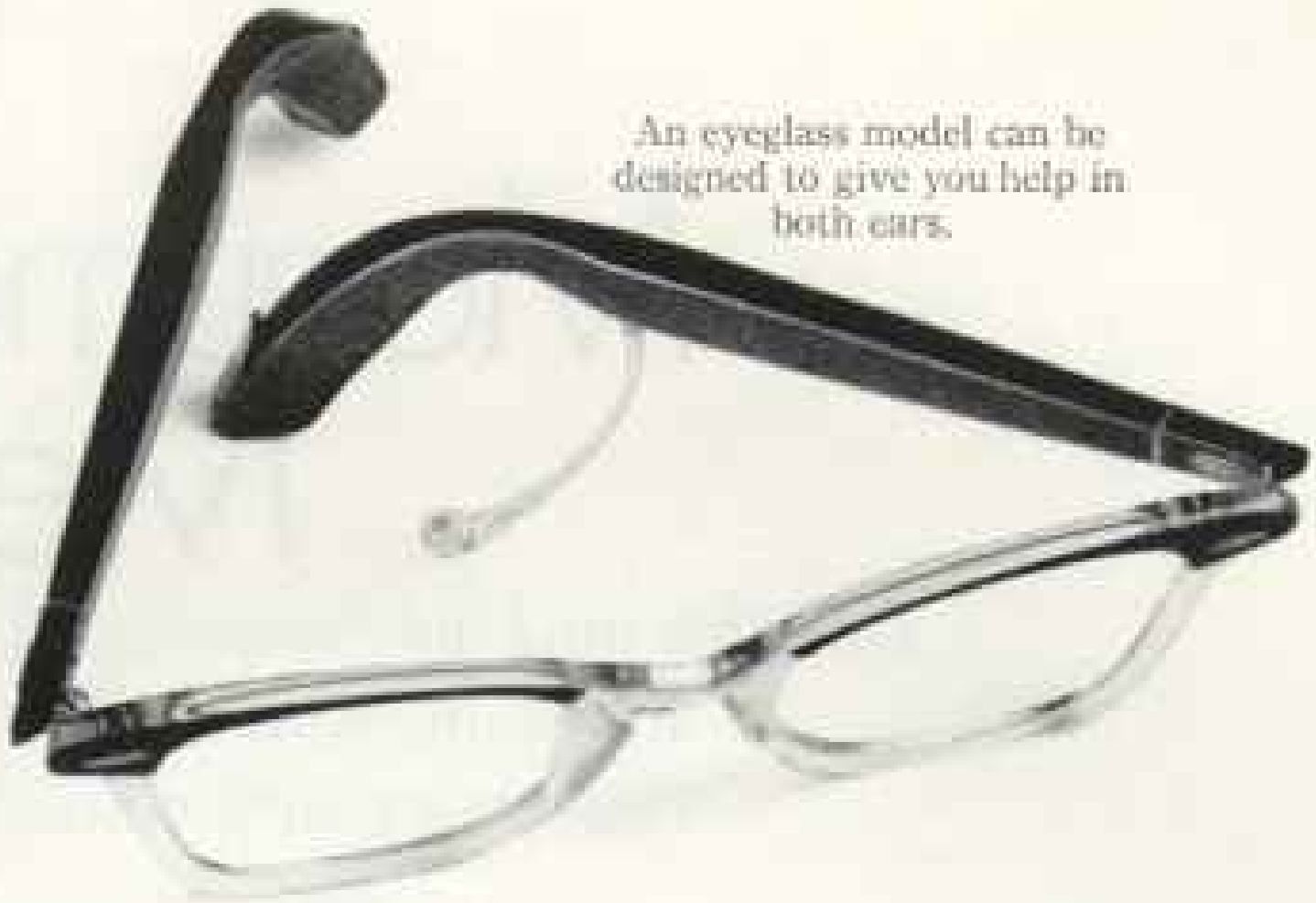

An eyeglass model can be designed to give you help in both ears.

A Zenith Hearing Aid can "listen" harder just for the sounds you are missing.

For a severe or unusual loss, a case-and-cord model is still best.

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Zenith believes a hearing aid should do more than just make sounds louder. It should be balanced to bring back the lows, if those are what you are missing. Or the highs, like a small child's laugh.

Every hearing loss is personal. Yours is different from someone else's. That's why Zenith makes so many different kinds of hearing aids. 18 different models. Fifteen of these may not be for you at all. But of the remaining three, one is probably just right for your loss.

Your Zenith Hearing Aid dealer is carefully trained to help you choose that one Zenith Hearing Aid. More than that, he can skillfully adjust its performance to your particular needs.

You can buy a Zenith Hearing Aid for as little as $75* and get Zenith quality. Some of the more miniaturized, inconspicuous models, however, cost up to around $300*. All are covered by Zenith's exclusive 10-Day Money-Back Guarantee. If, within ten days of purchase, you don't feel the best is good enough, return it to your Zenith dealer and your money will be refunded.

Visit your nearby Zenith Hearing Aid dealer listed in the Yellow Pages. He'll be happy to work with you to help you choose the Zenith Hearing Aid that's best for you.

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One of Canada's Atlantic Provinces

Virginia has a romantic past. And lots of mementos to prove it.

Woodrow Wilson Slept Here. At Staunton's stately "Manse", you can see the crib that held a future president. And the home where Jessie Wilson gave birth to the son who later gave birth to the League of Nations with its vision of world-wide peace.

The General's Assembly. Douglas MacArthur called Norfolk home, though he was born in Arkansas ("while his parents were away", the Norfolk paper said). Here, at the MacArthur Memorial, you can see the possessions of this great soldier.

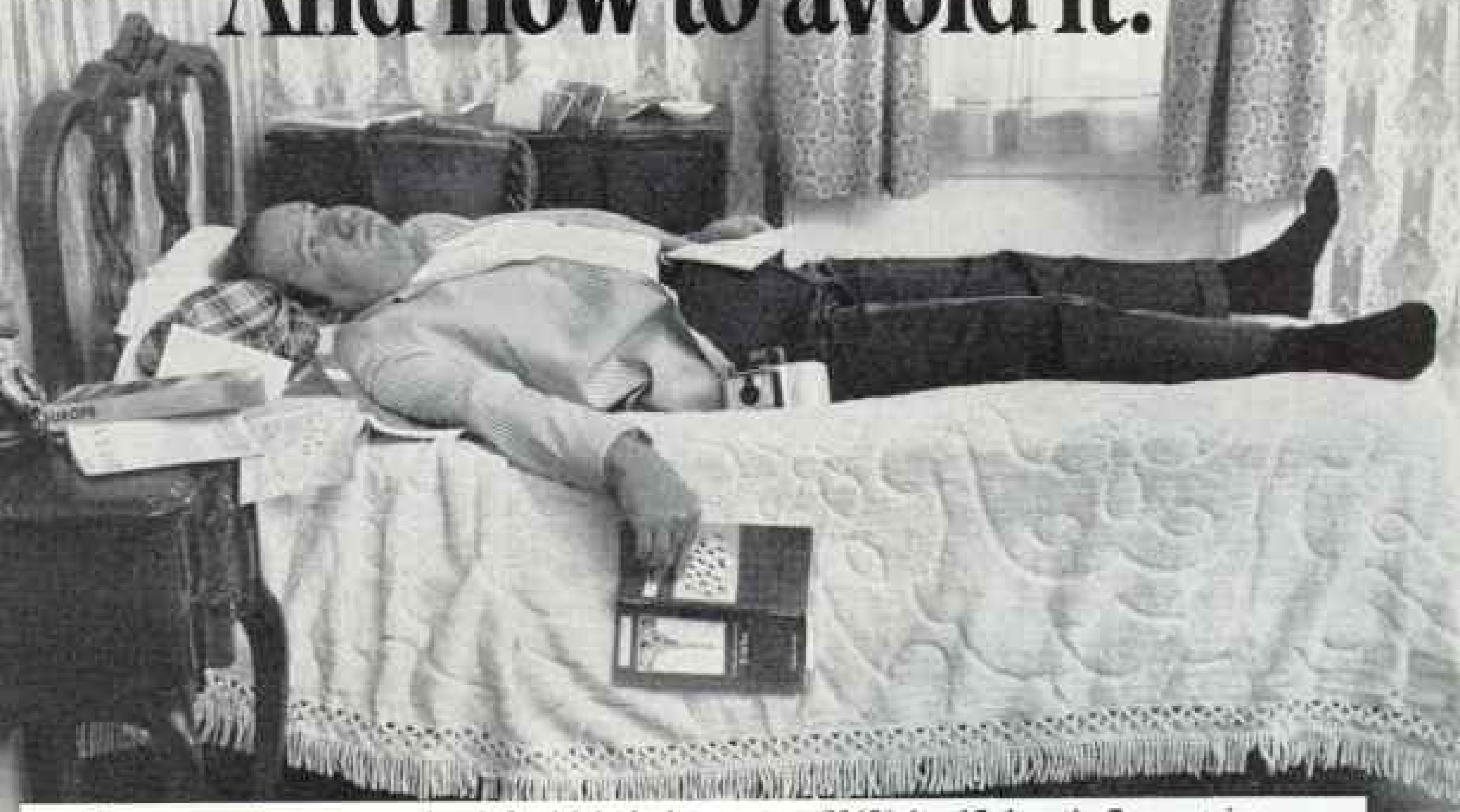
The Doll Who Spied For Dixie. She had a head for smuggling. Hollow. Just right for carrying medicines across Union lines. She's at Richmond's Confederate Museum now. In retirement.

Broadway In The Blue Ridge. These spurs were worn in an early play at Abingdon's Barter Theatre, so-called because its depression-hungry founders traded seats for food. To date, over 2 million tickets have been sold; most of them, in recent years, for cash.

The Mighty In Miniature. These water color miniatures of the first President and his lady, painted from life, are now on view in Williamsburg. Come see them, and the rest of Virginia.

For free 100-page booklet and brochures on your travel interests, visit, write or call Virginia State Travel Service. Richmond 23219, 911 E. Broad St., phone (703) 770-4484. New York 10020, 11 Rockefeller Plaza, phone (212) 245-3080. Washington 20006, 906 17th St., N.W., phone (202) 293-5350.

The too weak tour of Europe. And how to avoid it.



You can take any number of whirlwind tours of Britain and Europe. Zip from city to city. Dart in one museum and out the other. And end up running yourself ragged. Sure, you'll see a million things. But how many will you *experience?*

In place of the usual "tours of", BOAC offers Holidays in Britain and Europe. The difference: We show you a lot for your money —but we also show a little restraint. We provide a vacation, not a merry-go-round. We give you an opportunity to meet people as well as see places.

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is an oil field.

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And, wherever you wander on this peaceful island, you have to look hard to spot the oil wells. Many are hidden by grandfatherly oak trees bearded with Spanish moss. Others are screened by banks of azalea and rhododendron. To Jersey's affiliate, Humble Oil & Refining Company, this respect for environment is only right and proper.

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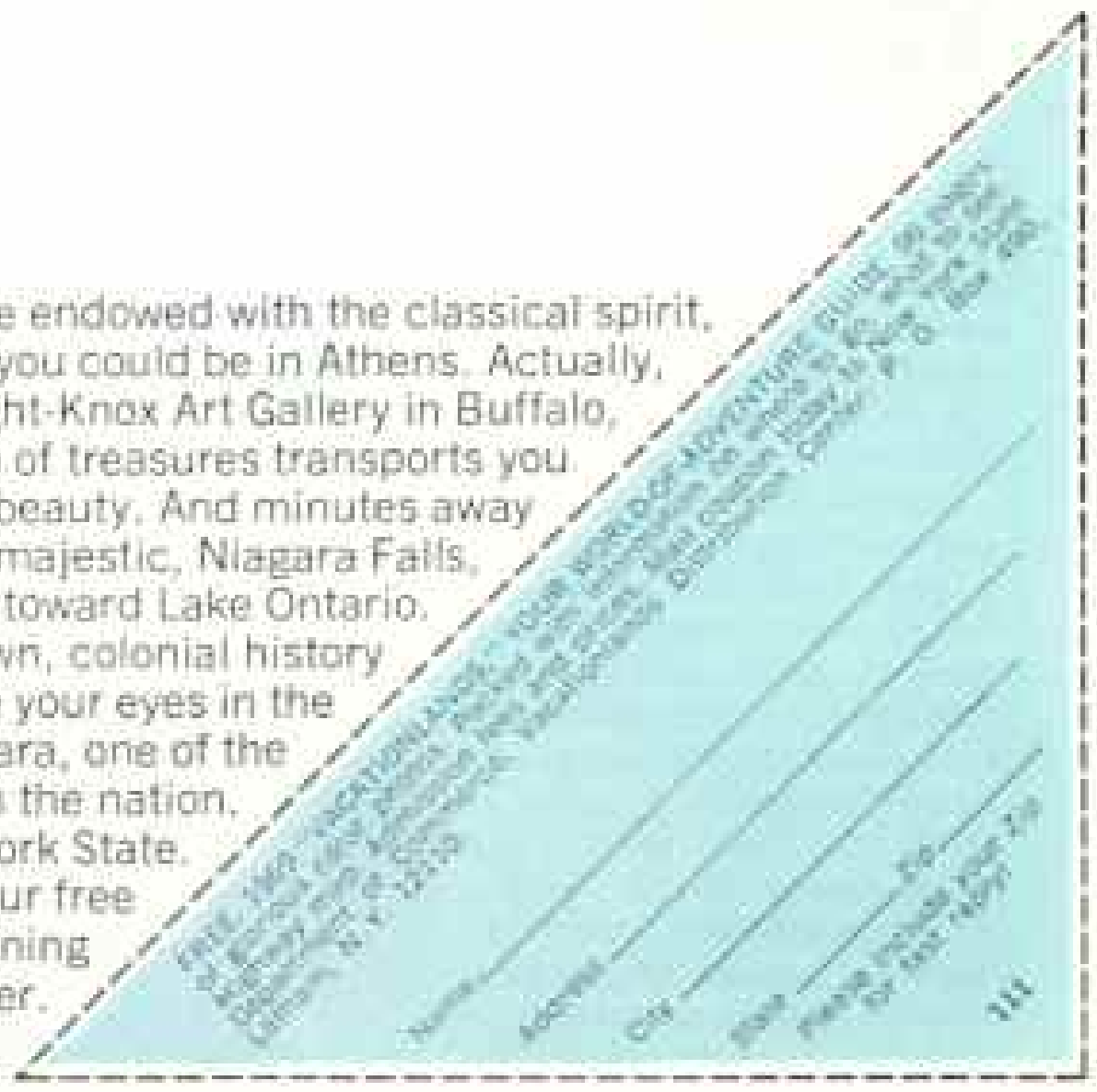

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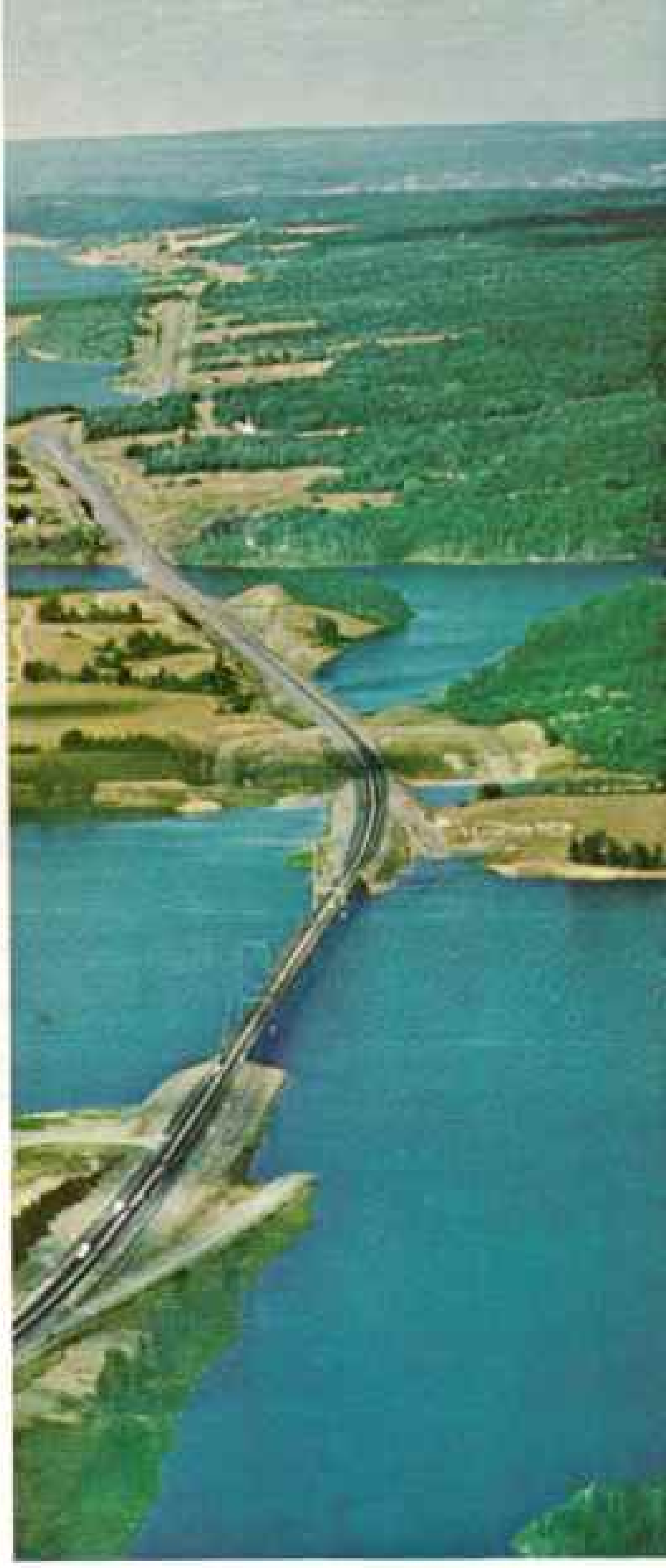

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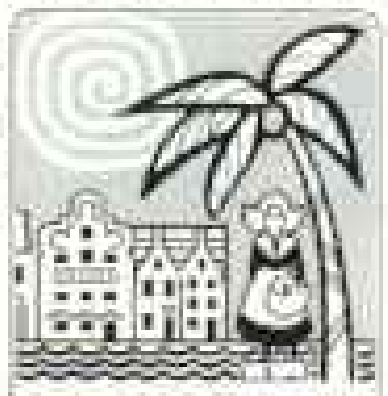

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April 1969

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World-roaming Teen-ager Sails On

By ROBIN LEE GRAHAM

Last October, National Geographic presented the story of Robin Lee Graham's adventurous voyage from California to South Africa. Here Robin makes his way along the African coast to Cape Town, then across the Atlantic to Surinam and Barbados.

DURING THE NIGHT the wind had backed around to the northeast. The forecast called for a strong blow. If it came, I could run before it as I made my southwestward way along the South African coast. It was time to go.

I wasn't very eager to resume my singlehanded sailing around the world. I'm never eager to go back to the sea and the awful loneliness and exhaustion a singlehander has to face. But I'd been in Durban more than four months now. It was already a bit late in the season to round the Cape of Good Hope. And *Dove* and I were as ready as we'd ever be.

Boyhood Ends—a Sailor Marries

We'd changed, both boat and boy, since we sailed into Durban on October 21, 1967, beat up and battered. *Dove* had been transformed and strengthened. So had I. You could see the changes in *Dove*. I looked about the same as ever, but I'd changed too. I wasn't a loner any more. I'd sail singlehanded to my journey's end, but my single life was over. I'd found the girl I was going to marry. Patricia Ratterree and I were engaged.

I was still a minor, and I had to have my parents' written permission before we could be married. But it was on its way. Patti would become Mrs. Robin Lee Graham before I left for South America.

Looking back on it now, one hemisphere and most of a year later, our wedding seems pretty funny. But it was really neat, in its own way. We got on our old motorbike, which we called Elsa, and drove off to a little resort town on the coast.

There was one beautiful little hotel that had no guests just then. We looked at all the rooms, discussing each one, and finally picked one in a corner with windows facing the mountains and the sea. When we told the receptionist which one we'd picked, she laughed and said, "Oh yes, that's the honeymoon room."

Sailing the long Atlantic leg of his solo global voyage, 19-year-old Robin Lee Graham scuds toward the island of St. Helena, the first land he has seen since leaving South Africa, 1,700 nautical miles to the southeast. He must cross another 3,300 miles of ocean before he and his 24-foot sloop *Dove* reach Surinam.

KODACHROME BY ROBIN LEE GRAHAM (C) NATIONAL GEOGRAPHIC SOCIETY

In following winds, Robin furls the mainsail and runs under twin genoas; he takes his picture by pulling a string attached to the camera. Robin did not go ashore on the lonely island where the British imprisoned Napoleon in 1815; he had ample supplies and was anxious to rejoin his bride in South America.

We'd already checked with the officials, and we knew we had to have formal clothes: a coat and tie and shoes for me—the whole lot—and a hat for Patti. All she had was a watch cap, but that's a hat.

I produced my parents' written consent and 10 rand ($14). Then the magistrate put on his robe and began the ceremony. At the crucial point he asked for the ring—and I didn't have one. But Patti pulled off her engagement ring, and we made it do double duty.

To get back to my story, that strong northeast wind that was forecast never showed up. My outboard motor wouldn't work, either, so I had to be towed out of the harbor.

Patti was on the other boat. I hated to see it take her back to shore, but at least I knew we'd meet soon. I was bound for East London, only about 250 nautical miles away (map, page 456). She would ride there on Elsa, and would be waiting for me when I got in.

I'd gone about 20 miles from Durban when the wind quit. In real disgust, I said to my tape recorder:

I'm just sitting here with flopping sails. Good old weather reports! There's a big old hotel on the shore, a couple of miles away. I've been right in front of it for an hour. Gee, I wish I could get going.

Robin's Worst Enemy—Loneliness

It's always toughest when you first leave. You can see how slowly you're going, and you can hardly stand to think of all the miles and all the lonely days that lie ahead. It's pretty discouraging.

Why do I go on with it? Well, partly because I don't want to disappoint the many people who've helped me. Besides, I've come a long way; I'd like to finish what I've started if I can. But I really don't know if I can. Each

ENGRAVING BY CHARLES ALLMO

departure is harder than the last. The mental strain gets worse.

The wind began to freshen at last, but it was blowing right out of the southwest, which was where I wanted to go. It might turn into a "buster"—a really stiff gale.

I wasn't worried about the boat standing up to it. Even if a wave should break over her, she'd still be all right, because I'd torn out the cockpit and decked her over aft. The cockpit was never any use to me anyway; it was always full of bottles and jugs of fresh water, and a breaking wave could slap a ton of ocean into it.

What did bother me was that I couldn't make any progress at all beating to windward. *Dove* was just too little. Seas smashing into her bow kept stopping her. I could tack back and forth for hours, but I couldn't get anywhere.

I never want to beat, I noted. *If the wind is forward of the beam, and 15 knots or more, I say forget it. No use fighting this weather. I'm going back to Durban.*

The gale lasted another day. I had to stay in Durban harbor until it blew itself out, and I wasn't too happy to be back. For one thing, Patti wasn't there. Not knowing I'd had to return to Durban, she had taken off for East London as we had planned.

Chance Meeting Led to Marriage

Patti and I had met twenty months before, in the Fiji Islands. She was traveling around the world too, stopping off here and there to work for a while and meet people. I heard about her from an old friend of mine, who was in Fiji crewing on another yacht. He told me about an American girl he'd known for years in California who was supposed to be working on the island somewhere. One day he saw her on the street in Suva, just by chance, and he brought her over to the *Dove*.

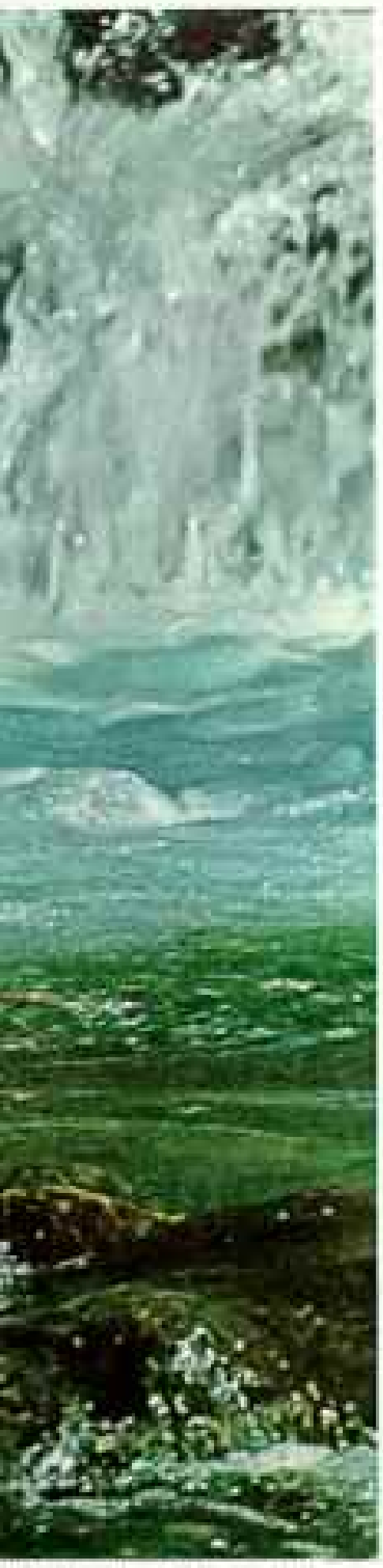
It sounds corny, but it was really love at first sight. I couldn't believe it. Even so, neither of us was thinking about marriage, and we went our separate ways. But we wrote each other and managed to meet again, 10 months later, in Darwin, Australia (left). I asked Patti to stop in Durban when she got to South Africa. She did, and that's when we decided to get married.

By now, I reckoned (getting back to the present), Patti would be in East London, waiting for me. With luck I might still get away in the morning. I knew I'd better get what sleep I could, because I wouldn't be getting any once I started out. I'd have to stay close to the coast to avoid shipping lanes. *Dove* has a self-steering rig, but I wouldn't be able to use it when I had cliffs on one side of me and big ships on the other.

I got out of Durban for the second time on March 10, 1968, on a nice northeast wind. It held for a day and a half. *Dove* really made knots under main and spinnaker. It was so rough the coffee pot fell off the gimbaled stove and spread grounds all over the place, but at least we were moving. Then, near midnight on the second day, I suddenly faced 30 knots right out of the southwest. I got all sail down, and talked to the recorder again:

My kerosene running lights won't stay lit. I'm drifting out into the shipping lanes. It's pretty hairy. I'm tired, but I've got to keep my eyes open.

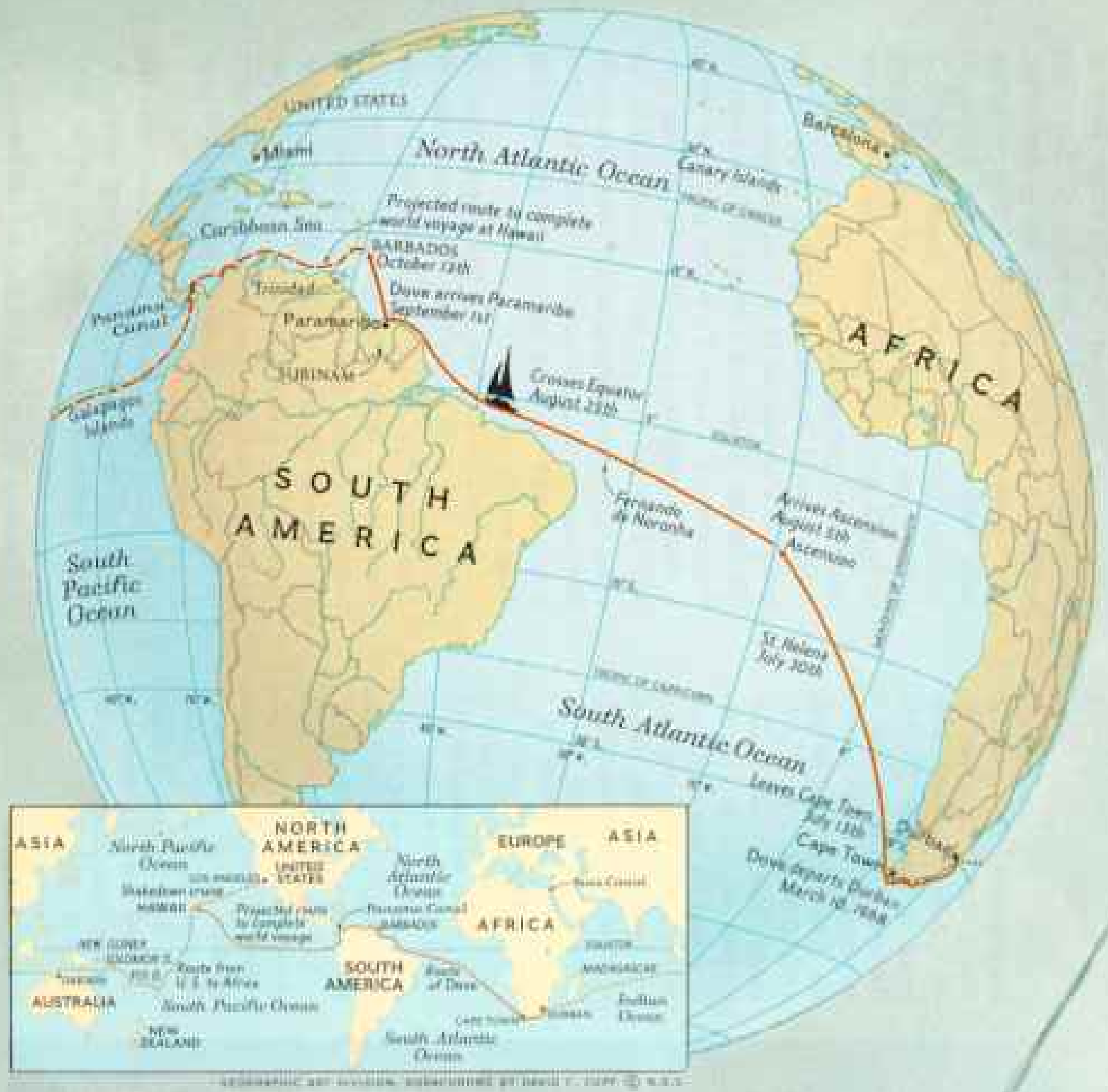
I would have headed for an anchorage if



Down-under courtship: Robin and Patricia Ratteree splash in a warm bubbling spring near Darwin, Australia. "Like bathing in champagne," Robin recalls. He had met Patti in July 1966 at Suva in the Fiji Islands. Also a native Californian, she was on a leisurely round-the-world journey of her own, stopping here and there to sightsee and to work at various jobs to supplement her savings.

"I guess you would say it was love at first sight for both of us," Patti admits, "but when we parted in Fiji, we didn't know that we'd ever see each other again. I gave Robin the gold chain he wears as a farewell gift."

But the youngsters kept in touch by mail and arranged to meet in Australia. Months later, they were married in South Africa, after Robin's long, trouble-plagued voyage across the Indian Ocean (GEOGRAPHIC, October 1968).



FAIR WEATHER *and favorable trades bless* **Dove** *on the Atlantic crossing, and Robin makes a fast passage. For the second time he crosses the Equator, returning after three years to*

the Northern Hemisphere. Dotted and solid lines on the inset map trace the 22,800 miles he logged from Los Angeles to Barbados; dashed line projects the contemplated course to complete his voyage. Here, in a squall off Barbados, **Dove** *sails under reefed main and jib.*

PHOTOGRAPHING BY PATRICIA GRAHAM © N.G.S.

A motorbike named Elsa carried Robin and Patti on a trip from Durban to Johannesburg and the Transvaal. Here, en route to Phalaborwa, the author studies a map near a miniature mountain shaped by nesting termites.

"We saw a fantastic number of wildebeests, giraffes, zebras, and other wild animals in game reserves and national parks," remembers Robin, who has a great love for wildlife. "And we also met many wonderful people," adds Patti. For their meals they grilled fish they caught, roasted corn over open fires, and nibbled candy for energy.

there had been one nearby, but on this coast there is nowhere to go except into one of the few big harbors.

I taped: *I have to keep going, but I'm so weary I'm answering myself when I talk. Maybe I'm going crazy. We've into the third day, still drifting. I've just got to get some sleep. . . .*

The fourth day brought a light wind, and I could sail again. I knew I was far out at sea, so I headed northwest, looking for the coast. Hours passed. I knew I ought to see land, but I didn't. It was weird. I was completely lost.

Fatigue had blurred my judgment. You can't be completely lost when all Africa lies somewhere to the north. At last I could see the lights of the coast, as night fell, and I braced myself for another sleepless night. I'd found that one way to stay awake was to keep busy repairing things. I had nothing to repair—yet—so I made a pudding. Every few minutes I stuck my head out for a look around.

It was a good thing that I stayed awake, because once, before dawn, I saw something darker than the darkness and managed to steer clear. It was a ship, running without proper lights, and I don't think it saw me.

The next morning, the fifth since Durban, the wind was down. The outboard was working again, and I

decided to power the rest of the way to East London before another gale could come up and blow me back to Durban. Patti had been waiting for me for three days. I knew how worried she must be. But in a few more hours I'd be in port.

I got in all right, and tied up to the East London wharf. But there was no sign of Patti. After wandering around town for a while and finally checking at the local police station, I spent a miserable night aboard *Dove*, thinking that Patti must have had an accident on the way down. Next morning, thank heavens, she showed up. She'd been there right along, but the shipping officials had told her that the storm would delay me longer than it did, so she didn't come looking for me. It was a pretty shaky reunion.

After we calmed down, we went for a ride on Elsa and then to the zoo to celebrate each other's survival. We don't like towns much. There are too many people in them. But we love animals, and there was a great one at this zoo: a lioness so tame you could pat her.

After that we mostly waited for the wind. In this part of the world it follows the coast, so it's usually either just right or dead wrong. I'd had enough of wrong wind.

As soon as the weather looked good, I left for Port Elizabeth, the next port along the coast and, with Durban and Cape Town, one of the three biggest in South Africa. This time Patti watched from shore to see how I was making out. Sure enough, the wind turned on me, and I had to go back. But this time Patti went back too.

The next day the east wind held, and I made it to Port Elizabeth in 26 hours. Patti was on a breakwater there to meet me.

Wet Way to Meet One's Bride

I think it was knowing that Patti would be waiting for me at each stop along the coast that kept me going through some of the most disheartening sailing I've ever faced. I had to make a lot of stops, simply because of the fluky weather. It's not much fun to be ashore when you can't go anywhere or do anything except keep a close watch on the wind. But Patti made each of my arrivals at a new port a sort of homecoming.

As usual, I sailed away as soon as the wind permitted, and, as usual, I was driven back. But I tried again the next day and made it to Plettenbergbaai, a beautiful little resort town 120 miles farther on. I got there in two days.

There were no docking facilities at Plettenbergbaai, so I anchored offshore, looking for Patti with the binoculars. I spotted her on the beach, rowed in in the dinghy—and capsized in the cold surf.

Most of my boat troubles take place at sea, but I was in for something new in Plettenbergbaai. I hadn't been ashore long before some men came looking for me to tell me that an onshore gale was expected, and that I'd better anchor farther out. I couldn't get out through the surf in the dinghy (I tried, and again capsized), so some fishermen took me out in an outboard-powered fishing boat and towed *Dove* about half a mile from shore.

They helped me get two anchors out with enough chain and line to give each anchor about 400 feet of scope. I figured that would hold her in anything. Then we headed in, literally surfing down the slopes of the big breakers. Those fishermen really knew how to handle a boat.

Dove Drags Toward a Violent End

Patti and I found a place to stay, and I turned in. I'd had no sleep for two days and was beat. I slept, got up in the morning to check on *Dove*, and turned in again. Suddenly there was a pounding on my door; people had come to tell me that *Dove* was dragging. I called Patti and rushed down to the beach. *Dove* was in almost as far as the breakers. If she dragged another couple of hundred yards, she'd be wrecked.

By this time the wind was howling and the surf was so heavy that not even the big fishing boat could get out. The only way to get through those crashing breakers was to swim, so that's what I did. The water seemed icy (it was probably in the fifties), and I really didn't know if I was going to make it. It took me 15 minutes to reach *Dove*, and when I did, I had to hang on for a while before I could haul myself aboard.

One of my anchor lines had parted, which was why *Dove* was dragging. The remaining line, made of three-quarter-inch nylon, was stretching like a rubber band. It had ripped away a five-foot length of the toe rail, and I was afraid it might snap as I stood facing it and tear my guts out.

Another man, dressed in a diver's wetsuit and swim fins, swam out to help. Together we got my reserve anchor over the side with 150 feet of chain and all the nylon line I had left. It was all we could do. I figured *Dove* had no

more than a fifty-fifty chance, so I grabbed my passport and all the money I had (about $100), a plastic folder full of correspondence, and a life preserver, and jumped overboard. I never would have made it back without that life preserver.

The next day the wind began to fall, and *Dove* was still there. I couldn't get out to her for another day, and when I did, I found her all messed up inside but not really badly damaged. I cleaned her up and moved to a new anchorage.

The storm was over, but the wind was in the wrong quarter. We settled down to wait. There wasn't much to do. The whole town was closed up tight. But there was a cute little Anglican church in Plettenbergbaai, so we went to it.

Plett (as the locals call it) had no separate district for the coloreds, but they were building

In a desperate tug of war with the seething sea, men of Durban struggle to beach the *Ohva*. The 25-foot cutter, with an Australian skipper and a Canadian mate, had embarked from Darwin on a projected global voyage, but off Madagascar her rudder broke in a storm. When a Japanese freighter came alongside, trying to help, the boat was damaged. The two men had to

one out of town. It was going to be a decent place to live. The only bad thing was that the coloreds wouldn't have any choice about living in it. They'd *have* to go there, even schoolteachers and other educated folk.

You could tell that the whites cared about the coloreds, though. Some ladies in Plett and in other towns along the coast had organized a nonprofit welfare store where the needy people could get staples like rice and vegetables, fruit and peanut butter for much less than they cost in the other stores. The only trouble was that some of the really poor people were white Afrikaners, and they wouldn't buy where the poor coloreds bought. We did.

Dangerous Passage to a Safe Anchorage

On Easter Sunday I went to sea again, headed this time for an almost landlocked harbor at Knysna, just 40 miles west. We

abandon her. A day later *Okra* washed ashore. Uniformed customs officials (right) watch as rescuers, with Robin knee-deep in surf at the head of the line, try to drag *Okra* onto the beach before the incoming tide recaptures her. This herculean attempt failed, but a bulldozer shortly pulled the cutter to safety. Ships anchored offshore wait to enter Durban's crowded harbor.

wanted to leave *Dove* there and hitchhike to Cape Town to get parts for Elsa, who wasn't running too well. You can't get through the narrow, unmarked channel into Knysna if there's a heavy sea running, but it was pretty calm when I got there. As it was, I almost surfed in on the big swells.

Knysna is a neat place. It has stinkwood and yellowwood forests, and people build good boats of them, and homes too. Less English is spoken there than at Plettenbergbaai, but you can always get along in English in South Africa.

We got the new parts for Elsa, but she still wouldn't run. We decided to put her and Patti on the train to Cape Town and meet again in Gordon's Bay, an anchorage east of the city.

A good wind came up, and I left. I didn't feel like leaving, but that's nothing new; I never do.

Frustrating Fight to Round Africa's Tip

This would be my longest haul along the coast, and would take me around Cape Agulhas, the southernmost point of Africa. For some reason, everybody thinks the Cape of Good Hope, near Cape Town, is the tip of the continent, but it isn't (map, page 456).

Anyway, we'd figured that if the wind favored me I could make it to Gordon's Bay in three days. Since it never does, we decided to count on a week at least. But we never would have reckoned on three weeks.

At first I sailed along nicely with the wind on the port quarter. The wind vane on my self-steering rig was working well, so I had a chance to go up forward and examine the place where part of the toe rail had been torn away. When I did, I understood why my deck had been leaking all around its edges. The deck itself was a sandwich of fiberglass, plywood, and fiberglass; but its edge, where it joined the hull, was raw and unsealed. There were signs of rot, and the layers were beginning to separate. I didn't really need a new worry, but I had one now: If the deck had been weakened enough, a wave breaking on it during a storm could smash it in. And if that happened, *Dove* would fill and sink.

The second day out the wind swung around strong from the west. I couldn't go back, unless I went all the way to Plett, so I beat to windward all that night. Forty-eight hours out of Knysna I got a good moon fix and found I'd hardly made any headway since I started beating. I kept on for another 24 hours, making 13 miles in the last 12 of them. Then I dropped anchor in a place called Stilbaai, which is sheltered on the west. I just couldn't sail in weather like that. After three days I was only 83 miles from Knysna, though I had gone 173 nautical miles by my taffrail log.

The boat was a shambles. The deck leaked. I told my tape recorder: *I wouldn't be surprised if any minute the whole stupid boat didn't fall apart.* At least I could get some sleep now. It would be nice to have some.

I set my alarm to wake me at 2245 (10:45 p.m.) for the weather news in English. It called for westerlies, but light for a change. I powered out next morning and picked up a nice southeast wind. I could hardly believe it.

I could make Gordon's Bay tomorrow if the wind holds, I recorded. *I just hope I can at least get around Cape Agulhas.*

I sailed all that night with the wind forward of the beam. I spotted Cape Agulhas Light 44 miles away, bouncing off the bottoms of low-lying clouds, and that made me happy. Cape Agulhas was an important milestone on my route; from there on the winds would favor me. It would all be downhill, all the way to Hawaii. It would be a feat to get to the cape, and I seemed to have it made.

Dove Holes Up in a Gale

So it seemed, until the radio said, "Gale coming!" I ducked into Struisbaai, right behind Cape Agulhas Light, and dropped anchor in the nick of time. The gale hit, and it blew for a week. There was no question of getting ashore in my six-foot dinghy, and I wouldn't have dared leave *Dove* anyway. I set about waiting it out. First I cleaned things up; it's a lot nicer being on a boat that's not messy. Then I talked to my tape recorder:

I've lost my coffee pot over the side, so I'm making coffee by boiling percolator coffee in a

Threading a narrow, rock-strewn channel at Knysna, South Africa, *Dove* heads seaward, driven by her little six-horsepower outboard. Robin had entered this harbor by coming in on the swells, a dangerous maneuver that carries the risk of broaching to and possibly capsizing. Because of the shallow, treacherous waters, yachtsmen can venture into Knysna, 40 miles west of Plettenbergbaai, only when seas are relatively calm.

"**Fairest cape we saw in the whole circumference of the earth,**" Sir Francis Drake called the Cape of Good Hope, where Atlantic breakers crash on one coast and waters of False Bay gently lap the other. Contrary to popular conception, this finger of land is not the southernmost tip of

SOUTHBOUND BY TERENCE J. MORALLY © N.G.S.

the African Continent. Cape Agulhas, 125 sea miles southeast, claims that honor. Below the plane's wingtip at upper right looms massive Table Mountain, rising 3,567 feet above Cape Town. Sailing into South Africa's oldest city, Robin Graham dropped anchor in his 95th port.

pan. This makes a warm drink. I've gone over my food supply. My good stuff is gone. Now I'll have to use up the old rusty cans left over from the Solomons and New Guinea. I hope this wind stops, so I can get to Cape Town and get some food.

A day later: *I painted the inside of the cabin. It looks great. I'm reading* Angry Hills, *by Leon Uris* [an adventure novel set in Greece during the Nazi invasion], *and trying to make a pair of sandals.*

Two days later I recorded: *The gale was worse yesterday. The wind was blowing water off the surface. There's a big fishing boat anchored near me on two bow anchors. I sure wish the wind would change. The food supply is getting monotonous. Nothing but old soups now. But I just eat to exist. Nothing tastes good at all.*

The skipper of the fishing boat near me must have read my mind. Just about then he edged up and threw me a line with a fresh fish on the end of it. Boy, was it welcome!

Patti Arrives With Rescuers

Two more days went by, bringing me nothing but disturbed sleep and a chance to get rid of old groceries. On May 6, my eleventh day since Knysna, a search plane passed overhead. This was the first day I could come up on deck without getting soaked just riding at anchor. Toward evening on that same day I heard voices calling from a boat coming alongside. One of them was Patti's.

Patti had been waiting in Gordon's Bay, outside Cape Town, and going out of her mind. When the search plane reported my position, she came up to Struisbaai to find me. I went ashore with her and stayed five days.

I left Struisbaai on May 12, running under main and spinnaker before a good easterly. I reached Gordon's Bay the next day.

Gordon's Bay is a nice little town, sort of a nearby summer resort for Cape Town people (opposite, above). It has brick-and-stone cottages, pretty trees, and even a few small lawns. We ate every evening at a boarding house called Thelma's, where a bunch of nice old people lived.

We had no firm plan about where I'd go from Gordon's Bay, or when. I knew I'd have to get my leaking deck fixed, which would be quite a job. I wasn't in any hurry to leave, either. When the time came, I'd sail the few miles to Cape Town harbor proper, take on supplies, clear customs, and head out across the Atlantic.

But that wouldn't be for a while yet.

As it turned out, I left Cape Town exactly two months later.

We had a lot to do in Gordon's Bay, and rotten weather to do it in. We tied up to a mooring, and the first thing I did was to clean up the boat again. On tape I said: *It's a drag, you always have to clean this boat up. It's so small you can't keep it clean. That sounds funny, but that's how it is. It hasn't any good, permanent storage space.*

I cleaned and painted all my rusty tools. Then I worked on the bow, and Patti and I played canasta in the cabin, bundled up in blankets against the cold. The people at Thelma's gave us some sweets and some nice bright, beautiful fruit. They were really good to us. And there was an old couple, a man about 85, who could crochet, and his wife, about 75, who could knit. They'd only been married five years, and they were so happy with each other it made us feel good.

(Continued on page 469)

Perched on the bluffs above Gordon's Bay, Patti and Robin can look down on the breakwater harbor and see *Dove* bobbing at anchor among the other boats. A corkscrew road carried the couple to the rocky heights from the small bayside town, near Cape Town, where they spent two months while Robin readied *Dove* for the transatlantic voyage (page 468). Haze shrouds the fertile valley that spreads beneath the Hottentots Holland Mountains.

In the OK Bazaar at Cape Town—South African counterpart of an American supermarket—Robin buys $120 worth of food, mostly canned goods, for his Atlantic crossing. Patti wears cowhide boots Robin made for her while he was sailing the Indian Ocean.

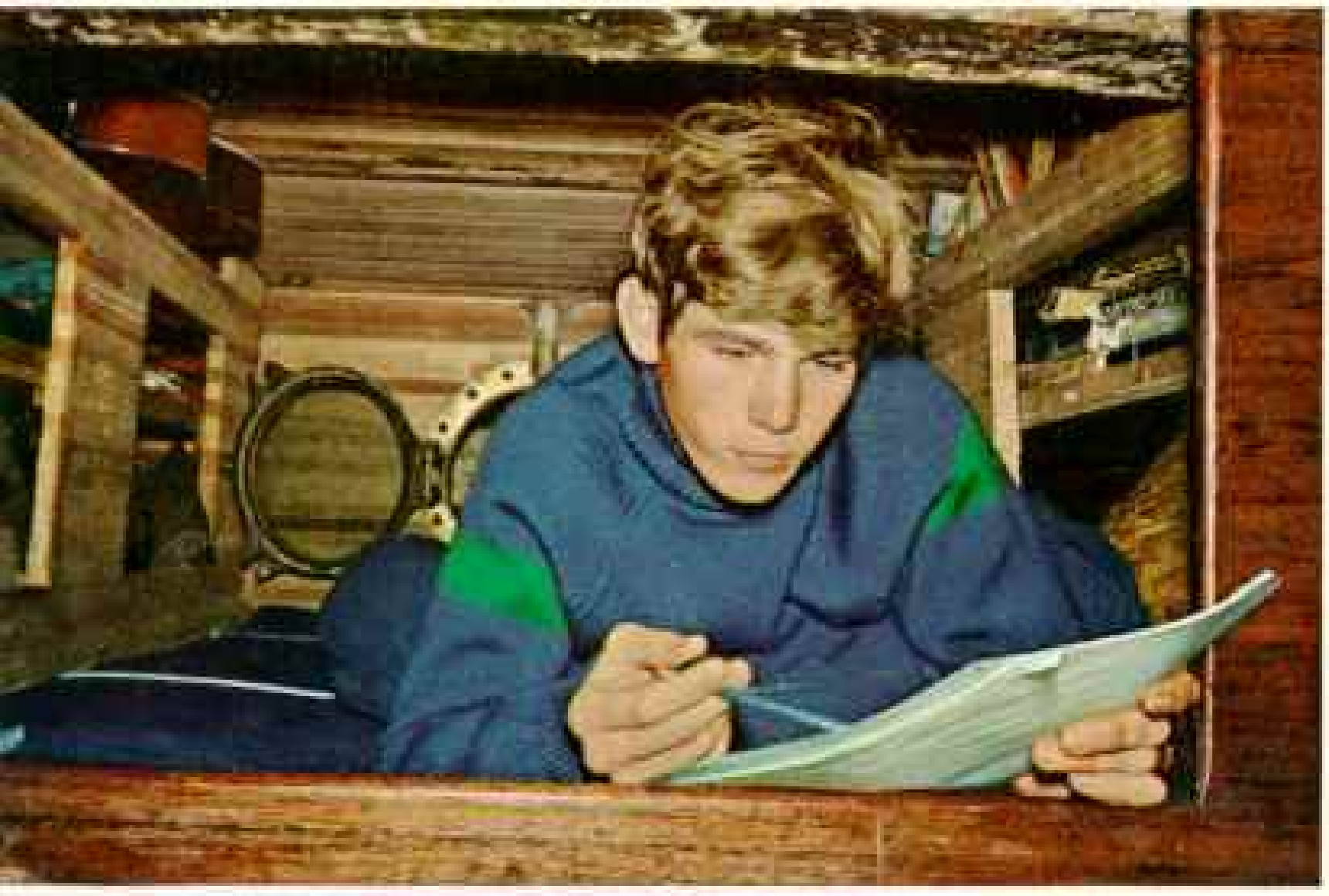
Keeping step with a flippered friend, Robin paces the strand of False Bay. The jackass, or Cape, penguin is one of hundreds that owe their lives to the local Society for the Prevention of Cruelty to Animals. A tanker grounding outside the bay during a storm leaked oil that coated the birds. The society washed the hapless creatures, but in the process removed the natural oil that acts as insulation and keeps the

birds from getting waterlogged. Their protectors kept them confined until they molted and grew new feathers.

With a greedy grab, a baboon snatches a cookie from Robin's fingers in a game reserve on the Cape of Good Hope. The Grahams, touring the unfenced park with a Cape Town acquaintance, kept the windows rolled up, but the insistent animal pounded on the glass for a tidbit.

KODACHROMES BY PATRICIA GRAHAM AND TERENCE J. McNALLY (TOP RIGHT) © N.G.S.

Piet, pet seal of Gordon's Bay, surfaces for a handout from Robin. Named and befriended by the harbor master, the sleek mascot of the port, a Cape fur seal, keeps close tabs on trawlers that pull into the docks, spilling over with fish.



"The cave," Robin nicknamed *Dove*'s after section, which he had decked over in Durban. Earlier, breaking waves often sloshed into the open cockpit and threatened to wash overboard his precious supply of bottled fresh water.

Living on the ways is less exciting than on the waves, but being in port at Gordon's Bay allows Patti to stay aboard with Robin. During *Dove*'s three weeks on dry land, he puts on a new toe rail and reseals deck to hull with fiberglass to stop leaks. Wind vane on the stern turns an auxiliary rudder that automatically steers the boat.

We got *Dove* up on the ways in order to fiberglass the deck to the hull all the way around (below). I thought that would stop her deck leaks. Patti and I lived aboard. It wasn't very comfortable, but at least it wasn't the sauna bath it had been while on the ways at Durban. Besides, the people at Thelma's let us wash ourselves and our clothes there, and we often played cards with them and other older friends in the evening. We always seem happier with older people.

Rain held off the tricky job of fiberglassing time after time, but we finally got it done. I scraped the bottom too, and we painted it. We filled the water jugs and 10-gallon tank, and generally got *Dove* ready for sea.

Before we left, Major Douglas van Riet, the harbor master, found me a couple of new crew members to help me across the Atlantic. They were two little kittens, one orange and one tortoise-shell, and we called them Fili and Kili after the youngest dwarfs in J. R. R. Tolkien's *The Hobbit*. Both kittens had bad eyes, and I guess most people wouldn't have wanted them. I took them to a vet. He had to remove one of Fili's eyes, which left her blind because the other one was no good. Then he fixed Kili's deformed lids, and I took them back to the boat.

We gave Elsa to the Reids, the people who own Thelma's. The old people came down to say goodbye and to give us a box of candied fruit. Then they went out on the breakwater to wave to us as we sailed away. Since it was just a little trip, Patti came with me. Sure enough, just before we got in, the wind picked up and Patti and one cat got seasick. We anchored in Table Bay Harbor, my 95th port. Next morning I walked into Cape Town, barefoot in the cold rain.

PHOTOGRAPHS BY PATRICIA GRAHAM (C) N.G.S.

Boat and Skipper Readied for Long Haul

When I left Cape Town, I'd be heading out on the longest leg of my voyage so far. I'd finally decided to go to Surinam, 5,000 nautical miles away on the north coast of South America. I would stop at Ascension Island, in mid-ocean, for supplies. Counting the Ascension stop, the journey could take as long as two months, even if nothing went wrong with *Dove* or me. I wanted to be sure that we'd both be in good shape. Patti saw to it that I tucked away plenty of food and sleep, and I saw to it that *Dove* was thoroughly provisioned and that all her gear was sound. Most important of all, we installed a two-way radio, thoughtfully provided by the National Geographic Society as a safety factor.

I was really looking forward to using that radio. I'd often wanted one before, not just for safety but for the pure pleasure of talking to another human being when solitude got too painful to bear. But a radio like that has to have a battery, and the battery has to have a generator. The whole rig is expensive, and it takes up room.

Still, now that the longest haul was coming up, now that I knew for sure that each trip would bring me more mental suffering than the one before, I'd have put in that radio if it had meant eating pemmican all the way across the South Atlantic.

It took several days to get the radio installed. We lived aboard with Kili and Fili, who'd become quite accustomed to shipboard life. They attacked each other and jumped in

ATACHROME BY TERENCE J. MCNALLY

their milk and climbed up on us with their claws—real little nuisances—but I could tell they would be wonderful company out at sea.

As I watched the kittens play, I taped: *Fili, the blind one, jumps at Kili, and misses by a cat's length. Then you hear her thump into a bulkhead, poor little thing. But both cats have been good. They haven't messed outside their box even once.*

Living aboard *Dove* wasn't too bad, now that cold weather had come. It was kind of cozy. I built a nice big bunk under the poop deck, where the cockpit used to be. We called it "the cave" (page 468). You couldn't sit up in it, but we were used to watching our heads; you couldn't stand up in *Dove*'s regular cabin anyway. I couldn't even when I left the United States, and I was a lot younger then. Only the cats had headroom on that boat.

Patti made some great meals. Once we invited another couple aboard and had sailor's delight (a special chicken fricassee of Patti's), and marinated artichokes and avocados. I was really proud of her. We couldn't have had a better meal in any restaurant in town.

We got Patti reservations on an Italian ship called the *Europa*, bound for the Canary Islands and Barcelona. Later, she'd find another ship to take her across the Atlantic. The *Europa* would leave after me, but we figured Patti would still reach Surinam first. I went aboard the ship to make arrangements for calling Patti with my new radiotelephone.

Dove Sails on a Fair Wind

For once, I was ready to get going. It was now July—midwinter in the Southern Hemisphere. The weather was getting worse (*Dove* was the last yacht to leave Cape Town), and the band of southeasterly trade winds that would take me across the ocean was moving northward, as it does in winter. I'd have to sail northwest for six, maybe seven days to pick up the trades. But winds blowing steadily out of the northwest held me up again.

Patti and I saw a couple of movies, got staples at the OK Bazaar (page 465), and bought goodies to tempt my appetite on the

Toasting the future, Robin and Patti dine by candlelight on one of their last evenings together in South Africa. From this seaside restaurant, the couple gazed out at the lights of Cape Town sparkling across Table Bay. While in Cape Town Patti gave Robin the ring he wears on page 451.

For Robin, the thought of approaching separation tempers the gaiety of the occasion. Ahead of him lies the long sail from the tip of Africa to the shoulder of South America. He knows that no matter how fair the Atlantic winds or weather, the loneliness will be appalling. But there is one consolation. Patti will be sailing on an Italian liner bound for Barcelona, and somewhere in the vastness of the South Atlantic they hope to talk together by radiotelephone (page 475).

boat—artichoke hearts, ravioli, chili sauce, sour-cream mix, pickled fish.

One day when we were walking on the beach, the wind went around south. That was it. We went right back to the boat. I left so quickly that Patti didn't get all her stuff off, but she did take my comb and my only pen. All the way across the ocean I had to comb my hair with a wooden Fijian comb and keep my log in pencil.

The first thing I penciled was, *Dam it, I hate leaving!* I never was a very good speller, and anyway, I don't swear much.

But that was the best way to go. I powered out, picked up a nice south wind, and headed northwest from the coast, trying not to think of an excuse to turn right around and go back. Patti followed in a friend's boat. At sundown they turned away, and I was alone.

Each leg of my voyage creates its own routine. This one began with a special twist to it. I would have to stay up all night, every night, for the first week. The reason for this was that all the east-west shipping that used to use the Suez Canal now had to come around Africa, and the westbound ships all headed northwest from Cape Town for 300 to 400 miles before separating on their individual courses to Europe or the Americas.

As I settled down for my first night, I told my recorder: *Gee, I haven't been out three hours yet, and it's very lonely already. I'm also starting to miss Patti quite a bit.*

One nice thing was that by morning of my first full day at sea I'd lost sight of land, so I couldn't see how slowly I was going. As a matter of fact I was doing pretty well. I planned on a hundred miles per 24 hours, and with the favoring wind and current, I usually did a little better than that. I was lucky to have a good southeast wind the second day, and I ran before it at four to five knots with two genoa jibs wing and wing on whisker poles.

I managed to stay awake right around the clock for a couple of days, but then I slept during daylight hours and watched during darkness. I had a radar reflector on my mast, but I didn't dare assume that all those ships would be keeping a good watch. I'd had enough close calls already.

The wind shifted on the third day, but the sky stayed clear and I could keep sailing one way or another. I stayed on schedule. The cats seemed okay, though it was hard to feed them. Their milk kept slopping around. Also, Fili threw up each evening, I don't know why.

The passing ships gave me something to look at and think about. I'd never seen so many—54 went by during my first six days out. But the biggest thing in my mind was the radiotelephone call I was going to make to Patti. I knew the *Europa*'s course and speed, but I couldn't be sure of her hour of departure. I figured she ought to be within 200 miles of me on the morning of my fourth day out, July 17, 1968. The radioman and Patti had agreed to stand by for my call at 0700 and 1200 Greenwich time.

Radio Keeps Newlyweds Together

The night before the call I stayed up watching for ships, reading Tolkien's *The Fellowship of the Ring*, and crocheting a hood to keep my head warm. I was anxious about the call, all nervous, and I wrote down everything I wanted to say.

At 0700 I called, and soon I could hear Patti's voice, only she didn't seem to be able to hear me. The radio operator kept asking me to change to frequencies my radio didn't have. It was quite depressing.

At noon I made contact again. My tape recorder tells about it: *I had a long, really nice talk with Patti. Gee, it was nice. I feel really good now. I'm so happy I even sing a little. This one call was worth all the work and cost that went into this radio!* . . .

Oh! Kili just jumped into a dish of eggs and then shook her paws.

My log adds, *I had a great talk with Patti. I love her very much.*

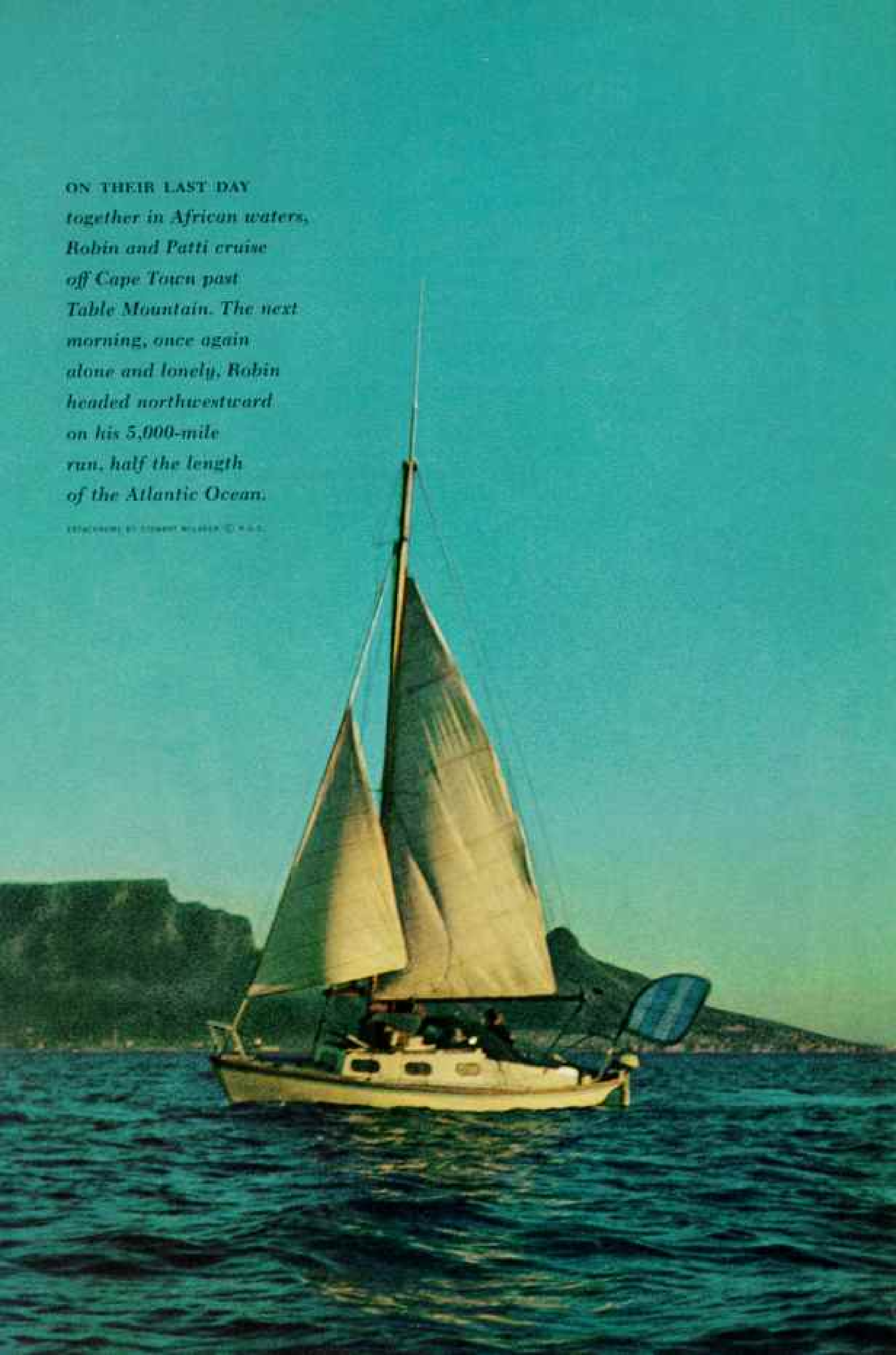
We talked again that night on a ship-to-ship radio frequency. You weren't supposed to talk long on that particular wave length, because others might need it, and we kept our conversation as short as we could. But she sounded good. Talking to her would be worth any fine, or anything.

After the sixth day the shipping disappeared. I was alone, 700 miles from Cape Town with 1,000 miles still to go to St. Helena. The next day I picked up the southeast trades. This meant good weather, sunny, with the wind astern, and usually just nice for running wing and wing. Almost perfect weather.

Loneliness Takes Hold

But each day was like the next. Loneliness began to take hold of me like a pain that wouldn't go away. I fought it every way I could. You have to, or it will drive you crazy. It's slow torture, not like the sharp stab of fear

ON THEIR LAST DAY
together in African waters,
Robin and Patti cruise
off Cape Town past
Table Mountain. The next
morning, once again
alone and lonely, Robin
headed northwestward
on his 5,000-mile
run, half the length
of the Atlantic Ocean.



a bad storm brings. But I think it's worse.

Sleeping helps. I think sleep is kind of neat. It's the only real escape there is. I wanted to stay in that bunk until one day I'd wake up and find myself in port. That was only a dream, but now that the ships had disappeared, I did begin sleeping at night—or trying to. The sounds of sailing before the trades are the same, hour after hour, so they're like a kind of silence. Every strange sound jolted me awake, thinking I was being run down.

Keeping busy helps, too—or at least keeping distracted. I'd wake up at dawn every morning and read for a while (I never could have stayed sane without books). That was a nice time, because the rising sun felt cheerful after the darkness and the cabin wasn't hot yet. When the sun was up to about 15 degrees, I'd take a couple of lines of position with the sextant to see if I was still on course. I'd read the taffrail log and do my navigation. Then I'd make myself something to eat.

Near disaster: In the middle of the Atlantic, *Dove* lurches on the crest of a swell, hurling Robin overboard—the first time he has been tossed into the sea with the vessel under sail. Fortunately, Robin grabbed the wind vane and went into the water only waist-deep. Otherwise, even with his safety harness on, he would have been hard put to haul himself back to the speeding boat. Here, hanging on grimly, he clambers back aboard.

I had some nice things to eat, but even eating could bring on a fit of depression. Most of the goodies I had aboard—the ones I bought with Patti—were still unopened when I got to Surinam. It made me sad to eat them alone. One day I opened a can of pickled fish. Patti and I had eaten pickled fish on our bike trip in the Transvaal. When I tasted it I cried, and I threw it overboard.

Sounds to Keep Loneliness at Bay

I used the radio a lot, not to talk to other ships (there were probably none within range anyway), but just to listen to voices. I had tapes of folk songs, too, but I didn't use them much. I wanted to hear live people. For once, I liked the commercials better than the music. When I couldn't pick up a program in English, I'd get one in any language I could. It didn't matter that I couldn't understand a word the people said; they made human sounds.

Even nonhuman sounds were welcome. I loved to hear porpoises talking to each other —their squeaks and squeals came right through the hull. And before I left the coast, seals would sometimes surface near me at night, and I could hear their breathing in the darkness. It was weird.

It didn't do any good to make noises of my own, though. That only reminded me of how alone I was. I don't like to yell or scream, either. But once, out of sheer frustration, I did put my fist through the wind vane.

There were always things to be cleaned or repaired. I put in a good deal of time fixing and cleaning, and now that the water was warm, I added a bucket bath for myself every day (next page). I had plenty of fresh water for drinking and cooking, but bath water had to come from the sea.

But sometimes the monotony got to me, and I couldn't get myself moving. One day, when I was filling my bucket over the side, the handle broke off—and there went my bucket, floating away. I needed that thing, but it took me a couple of minutes to get up enough initiative to bring *Dove* about and beat back upwind.

If I had known what that maneuver would cost me, I would probably have let the bucket go. A couple of days earlier I'd caught a big barracuda, the only fish I got between South Africa and Ascension, and I'd cut it up in strips to marinate and dry. I had spread the drying strips up on deck in the sun. When I beat back to windward, heeling sharply, almost all my fish went overboard.

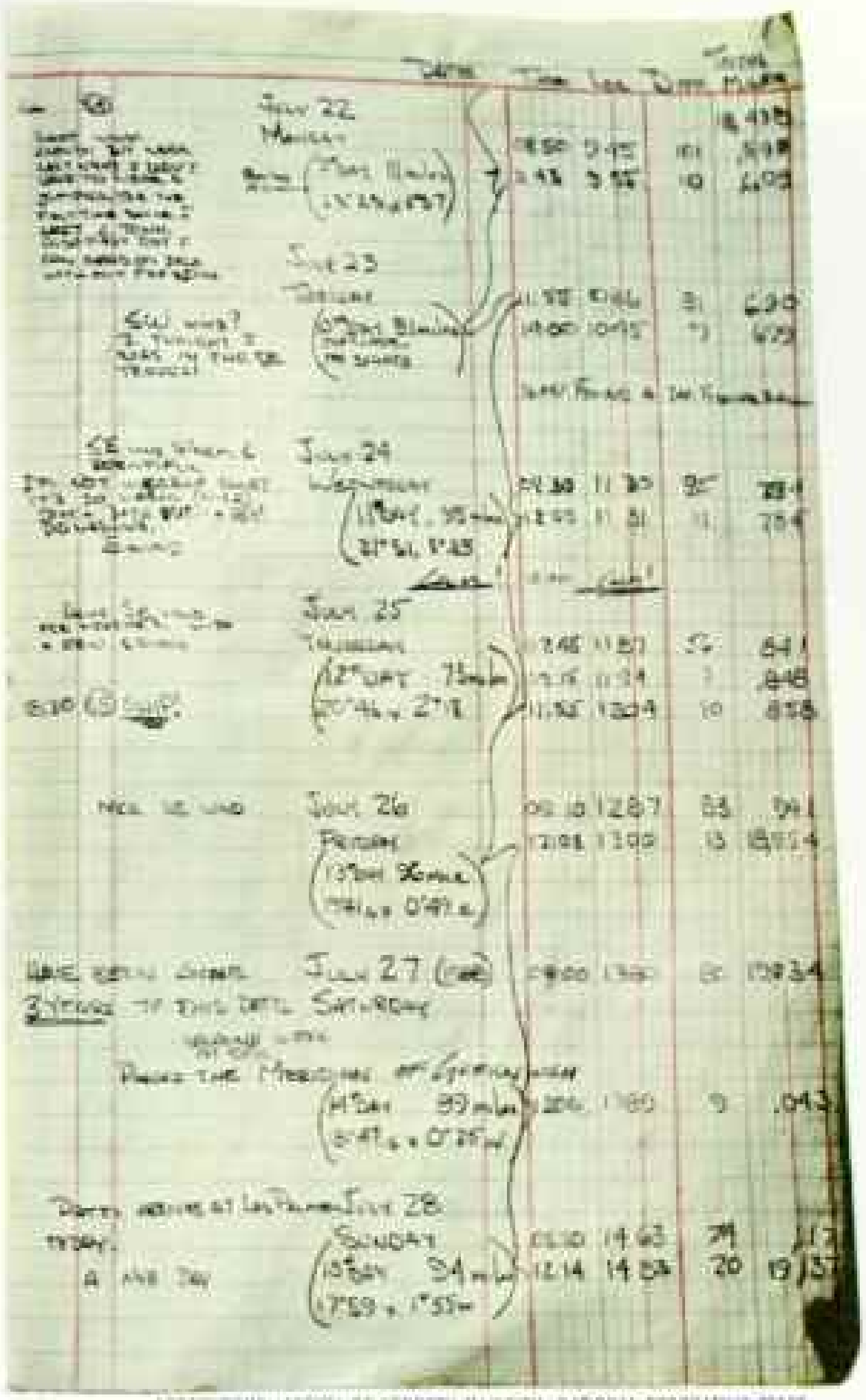
I did get the bucket back, though. Picking it up was no problem. *Dove*'s freeboard is less than two feet. Heeled over as she was, I could reach out my hand and grab the bucket as I sailed past.

The cats took to sea better than I did. Cats are really cool; they get their balance right away. I fixed a place for their dish, so it wouldn't slide around, and they began to eat like pigs and get fat. But Fili still threw up every evening. She cried a little bit each time before she barfed, so I'd pick her up and take her to her box to keep her from making a mess all over everything.

The cats were a nuisance sometimes, but it was great to have them. Just seeing something alive helped. And there wasn't much life in that empty sea. On this run, the only other living things I ever had aboard—not counting a few cockroaches—were two crabs.

Joy at sea: On his fourth day out of Cape Town, Robin makes radio contact with Patti aboard the liner *Europa*. "At first she couldn't hear me," he recalls. "I was really depressed. But a second call went through clear and strong. It was wonderful!"

SKETCHES BY SUE BARNETT © N.G.S.



ROUNDHOUSE (ABOVE) BY KENNETH MACLEISH, NATIONAL GEOGRAPHIC STAFF; EXTERIOR BY ROBIN LEE GRAHAM © N.G.S.

"Have been gone 3 years to this date," Robin records in his logbook on July 27, 1968. The following day he notes Patti's arrival in the Canary Islands. Earlier, he commented on the gradually warming weather that allowed him to strip off his shirt and take a bucket bath (left).

"Every afternoon I washed the sweat off," reports Robin. "I didn't have any salt-water soap, so I didn't lather up." Here in good winds he sails with twin genoa jibs reefed. Holding the bucket aloft with one hand, he snaps his portrait with the other.

I was sailing along one day, reading up on the poop deck (that deck was a great improvement over the cockpit it replaced, in which I used to trip and fall all the time), when I saw an orange thing up ahead. I tacked over to pick it up. It was a plastic Japanese net float, and it had a bunch of gooseneck barnacles on it, and two crabs. I didn't know what to do with the crabs. I was afraid they might die if I put them back in the sea with nothing to hold onto. I figured they would just sink to the bottom, and the depth might be too much for them.

One of them fell overboard. But then I cut a piece of Styrofoam insulating material out of my old useless icebox (which hadn't had ice in it since Cape Town), and I made a raft of it. I carved a little cave for the crab to live in. Then I put the gooseneck barnacles on it, so the crab would have plenty of food, and I sent him to sea again in a nice new floating home of his own.

Robin Begins Fourth Year of Voyage

My log entries were brief these days. There just wasn't much to put down. On July 25, my 12th day out, it notes *SHIP!*—the first I'd seen in almost a week. On the 27th, I wrote, *Have been gone 3 years to this date.* And, *Passed the meridian of Greenwich* (preceding page). I started my fourth year at sea in the Western Hemisphere.

EKTACHROME (LEFT) BY DOUGLAS KIRKPATRICK; KODACHROME BY HERBERT S. SCHULTZ © N.G.S.

At desolate Ascension, midway in the Atlantic between the South African and South American coasts, Robin touches dry land for the first time since he left South Africa, 23 days before.

Thrust from the sea by volcanic convulsion, Ascension presents a moonlike surface to her infrequent visitors. Robin set off to tour the island without shoes; he soon found that the sharp cinders hurt his feet.

The British Navy occupied the island in 1815 to prevent the French from using the outpost to free Napoleon from St. Helena. Today a jungle of antennas and radio masts springs from the wasteland. The U. S. Air Force uses it as a satellite-tracking base, the British Broadcasting Corporation and Cable and Wireless, Ltd., for a relay station.

Doughty land crab scrabbles across the primordial landscape of Ascension Island.

On July 30 I sighted St. Helena, green and inviting in the distance (pages 450-51), and might have been tempted to go ashore if I hadn't been so eager to get across the ocean.* I noted a few more details on tape:

Now I'm on the other side of the world. I've gone 1,700 miles, and I have 700 to go before I reach Ascension. I lost my chronometer today, and I panicked when I couldn't find it. I can't navigate without it. Then I found it among the food stores. I don't know why I put it there. . . .

I'm not doing anything, just trying to pass the time. Eating is really a drag. Everything tastes the same. I just drink coffee and eat what I have to. . . .

Kili is fascinated by the wheels of this tape recorder going around. . . .

Patti should be in Barcelona by now. . . .

By the second of August I was nearing Ascension, but my spirits didn't rise much at the prospect of getting there.

I'm just going there to get provisions, I taped. *I'm not eager to stop. As each day passes, I get a little more depressed and lonely.*

The next day something happened to break the monotony, but I would rather have done without it. I fell overboard.

I was hauling in the taffrail log, and I lost my balance. Luckily I grabbed the wind vane

*See "St. Helena: the Forgotten Island," by Quentin Keynes, NATIONAL GEOGRAPHIC, August 1951.

To a sailor tired of canned foods, a dorado fresh from the sea provides a welcome change. Robin caught the fish on a lure. He fried some fillets, dried others, and used the rest for a fish soup. Here *Dove* nears the coast of South America, and Robin's

deeply tanned skin and long, tangled hair show the effect of many weeks on the water. Though he lacked real interest in food and ate less than half of what he purchased in Cape Town, Robin surprisingly lost no weight on his Atlantic crossing

PHOTOGRAPHED BY JAMES P. MCLANE

Smallest South American nation except for French Guiana, Surinam disputes unsurveyed jungle boundaries with her flanking neighbors.

Sojourn in Surinam

A BLENDING PLACE of races, Surinam lies on the northeast shoulder of South America. Long known as Dutch Guiana or Netherlands Guiana—as well as Surinam—the country became an autonomous part of the Netherlands Kingdom in 1954. The population of 365,000 comprises Creoles, East Indians, Indonesians, Chinese, Europeans, Bush Negroes, and aboriginal Indians. One visitor likened the assemblage of assorted peoples to a small United Nations working in a practical and everyday way.

Eager to see the interior of Surinam, Robin flew from Paramaribo, the coastal capital, to Paloemeu, deep in the bush, then traveled by dugout canoe up the Tapanahoni River to the Indian village of Tepoe, where Dutch and U. S. missionaries maintain a station. "Very friendly people," Robin describes the Indians, who let him sleep in the thatched hut of a family absent from the village. One pint-size marksman proudly showed Robin the fish he shot with bow and arrow (above). Other boys brought forth the feet of a jungle bird (right), and Robin draws smiles by making them "walk." The boys then used them as targets to demonstrate for the visitor their skill with the bow.

in time and was back aboard before I'd gotten all the way in the water (sketch, page 474). But it really shook me. I had my safety harness on, but the boat was doing five and a half knots, and if I'd gone all the way in, I'm not sure I could have gotten back aboard. This was a lot more dangerous than the time I fell in the Indian Ocean, because then the boat wasn't moving.* This was the closest thing yet.

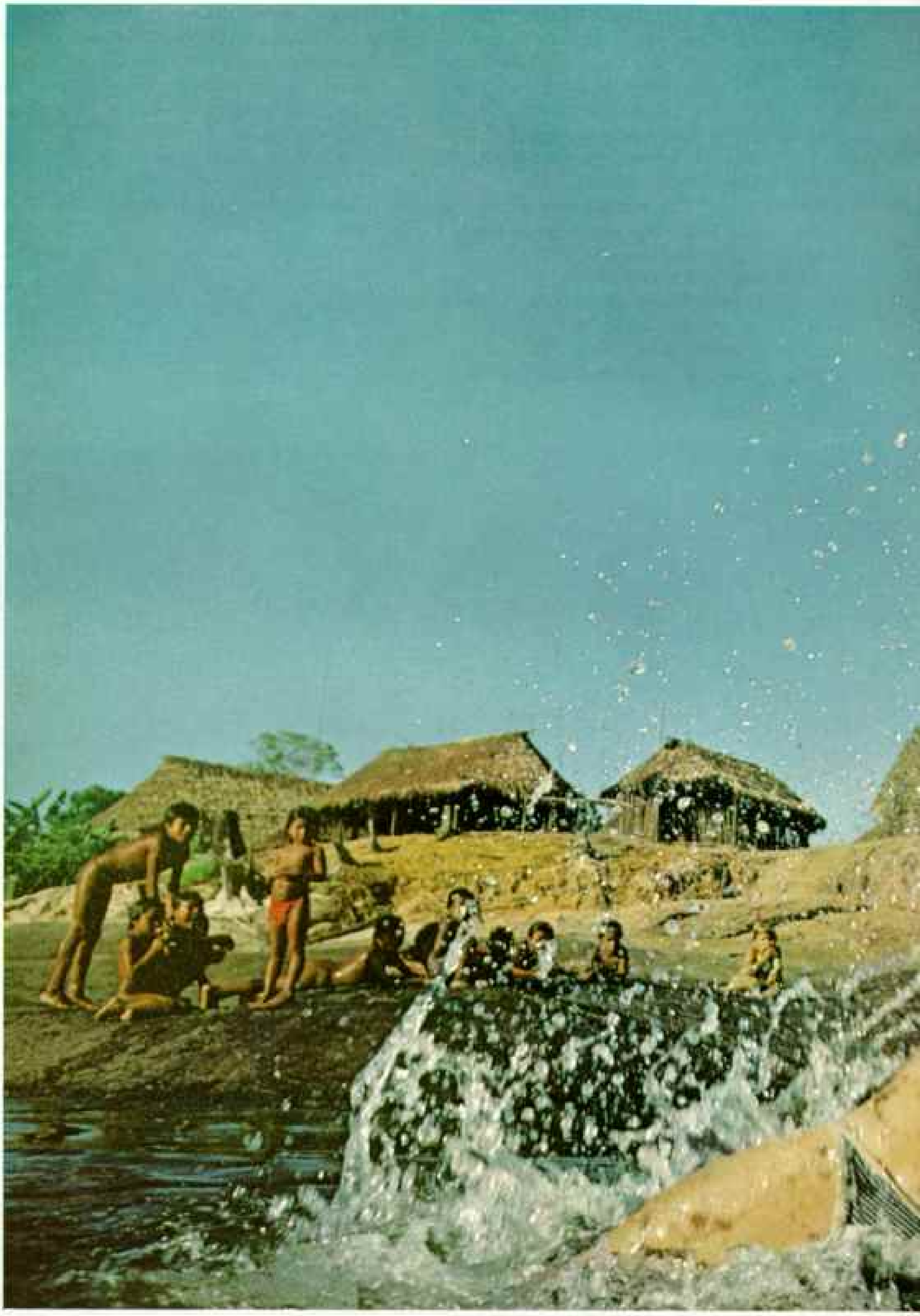
On August 5, 23 days out of Cape Town, I dropped anchor in Ascension's Clarence Bay.

Ascension is a weird island. It looks the way I'd expect the surface of the moon to look, full of craters and hills of volcanic ash, dead and dry (pages 478-9). All over that strange landscape are big pieces of electronic equipment—radio towers and radar saucers. With all that futuristic gear on it, it looks like the setting for a James Bond movie.†

I rowed in, not knowing where to go. The Pan American people, who operate the tracking station there for the U. S. Air Force, had word that I'd be coming, and they let me eat in the mess (once I'd gotten a pair of shoes to wear) and gave me a place to stay. They were

*See "Teen-ager Sails the World Alone," by Robin Lee Graham, GEOGRAPHIC, October 1968.

†NATIONAL GEOGRAPHIC described this lonely isle in "Ascension Island, an Engineering Victory," by Lt. Col. Frederick J. Clarke, May 1944; "Greens Grow for GI's on Soilless Ascension," by W. Robert Moore, August 1945; and "Cape Canaveral's 6,000-mile Shooting Gallery," by Allan C. Fisher, Jr., October 1959.



Human diving board, Robin catapults an Indian water sprite. Since this stream flows swiftly, the swimmers need not fear piranhas, the deadly flesh-eating fish that infest so many slug-

KODACHROME BY JAMES H. HILLARD © N.G.S.

gish South American rivers. Dense tropical rain forest ringing the village is full of wildlife: tapirs, sloths, anteaters, jaguars, iguanas, and 100-pound capybaras, world's largest rodents.

very nice to me, but I had a hard time talking that first day. I hadn't talked for so long it didn't feel natural.

I didn't want to stay long on Ascension, because the season was getting late, and anyway I wanted to get to Patti as quickly as possible. I felt alone there, too. I was different from the other people there. Or maybe I just wasn't used to people in the flesh.

One man took me for a tour of the 9-by-7-mile island before I left. He showed me the highest peak. It was all green with trees and grass. It seemed out of place. The rest was dead, dry ridges of volcanic slag and pumice.

Mid-Atlantic Seems Endless

I stocked up and left on August 12, and it was good to be under way. If I had to feel lonely, it was easier to do it by myself. I got my twin genoas rigged on whisker poles and settled down with a novel by James Michener. Then I cooked rice, but I ruined it. Time began to drag again.

I had no comments for my log except *took a bath* and *same as always*. On tape, I noted: *You just look at the progress you make each day, hoping to get a little farther, which you do most of the time.* Also, *I haven't used much of the stuff I have aboard that has to be cooked. It's just a waste of time to cook when you can't enjoy it. I'd rather heat up a can.*

I passed Fernando de Noronha on the 21st, just a little peak on the horizon. At least my navigation had been good. This island is just off the hump of Brazil, so I could tell myself I was across the Atlantic (map, page 454). Now all I had to do was to parallel Brazil's northeast coast for 1,600 miles, and I'd be in Surinam. The coastal current was beginning to help. I was making good up to 180 miles a day.

On the 23d the wind came up strong and

There's no need for a shoeshine boy when Robin gets a haircut in Paramaribo, his first professional trim in many months. In South Africa Patti had cut his hair, "and did just as good a job," adds Robin. He sits in a carved chair that is the pride of this English-speaking Dutch barber, who emigrated to Surinam some 25 years ago.

Jungle-side mooring upriver from Paramaribo looks idyllic but proved otherwise. "The river was so filthy with oil and scum that we couldn't swim in it," says Patti. "I even had to bring water from land to wash our clothes" (page 489).

Ferrying his pets out to *Dove*, Robin paddles in pelting rain at Paranam, a bauxite-processing center upstream from Paramaribo. A missionary in the Indian village of Tepoe gave him the parrot. The bird apparently didn't take to the nautical life, for it flew off a week later, never to reappear.

Kili the kitten crossed the Atlantic with Robin, as did a sister kitten, Fili. Robin named them for the youngest dwarfs in *The Hobbit*, a novel by English author J. R. R. Tolkien, which he read while in South Africa. Another book that helped Robin pass the time *Wanderer*, by Sterling Hayden, the story of a man who prefers the sea to cities and civilization.

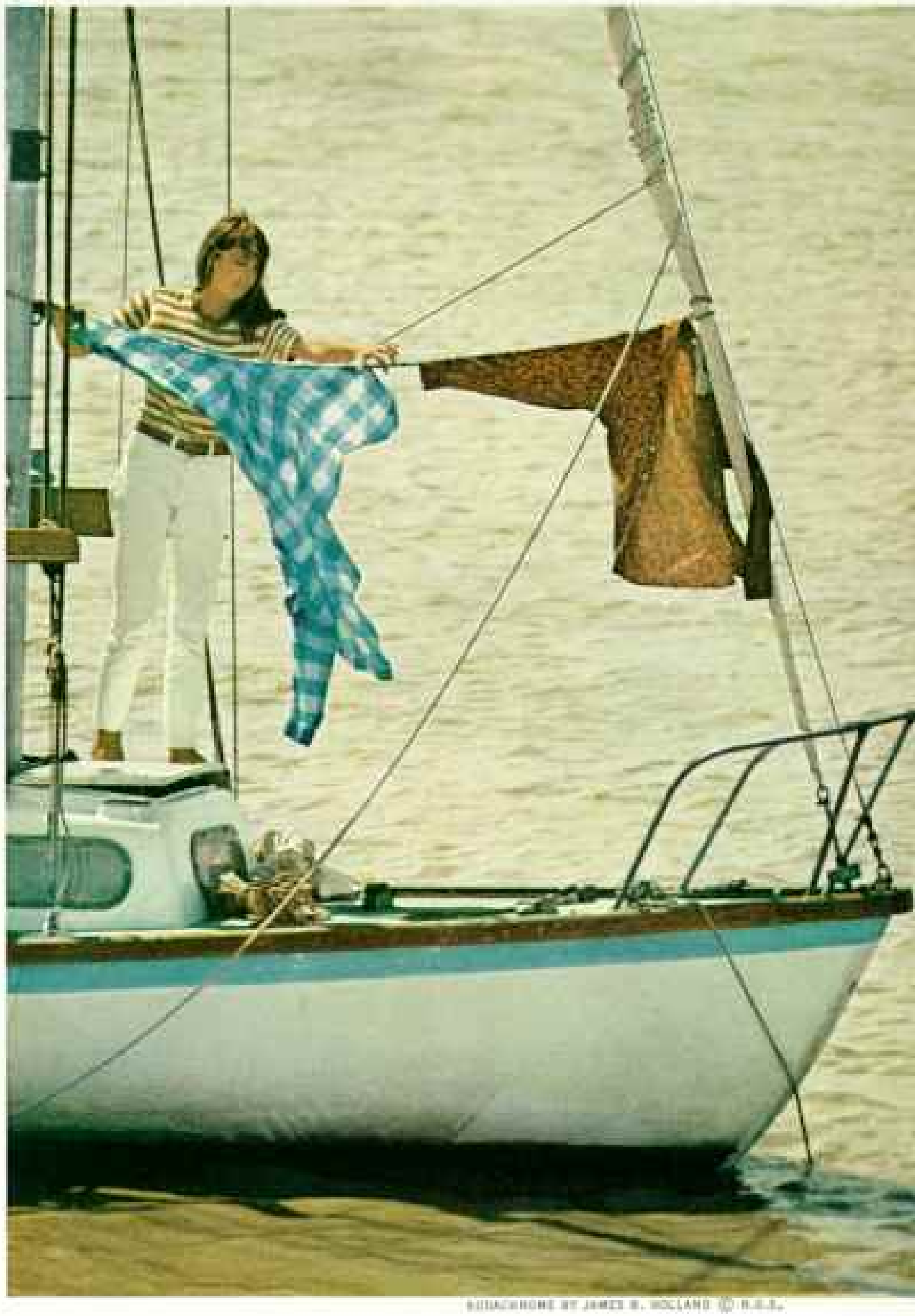
blew me a visitor. I was running at full hull speed under two small jibs and had the main furled and lashed to the boom. A tern blew in and sat on it. *Dove* was rolling so much that the bird was having a hard time holding on, and I thought of catching him and putting him on the gimbaled stove, which stays level no matter what the boat does. But I was afraid of scaring him and making him fly some more. He rode out the blow and went away.

Next day I was making good time on a single jib and reading Ayn Rand's *The Fountainhead*. The seas were growing dangerously big—close to the stage where they'd start breaking on top of me. I taped: *I wish I'd hurry up and get in. This trip's really tiresome.*

I was making good time, though. At 1610 on the 25th I crossed the Equator for the second time on my round-the-world voyage. By way of celebration, I turned in and got my first good sleep since leaving Ascension, 13 days before, while *Dove* plunged on at about eight knots, riding a three-knot current.

On Last Leg, Robin Gets Lost

This was my last long sleep. Ships were appearing again, and I had to keep watch at night. I saw a sailing vessel on the 30th, a Brazilian schooner named *Grace*, and hailed her as I passed. At midnight the next day I picked up the lightship at the mouth of the Suriname River. I headed upstream toward Paramaribo, Surinam's capital, and proceeded to get all lost. Sunrise saved me.



KODACHROME BY JAMES B. HOLLAND © N.G.S.

On a clothesline strung between mast and rolled headsail, Patti hangs out the wash at Paramaribo. No stranger to shipboard life, Patti often sailed California waters with her family and friends. "A first-rate mate," Robin terms his wife.

Despite their love of ships, the Grahams do not know whether they will live on the sea when Robin completes his round-the-world voyage. "Frankly, we're going to let the future take care of itself," says Robin. "We have a lot of ideas, and we're very flexible as to where we might go and what we might do. Personal freedom is extremely important to both of us, and we don't want to be tied down by a lot of material possessions."

Paramaribo is quite a big place, and I had no idea where I should go for customs and health clearance. I anchored near what looked like a main square, with big buildings around it, hoping Patti might see me there. I'd had no word from her since Ascension, where I'd received a cable, but I supposed she'd be waiting in Paramaribo. There wasn't a sign of her.

By the time the local officials had moved me around from dock to dock and office to office, I was feeling quite discouraged. To cheer myself up, I bought bread, cheese, pickles, and Coke and ate them back aboard *Dove*.

I was sitting there glowering when something like a big white butterfly appeared on the river. It was the *Grace*, ghosting along wing and wing. She came close, and her crew recognized me and hollered in Portuguese. That made me feel better. Those men and I had something in common. The people on shore could have come from another planet.

I found out later that *Grace* had come up to Paramaribo with coffee beans. This was her last journey. Her sails and other gear would be shipped back to Brazil, but her hull would never go to sea again. She was ugly and old, but really beautiful.

I'd been in Paramaribo six days before word came from Patti that she wouldn't show up for another ten. She'd gotten stuck in Europe, but finally found a ship that would come island-hopping down the Caribbean.

Frits Barend, the District Commissioner, had offered to show me something of the

country's interior. I didn't want to be away when Patti arrived, but he offered to have her flown inland as soon as she got in.

First, the D. C. took me fishing in a huge new lake that was made three years ago by damming the Suriname River (map, page 482). There were still treetops sticking out of the water, and among their drowned branches we caught piranhas. We took them back to town on ice. Piranhas may be vicious, but they're also delicious.

Next we went by plane to Paloemeu, way back in the bush, with 11 priests. From there we traveled by outboard-driven dugout up the Tapanahoni River to an Indian village, where we stayed for a couple of days.

The village was a mission station, but the Indians still lived pretty much as they always had. Their homes were round thatched huts, and they slept in hammocks. They wore little aprons fore and aft, and nothing else.

I liked them. They were friendly people, and they were glad to show me how they hunted with bow and arrow, how they fished,

As *Dove* heels hard to port off Barbados, Robin holds the tiller with one hand and grabs the boom for balance with the other. Making a test run off the Caribbean island, *Dove* bowls along in a fresh breeze. Though it looks as askew as the blue horizon, the knotted rope—used at times as a handhold—actually hangs straight down.

how they made bread from manioc root. I liked the place, too. It wasn't crowded the way cities are, and there was dense green forest all around and a fast-running stream with huge rocks sticking out of it. You could swim there, too; piranhas don't live in rapids.

Just as we got back to the jungle airstrip, Patti flew in. I was standing there waiting, with a tame parrot on my shoulder, but when I saw her, I just threw him off so I could run out to her and hold her. We hadn't seen each other for two months, exactly to the day.

We flew back to Paramaribo, and during the next three weeks Patti and I worked on *Dove* and explored the city. We bargained for food and vegetables in the native market, where people laughed and pointed because I went barefoot. I don't suppose they'd ever seen a European go barefoot.

Most of the time we lived on board (page 489), but it was so hot and humid that we were glad to spend a week in a hotel with clean sheets and a bath. You couldn't swim in the dirty water where *Dove* was anchored.

Dove Objects to Standing on Her Keel

Once we took *Dove* up to Paranam, the big bauxite-processing center upstream from Paramaribo. There was red dust everywhere. The plant looked like something from another century. We tied up at a dock and went to bed aboard, not knowing what high tides there were that far up the river. In the middle of the night we were violently awakened when *Dove* fell flat on her side—a heck of a maneuver for a sailboat. It seemed that all the water had gone away, leaving *Dove* balanced on her keel, leaning gently against the dock. Then something upset her balance, and over she went. We slept the rest of the night on the cabin's side.

Time was running out again, as it seemed to do all too quickly in every port I put into. There was no good reason to stay longer in Paramaribo, and I didn't really want to. But I didn't really want to go back to sea, either.

And this time—for the first time—I had no clear-cut plan about what I was going to do next. For a while, the closest thing I had to a plan was the strong feeling that I'd end my journey then and there.

I had logged 22,300 miles. I was three years older than when I started, and a little taller. *Dove* had never been big enough below decks, and I sensed her smallness more and more. In a way, I'd outgrown her. Also (and I hate to say this) I didn't trust her any more. I knew every fault she had—maybe I exaggerated them in my mind—and I couldn't believe she'd weather a bad storm.

Sailing *Dove* singlehanded meant discomfort and danger. I was sick of both. I'd had it.

For a while I thought I'd had it with singlehanded sailing itself. That was when I almost quit. To tell the truth, I'm still not sold on sailing alone, and never will be. But I realized that a bigger boat would at least make it bearable. And I couldn't forget all my time and effort and all the encouragement and support from other people that had gone into bringing me this far. I'd come three-quarters of the way around the world—the worst three-quarters. I ought to do what I could to finish what I'd started.

That meant selling *Dove* and buying a boat of 35 feet or so. I couldn't do either in Surinam. The United States would be the place to find and equip *Dove* II. Patti and I decided that I would sail *Dove* up to Barbados, where she would meet me for a long, badly needed rest. We would leave *Dove* there, fly to the States to pick up *Dove* II, and take her to Barbados. Then I'd sail on alone, through the Panama Canal and out across the Pacific to Hawaii, where my round-the-world voyage really began.

"... Fated to Go On?"

It was a good scheme. It was logical. But logic doesn't always cure worry and frustration and anger. I hated to set sail again in *Dove*. I was mad at myself, and her, and the whole world, except Patti. And when the bauxite boat that was taking Patti to Trinidad passed me on the Suriname River, and she waved goodbye to me from the rail, I got so frantic that I took one of the whisker poles and smashed it against the mast. That wasn't very logical. There isn't much you *can* do on a little boat to blow off steam logically. But it made me feel better. Anyway, I had a spare whisker pole.

That wasn't much of a start for the last leg of *Dove* I's travels. But things looked better when I made radio contact with Patti's ship and had a nice talk with her. After that I stuck to my sailing (which turned out to be no problem) and my reading and puttering around.

I used to daydream a good deal out at sea, but no more. I don't want to ask myself why I'm out here alone. Maybe adventure has turned to obligation; perhaps to myself, perhaps to others. I don't know. I just know I have to keep going. Perhaps I'm fated to go on. Otherwise how did I ever get this far?

On my fifth day out I sighted Barbados. By nightfall I'd be with Patti on that lovely island. I felt so good I went below and began cleaning everything up.

THE END

Sailor on horseback, Robin rides with Patti on the beach at Barbados. He spent a month on the island, water-skiing, skin-diving, and resting from his arduous Atlantic crossing. *Dove* lies anchored offshore. For her, Barbados was the last landfall of the voyage. Robin plans to sail a new and larger boat across the Caribbean, through the Panama Canal, and on to Hawaii via the Galapagos Islands—and to conclude in a future GEOGRAPHIC his account of his world voyage.

Life With the King of Beasts

Article and photographs by
GEORGE B. SCHALLER
New York Zoological Society

TWO MALE LIONS rested side by side on the Serengeti Plain, surrounded by immense herds of zebra and wildebeest. Heat waves danced over the ground, and toward the east thunder clouds gathered above the Ngorongoro Crater highlands.

I approached slowly in my Land-Rover and cautiously raised my gun. When one lion turned, presenting his flank, I pulled the trigger.

With the impact of the drug-filled syringe, the lion grunted sharply, looked at his companion as if he had been responsible for the sudden pain, then relaxed. Three minutes later, as the drug began to take effect, he found it difficult to keep his head raised, and after two more minutes he rolled onto his side. I drove close and quietly stepped from the Land-Rover.

While the other male watched curiously from 50 feet away, I clamped a red metal tag into each ear of the drugged lion. After collecting a blood sample, to be checked later for disease, I watched the animal's breathing from a distance to make certain it remained normal. Fifteen minutes later he arose, fully recovered. Another lion had been successfully tagged, and I would be able to recognize him when I encountered him again in Tanzania's 5,700-square-mile Serengeti National Park.

Study Produces Surprising Results

Much has been written about lions by hunters and naturalists. But because no intensive, long-term study of them had been made, I was delighted when John Owen, Director of the Tanzania National Parks, invited me to join the Serengeti Research Institute to determine the effect of the lion's predatory habits on the lives of other animals in the park.

Such information as this must be obtained if the Serengeti's animal life is to be preserved and managed for future generations to enjoy. While I am studying lions, fellow scientists are observing other predators—for example, the hyena—and still

Lick of affection from his father comforts a four-month-old cub hungrily awaiting mother's return from the hunt. Making the first comprehensive study of the animal kingdom's royal family, the author has spent nearly three years in Tanzania's richest wildlife refuge, Serengeti National Park. Aided by drug-bearing darts, radio-tracking devices, and infinite patience, his research lifts the lid of privacy from the extraordinary life story of *Panthera leo*.

others are studying the habits of their prey.

By tagging about 150 lions, I am able to follow their movements and observe their social life and eating habits. These are essential elements of my research in the home of the greatest concentration of large wild mammals left in the world.

With the generous financial support of the National Science Foundation and the New York Zoological Society, and photographic help from the National Geographic Society, I began my three-year study in June of 1966. My work is not completed, but new facts about the king of beasts have already emerged.

For example, surpassing skill as a hunter is not an invariable part of his kingcraft; he often dines on the kills of other predators. He is not all raw courage and fighting fury; hyenas may drive him from a kill.* Lions, on the whole, make rather poor parents, and the mortality rate among cubs is high.

Such fact-finding in the company of lions requires time, patience, and, at times, nimbleness. On one occasion the breathing of a drugged lioness faltered while I was tagging her. As I administered artificial respiration by pressing on her chest, another lioness charged. I had to dash to the safety of my Land-Rover. Fortunately, the immobilized lioness survived—and so did I.

Patient Awakens Ahead of Schedule

Usually I work alone because I can better concentrate on my dangerous task, but on one trip Howard Baldwin of the Sensory Systems Laboratory in Tucson, Arizona, was with me. We wanted to monitor a lion's temperature continuously by radio as the animal roamed free.† Howard had just inserted a special thermometer under the neck skin of the immobilized lion when the drug began to wear off. The lion growled ferociously, rolled his eyes, and swept the air with his enormous paws. I hung on to his mane while Howard tried to suture the incision to keep the thermometer in place.

"Hurry," I whispered urgently. "He's ready to get up." Howard continued as calmly as if he were sewing a button on his shirt.

"Finished," he finally called, and we both dived for the Land-Rover a few important seconds before the lion struggled to his feet.

My Land-Rover is not only a refuge from danger; I do nearly all my work from it. Lions tend to ignore the vehicle, and I can drive to within 20 or 30 yards of them. On foot, of course, it's a different matter. Lions readily recognize humans, and their reactions are not always predictable.

With my wife Kay and sons Eric, 7, and Mark, 6, I live at park headquarters in Seronera, an ideal place for studying lions. Our bungalow, shaded by acacia trees, stands near a park guesthouse at the edge of the plains. Giraffes browse in our front yard, gazelles nibble the grass by our doorstep, and lions pad by on their nightly errands.

Old One Feeds on Other Lions' Kills

To become familiar with the social life of the lion, I concentrated first on learning to recognize all the lions in a 250-square-mile area around our home. With some, this was easily done by noting such natural markings as torn ears and scars. When I take the family for a drive now, lions we meet are old acquaintances whose recent history I can relate to Kay.

"The female with the left ear bent over is the one I call Flopear. She's a very competent mother. She raised a litter of four cubs, and when they were 21 months old, she bore the three cubs that are with her now.

"The female with the notch in her right ear lost both her litters in the past year. Next to her is the Old One. See how her canines are worn to blunt stumps? She may well be 20 years old."

"Doesn't she have a difficult time killing prey?" asked Kay.

"Probably so," I answered. "She's lucky she belongs to a pride. When she is hungry, she can always get a meal by helping herself to kills made by the others."

Most lions belong to prides. Some prides are small, with only four or five members, but others may be very large. One I have watched contains two males, 13 females, and

*See "Hyenas, the Hunters Nobody Knows," by Hans Kruuk, NATIONAL GEOGRAPHIC, July 1968.

†For more on this technique, see "Trailing Yellowstone's Grizzlies by Radio," by Frank and John Craighead, NATIONAL GEOGRAPHIC, August 1966.

Needle-clawed huntress strains to pull a young Cape buffalo to the ground. Refusing to go down, the bull flails with lethal horns. Scarred and minus part of his tail, he finally forced the lioness to retreat. The big cats usually choose easier prey than the rugged Cape buffalo, one of Africa's most formidable and dangerous animals.

20 cubs. Although some members of the pride, especially the males, may roam widely, the lions usually confine themselves to a definite territory, the size of which depends to some extent on the amount of prey present. In the Serengeti, territories are large—sometimes more than 100 square miles.

Pride members are affectionate among themselves. They rub cheeks when they meet. They rest and hunt together, and cubs suckle indiscriminately. But strangers or members of a neighboring pride are not usually accepted. If a pride male meets a strange female he may greet her in a friendly fashion and even mate with her. But the pride females will drive her off. Conversely, a lioness may tolerate a strange male, but he will be evicted by the pride males.

When members of a pride meet a stranger in their territory, there is rarely a fight. Although one male may chase another for two miles or more, roaring fiercely, the pursuer seldom catches the intruder. In fact, he seems to avoid doing so by adjusting the speed of his pursuit to that of the fleeing stranger.

But fights do occur. One dawn I found a pride male lying on his side, breathing heavily. Golden tatters of his mane were strewn in the grass. Deep wounds covered his body. One

(Continued on page 503)

Banquet table of the king of beasts: Beyond three Thomson's gazelles, grazing wildebeest speckle the Serengeti Plain. Green-mantled outcrops of granite, called *kopjes*, often shelter lions. Vast herds of wildebeest and zebra ebb and flow with the rains across 5,700 square

HEART OF LION COUNTRY, *Serengeti National Park—bigger than Connecticut—provides an oasis of security in the shrinking domain of Africa's wildlife. Within historic times, the lion roamed most of Africa, southern Europe, the lands of the Bible, and northern India.*

miles of park land, disappearing for months from the fixed territories of many of the park's 1,000 lions. Then each pride must scour its territory—which may cover 100 square miles or more—in search of scarcer, harder-to-catch prey such as buffalo, topi, and impala.

CRTACHROMES BY ALAN ROOT (ABOVE) AND GEORGE B. SCHALLER © N.G.S.

Battle for supremacy matches a full-grown monarch, with luxuriant dark mane, against a young challenger. Such flare-ups, rarely fatal, help determine membership in the pride, a grouping that may include several females and their cubs but rarely more than three adult males. Young or aged males may be forced from the clan—to establish prides of their own or to become nomads. Females do most of the hunting; males protect them and the cubs from marauders.

Family provider, a lioness hovers threateningly over the carcass of a freshly killed topi. She gorges quickly to get her fill before others of the pride pile in for their share. When food is scarce, a hungry mother sometimes swats away offspring struggling for morsels. In good times, however, a father may permit cubs to share the remains of a carcass. Lions eat communally, but completely lack "table manners" and growl and snap throughout the meal.

EXTRACURRICULAR BY ALAN NOBY © N.G.S.

Good neighbors to lions

TO CONDUCT THIS STUDY, the author and his family moved in 1966 to Seronera, headquarters of Serengeti National Park. There they fell heir to a three-week-old cub abandoned by an aged lioness. Wife Kay (left) feeds him powdered-milk formula. Sons Eric and Mark (below) romp with the fierce tyke as he learns to stalk and pounce. The Schallers kept the cub for three months. Then they reluctantly gave him to a game warden. After he learns to hunt, he will be loosed with others to stock a park in Ethiopia.

With cool precision (right), Dr. Schaller works on a lioness he felled with a drugged dart. Immobilized in five minutes, she will be on her feet again in twenty. Only a hop from his Land-Rover, Dr. Schaller has perhaps five safe minutes to tag her ears and take a blood sample. To some of the 150 lions he immobilized, he attached radio transmitters so he could follow their movements. His study shows that the lion reigns not as a detriment to the Serengeti's balance of nature, but "as an integral and valuable part of it."

EXTINCTIONS BY ALAN ROOT © N.G.S.

of his lionesses moaned softly nearby (pages 512-13). He had been attacked by three males of a neighboring pride while he guarded not only a zebra kill but also a lioness in heat. He died an hour after I found him.

It soon became apparent that the other pride male could not stand alone against intruders encroaching deeply into his territory. One morning I saw two males from an adjacent territory chase him a mile, then return to a thicket where three cubs lay hidden. The males bit the cubs to death, ate one of them, and carried another off as though it were a trophy (page 512).

I waited by the body of the third cub to see what the mother would do when she returned. I expected some display of emotion when she realized her cubs were dead, but she merely sniffed at the one remaining carcass—then settled down and devoured it.

Males Mark Their Pride's Territory

Lion males are usually pictured as indolent freeloaders who let the lionesses do all the hunting and contribute nothing to the pride. While it is true that the males hunt little when the females are around to do it for them, they are not mere parasites. They maintain the integrity of the territory, providing the lionesses with a secure place to raise cubs. It is significant that the pride which lost one of its two males has had little success rearing young. Of 26 cubs born in two years, only two have survived. But in a neighboring pride with three males to guard it, 12 out of 20 cubs survived.

Direct confrontations between strangers are relatively uncommon because lions mark the boundaries of their territories, serving notice that they are occupied. A lion cannot patrol his huge area thoroughly, nor always keep intruders out, so he leaves warnings. As a lion walks along, he stops at a bush, raises his tail, and squirts a mixture of scent and urine on the leaves—an olfactory calling card. Even his tracks advertise his presence, for lions have sensitive noses.

Prey Migrates, but Prides Stay Put

Night time is lion time (page 509). Only at night does the lion fully display its majesty and personality, striding boldly across its domain, muscles moving smoothly, its tawny hide turned silver by the moon. The immense silence is suddenly shattered by the lion's thunderous roar. When the sound dies away, the earth is left shaken and subdued.

To me the lion's roar is the voice of Africa. At night, lying in bed, Kay often nudges me and says, "Listen, the lions are roaring down by the river." Then we lie silent as the calls drift over us until we fall asleep.

The roar has several functions. For instance, with a soft moaning sound—a roar of low intensity—a lioness calls her cubs from the hiding place where they have been awaiting her return. When a member of the pride

Day-care center: A lioness and a group of three-month-old cubs take their ease on the rocky ledges of a kopje. Ladies of the pride share many of the responsibilities of raising offspring, even to the point of suckling each other's young. Litters occasionally run as

ENGRAVING BY ALAN HOOT © N.G.S.

large as six, but most contain from two to four. The pride to which these seven youngsters belong has two males, 13 females, and an unusually large number of cubs—20. Prolonged childhood—about two years—conditions cubs for collective living in the pride.

is looking for others, it will roar loudly, then listen attentively for an answer. A strange lion hearing these roars will avoid the area, knowing other lions are present.

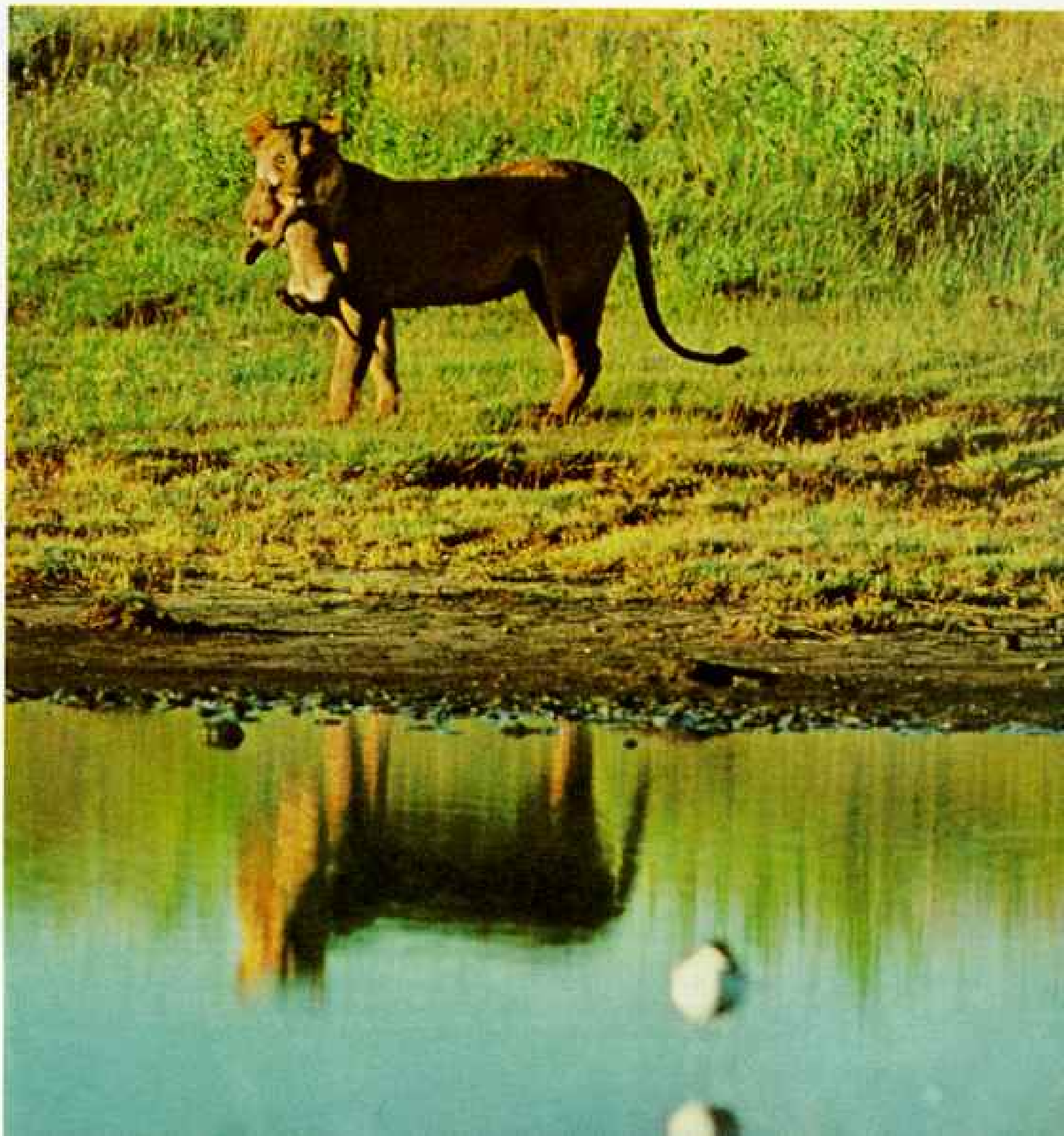
Most prides in the park spend their lives within their own territories. They do not, as was previously thought, follow the huge herds of zebra, wildebeest, and Thomson's gazelles on their annual migration to the plains at the onset of the rains and back to the woodlands with the advance of the dry season.

However, some lions wander widely, roaming over a thousand or more square miles in a year, existing as squatters in established territories until thrown out. Some nomads are females that have left the pride, perhaps because there was not enough food in the area. By age three, most males are driven from the pride by their fathers. Unless they can take over groups whose males have died, or evict other males forcibly, they are doomed to lives of wandering, for all the suitable territories in the Serengeti are occupied.

Radios Help Track Lions at Night

At least 200 nomads follow the migratory herds onto the plains, because land there is free for the taking. But no permanent territories can be established on the plains because of lack of food for about half the year.

To learn what a lion does with its life, I follow certain individuals day and night, day



PHOTOGRAPHS BY GEORGE B. SCHALLER © N.G.S.

Half time in the game of love: Honeymooning lions contemplate separate horizons. Mating couples, such as this pair, often become separated from their prides. Sometimes, two or more males openly court the same female. An adult lioness normally bears cubs about every two years.

Collaring a straggler, a mother lion (left) leads her five-week-old toddlers to a hiding place where she may leave them for a day or more while she hunts. Whelped after 3½ months' gestation, newborn cubs weigh only three pounds. About half survive nature's hazards to reach maturity.

Playful mischief-maker clamps down on a larger cub's tail. Youngsters often follow along on a hunt, observing strategy from afar and later mimicking killing techniques while at play. Only when a year or more old do they actually help pull down a victim. By age two they may hunt alone.

after day. This is not difficult for me when the moon is bright—except for the problem of staying awake.

The park lions usually are so tolerant of vehicles that I can stay within 100 feet of them. In fact, they show less fear at night than during the day. They may even come up and chew on the tires of my Land-Rover.

Only once did a young male resent my presence. He lashed his tail, growled a warning, and rushed at the Land-Rover. He straddled the fender and bit two large holes in it with his canines before retreating disgruntled, perhaps with a toothache.

One Lion Trailed for 21 Days

On moonless nights, following a lion becomes more difficult. So Howard Baldwin provided me with several small radio transmitters, each attached to a collar. I put one of these around a lion's neck while it is immobilized. A direction-indicating receiver in the Land-Rover picks up the beep-beep of the transmitter, telling me where the cat is.

With an assistant, William Holz, I followed one male continuously for 21 days. The lion was a large, shaggy beast, somewhat past his prime. He and a companion had set up a temporary territory of about 75 square miles, which they shared with several females. Bill and I alternated as his shadow, spelling one another at midday. At the end of his 24-hour watch, Bill would report the lion's activity:

"At 8 p.m., he and his friend traveled east about two miles and scavenged a piece of zebra from several hyenas. Then they swung west one mile and met the lioness with two cubs that we have seen him with before. The rest of the time he just lay around."

During daylight, when hunting on the plains is futile because of lack of cover, the lion rested. He also rested most of the night—altogether, an average of 20 hours in each 24.

While he rested, he listened to the night noises, always alert for a possible meal. If hyenas in the distance hooted in a certain way, he immediately trotted over, knowing they were squabbling over food. One night he appropriated half a gazelle from a leopard. Another night his female friends caught an eland, and he joined in the feast. In the 21 days, he ate seven times, always prey killed by another animal. His only effort at hunting was an unsuccessful chase after a dik-dik—an antelope that weighs a mere 10 pounds.

During the rainy season of 1968, I found lions feeding on carcasses 121 times on the plains. About half the kills had been made by the lions themselves. A quarter were scavenged, mostly from hyenas, which readily kill their own prey. I wasn't able to make judgments on the others.

The scavenging, however, is not all one-sided. Hyenas, often described as cowardly, sometimes rob lions of their kills. One night Kay and I watched two lionesses feeding on a zebra they had killed that morning. Silently, singly and in twos, hyenas arrived until there were more than 15 of them. In the beam of my flashlight I could see the circle of eyes, glowing, waiting.

Near midnight Kay exclaimed, "Here they come!" The hyenas had risen as if on signal, and now they advanced on the lions, emitting unearthly moans and roars. The lions fled.

Lone Male Cowed by a Hyena Pack

Once I came on a pack of hyenas harassing a large male lion for no obvious reason. The lion lay down and turned his head sideways in utter submission—the king humbled by a mob, something not unknown in human affairs. But when several other lions arrived, the hyenas left.

The lion welcomes almost any carcass, no matter how large or how small, how fresh or how rotten, whether scavenged from a cheetah or dead from disease. On the plains, where some half a million wildebeest and zebra concentrate during the rains, about 90 percent of the lions' food consists of these two species (pages 498-9 and 514-15). In other parts of the park they catch mostly buffalo, topi, and impala. Some prides live for months on the small Thomson's gazelle when nothing else is available.

On the plains, lions do most of their stalking under cover of darkness, but they will catch an animal in daylight if they have the opportunity. In the woodlands, where lions are able

Every sense alert to night time's telltale sounds and scents, a lioness—aptly nicknamed Flopear by the author—poises with another pride lioness at the edge of a kopje. In open areas lions must hunt under cover of darkness to conceal their movements from sharp-eyed prey. At least a quarter of their diet consists of meat scavenged from other predators. At times, packs of hyenas turn the tables on lions—driving them from the kill and snatching their dinner.

to approach undetected or where the prey must descend into a ravine to drink, much hunting is done during the day.

To watch a lioness stalking is one of the most exciting spectacles in Africa. Alertly she watches her prey, body tense, tip of tail twitching as she advances a step at a time. If the animal raises its head, she freezes until it resumes its grazing. Then she crouches motionless, hugging the ground. Only the quivering of her flanks reveals her tension as she waits for the unsuspecting victim to drift closer.

The tension infects me. I find myself holding my breath, and I feel my muscles flexing as if for a rush.

Suddenly she attacks, seizing the startled animal by its rump, or a side, with her hooked claws. She pulls it swiftly to the ground. With the same motion she lunges for the throat to strangle the animal, or sometimes for the nose, clamping her teeth over it to suffocate the victim. This may take 10 minutes.

It has often been said that lions kill large prey quickly and efficiently with a bite through the back of the neck, crushing the vertebrae, or that they pull the prey down in such a way that it breaks its neck. I have never seen this happen. The majority of kills, in my experience, are made by strangulation or suffocation.

Lions Ignore the Wind's Direction

Many stalks are spoiled because a lion fails to take advantage of the available cover or ineptly rustles the grass. Moreover, lions do not take into account the direction of the wind, and stalks often fail because the prey, with its keen sense of smell, detects the danger at a distance of several hundred feet.

The lion is built for power, like a heavyweight boxer, and not for sustained speed. Most prey animals can easily outrun a lion, whose top speed is about 35 miles an hour, compared to nearly 50 miles an hour for a Thomson's gazelle. The lion must stalk to within a few feet of a potential victim before its rush has much chance of success.

Prey animals are fully aware of the lion's limitations. They have learned how near to a lion they may wander without danger of attack—usually to within about 120 feet. This leads to ludicrous situations. I have often seen

Death stalks past, eyes too intent on other prey to notice a baby Thomson's gazelle in the grass. Infant animals have little odor and often escape detection by remaining motionless. PAINTING BY ALAN ROOT © N.G.S.

Reaching escape velocity, a Thomson's gazelle streaks away from a charging lioness. Built for power, but not for sustained speed, the big cats usually ambush their fleet-hoofed prey, most of whom can easily outrun them. On cooperative hunts, one or two lions may drive prey into the reach of pride members hidden nearby.

a herd of animals lined up alertly in parade formation with a lion padding indifferently by, as if inspecting the ranks. A visible lion is a safe lion. The lion knows this too and makes no futile rush.

With these shortcomings it is not surprising that a lion may go without food for as long as a week. But it is adapted to a feast-or-famine regimen. When food is plentiful, it gorges. In the course of one day, five lions can easily consume a zebra weighing 600 pounds, eating skin, viscera, meat—everything except the bones and the stomach contents.

To find out how much a male lion can eat in a night, I gave one a piece of weighed meat in the evening and weighed the remains in the morning. He had eaten 73 pounds—equal to nearly one-fifth of his body weight.

But average daily consumption is less. I watched two males and three females for 13 days during a time when prey was abundant. They killed four male wildebeest. Knowing the approximate weight of an adult wildebeest and the weight of the inedible parts, I figured out that each lion averaged about 15 pounds of meat a day.

Although the lion usually has no trouble subduing an animal like a zebra, anything larger may attack in return, and on occasion become the victor. John Goddard, a Canadian zoologist, described in the *East African Wildlife Journal* an attack a lion made on a rhinoceros calf in the Ngorongoro Crater. The calf's mother "wheeled around with incredible speed and gored him twice in the centre of the ribs, using the anterior horn with quick stabbing thrusts," he wrote. "The lion rolled over, completely winded. The rhinoceros then gored the lion once in the centre of the neck, followed by another thrust through the base of the mandible, killing him instantly."

Once I came on a bull buffalo lying on his side, seemingly dead, while a lioness chewed first on his tail, then on the tough hide of the flank. However, the buffalo seemed to have been merely in a state of shock. Suddenly he

PAINTINGS (ABOVE) AND KODACHROME BY GEORGE B. SCHALLER © N.G.S.

A king lies dying, mauled by three rivals from a neighboring pride during a battle over a piece of hunting territory. Sunlight of dawn gilds the fallen leader's mane; its tatters litter the grass around him. A lioness from his pride discovers the loss, which led to an even greater disaster. The group's other adult male was driven off by another gang of marauders, who then bit to death three cubs hidden in a thicket.

Grisly trophy hangs from a usurper's jaws. Completing the defeat of the rival pride, this male and his companion ate one of the cubs on the spot and carried another off for a later meal. When the mother returned from the hunt, she merely sniffed at the carcass of the third cub—and then devoured it herself.

reared up and lunged at the lioness with a vicious sweep of the horns. She tried to pull him down, but the buffalo held her off for nearly an hour, charging repeatedly, until she finally left (page 497).

The lion is the most social of the big cats. This is probably an adaptation for hunting large mammals in open terrain, where a stalk by several lions tends to be more successful than a solitary effort.

Much has been written about the cooperative hunting of lions. It has been said, for instance, that the male drives prey toward the hidden females with a shattering roar. I have never seen lions do this. I have, however, seen one or two lions leave their pride, circle their intended victim, and silently drive it toward the others.

Lionesses Cooperate to Bag a Gazelle

The best time to watch such cooperative activity in the Serengeti is during July and August, when the Thomson's gazelles trek from the plains to the woodlands. In high grass and river thickets, the lions hunt them in daytime.

All day I sit then with the lions, waiting for them to hunt. It is hot, and the hills are lost in a smoke haze from the fires that sweep the park during the dry season. The hours drag. Finally some gazelles wander into the vicinity of the five lionesses near me. One lioness looks up alertly, and immediately the others do the same. Then they fan out and advance.

One rushes at the gazelles from 70 feet away. The startled animals scatter, and one dashes toward a hidden lioness. All I see are two paws reaching from the high grass, plucking the leaping gazelle from the air.

Even cooperative hunts fail, however, more often than not. Hunting success depends, among other things, on the density of the vegetation and on the species pursued. When lions stalk Thomson's gazelles in areas of short grass, about one rush in six is successful; in tall grass, one in three.

In a study such as mine, it is important to know why the predator selects its victim. Does it kill more males than females? Does the lion catch only the young, old, and sick, or are many taken in their prime?

From observations and from examining carcasses, I have been able to draw some conclusions. Lions kill the weak and sick whenever the opportunity arises. Gazelle fawns crouching in the grass are snapped up in passing, and a zebra stumbling along in the advanced stage of some illness is quickly dispatched. But unlike wolves, which may relentlessly pursue a chosen animal, lions have no chance to select an inferior victim in their short rushes. Consequently, much of their prey appears to be perfectly healthy.

Lion cubs are born with an innate behavioral repertoire which enables them to learn later how to hunt efficiently. I was able to watch the development of hunting behavior in a cub we had as a house guest for three months.

Tawny death strikes

A BURCHELL'S ZEBRA stubbornly spreads its forelegs, hoping to stop an attacker from pulling it down (above). The lioness pounced from one side, but lost her grip and now clutches at the zebra's head. Thrashing violently, she finally hauls the beast to earth (right). The zebra struggles to its feet and flees (lower right) as another lioness, attracted by the commotion, joins the pursuit.

In nearly every kill, observed the author, lions dispatch their prey by clamping steel-spring jaws over its throat to strangle it, or, sometimes, by biting down over its muzzle to suffocate the victim.

I found the cub beside the fresh bones of a wildebeest. About three weeks old, he was emaciated and barely breathing. The milk supply of his elderly mother had failed, and when he became too weak even to suckle, she abandoned him.

"Look what I have in the car," I called to Kay, when I returned home.

"Oh, the poor thing," she said, examining the limp body. She warmed him and hovered over him until he was fully revived, bottle-feeding him powdered milk laced with extra protein, calcium, and vitamins.

At five to six weeks of age he became a typical lion. His canine teeth pushed through the gums, and he showed an interest in meat. He stalked moving objects and rushed clumsily, swiping at them wildly (page 502). When he hooked something, he drew it in and, clutching it close to his body, bit it.

Our cub will eventually have the chance to use his instincts in the wild. We gave him to a game warden who is raising several cubs to be released in a lionless park in Ethiopia.

Such hunting behavior as our cub displayed is not seriously used in the wild until cubs are about a year old. They learn to hunt first by watching and later by participating. At three

ENTACHROMES BY GEORGE R. ACHAUER © NATIONAL GEOGRAPHIC SOCIETY

months of age, they sometimes follow the pride on a hunt. During the stalk they remain behind until the kill has been made. When a year old, they may help pull down a victim.

But I never saw a cub catch anything on its own until about 15 months old. One about that age grabbed a Thomson's gazelle—then sat down with a surprised, yet smug, look on its face. Not until cubs are nearly two years old can they become independent with a reasonably good chance of surviving.

Although adult lions cooperate in hunting, they do not in feeding. There is a terrible fascination in watching these social creatures over a kill—a snarling, growling mass, each thinking only of itself. Even cubs must fight for every scrap. Lions give the impression that their evolution toward a social existence is incomplete—that cooperation in achieving a task does not yet include the equal division of the spoils.

Life Is Uncertain for a Baby Lion

If a lioness kills a small animal, such as a Thomson's gazelle, any male in the vicinity will rush over and take it from her. This reflects the pride's peck order, based on size. Males, weighing some 400 pounds, are dominant over females, which weigh about 250 pounds, and these in turn dominate cubs.

The young—of which there may be one to six in a litter—lead a precarious existence. Born blind, weighing a mere three pounds after a gestation period of 3½ months, they spend their first few weeks hidden amid boulders or dense scrub. Their mother is often away hunting, and sometimes they are left alone for 24 hours or more. At first they live on milk; the mother does not regurgitate meat for them, as is sometimes stated.

When cubs are fully mobile, their mother leads them toddling to the kill. Or she may take some meat back to them. However, she does this only when she is well fed. Lionesses at times behave atrociously as mothers, if judged by human standards. When food is scarce, the mother eats first and viciously swats at any cubs that try to snatch a morsel.

Our pet cub, usually so friendly, became irascible and antisocial as soon as food was

Sharing a ribbon of shade, two males and seven females slumber in the heat of day. They sometimes rest for 20 hours at a stretch, but most nights find them on the prowl. When game is scarce, they trudge long distances in hope of finding prey. Then rest is infrequent and plagued by hunger.

in the offing. Afterward, as if to indicate that no harm had been meant, he indulged in a veritable orgy of affection.

Almost all books on lions state that a lioness with cubs is usually accompanied by a childless female, an "auntie," who guards the young and hunts food for them. I have never seen this. Childless females frequently visit a lair, and sometimes two females are more or less steady companions, whether one has cubs or not. But the extra female never hunts for the cubs.

In the normal course of events, about half the cubs of a pride die of starvation, abandonment, or other causes. I remember particularly the fate of one litter.

A lioness killed a wildebeest during the night and, after feeding, she went for her two cubs, only a week old, which she had left a mile away. While she was gone, a leopard came and scavenged the kill. Soon the lioness returned, carrying one cub. The leopard climbed into a tree by the kill. Now she wanted to fetch her second cub. But how could she, and still guard the first from the leopard?

She took a few steps, returned to the cub, looked at the leopard, then moved a few steps away again. After half an hour of indecision she left. When she was a hundred yards distant, the leopard descended and grabbed the cub. It squawked loudly. The mother returned at a run. The leopard dropped the cub and fled. But the cub was dead.

On the following day, I found the second cub crushed to death, apparently by a male lion that had rolled on it.

Many Factors Limit Lion Population

The high death rate of cubs is one of nature's ways of controlling the lion population. Other controls affect those lions that survive to independence. Some die in fights among themselves, some during clumsy attempts to hunt buffalo, and others from disease, such as

that caused by the blood parasite *Babesia*, which killed George and Joy Adamson's famous lioness Elsa. Poachers snare lions at the borders of the park, and hunters shoot them.

Nevertheless, the adult lion is relatively secure, and it is my impression that the Serengeti has perhaps as many as it can conveniently support. This is about a thousand.

Since the Serengeti harbors more than a million hoofed animals, one would expect the lion population to be larger. But it should be remembered that, in general, lions are sedentary, whereas most prey is migratory. Thus the majority of lions have no migratory species like wildebeest and zebra as food for months on end. They subsist on whatever nonmigratory prey they can find, principally buffalo, topi, and impala, which are far less abundant. Were prey more abundant the year round, the Serengeti could support more lions.

Like other predators, lions have been condemned for the destruction they are said to cause to wildlife. But in the Serengeti, lions take only a small percentage of the game. In doing so, they help control the population of hoofed animals; these, if not checked, multiply so rapidly that they soon overgraze their habitat and ultimately die of starvation. The lion reigns not to the detriment of the Serengeti, but as an integral and valuable part of it.

The lion's nature is one of contrast. He is irascible, indolent, and selfish, but he can be gentle and affectionate. There are those who would dethrone him for his brutality and scavenging, and there are those who exalt him for his beauty and power.

I do neither. I like lions for what they are: for their fathomless amber eyes, for their massive grace, for their intricate way of life. I agree with the Turkana tribesman who told George Adamson that the lion's roar is saying:

"Who is lord of this land?... Who is lord of this land?... I am!... I am!... I am!... I am!"

THE END

SOVEREIGNS OF THE SERENGETI, *two male lions stride across a dawn-lit plain. A Thomson's gazelle—knowing that a visible lion is nearly always a safe lion—reviews the parade.*

KODACHROME © N.G.S.

Macao Clings to the Bamboo Curtain

By JULES B. BILLARD

Photographs by
JOSEPH J. SCHERSCHEL
Both National Geographic Staff

THE GREEN-AND-RED FLAG of Portugal, faded and a bit frayed at the edges, shivered on its staff atop Government House in Macao. It caught my eye as I walked along the banyan-shaded Rua da Praia Grande, where the avenue's graceful sea wall curbs brown waters of the bay. And in that moment, it took on a special symbolism for me.

The aging colors spoke of bygone brilliance for this bit of Portugal tacked to the Asian mainland. The trembles that swept the cloth told of a breeze out of Communist China next door. Macao, so mute a thing as a flag reminds you, sways precariously with each stirring of its giant neighbor.

Yet it exists—and has for 400 years—as an intriguing anomaly, a tiny outpost amid the power and vastness of an alien land. And its

A taste of Europe on the lip of Asia: Near the ruin of 17th-century São Paulo Church a Chinese water carrier climbs a shuttered street in Macao—the West's oldest trading post on the China coast. Behind its Occidental façade, the little overseas province of Portugal lives an Oriental life and survives, as it has for four centuries, by accommodation with China's rulers.

name through the centuries has evoked a blending of East and West.

I saw the flag as I returned from an unsuccessful attempt to peer through the Porta do Cêrco, the Barrier Gate between Macao and China. Macao—the Portuguese spell it Macau—crowds its storied allure on a thumb-shaped peninsula three miles long and a mile wide at its broadest (maps, pages 524-5). It hangs like a drooping lower lip on the mouth of the great estuary known as the Pearl River, and it is regarded by Lisbon as an integral part of Portugal, a province overseas. People born in Macao, whether of European or Asian parents, are Portuguese citizens.

Mob Topples a Hero's Statue

American visitors used to gawk through the Barrier Gate at Communist soldiers beyond the walled border. There the neck of the peninsula makes a frontier only 700 feet long. But when I tried to walk up for a look, a Portuguese policeman stopped me a block away.

"Since the difficulties of 1966," he explained, "foreigners are requested not to go nearer than this." By the way he pronounced "requested," I knew he meant "not permitted and no use arguing." I acquiesced.

The "difficulties" were riots by Communist elements in Macao's Chinese population. (Of an estimated 280,000 inhabitants, only about 8,000 are non-Chinese.) The troubles began in November 1966, when Communists defied a government order to stop building a school for which no construction permit had been issued. Police stepped in, and in the clashes that followed, eight Chinese died.

Bands of youths promptly marched through Macao shouting slogans and threats. A mob broke into the Leal Senado—Loyal Senate—where the province's legislative council meets, and tossed books from the Municipal Archives into the street. Another mob toppled a statue of local hero Vicente Nicolau de Mesquita, who in 1849 had led 36 volunteers to capture a Chinese fort defended by 400 men.

Macao police and troops retaliated with truncheons and fire hoses. From neighboring Kwangtung Province 15,000 Chinese gathered beside the Barrier Gate. Red gunboats steamed into nearby waters. Agitators threatened to cut off the flow of drinking water and foodstuffs from China. The stream of tourists from Hong Kong that helps to underpin Macao's economy dried to a trickle.

Finally, on January 29, 1967, Portuguese authorities gave in to some of the Communist demands. They accepted blame for the riots and deaths, paid $350,000 as indemnity to the relatives of the dead and injured, agreed

Glittering jewelry like this pin held by Alda Dias—a Macanese beauty descended from Portuguese and Oriental forebears—is the only obvious sign of the $30,000,000 worth of gold that flows through Macao in a year. Refusing to be bound by international monetary restrictions, Portugal licenses a gold syndicate. The company imports the metal in ingots; after conversion to small sheets, the gold finds its way across Asia for profitable resale. The import taxes and fees paid by the syndicate provide Macao with its largest single source of revenue—$1,480,000 in 1968.

Contest for right of way pits pedestrians against pedicabs and taxis during the Chinese New Year's rush in midwinter. The three-day celebration, banned in Communist China, erupts with special fervor here as the Chinese majority enjoys feasting, fireworks displays, and gambling. Signs proclaim rice, book, apothecary, and preserved-meat stores.

慶和堂參茸藥行
WORLD
COMPANY

Macao City

Parks, wooded areas, and cemeteries in green
Elevations and soundings in feet

STATUTE MILE

Matteo Ricci, Italian Jesuit based at Macao, opened China to Roman Catholic missionaries in the late 1500's and published the first detailed geography of China available to Europeans.

Grave of Robert Morrison (above), the first Protestant missionary to China, who translated the King James Bible into Chinese in the early 19th century.

Low tides expose mud flats that surround Macao.

Pearl River

On the doorsill of Red China, 280,000 people crowd a peninsula and two islands smaller in area than New York City's Kennedy Airport. This westward view from Guia Lighthouse sweeps from the new waterside casino-hotel complex, beyond the Portuguese flag at far left, past China's haze-shrouded Lapa

Lisbon's lieutenants: Governor of Macao José Nobre de Carvalho, left, and Secretary General Alberto Eduardo da Silva confer beneath a portrait of Portugal's President, Adm. Americo Thomaz.

Island, center, to the causeway, right. Ever present is the threat that China will halt food and water supplies at the Barrier Gate (top of map). In 1557 China granted Macao to Portuguese traders and began to sell them treasures of the Ming Dynasty: silks, porcelains, and seed pearls. Through Macao poured the wealth of Portugal's empire: Indian cotton, drugs, and ivory; European mirrors, clocks, and cannons. Carracks of up to 2,000 tons, largest ships of their day, carried silk to Japan to exchange for silver. After 1842 Britain's deepwater port at Hong Kong forged ahead of Macao.

to turn over to the Communists any "illegal immigrants," promised to expel known agents of the Chinese Nationalist Government on Taiwan (Formosa), and announced a ban on all Nationalist activities.

The following year Macao's Communists celebrated the anniversary of the event. When I visited the city, posters denouncing "foreign imperialists" plastered buildings (page 528). Loudspeakers blared Communist propaganda. But I, an obvious Occidental, walked the streets with only occasional glances from passers-by. Macao, it was plain to see, had weathered another storm in relations with its neighbor.

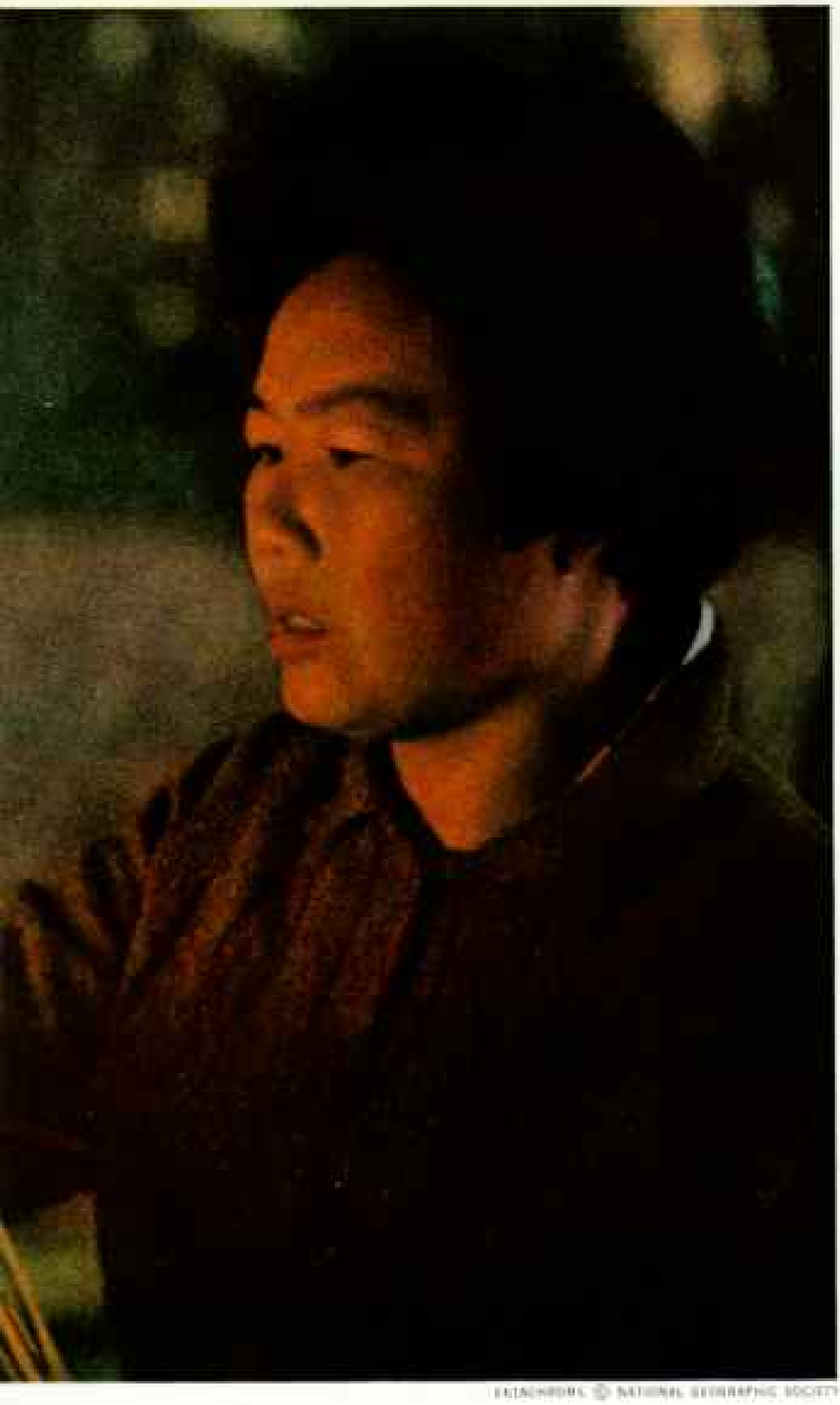
Its history has been full of them.

"Macao belongs to the Portuguese in name only," one observer wrote in 1803. They "do not own a piece of land . . . open a window, or repair the roofs . . . without a license from the Mandarins." A century and a half earlier another chronicler had reported that Macao spent a great deal "in bribes, embassies, and presents to the mandarins . . . which must be done for the preservation of this city in the midst of so many and such powerful enemies."

Macao Learns to Ride Out the Storm

Frictions across the border have, on occasion, brought armed conflict. But always Macao has bent like the flexible bamboo before the fury of the typhoon. And survived.

"The fact remains that we have made a meeting here of East and West," Dr. Henrique



Sandalwood scent of joss sticks fills Kun Yam Temple, a Buddhist shrine to the goddess of mercy. As the worshiper lights each stick of incense, she utters a prayer. Buddhism claims most of Macao's residents, but Christianity and Taoism have followings.

de Senna Fernandes remarked. Wavy-haired and energetic, Dr. Fernandes headed the province's Information and Tourism Department. "We have made a meeting, and we have here something that is beautiful," he said. "The typical tourist who comes from Hong Kong and spends an afternoon or an evening doesn't get to know it. You have to stay for a while to understand."

I stayed a while, and I must agree.

The province perpetuates an incongruity—a bit of southern Europe plopped down amid the color and hubbub of the Orient. I walked narrow, cobbled streets that climbed the peninsula's seven hills, and the balconied buildings crowding around me seemed magic-carpeted out of Portugal. But pedicabs and Chinese signs argued that this could be no Iberian town.

Passing wrought-iron grillwork and shuttered windows, I half expected a glimpse of a senhorita's eyes or the sound of guitars; instead there came the sing-song of Cantonese and the clacking slap of mah-jongg tiles.

I paused beside plastered walls where the late-afternoon sun caressed time-moldered greens and ochers of Mediterranean hue. Yet even these walls flew an Oriental touch—laundry strung on bamboo poles and propped out to dry.

From the Bishop's Residence atop Penha Hill, a spot where all tourists go, I took in the sunset. Shafts of gold touched the verdant courtyards that have brought Macao the label "garden city of the Orient." Bells of a convent below tolled the Angelus. Only the junks with batwing sails belied the European tranquillity of the scene.

Macao tranquil? Yes. Nevertheless, its reputation as a roaring city of sin dies hard.

"Oh, there was a time when opium and vice of all kinds flourished," historian Luis G. Gomes, who headed the National Library, told me. "In the past few decades, however, Macao has changed a lot.

"Of course, we do have casinos where visitors who come from Hong Kong can find entertainment and a place to risk their cash. It's true, too, that some pedicab drivers may suggest other pleasures to a late-evening fare, but the tenhouses and sing-song girls that once brought fame to Rua da Felicidade—the Street of Happiness—are mostly shuttered. And I defy you to find an opium den.

"Macao may not have been puritanical during its long history, nor is it today. But neither is it vice ridden."

The city bustled as a trade center already half a century old when English colonists

打倒英帝

Façade without a church surmounts Macao. Designed by an Italian Jesuit, the baroque Church of São Paulo was destroyed by fire in 1835. Oriental lions flank Christ and His angels on the elaborate front, the work of Japanese sculptors in the 1600's.

Slogan lettered in white by a Communist sympathizer with Hong Kong in mind reads "Down with British imperialists!" Across the channel on Lapa Island, soldiers in pillboxes watch for would-be escapers from Red rule.

Face-lift for Macao comes from gambling profits. Hong Kong businessman Stanley Ho, left, director of Macao's gambling syndicate, stands with architect Liang Tat Man behind a model of a $7,000,000 hotel-casino complex. Beyond them the multistory circular hotel nears completion.

Double-decker gambling increases the playing space at a floating casino. During a game of fan-tan, a uniformed attendant lowers bets of upper-story players in a basket.

landed at Jamestown. Portuguese date Macao's founding as 1557, though Chinese records have Europeans there as early as 1535.

Suppression of pirates earned for the Portuguese the gratitude of a Chinese mandarin —and sanction for the trading post on the rocky little peninsula. It flourished because the Celestial Empire then prohibited Chinese merchants from dealing directly with the Japanese. Portuguese entrepreneurs prospered as middlemen, their unwieldy carracks carrying the riches of the Orient.

But Macao began to decline in the late 1700's, after other Chinese ports were opened to foreign ships. In 1842 the British established a far better anchorage at Hong Kong, 40 miles away, and prosperity ebbed further. In recent years Peking has limited trade with Macao, and the U. S. has barred all trade with Red China, shrinking commerce to a trickle.

Now Macao slumbers, with two ideologies meeting in wary tolerance. European architecture and customs blend with Chinese ways. Even blood lines mix in a racial caldron.

Portuguese men-at-arms and merchants took their women with them when they sailed in the great age of exploration. But they were wives and mistresses from Africa, India, Malacca, Timor—seldom from home. In Macao, one historian writes, there was practically "a total absence of European-born Portuguese women for almost three centuries."

Today the province's 8,000 non-Chinese citizens include 6,000 who proudly call

themselves Macanese, tracing their lineage through this rich heritage of intermarriage. Like all Macao citizens, they are eligible to go to the mother country to live. But they stay.

"After a while you can't help loving this place," António José Pereira explained. He had been sent to Macao for his army service, and afterward settled here. Now he works as an agricultural agent on the big island of Coloane, off the peninsula's tip. Together with the neighboring island of Taipa, it accounts for two-thirds of the province's six-square-mile area (map, page 525).

"My job involves helping Coloane's Chinese farmers raise better pigs and chickens," Senhor Pereira said. "I also manage a reforestation program. One of these days we'll have a small timbering industry here."

Coloane's slopes wore the green of pines, acacias, and casuarinas. By contrast, the Chinese island of Wong Kum a few hundred yards away displayed barren hilltops and raw ravines—with an edging of trees sprouted from seed carried in by winds off Coloane.

Shortage Converted Into a Surplus

Just as important, Senhor Pereira said, has been the reforestation program's success in halting erosion and improving water catchment. "Runoff is no longer uncontrolled, so we have all the water we need on the island."

With Senhor Pereira and Euricles Brito Lima, administrator of Coloane, I drove across the 1.4-mile-long causeway linking the two islands. A new dam pens a 185-million-gallon reservoir of fresh water between this causeway and the Coloane shore. Other projects call for smaller reservoirs in the hills.

"We hope to have hotels in the hills for tourists, to go along with our island's seashore and forests," Senhor Lima said. "Already people come on weekends to picnic and hike in the cool of the trees."

Thus Macao, despite the difficulties of 1966, still plans for the future.

Encouraging tourists to stay longer figures importantly in those schemes. Now the average visitor comes for a day and skims Macao's sights—its ancient fortress atop one of the city's hills, its Guia Lighthouse (first to be built on the China coast), its Kun Yam Temple, where a stone table stands in the garden. On it was signed in 1844 the first treaty between the United States and China, opening Chinese ports to U. S. ships.

Like the typical tourist you can, if you wish, zip through the Old Protestant Cemetery established by the British East India Company in 1821. Its 158 graves include those of New England seamen who sailed

Slap and clatter of mah-jongg echoes through a Chinese household as players shuffle with machinelike speed; three generations follow the turn of the tiles. In the 1920's this Oriental cousin of rummy passed in and out of fashion in the United States, but the Chinese play on and on and on.

the China clippers. Here too is a memorial to the great-great-uncle of Sir Winston Churchill; naval Capt. H. J. Spencer Churchill died in 1840 off Macao. The cemetery also contains the grave of Robert Morrison, Scottish missionary who in the early 1800's founded the Protestant Church in China, compiled an English-Chinese dictionary, and translated the Bible into Chinese.

You can trot past the statue of Sun Yat-sen, father of the Chinese Republic, who practiced medicine while living here in exile. Or hurry through the pleasant gardens where elderly Chinese chat in the sun beside Camões' Grotto —a strange natural shelter of stone under which tradition says Luiz Vaz de Camões wrote part of his 16th-century epic *Os Lusiadas (The Lusitanians)*. This one-eyed soldier-poet was to Portuguese literature what Chaucer was to English and Dante to Italian.

Many visitors pause in the Buddhist temple dedicated to A-ma, patroness of seafarers. In the courtyard a junk carved in relief on a granite boulder commemorates the legend of the goddess. Brown-eyed Maria do Carmo Rego told me about it.

"Long ago a poor girl wandered among junks about to sail from Fukien Province in China, but only the master of the smallest would give her passage. At sea a typhoon came up, destroying the big boats. But the little junk was carried from wave top to wave top and set down gently in a harbor sheltered by huge rocks. The girl stepped ashore, climbed the rocks, and vanished—a goddess gone to heaven, so the legend goes.

"A temple was built on the site, near a small fishing village," Senhorita Rego said. "The Chinese called this anchorage A-ma-ngao—the Bay of the Goddess A-ma. The Portuguese converted this to Macau."

With Senhorita Rego as my guide, I went to Macao's most photographed spot, the ruined façade of the Church of São Paulo. It rises above a sweep of steps on a hillside near the center of the peninsula (page 528). The church was completed in 1602, when Macao was "above all . . . the head of Christendom in the East," as a Jesuit wrote. A fire in January of 1835 destroyed all but the carved façade.

As I stood before the structure, marveling, Chinese youths with red arm bands slapped posters on nearby buildings and hammered lumber into a stage at the bottom of the steps.

"What are they getting ready for?" I asked.

"They're going to have a demonstration against 'running-dog imperialists and foreign devils,'" my comely guide translated.

I thought it prudent to depart—for Senhorita Rego's sake, of course.

Revenue Swelled by Packaged Noise

In the Far East a demonstration, or almost any other occasion, isn't much without firecrackers. Macao supplies them to the world, so I satisfied the little boy in me by visiting a firecracker factory.

The island of Taipa boasts five, though part of the manufacture is done on a piecework basis at home by women and children among Taipa's 5,000 inhabitants. I went through one of the island's biggest, the sprawling Kwong Hing Tai works, accompanied by factory manager Chang Tac and Gastao Barros, administrator of Taipa and Coloane.

Wooden sheds separated by masonry bul-

EKTACHROME (RIGHT) AND KODACHROME © N.G.S.

Small fingers must learn to earn among families eking out a bare existence. Three-year-old Kam Chi plays at sewing sequins on a lady's satin handbag, but in a few years she will embroider in earnest to help increase the output of her family's home industry.

Hours of infinite care go to produce seconds of sound. At a firecracker factory on Taipa Island, a girl adds fuses while the woman beyond tamps the cases closed with a mallet and wooden pin. Macao packages more than 3,700 tons of fireworks a year, most for export to the U. S.

warks stood on the factory grounds. A pond stored water at the center of the quadrangle of buildings—for use in case of mishaps. Inside the sheds, employees filled cardboard tubes with black powder, placed fuses, and tamped ends tight—fashioning hexagonal packets of a thousand firecrackers at a time. And as I walked through a warehouse crammed with everything from six-inch salutes to little "lady fingers," I couldn't help wondering aloud what a whale of a display a surreptitious match might set off. And was ashamed for mentioning it.

"Don't feel embarrassed," Senhor Barros said. "Other visitors make the same remark."

In Mr. Chang's office I got statistics on Macao's firecracker industry—and a surprise in seeing a National Geographic map of the United States on the wall.

"We use it to keep track of the states which ban the sale of firecrackers," he said. Their increasing number—now 30—has put a crimp in Macao's exports, which even so amounted to 10 tons a day in 1968. Some 80 percent went to the United States.

Along with firecrackers, Macao's chief sources of industrial income are textiles and footwear. But gambling, gold, and tourism are the main props of its economy.

To many an Oriental mind, gambling isn't a vice but a passion. Macao sits neatly between Communist China and Hong Kong, where governments frown on gaming. Thus to its tables and "hungry tigers"—the Chinese expression for slot machines—flock visitors anxious to risk Macao patacas or Hong Kong dollars. The latter circulate at par with local coin; each is worth about 17 U. S. cents.

Gamblers Excited by Battling Crickets

Hydrofoils on their 75-minute run from Hong Kong, or more leisurely ferries, bring gamblers by the scores to casinos open around the clock. Roulette, boule, blackjack, and keno draw their devotees. So do such Chinese games as the complicated *sek-pou*, a kind of high-low dice, and the simple fan-tan, where you bet whether one, two, three, or four counters will be left after the banker reduces a pile on the table by four at a time.

Sidewalk snail shop processes marine mollusks for sale beside the Inner Harbor. After gathering them from the muddy shoreline, the women dig out the meat and spread it to dry in the sun. Snails add flavor and protein to soups and vegetable dishes.

Many Chinese of Macao take their livelihood from the ocean; fishermen sail out into the South China Sea on the scores of junks harbored here. To fish China's territorial waters, they operate within a system called the "Three Fixes," meaning they must carry Chinese registration, attend political meetings, and sell part of their catch to communes or pay a tax on it. Macao exports some $2,800,000 worth of fish and crustaceans a year. Open-air markets sell the rest of the catch.

In autumn, gamblers can find cricket fights to wager on. The male crickets battle in small wooden-tub arenas, and bets up to 4,000 patacas have been laid. The best fighters, I learned from importer Chong Ming Hong, come from graveyards or the invigorating environment of mountainsides. Mr. Chong sells bananas on the Rua do Teatro, and deals in crickets from China as a sideline.

"Owners train them on a diet of lotus seed and rice cooked with frogs' legs," he said. "Every few days you have to put a lady cricket with them to keep them happy.

"Males are matched by weight before fights and are made angry by having their antennae brushed with a mouse whisker. A fight lasts until one cricket gives up and hops away—a few seconds to half an hour. Consistent winners can be worth hundreds of patacas."

All forms of gambling, even the cricket matches, are strictly controlled in Macao. The syndicate that holds the concession from the government pays handsomely for its exclusive rights. In 1961 the Sociedade de Tourismo e Diversões won the bidding for a 25-year contract. Its announced terms: establish and maintain additional ferries, including a hydrofoil, dredge Macao's Outer Harbor, erect a sumptuous casino-hotel, pay an annual tax that now equals nearly a million U. S. dollars.

Gold Flows In, Then Disappears

Figures on Macao's traffic in gold are harder to come by. Portugal did not sign the Bretton Woods Pact that, at the end of World War II, regulated the international exchange of gold. As a result, its overseas province can trade legally—and freely—in the yellow metal.

Imports of 22.5 tons—some 30 million dollars' worth—were officially recorded in 1968. Exports? Nil. Gold comes into Macao in brick-size ingots via Hong Kong; it has been properly bought—usually through banking circles in London. A fraction becomes the gold jewelry that abounds in Macao shops (page 522). The rest disappears.

"Where does it go? To make rich people richer," quipped my journalist friend Edmundo J. Martinho-Marques.

"The ingots are melted and the gold is divided into small, easily handled packets. Then it goes abroad by devious means, most of it to India, China, and Southeast Asia.

"You see, people in the Orient don't trust paper money. They prefer to put savings into something more dependable, like gold. And they're willing to pay a premium to get it."

I met a Chinese fisherman who admitted

Where pirates plundered, the Red Chinese patrol as doggedly as the Portuguese once did. Communist gunboats, on the alert for smugglers who ship gold, drugs, or refugees across the border, often stop and search the great batwing fishing junks. This flag-laden gunboat carries an overload of soldiers on an excursion through the Inner Harbor. The Portuguese in the 16th century won Macao from China as a reward for dispersing a band of pirates, one of many that have plagued this coast.

Refugees from Red China make former wastelands bloom. Tilling empty land near the Outer Harbor, they raise six to eight crops of vegetables a year, including string beans, cabbage, turnips, spinach, and radishes. Here a farmer dips water from a pond filled by August rains. Much of the city's drinking water comes by pipe from China.

he bought gold with the patacas he earned, and kept it in secret hiding places on the junk that was both workboat and home for him. He made me promise not to use his name.

"The sardines and small fish I catch I deliver to Lapa Island across from Macao—to meet the monthly quota the Communists set as a tax for fishing in Chinese waters. But the groupers and prawns I sell for a good price in Macao. And buy gold."

He had been reluctant to talk to an American, and I asked if this meant he favored the Communists—or feared their disapproval.

He hesitated a moment. "I am not a Mao Tse-tung Communist," he said. "Neither am I a Chiang Kai-shek Nationalist. I just want to live my life in peace. But Chairman Mao has made China important among nations of the world. And I am a Chinese."

I think he expressed the feeling of the average Chinese resident of Macao.

Syndicates Help Pay the Bills

Aside from fish, Macao has few natural resources. It must import practically everything its people use. Without income from gambling, gold, and tourism to balance its trade deficit, it would wither. And the gold and gambling syndicates contribute to its existence in other ways—by putting up part of the prize money for the Macao Grand Prix, biggest automobile race in the Far East, for example. And supporting local welfare.

Macao has a long tradition of humanitarian activities. It sheltered Asian converts to Christianity who had to flee from waves of oppression in their native lands. It provided asylum in World War II for refugees from Hong Kong during that city's occupation by the Japanese. And in recent years it has been a haven for fugitives from China.

That stream of refugees hit a peak of 1,200 a month in June 1962. Many went on to Nationalist China on Taiwan.* Others managed to qualify for entry into Hong Kong, where, after a period of residence, they may become eligible for naturalization.

"But a backlog of some 70,000 remains," William K. McCoy told me. As representative of the High Commissioner for Refugees, the pipe-smoking Australian heads United Nations relief work in Macao.

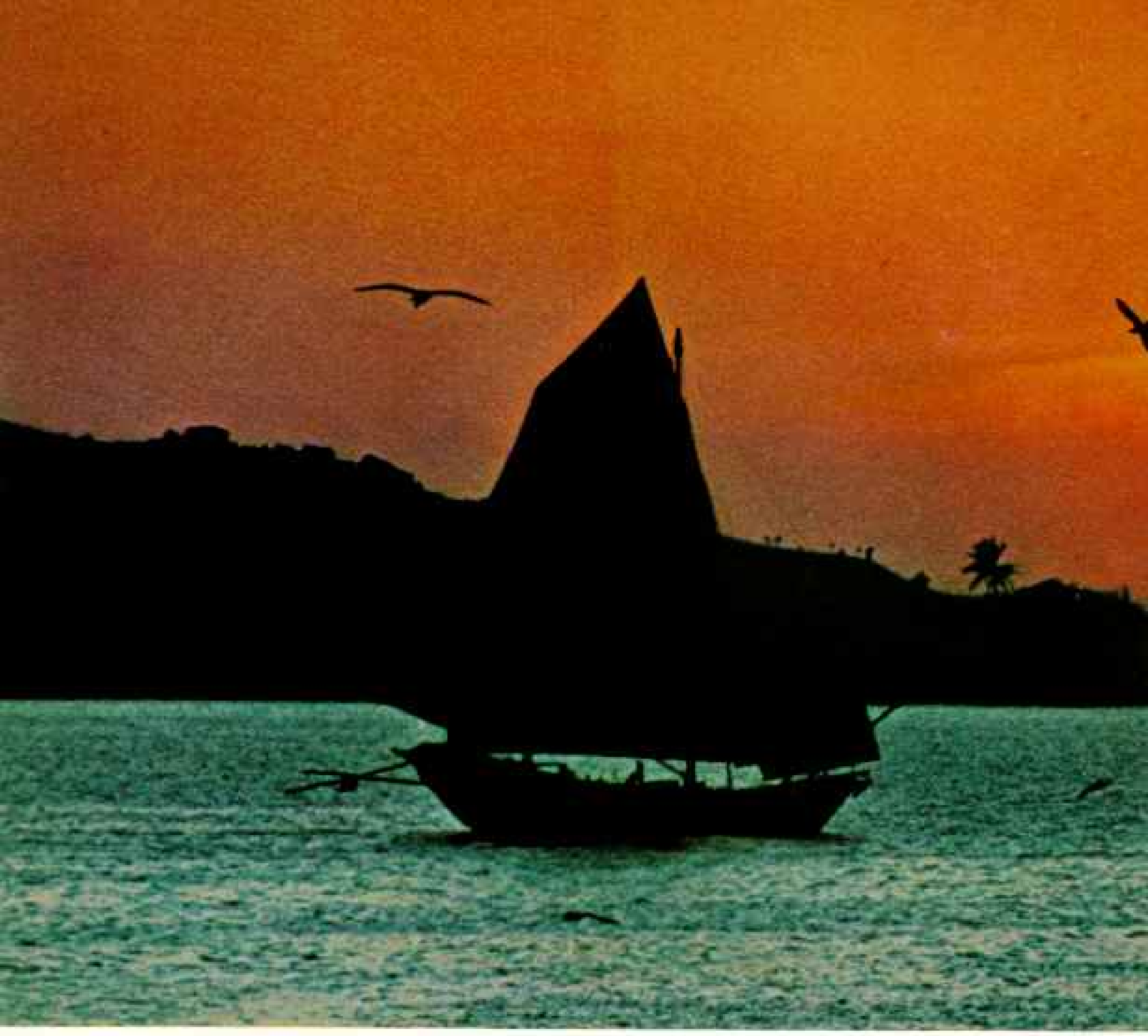
"Since the 1966 rioting here, fewer people have fled China," Mr. McCoy said. "Terms of the agreement ending the troubles provide that unauthorized entrants must be returned."

*See "Taiwan: The Watchful Dragon," by Helen and Frank Schreider, GEOGRAPHIC, January 1969.

Grim-faced disciples of Mao Tse-tung parade with pictures of the Chairman of the Chinese Communist Party and banners proclaiming his "invincible thoughts" (right). Marching below hilltop Guia Lighthouse, they commemorate a victory. After riots disrupted the city late in 1966, the Portuguese yielded to Red demands, including a ban on Nationalist Chinese activities and the return of any refugees requested by China. Instead of taking over the administration, local Communists pressure officials and mold public opinion.

Revolving door for the Reds: Businessmen travel to and from Canton, only 60 miles away by ferry, via heavily policed, Communist-owned Wharf 14. The pier also marks journey's end for a trickle of immigrants—the old and disabled—granted exit permits by the Reds. Here a son has just greeted his mother, newly arrived from China. Before the Communist clampdown of 1966, as many as 1,200 refugees a month escaped to Macao.

DR. K. K. HUI MEDICO



Beneath the flaming eye of the setting sun, fishing junks slip past the Communist

At first seven or eight a month were sent back, but then the number declined. No one wants to estimate how many reach Macao without being detected.

Travel through the Barrier Gate between Macao and Red China is strictly controlled. Trucks that carry foodstuffs or goods get a careful searching by Communist guards. Documents that allow individuals to pass are hard to obtain. Few persons dare try to sneak past the surveillance of Red pillboxes along the border. Some slip in by sampan or junk, or swim the gunboat-patrolled waters between Chinese islands and Portuguese territory. But the hazards are great.

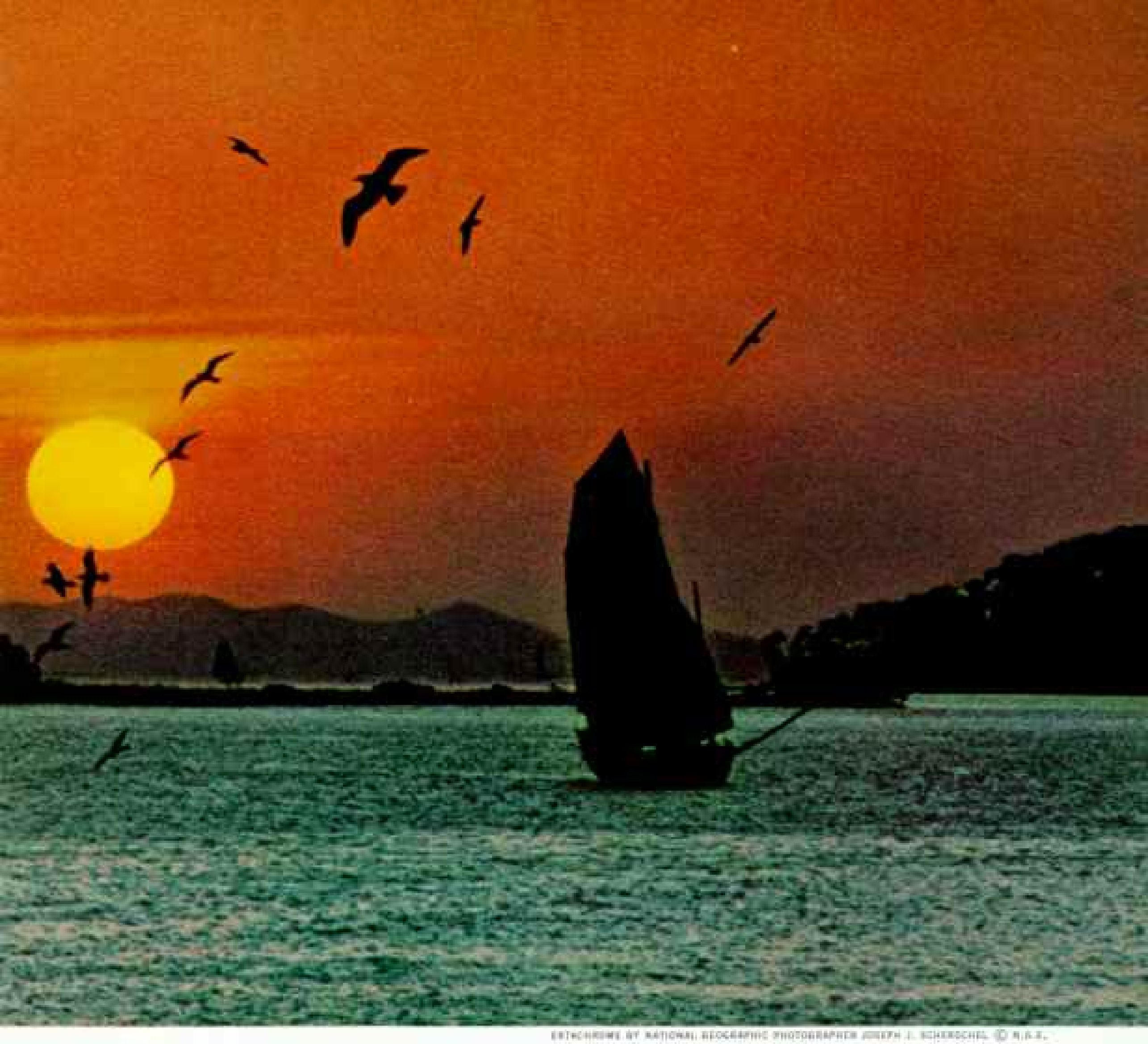
"Four youths once tried it," Father Lancelot Rodrigues told me when I visited him in his cluttered office. The curly-haired, personable priest heads Macao's Catholic welfare organization. "Three drowned in strong currents. One made it after seven hours in the water, buoyed by an inflated football bladder.

"Many of the postwar refugees were the aged, the maimed, the blind, the drug-addicted, the sick. People the Communists called 'useless mouths' found it easy to get permits to leave China legally," Father Rodrigues said. "We've tried to do what we can for them."

Heroin Replaces "Dream Pipes"

Mention of drug addiction reminded me of my visit to the Macao Government's rehabilitation center for addicts on the island of Taipa. There I talked about the drug traffic with Capt. H. M. Lages Ribeiro, the province's deputy police chief and director of the center.

"Beginning in 1945, progressively stricter laws and enforcement gradually put an end to the divans where addicts smoked opium in 'dream pipes,'" he said. "By 1962 the dens



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

islands that ring Macao and head for the sanctuary of the Inner Harbor.

had disappeared. Now heroin, smuggled in from abroad, is our problem."

Stamping out traffic in the vicious white powder poses difficulties, the youthful captain explained. "A vendor can hide a packet in a hole in the wall or in the fork of a tree. Later he collects from a buyer and gives directions to the hiding place. It's hard to catch the seller with the goods."

In its drug problem, Macao is no worse than any other city of its size, Captain Lages Ribeiro believes. Most addicts are pedicab drivers, porters, or laborers. The rehabilitation center provides medical treatment, tries to teach inmates a better-paying trade, and helps them overcome psychological problems that led to dependence on drugs.

A haven for the unfortunate, the oppressed, and the refugee through the centuries, Macao has a humanitarian side of which the world has heard little. No one knows how many lives it has saved. As one of its bishops put it, "If Macao hadn't existed, it would have been necessary to create it."

There is a sonnet carved in stone on a wall in Camões' Gardens which calls Macao "Gem of Orient Earth." Poetic license may make it so. Yet to mother Portugal today, its overseas province retains little but sentimental value. To China, which could walk in at will, it remains a discreet door for trade with the non-Communist world—one whose veneer of Portuguese sovereignty apparently suits China's purpose.*

And this I can add. Its blend of southern Europe and giant China has steeped for 400 years and offers a memorable serving for all who pause to savor its charm. THE END

*See "Macau, a Hole in the Bamboo Curtain," by George W. Long, NATIONAL GEOGRAPHIC, May 1953.

Nomad

Article and photographs

Hardy walrus hunters, Eskimos from Little Diomede Island prowl the waters of Bering Strait. Spying a herd sunning on an ice floe, the man in the stern has cut the outboard motor; now all hands paddle quietly toward the huge mammals, which provide Eskimos with ivory for carvings, skins for their boats, and meat for food. Marine compass, walrus tusks, and sealskin floats—used to keep dead animals from sinking—crowd the vessel. The left hand of Frank Kayouktuk, center, was mangled on a hunt long ago when it caught in the leather thong of a harpoon.

in Alaska's Outback

by THOMAS J. ABERCROMBIE, National Geographic Foreign Editorial Staff

"*AIVIK!*" shouted the Eskimo from the bow of our skin boat. "Walrus!" Behind me, John Iyapana chopped the outboard motor and flipped his cigarette into the sea. Squinting, I scanned the white horizon.

We were seven: six Eskimos from Little Diomede Island and myself. For two days we had hunted the open water among the ice floes here in the middle of the Bering Strait. Twenty miles to the east stretched the gray outline of Cape Prince of Wales, westernmost reach of the North American Continent. To our west I could make out the snow-covered hills of Siberia (map, page 548).

A hundred yards ahead of us were the walruses, dozing in the sun on a crumpled slab of sea ice: two bulls, maybe a dozen females. We coasted silently toward the herd, leveling six rifles—and one camera.

Crack!

Frank Kayouktuk fired the first shot. The nearest giant went down. Another made for the safety of the sea, but was stopped by a well-aimed bullet. Two more were hit as they splashed into the water. We paddled hard to lasso them before they sank.

"Watch 'em!" John shouted. "They're mad!"

Suddenly one of the bulls charged straight for our walrus-skin boat. We tipped sharply as the hunters leaned to fire. Instinctively I scrambled to the high side.

To my horror the other bull surfaced not 20 feet away, spouting blood and anger. I shouted a warning, but the others were too busy fending off the first walrus with paddles and rifle butts. Water spurted in through a stray bullet hole just below the gunwale.

I dropped my camera and dug furiously under my parka for my .44 magnum revolver. Leveling it with both hands, I fired three deafening shots. The monster rolled belly-up a few feet from the boat.

Still shaking, I helped John hook a line around a flipper. It took all seven of us to drag the beast onto the ice; it was 12 feet long and weighed easily a ton.

John hurried us along with the butchering (pages 544-5). "The ice pack is moving," he said. "Five miles an hour anyway."

Startled, I checked our bearings. Before the shooting I had noticed Fairway Rock, an islet in the middle of the strait. It had been only a mile or so east of us. Now it lay south—and nearly out of sight. How could that be? There wasn't a breath of wind; the water between the floes was glassy.

"You don't feel the wind because the whole ice pack is moving along with it," John explained. Hunters had sometimes been carried far out to sea. A few had never come back.

Quickly we finished, loading the tusks and skins into the boat. The meat caches back on Little Diomede were already full, so the Eskimos saved only the tastiest morsels. These included the hearts, the livers, and best of all —so they insist—the stomachs, full of half-digested clams. John passed me a handful as we climbed back into the boat.

"A good hunter deserves a treat," he said, smiling at my squeamish expression. "And these clams are best while they're still warm."

A poor Eskimo I'd make, I thought as we churned back toward Diomede. I could relish the adventure of their hunt—but I'd never survive their feasts.

Slowly the island of Little Diomede took shape, a bleak mound two miles long and a quarter of a mile high.* Soon the echo of our outboard was flushing swarms of auklets and murres from their cliffside rookeries. As we rounded the island's southern flank, another, larger piece of land loomed into view. Soviet Russia's easternmost rampart, Ostrov Ratmanova—Big Diomede, as we call it—stood less than two and a half miles away.

"The Eskimos on Big Diomede were our friends," John said. "Often I visited the island as a boy. But in 1948 the Russians arrested a boatload of visitors from our village and held them prisoners for almost two months.

"That was our last contact with the island. Now it's a military base. The Eskimos there were taken away—we don't know where."

Between these two estranged islands runs the Date Line. Big Diomede is not only in another country, but in another day. On a clear day you can see tomorrow!

Carvers Multiply Ivory's Value

"*Kayakoi!*" shouted the cluster of parka-clad children on shore. "Boat coming!"

Half the village turned out to help us haul the skin boat up onto the boulder beach and unload the tusks and hides. Ignaluk is Little Diomede's only village, a jumble of wooden huts propped with stilts—home for some 80 citizens. We walked up stone steps, shored with the giant ribs of whales, past the school and the new prefab hospital to John's house. He led me through the rock-lined tunnel entrance, and we popped through a trap door into the center of the single main room. A small skylight in the ceiling was the only window; a seal-oil lamp provided heat. John's

*See "Alaska's Russian Frontier: Little Diomede," by Audrey and Frank Morgan, GEOGRAPHIC, April 1951.

wife served us a plate of walrus liver as we warmed our hands and talked.

The Diomeders thrive on the abundance of seals, whales, and walruses that funnel regularly through the strait. In summer they net auklets and collect murre eggs from the steep slopes above the village. But their only money crop is walrus ivory. Islanders spend the winter carving small polar bears, arctic foxes, and birds. A pair of large tusks may weigh 20 pounds and bring $40 as raw ivory—or 10 times that much as finished carvings.

"Outboard motors and rifles have changed our lives," John admitted. "But hunting the walrus or the whale is still a man's job." I couldn't agree more. But then I had been flying around Alaska's Arctic all summer. Along the way I had met few weaklings.

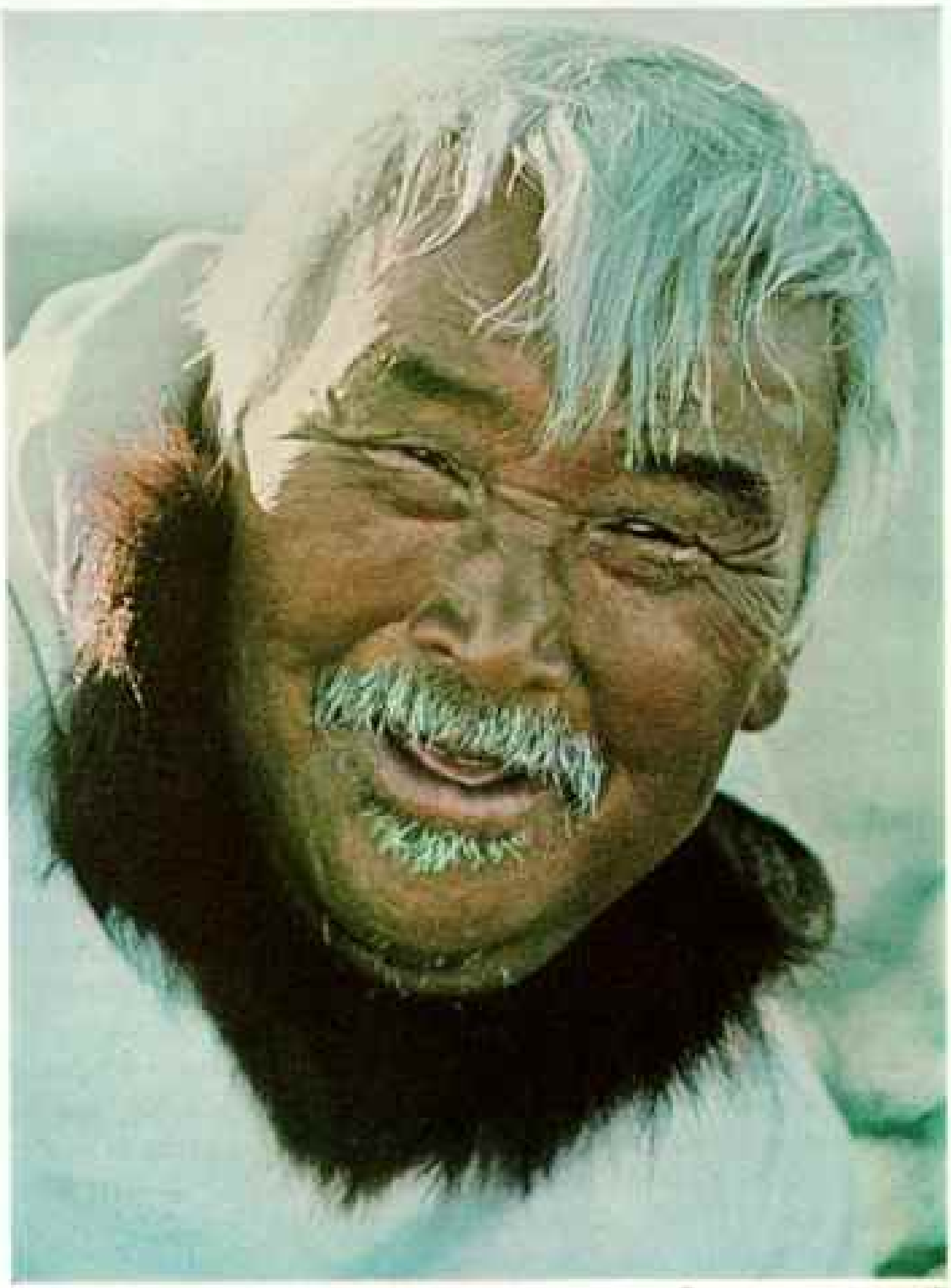
With me was bush pilot Ken Armstrong, a burly 30-year veteran of Alaskan flying. Happy-go-lucky on the ground, he was all business behind the controls, and he flew a plane as if it were part of him. Ken had taken time off from prospecting in British Columbia to show me around the Arctic he knew so well, and to coach me in the subtle skills of bush flying.

Next day, when John Iyapana dropped us back on the mainland, we found our red-and-white Cessna still tied down on the landing strip at Wales, where we had left it a week earlier. It looked small against the snow-covered mountains, but this single-engine plane had already carried us 7,000 miles across the United States and Canada from Washington, D. C. (pages 548-9).

No Fence or Road for 500 Miles

It was good to be airborne again. Minutes out of Wales, I eased back on the throttle, leveling out at 7,500 feet, then set course for Nome. Fresh snow had powdered the black buttresses of the Kigluaik Mountains and wintry clouds smothered the valleys. Even in June, Alaska's weather can be obnoxious.

Inside our snug cockpit the purr of the engine was reassuring; the dials on the instrument panel familiar. Course: 121° magnetic.



Face etched by the elements, an Eskimo elder beams his good luck after a seal hunt. Together with the caribou and walrus, the seal has long provided the essential needs of these Arctic dwellers. During the winter, seals swim under the ice from air hole to air hole, for they must breathe every few minutes. Hunkering patiently over an opening, the hunter shoots his quarry, then harpoons it to keep it from sinking.

For thousands of years the Eskimo has focused his skill on the task of surviving in an icy wasteland that stretches from the northeast corner of Siberia across the Arctic reaches of Alaska and Canada to Greenland. He not only won the fight, but also created a distinct culture rich in art and folklore—only to see it threatened by the march of 20th-century technology.

Air speed: 160. Manifold pressure: 22 inches. Fuel flow: 11.5 gal./hr. I tuned the dial of the radio direction finder on 850 kilocycles, KICY in Nome. While I checked bearings, the station blared hymns and the latest news.

"Alaska and flying have changed plenty since I came here in the early thirties," Ken said. "New airports—there are more than 500 now in the state. Weather broadcasts every half hour. Radio beacons to steer by.

"But she's just as big as ever," he added. "Where else in our country can you fly 500 miles without seeing a road or a fence?"

Cities Compete With the Call of the Wild

Some old-timers complain of Alaska's "population explosion," but the place doesn't strike me as crowded. By far our biggest state (586,400 square miles), Alaska claims the fewest citizens: 272,000. Imagine scattering the people of a single city like Akron, Ohio, over the combined area of Texas, California, and Montana, and you have an idea of the population density: an average of two square miles of elbow room for every Alaskan.

In Alaska the lure of the city rivals the call of the wild; more than a third of its people now live in the greater Anchorage area. But it was the rural Alaskans we had flown north to find: trappers, miners, scientists, fishermen, farmers—and the Eskimos who settled in this rugged land in prehistoric times. In all we covered more than 40,000 miles to meet these outback Alaskans. One of our first stops was Nome (map, page 548).

Nome has declined since its gold-rush days. Its population, once unofficially listed at 20,000, has withered to a mere 2,300. Seventy percent of the residents are Eskimos.

Living in a harsh and unpredictable land has made Alaska's Eskimos an adaptable people. Yet the jump from Stone Age to Jet

EKTACHROME (ABOVE) AND KODACHROMES BY THOMAS J. ABERCROMBIE © N.G.S.

Reaping a harvest of the north

TO PROTECT its walruses, Alaska sets a limit for resident hunters on cows and young, and discourages nonresidents by requiring a $100 license to shoot one bull. For the Eskimos, outboard motors and rifles add modern touches to an age-old pursuit. Drifting toward their quarry, they take aim (above). Shots strike a 12-foot giant weighing a ton, then another and another. Two bulls, wounded as they flee to the water, charge the boat until more bullets dispatch them.

Desperately the men work to lasso the animals before they sink. Then they drag them onto an ice floe (left) not far from Fairway Rock, where they dress the carcasses. Ever-moving—at a speed of some five miles an hour—the floe nears the two Diomede Islands in the middle of Bering Strait. Only 2½ miles of water separates Soviet-owned Big Diomede, left, from Alaska's Little Diomede. Between them runs the Date Line. From Little Diomede on a clear day, says author Abercrombie, "you can see tomorrow."

Age has been a strain. Some, like the Diomeders, prefer to stay isolated, tasting civilization in small bites. Others plunge into the 20th century and emerge successfully as merchants, mechanics, artists, teachers, and airline pilots. All too many wind up in between.

One pathetic old-timer from King Island summed it up for me. "Before the missionaries came, we lived underground in sod houses and laid away our dead out on the tundra," he lamented. "Now we live above ground and bury our dead—and I haven't really been warm since."

The Alaskan office of the Bureau of Indian Affairs is charged with the job of helping Alaska's 54,000 Indians, Aleuts, and Eskimos adjust to changing times. The B.I.A. has built and staffed schools in the remotest back country. In addition it conducts programs to make local native economies more viable.

Caribou Lead Reindeer Astray

One of B.I.A.'s most interesting ventures is a reindeer ranch a few miles north of Nome, with a model herd of 1,400 animals. In charge of the experiment is tall, bearded Dave Scott. He outlined the project as we hiked across the tundra, cutting off a dozen strays.

"We're trying to help a few Eskimos make the transition from hunter to herder," Dave explained. "The herder can sell the meat; the hides are valuable as glove leather. We've even found a market for the antlers. In Japan they grind them up to make an aphrodisiac.

"Our idea is to lend, say, 500 reindeer to a potential herder," Dave continued. "He can pay them back to our model herd after a five-year period, when his animals have had time to multiply."

The caribou poses a problem to herders, Dave noted. This wild native cousin of the reindeer migrates through the rangelands, leading the tame herds away.

It was probably the caribou that led Eskimo predecessors across from Asia, too. Geologists have found that during the Ice Age, as recently as 10,000 years ago, a vast area between Siberia and Alaska lay above water. Most likely, North America's first inhabitants followed the roaming herds across this land bridge. Now archeologists are finding concrete evidence of such ancient peoples.

Taking off from Kotzebue, Ken and I flew 120 miles up the serpentine Kobuk River and landed on a curved stretch of gravel wash at Onion Portage. Here we met a group of archeologists from Brown University, headed by Douglas Anderson. They were at work with shovels and wheelbarrows, patiently peeling away layers of the high riverbank.

Rising Seas Flooded Stone Age Villages

"Some early Arctic peoples probably built their villages along the coast, where fish and game were plentiful," Doug explained. "So when the glaciers of the Ice Age finally melted, the rising seas flooded most of their ancient sites. Fortunately others lived inland. The Kobuk here is full of salmon and its cousin the sheefish. This high bank was a perfect place for spotting herds of migrating caribou. For centuries hunters have been camping here."

Doug pointed to a pattern of stones set in the wall of one of the trenches. "This is the remains of a hearth in one of the dwellings we found buried here. Carbon-14 tests put it at about 2000 B.C."

I followed Doug down steps cut into the light-brown silt. Round key tags pinned to the side of the trench classified more than 50 different layers, each marking a period of habitation. With a hand trowel he scraped away the dried earth at the bottom of the 13-foot-deep trench.

"Here is the earliest period we've discovered so far, a layer of debris left on the ground by people living here, we believe, as early as 15,000 years ago. It's the oldest sign of man found anywhere in the Arctic."

To Doug and his colleagues the layers read like pages of a history book—an account of Alaska's early inhabitants. What's more, many of the "pages" are richly illustrated.

"From the artifacts we find in the dated layers we can now date other sites scattered around the Arctic," Doug said, showing me a handful of fishing lures, combs, and harpoon

Storm waves of centuries past give distinctive design to the sediment that created jutting Point Hope, which shields Marryatt Inlet from the ice-studded Chukchi Sea. The tiny Eskimo settlement on the cape sits amid the ruins of a village that housed more than 4,000 people at least 2,000 years ago—one of the oldest and most highly developed Arctic communities yet found. The brief summer brings relief from snow and sub-zero cold; mosses, lichens, and grasses paint the tundra green, and patches of tiny wild flowers speckle it with bright color.

Ermine-clad giant thrusting into the sky, Mount McKinley rises 20,320 feet in its namesake national park—3,030 square miles of subarctic wilderness. Titan of North American peaks, McKinley far overshadows California's 14,494-foot Mount Whitney, loftiest in the U. S. outside Alaska.

In this single-engine Cessna, Mr. Abercrombie and bush pilot Ken Armstrong logged more than 40,000 miles touring widely scattered Alaskan outposts (map, left). "I gained the greatest respect for bush pilots," says the author. "Even in summer the weather is bad more often than good, with frequent fogs and treacherous cross winds. Runways are varied. Often we put down on a riverside gravel bar or mud flat—and even on glaciers."

points carved from bones and antlers. One time-darkened fragment of walrus ivory was etched with a scene showing Eskimos on a whale hunt.

"But our real treasures are these tiny blades of chert," said Doug, laying out half a dozen across the palm of his hand. They were about an inch long and razor sharp. Set as points in the end or as cutting edges along the side of an antler spearhead, they would make a fierce weapon.

"Identical blades have been found around Lake Baykal in Siberia and in Japan's northern islands," Doug said, "demonstrating that ancient peoples in America and Asia have been in contact with one another."

Alaska's biggest—and busiest—Eskimo town is Barrow; population, 1,300. Facing the Arctic Ocean on a wind-swept bight of black gravel 330 miles above the Arctic Circle, Barrow is the northernmost town in the U.S.A.

KODACHROME © NATIONAL GEOGRAPHIC SOCIETY

Barrow Eskimos have been dealing with the white man for more than a century—ever since New England whalers began venturing into the Arctic Ocean. Since World War II they have prospered, helping to build and man the nearby DEW Line station* and the U. S. Navy's Arctic Research Laboratory. In the process they have learned carpentry, plumbing, how to keep books and drive bulldozers—and the discipline of a nine-to-five schedule. To break the monotony, there is always hunting. And after the winter caribou and spring whales come the summer tourists.

Back in 1947, Wien Alaska Airlines in Fairbanks began regular tourist flights to Nome and Kotzebue. Last year the firm, now called Wien Consolidated Airlines, flew 6,000 people on visits to the Land of the Midnight Sun.

As Ken and I tied down our small plane at the edge of the Barrow airstrip, a fresh planeload of Wien's visitors noisily boarded an outsize plywood bus, fitted with giant aircraft tires, for the trip into town.

One of Ken's old friends came over to greet us. He was Tom Brower, a short, round Eskimo wearing sealskin mukluks, gabardine slacks, a caribou-fawn parka, and horn-rimmed glasses.

"Igloo" Boasts All-electric Kitchen

Tom's father, Charles Brower of New York, came to Barrow on a whaler in 1884. He married an Eskimo girl named Toctoo and ran a trading post here for more than 50 years. By the time he died in 1945, he had earned the title "king of the Arctic." Tom still minds the store and has added a cafe and a small hotel. Dodging the tourist bus, we hiked toward Tom's place.

"I get tired of them tourists sometimes," Tom admitted. "Always askin' if they can come and see my igloo."

Actually it was Canada's Eskimos who made the dome-shaped snowhouses famous. Alaskan Eskimos never built them, though they did improvise snow shelters on winter hunts.

Tom's "igloo" turned out to be cozy enough. While coffee brewed in his Philco all-electric kitchen, we pulled up Danish-modern chairs around the fireplace in the walnut-paneled living room. The fireplace was mainly for decoration; like most houses in Barrow, Tom's was heated with natural gas piped in from

*See "DEW Line, Sentry of the Far North," by Howard La Fay, NATIONAL GEOGRAPHIC, July 1958.

nearby wells. In the dining room, children just home from school watched television.

"There are about 150 sets in town," Tom said. "It costs me about $20 a month to hook into our closed-circuit system. We get video tapes of 'Laugh-In,' Johnny Carson—all the latest shows from the Lower Forty-Eight."

In Barrow's streets I ran into the tourists lining up for the dog-sled ride. It was summer and there wasn't a speck of snow, but that didn't matter; the sled was fitted with wheels and balloon tires (left).

"Mush!" yelled the driver, a young Eskimo woman. The dogs—and the tourists—howled with delight, and down the street they rolled, making the gravel fly.

Tourists, Not Miners, Bring the Gold

I followed the crowds of visitors to an Eskimo dance demonstration. Four men beat drums—whale-liver membranes stretched over spruce frames—with long sticks. Women in knee-length "dancing parkas" bobbed rhythmically and chopped the air with karate-like gestures, acting out tales of heroic hunts and witch doctors' plots.

"Pretty square," said the teen-age Eskimo next to me who had paused for a moment at the spectacle. "If you want to see some real Eskimo dancing, come with me." A button on his windbreaker proclaimed "Eskimo Power."

What could I lose? I climbed aboard his Honda, and we sped off to the Polar Bear Theater, a pink frame building at the west end of the town. The last movie crowds were departing. While the seats were being folded up, my escort went to tune up his electric guitar. Soon the floor was full of Eskimo teen-agers doing the frug.

Arctic outposts attract an increasing share of Alaska's pleasure-bent visitors, who last year totaled 100,000. They came by car over the Alaska Highway, by steamer through the Inside Passage,* and by jet. About 700 flew their own planes, as Ken and I had done. Income from the tourist

*See "Alaska's Marine Highway: Ferry Route to the North," by W. E. Garrett, GEOGRAPHIC, June 1965.

Undaunted by snowless streets, eager-to-please Eskimos of Barrow use wheels instead of runners to give warm-weather visitors a ride behind sled dogs. Huskies and Malamutes haul passengers over summer's mud. The dogs pull authentic sleds in Barrow's long, snowy winters.

boom was 36 times that from gold mining. As one travel agent in Fairbanks put it, "Folks used to clamber up here looking for gold; these days they're bringin' it up with 'em."

"Alaskan gold has lost its glitter; it's just a matter of arithmetic," mining engineer J. D. Crawford told me in Fairbanks. "In the 1930's my company had 13 dredges going, manned by 1,300 miners. Gold brought $35 an ounce. Today the official price is still the same—fixed by law—but costs have doubled.

"We still have a couple of dredges going, one on Chicken Creek, another in the Hogatza River," he said. "But unless the price of gold is increased, or gold mining gets a subsidy, we'll soon be out of business."

Two-ounce Nuggets Add Up Fast

Whatever happened to the bearded sourdoughs, I wondered, the rugged boom-or-bust pioneers who had stampeded to Skagway, Fairbanks, and Nome early in the century and

put Alaska on the map? At Bear Creek in the lonely hills 150 miles northeast of Nome, I ran into one of the last of the breed, Beltram T. (Chubby) Douglas. Hard years had creased his face but not broken his spirit.

"I came up here in 1910 by way of the Yukon, and I been chasin' gold ever since," Chubby said. "I've had my share o' luck—once I picked out $1,500 in one day, in two-ounce nuggets—but prospectin' is mostly faith 'n' patience.

Headlights gleam at high noon as William Kaleak drives a snowmobile through the ghostly streets of Barrow, northernmost town in the United States. A simple steeple rises above the quonset hut sanctuary of St. Patrick's Church. Here, on the shortest day of the year, the winter temperature "soars" to −30° F.; only a rosy glow in the south relieves the darkness. Natural gas piped from nearby wells heats the town.

"With a pick and shovel I can dig out enough gold—$5 a day, say—to pay for my grub. Got a helper comin' up soon, and I aim to get three or four sluices goin'. We might make us some real money yet."

Once a month a pilot from Nome brought Chubby news and supplies. The nearest post office, Candle, was a three-day hike. But the isolation didn't seem to bother him.

"Not on your life. It's a sight better 'n puttin' up with all those city slickers," he said. "Most of 'em these days couldn't even build a fire in a stove. That's why I finally moved out of Fairbanks when it got too crowded—and Nome. I figger when you can't hear a wolf howlin' at night any more, things is gettin' too crowded."

Problems Come With Pay Dirt

Today, one-man mines like Chubby's are rare. Alaska is rich in minerals, but exploiting them for the competitive world market demands men, machines, money—and a willingness to gamble.

Take Kennecott Copper's venture at Bornite, a settlement of shiny aluminum-covered prefabs just north of the Arctic Circle. Kennecott had already spent nine years and several million dollars when I visited the site, and development was still in the exploratory stage. The copper deposits were promising, but as often is the case in Alaska, with the prospect of pay dirt came problems.

Bornite was already too crowded for someone like Chubby. Nearly a hundred men were at work. Shaft captain Austin A. Dundas and I pulled on oilskins, rubber boots, and hard hats and climbed into the cage that rattled us slowly downward through layers of shale and dolomite to the main crosscut, 975 feet under the mountain.

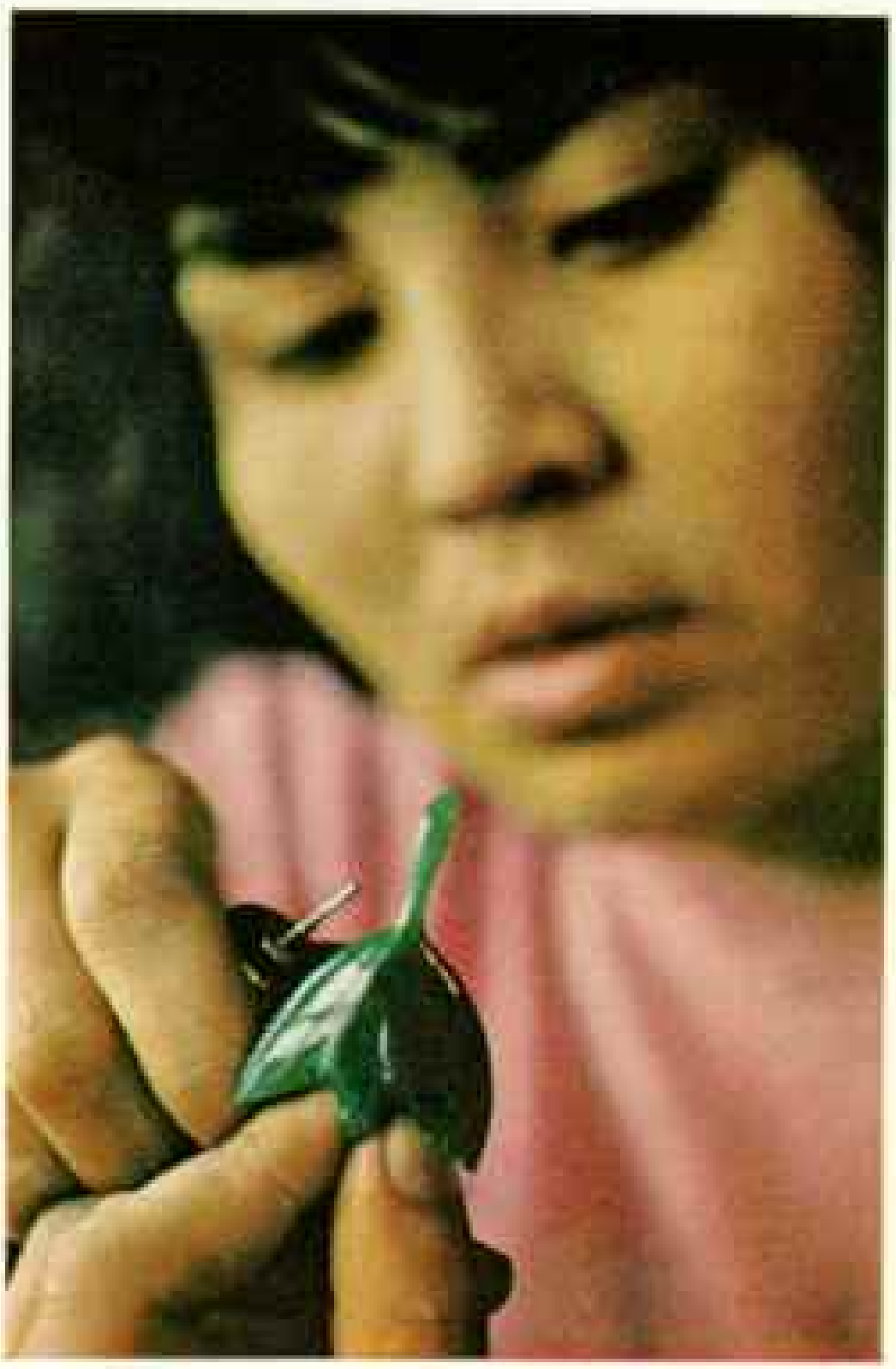
"Back in Utah, ore with 1 percent copper content is considered pretty good. But look at this." From the wall he broke off a choice chunk of the heavy ore. Under our miners' lamps it sparkled an iridescent gold and purple. "The brass-colored mineral is chalcopyrite [fool's gold]—35 percent copper. The purplish mineral is bornite, carrying 60 percent copper.

"It's got to be a rich lode—and a big one—to make an operation worthwhile up here," he said. "Some of what we have found so far is rich enough, but we haven't found enough of it yet to make a mine."

He had to shout over the din around us. Eskimo workmen were drilling blast holes and filling ore cars. Giant pumps whined,

KODACHROME © N.G.S.

Too tough to bite off, *maktak* yields to a pocket knife. The boy races to finish the chunk of whaleskin and fat in an Independence Day contest in Kotzebue. A slip of the blade has cost more than one Eskimo the tip of his nose.



EKICHIRIN © NATIONAL GEOGRAPHIC SOCIETY

Beauty shines from native jade as Doris Lee fashions a swan for a Kotzebue curio shop. Using a diamond drill, she carves the nephrite mined in the Jade Mountains, 125 miles northeast of the city.

Dancing on air, an Eskimo girl at Kotzebue soars 15 feet as men snap a walrus-hide "Trampoline." Sport of blanket-tossing may have originated with Eskimo hunters of old as a means of spotting game in the vast, flat Arctic.

holding the tide against water that hissed in from all directions. It was like walking through a car wash. "It's a tough job—and expensive—just digging out the ore," Dundas said, "and that's only the beginning."

Later, back in his office, Dundas unrolled a large map of Alaska.

"The trouble is, we're out in the middle of no place," he said. "The nearest railhead is down here in Fairbanks [map, page 548]. To reach it, we'd have to build a road 350 miles long. We could barge the ore down the Kobuk by dredging more than 200 miles of the river, but any port we built on Kotzebue Sound could only stay open four months a year. Either way we go, it's an expensive trip."

A more immediate problem than transport developed at Bornite soon after I left. Water began to flood into the shaft at the rate of 20,000 gallons a minute. This new trouble, coupled with the transportation barriers, could delay production for years, Kennecott spokesmen say.

Sockeye Salmon: More Than $1 a Fish

Considering Alaska's 34,000 miles of coastline, it is not surprising that fishing is the No. 2 industry (it was first until oil surpassed it in 1967). Unlike the state's Arctic ports, the southern coasts are open to shipping the year round. But the fishing itself is mainly for salmon, which are seasonal.

As a result, a town like Naknek, just off Kvichak Bay, stands almost deserted most of the year. Then, in June, airliners begin bringing in fishermen and cannery workers from as far away as California for the madcap month-long run of red sockeye salmon.* Ken and I arrived at the height of the run.

We buzzed the canneries that cling to the muddy banks of the Naknek River. Then, dodging power poles and pickup trucks, we touched down between two rows of houses. A Naknek street served as our runway.

Over at the Nelbro cannery, the fleet was waiting to pounce on the next tide. I sought out the *Neva*, one of the beamy little 32-footers, and found her skipper, salty Sigurd Lundgren, tuning the engine. Sig, I was told, had been fishing and trapping around Bristol Bay for more than 35 years. So far his *Neva* was the season's "high boat," making the biggest catches of the fleet.

"The season is short, but the average price is more than a dollar a fish," Sig said between

*See "The Incredible Salmon," by Clarence P. Idyll, NATIONAL GEOGRAPHIC, August 1968.

Gales and churning seas batter the salmon boat *Cherie* as she struggles across Kvichak Bay. Wheeling gulls snap up small fish whirled to the surface by the craft's propellers. Each summer Bristol Bay swarms with salmon fishermen. After oil, seafood brings Alaska its greatest income—$200,000,000 in 1968. Several rivers on the Bering and Chukchi coasts recently were opened to commercial fishing as an aid to the Eskimo economy.

puffs on a giant stogie. "My boat holds 4,000 sockeye, and I aim to fill 'er chock full."

After midnight we moved out of the Naknek River and turned north across Kvichak Bay. Just off the mud flats we hovered, waiting for the 4 a.m. opening of the next fishing period.

The Alaska Fish and Game Department sets the open periods according to the results of their offshore sampling and fish counts on rivers and streams. The idea is to let enough salmon reach fresh water to spawn future catches. Periods are strictly enforced; patrol boats and spotter planes discourage poachers.

In the first gray of dawn, bobbing lights around us materialized into other boats.

"It's gonna be crowded," Sig noted. "Let's get the nets ready."

At four o'clock sharp the scramble began. Sig's helper and I began feeding 150 fathoms of nylon gill net over the stern. Sig,

Alaska's busiest seaplane base, on Hood Lake near Anchorage, requires a control tower to handle its 130 float planes. Hangars that house and service the craft of commercial companies edge the shore. But most of the planes moored in these waters and adjoining

Lake Spenard are privately owned. In a land of few highways, lawyers take to the air to visit clients, doctors to see the sick, and clergymen to call on their scattered parishioners. Forests of black spruce and golden-leafed aspen mantle the shores of the lake.

EKTACHROME © N.G.S.

Starting their journey to the world of high fashion, Alaskan furs emerge from a storehouse on stilts. With the temperature hovering at −50° F., trapper Joseph Delia shows off ermine, lynx, marten, mink, red fox, river otter, and wolverine. He markets his pelts in Anchorage, 65 air miles to the southeast. Metal-sheathed posts protect the cache from mice and other skin-chewing vermin. A 20-year veteran of the Alaskan wilds, Delia lives with his wife and young daughter in a comfortably furnished wood-heated log cabin near Skwentna.

swinging the *Neva* around in a slow, wide arc, kept one eye on the rest of the boats and another on the muddy shoreline that rapidly changed shape with the tide.

By noon we had made three hauls, and the hold was half full of flapping fish. But the skies to the south were lowering and the wind was up. Over the radio I could hear boats farther down the bay calling for help. Four-foot waves slapped and tossed us, and flying spray had long since wilted Sig's cigar. I could see other boats were making a run for the shelter of Copenhagen Creek.

"O.K., let's get out of here," Sig shouted. "I'm not hiding and letting this load of fish spoil." He swung the bounding *Neva* into the wind and headed back across the bay.

Fleeing Tide Strands Tardy Boats

Behind us several boats were in serious trouble. They had waited too long to haul nets, and the wind had blown them aground. Now they were left high and dry by the plummeting tide. Two were at least a quarter mile inland!

"That's what happens when you push your luck," Sig shouted. "Next thing you know, you're homesteading!"

Neva's bow bored into the mud-colored waves, shooting huge arcs of spray to each side. On the way back to Naknek it was all I could do to hold on. Later, unloading our catch at the cannery, we learned that the winds had been blowing 70 miles an hour—just below hurricane force.

The cannery buyer tallied Sig's catch, nearly $2,500. It seemed like a lot of money. "Nobody can say we didn't earn it," Sig declared. "And we'll need every cent. It's going to be a long winter."

Many Alaskans whom I met felt winter was the best time of year, despite the days of searing cold that ended with a 2 p.m. sunset. In Barrow and across the Far North from mid-November to late January, the sun doesn't bother to come up at all (pages 552-3).*

Much of the state closes down, waiting for the spring thaw, but for many Alaskans, like the trappers, winter is

*The author has known sunless latitudes at both ends of the earth. He made many of the photographs for the late Paul Siple's historic article, "Man's First Winter at the South Pole," in the April 1958 NATIONAL GEOGRAPHIC.

the busy season. To me the silent frozen rivers and white slopes, the snow-laden spruce trees, the brittle birches sparkling with rime have a beauty all their own.

In the midst of such a December landscape I found Joe Delia's log cabin in the village of Skwentna, barely an hour's flight northwest of Anchorage. Joe was getting half a dozen traps ready to add to his line. He had been trapping around Skwentna for years. The 55-below-zero cold was no novelty to him. Snug in my down-filled parka and windproof trousers, I was surviving at least.

"The biggest danger with this cold is getting wet," Joe said. "A couple of years back an old-timer broke through while crossing a creek. They found him frozen stiff, bent over a pile of sticks. He didn't get them lighted in time. His dogs were still howling, harnessed to the sled.

"I got rid of my dogs a year ago when I bought my snow machine," Joe went on. "They were good company on the trail, but slow—and expensive to keep in feed the year round.

"With the dogs it took a week to cover my 75 miles of trapline. That meant spending many nights out on the trail. Now I can make the whole circuit in two days."

Wise Trapper Reads *Vogue*

Starting his motorized sled in the cold was a problem, but we lighted a small Primus stove, slid it under the engine, and in 15 minutes it was ready to crank up. I got on behind Joe and we drove down the frozen Skwentna River to Eightmile Creek to set the new traps. They were for lynx, and Joe carefully cocked each one and baited it with scent —his own concoction of mink musk, catnip, and lard.

"I'm working lynx harder this year," Joe said. "Lynx coats have been very fashionable recently, and the demand —like the price—has been going up."

Back at his cabin Joe showed me his growing collection of pelts: marten, ermine, red fox, mink, wolverine, and river otter (opposite).

"Prices for wild mink are down these days," Joe said. "Competition from the fur ranches, mainly, and then fashions are always changing. I read *Vogue* and *Harper's Bazaar* regularly, trying to keep up with the trends."

Pioneer woman of the 20th century, Joan Malone cooks pancakes for her husband Robert, who is out checking his traplines on a frigid winter morning. The wood-burning Yukon stove also serves to heat the one-room cabin, which has neither electricity nor running water. Gasoline lamps provide the only light for Mrs. Malone, an avid reader. A well supplies water in summer, but in the grip of winter she must melt snow for cooking and washing. To shop for supplies, she flies to Anchorage or gives her order to a bush pilot, who does the marketing for her. Her husband, like many other trappers in the Skwentna area, works as a guide in the summer months. Unable to afford a snowmobile—which many hunters have bought—he still uses sled dogs to run his trapline.

Joe's pretty wife Carlene heated a tub of water on the stove for the baby's bath. She said she enjoyed the rugged pioneer life, but admitted it was harder for a woman than for a man.

"I grew up in Vermont, and I'm used to cold winters," she said. "I don't even mind the isolation. But I worry sometimes about little Christine. There are no doctors here, and no schools."

"When Christine reaches school age," said Joe, "I'll have to face up to reality. We may have to leave the wilderness."

Rush for Black Gold Stirs Anchorage

Whenever I came back in from the wilderness, Anchorage seemed terribly civilized. Seaplanes from Hood Lake (pages 558-9) skittered across Cook Inlet, keeping below 600 feet to avoid the supersonic fighters from Elmendorf Air Force Base north of town and the jet airliners from Anchorage International. My own flight pattern into Merrill Field usually brought me down through the thick of it all. On the ground the automobile traffic wasn't much better. The greater Anchorage area has 113,000 people, and everyone seemed to be on the move.

If you search among tall buildings, you can still find a log cabin or two. A few Eskimos loiter down on Fourth Avenue where the Malamute Saloon still advertises "husky" entertainment. But folks these days talk as much about the Spring Music Festival as the February dog-sled races; the Indian princess who runs the souvenir shop spends her winters in Florida, and women coming into J. C. Penney's buy more cocktail dresses than parkas.

Spectacular sky shows brighten the long winter nights for Alaska's year-round residents. This display of northern lights sets the horizon aglow at Trapper Creek, 3½ miles west of Talkeetna. Stars of the Big Dipper, upper left, wheeling through the December sky, show as streaks in this 10-minute exposure. Residents of the region witness dozens of auroras yearly; those in the Point Barrow area farther north see as many as 100.

Snows of early winter pile high outside a one-room school at Trapper Creek, where eight students learn the new mathematics. The pupils, children of homesteaders in the Susitna River valley, live nearby and have only a short walk through the drifts to school. Their teacher, Mrs. Joanne Porterfield, enlarged her log-cabin home to accommodate the class. Despite the short summer, the Porterfields grow vegetables of prodigious size on their 160-acre homestead.

Thoroughly recovered from the disastrous earthquake of 1964,* Anchorage is the focus of another Alaskan gold rush. But it's not picks and shovels the newcomers are carrying north with them this time; it's slide rules and pipe wrenches. The gold they're after is black.

Fifty miles southwest of Anchorage new derricks dot Cook Inlet (pages 566-7). Since Richfield Oil (now Atlantic Richfield) brought in the first wildcat on the nearby Kenai Peninsula in 1957, Alaska has spurted to eighth place among our oil-producing states. Last year it was averaging 190,000 barrels a day.

A big Sikorsky helicopter whisked me across the ice-choked inlet from Kenai to Platform C, operated by Shell Oil Company. The platform is one of 14 "iron islands" set in the water around upper Cook Inlet. It costs $15,000,000 to build a unit like this—and $15,000 a day to run it.

Drilling Superintendent V. F. (Bud) Furry took me on a tour through mazes of screaming pumps and color-coded pipes out onto the main deck, 100 feet

*See "Earthquake!" by William Graves and "An Alaskan Family's Night of Terror," by Mrs. Lowell Thomas, Jr., both in NATIONAL GEOGRAPHIC, July 1964.

above the sea. The derrick itself loomed another 180 feet above us.

"The tower's normal crew is 45," Bud said, "and we divide the work day into two 12-hour shifts. The men work here 10 days, then spend the next five days with their families back in Kenai."

Television and movies help while away the off-duty hours. There is table tennis and a new pool table in the wardroom. The cooks do their part—by turning out three banquets a day. We lunched on thick steaks, New York cut, and baked potatoes with sour cream. For dessert: a choice of lemon pie, strawberry tarts, or cream puffs.

"Icequakes" Rock Alaska's Iron Islands

The platform stands on four huge hollow legs, which reach to the sea floor 130 feet below. A drilling bit, followed by pipe, goes down through conductor tubes set in the legs, each of which can hold eight separate oil wells. On the drilling platform up under the derrick, I watched a crew of "roughnecks" in greasy coveralls and hard hats hoist a mile-and-a-half of pipe out of the hole in clanging 93-foot sections.

"We've already got six wells put in through this leg of the platform," Bud said. "Down below we have to drill out at an angle to set the bottoms of the holes about a mile apart, in order to cover as much of the oil field as we can. That's Willits's problem."

Ken Willits's official title was "directional drilling engineer." We found him in his small lab, getting ready to lower a camera 7,000 feet into the hole.

"This little capsule carries a compass and a small level," Ken explained. "A timer is set to snap their picture after the capsule reaches the bottom. From the readings, we can tell where we're headed and just how much English to put on the drill bit."

No ordinary oil well, Platform C was a complete drilling facility—designed to accommodate 32 wells radiating outward underground from one common point. It seemed like putting a lot of eggs in one basket.

"Maybe," Bud admitted, "but it's the most practical way to do it in this kind of operation. Besides, it's a mighty strong basket.

"This is the toughest place I know to spot a drilling rig," he continued. "It took a lot of special engineering. We're built to withstand the crushing force of ice floes. Sometimes the ice measures five feet thick, and 30-foot tides really push it along. Eighty-mile-an-hour winds, 20-foot seas, and even earthquakes have less effect on us than the floes. We use specially tempered steel in the 18-foot-diameter legs. Ordinary steel would turn brittle and fracture in the low wintertime temperatures, which range down to −40° Fahrenheit."

I peered over the railing, and it seemed as if we were moving. It was the strong tide, rushing cakes of sea ice past us at six knots. I noticed one slab the size of a football field bearing down on us. I flinched as it crashed into us, shaking the whole tower. Then it split cleanly in two.

"It's hairy when the dishes start rattling," Bud laughed. "Sometimes you think those big 'icequakes' are going to bounce you right out of bed."

Before I left Alaska, news of a big oil strike was making headlines. Humble Oil Company and Atlantic Richfield had combined forces to sink a pair of wells near Prudhoe Bay along the remote northern Arctic coast.

Costliest Drilling Job Pays Off

All the equipment, even the derricks, had been hauled in by planes making more than 200 round trips from Fairbanks, the nearest railhead. It was probably the most expensive drilling job in history—and it paid off. While actual production is not scheduled to begin until the 1970's, initial tests of the wells showed flow rates of about 2,500 barrels a day. The Prudhoe Bay reserve has been estimated at 5 to 10 billion barrels of recoverable oil, possibly as large as any existing field in North America. Alaska was bracing for another boom.

Ken Armstrong and I parted at the airport—he to fly our small plane back to Washington, D. C., I to ride in a big jet over the North Pole to Europe for my next assignment. It was one of the many airliners that stop at Anchorage on the short cut from Asia to Europe.

I remember well my last Alaskan panorama

Mournful cry reaches across the Arctic wastes as a sled dog tied to a whale rib gives voice to his loneliness beneath the midnight sun. Already the efficient snowmobile has taken his place in much of this icy terrain. Such is the story of Alaska's north, as time-honored customs pass away and technology speeds the conquest of the frozen outback.

KODACHROME (ABOVE) AND EKTACHROME © N.G.S.

Grease-spattered "roughnecks," as oilfield workers are called, install hydraulic hoses on an offshore drilling rig in Cook Inlet. Black gold—petroleum—lures today's prospectors. Only a few diehard sourdoughs still seek the precious metal.

Island of iron on an ice-clogged sea, an oil rig of the Pan American Petroleum Corporation rides high above Cook Inlet. More than a dozen of these spidery platforms dot the inlet; as many as eight wells extend down through each huge leg. Last year this rig pumped some 6,500 barrels of oil a day. Fast-moving ice cakes often crash against the platforms, rattling dishes in the kitchens and almost tossing sleeping men from their bunks. Helicopter brings a relief crew.

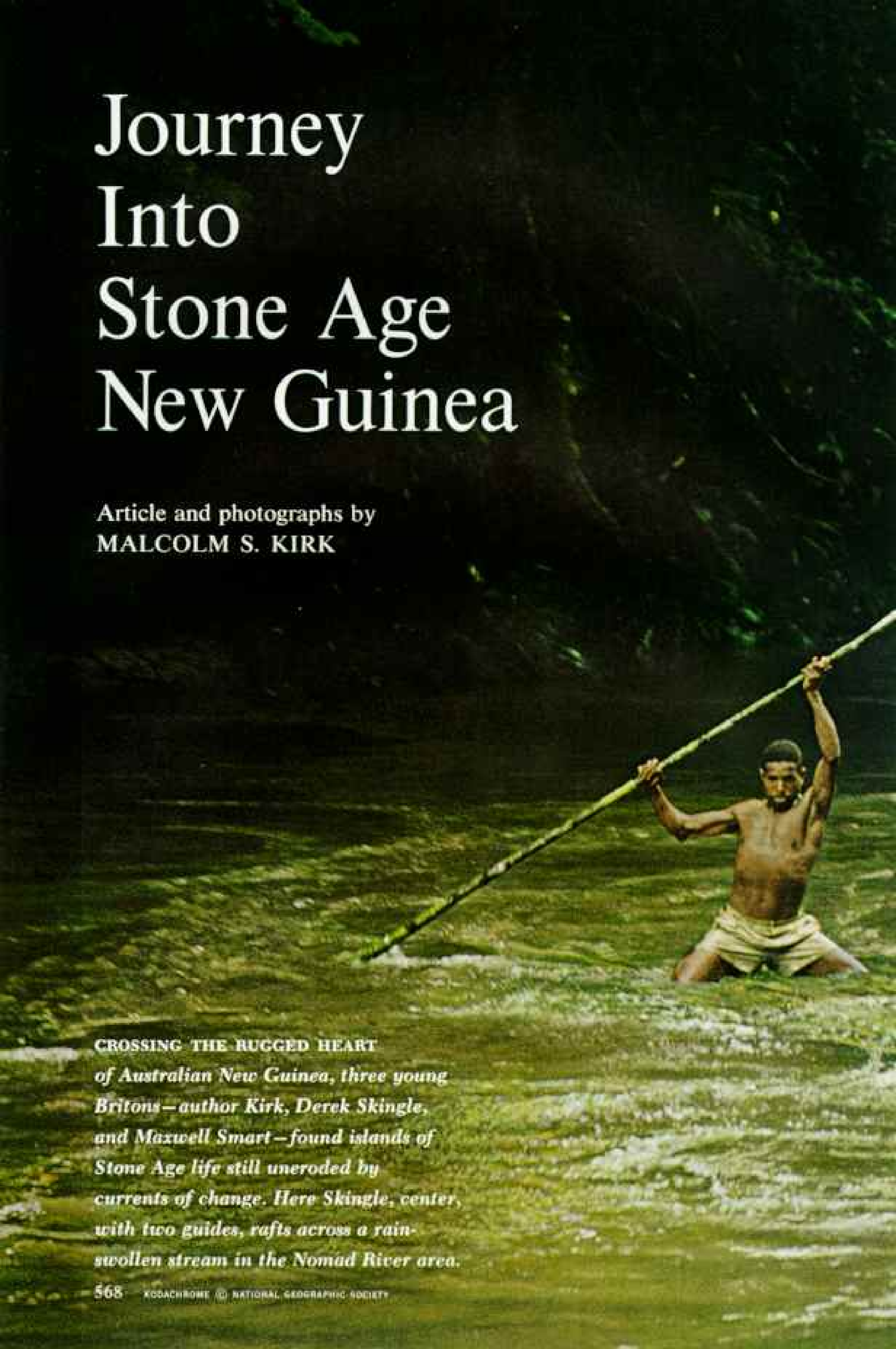
through the window of the jet. Anchorage quickly shrank away behind us, but Alaska's wilderness rolled on for another 600 miles. We skirted Mount McKinley, North America's highest peak (page 548), crossed the Yukon River, the Brooks Range, and the broad tundra slope to the Arctic Ocean.

I thought of all my friends. Far to the west John Iyapana and his Eskimo crew would be heading for the pack ice again to begin the fall hunting. Chubby Douglas must be nailing up his cabin against marauding grizzlies as he readied camp before his annual winter retreat to Nome. Joe Delia would be repairing his traps for the coming season. Drilling crews were moving in heavy equipment to start another winter season on Prudhoe Bay, now just below us. I could see no sign of the drilling rigs; all was lost in the vastness of the landscape that stretched white to all horizons.

It was a howling big land down there, and it took big men to tackle it. THE END

Journey Into Stone Age New Guinea

Article and photographs by
MALCOLM S. KIRK



CROSSING THE RUGGED HEART *of Australian New Guinea, three young Britons—author Kirk, Derek Skingle, and Maxwell Smart—found islands of Stone Age life still uneroded by currents of change. Here Skingle, center, with two guides, rafts across a rain-swollen stream in the Nomad River area.*

Fighting for survival against neighbors and nature, New Guinea's primitive tribesmen live with danger. To subdue the forest, a Biami warrior of the Nomad River region sharpens an adz head, laboriously hand-grinding stone upon stone.

Another Biami (right) peers from a fortresslike home, its doorway forces attackers from other villages to stoop, putting them at the mercy of the defenders. Bodies go bare, but vanity is served by cassowary-plume headdresses, bone nose plugs, and necklaces of seeds and cowrie shells.

A detour off the expedition's main route from Lake Murray to the interior highlands brought the trio face-to-face with these cannibal tribesmen.

SIX HUMAN SKULLS, hollow-eyed and mildewed, gaped out at us from the shade of a boulder in the New Guinea bush. They lay off the end of the airstrip at Tekmin, deep in the folds of the interior highlands.

In weeks of walking across the big island's backbone, we had seen nothing quite like this. I shuddered at the sight.

"They present a bit of a problem," said my host, Ian Flutters, a teacher in the Baptist mission at Tekmin. "We want to extend the airstrip, but the skulls embody a power that we can't just casually push aside."

Ian looked over my shoulder and nudged me. I followed his glance. A group of tribesmen had edged through the tall *pit-pit* grass to watch us closely.

I marveled at the great cassowary quills sweeping out of their pierced nostrils. Possibly the men had known the skulls in life as relatives. Now they revered them, for these weathered, grinning bones were suffused with spirit life.

Speaking pidgin, Ian asked the warriors where the skulls had come from and why they had been placed beside the stone. The older men shook their grizzled heads and grumbled that the skulls were "magic."

"There you have it!" Ian said. "That's why we can't lengthen the airstrip. We would have to move the skulls, and if we did, the tribesmen would be outraged for fear the spirits would avenge the desecration."

Tribesmen About to Step From the Stone Age

Face-to-face with the strength of superstition, I turned to walk the three miles to the Australian Government patrol post in the Oksapmin valley to rejoin my trail companions. The tribesmen stood staring, people on the edge of change but hesitant to take the step.

With two fellow Britons—Derek Skingle, a research chemist working in Australia, and mountaineer Maxwell Smart—I had been following the same "edge of change" across the world's second-largest island, exceeded in size only by Greenland. We had been slipping in and out, from present to past, between yesterdays and tomorrows, seeking in remote mountain villages and valleys the old ways before they faltered and were gone.*

What would we find of those primitive, traditional ways? I had kept asking myself the question while finishing photographic assignments in New York and laying plans by mail with my expedition mates.

"Lightweight shelters, dehydrated food, and air supply are what we'll need," Max Smart wrote from New Zealand —and Max knew the problems, with his wide experience in the jungles of Southeast Asia.

I joined Max and Derek in Wellington, New Zealand. For Derek the trip ahead would offer a chance to collect medicinal herbs used by the primitive New Guinea tribesmen. For Max it would be a challenge to his back-country skills; he would guide us through some of the most difficult mountain terrain on earth. To me, as a professional photographer, the journey would offer an opportunity to record a way of life that civilizing influences must inevitably end.

*See "Netherlands New Guinea," and "Australian New Guinea," both by John Scofield, NATIONAL GEOGRAPHIC, May 1962.

EKTACHROME © NATIONAL GEOGRAPHIC SOCIETY

Through the jungle's everlasting twilight, expedition members hike north from Lake Murray to Kiunga. Mountaineering pacesetter Maxwell Smart leads the group through an eerily quiet wilderness of waist-high vegetation and towering trees. Each pack holds 75 pounds of gear, survival rations, and trade goods. Smart and Skingle (left) carry .22-caliber rifles. All suffer fatigue and attacks from small enemies (opposite).

From Wellington we flew to Sydney, Australia, where we joined my fiancée, Barbara Nyland. She had volunteered to supervise and accompany the flights that would bring our expedition's supplies to two of the patrol posts through which we would be passing.

Our supplies were chosen to win friends, but we also anticipated the chance of meeting enemies. For barter we stocked up with salt, tobacco, matches, axes, and machetes. For security, Max and Derek would carry rifles.

Crossing Made Only Twice Before

We flew north over the Great Barrier Reef and the Coral Sea to Port Moresby, on New Guinea's coastal plain. My mind raced ahead as the plane came in to land, trying to visualize our ultimate goal.

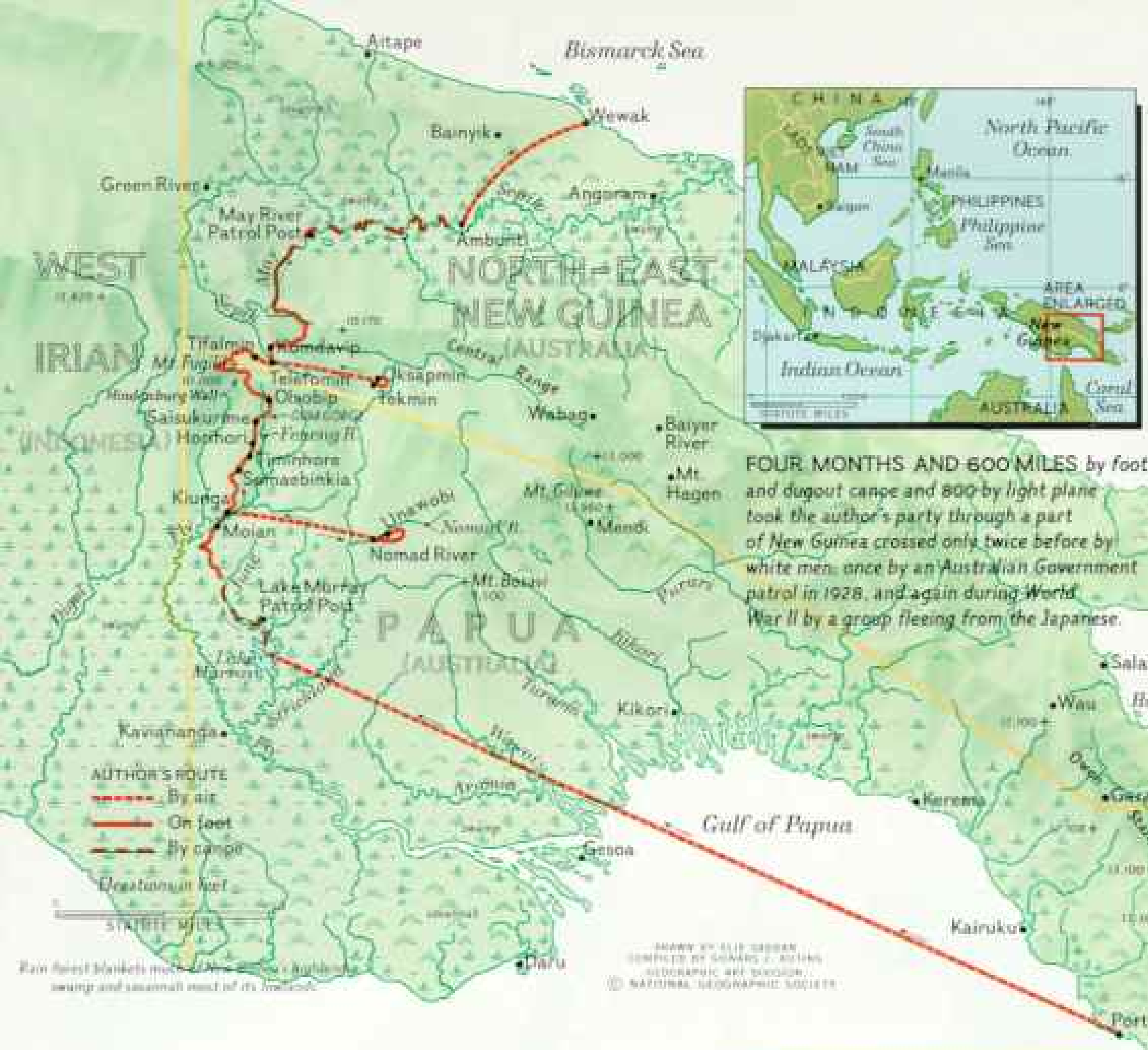
It lay out beyond the coconut palms, past where the dusty roads end, up the headwaters of the Fly River, and finally down the Sepik, through areas almost as little known, really, as the moon. Certainly it would be difficult to reach; the twisting way north from the Gulf of Papua to the Bismarck Sea led through the crumpled confusion of the highlands (map, opposite).

The expedition was, we felt, a last chance for us to get to places the bush planes had yet to reach, and beyond the sputter of outboard motors. We would be crossing the island at its widest part, much of the way on foot. The distance would be 450 miles as the crow flies. How many months on the ground? I wondered.

Only two other groups had ever made this crossing. Australian patrol officers Ivan Champion and Charles Karius succeeded in 1928—after two tries and 11 months. They traveled up the Fly and groped over limestone ridges to the Sepik and the north coast.

This remarkable traverse was repeated in the opposite direction during World War II. To escape capture by the Japanese, a party of five miners and two administration officials led by Jack Thurston, a gold prospector, set off up the Sepik with 80 bearers, and after a five-month trek reached safety at the mouth of the Fly River.

I wrote Champion, and in his reply he described how he and Karius had lived off the



FOUR MONTHS AND 600 MILES *by foot and dugout canoe and 600 by light plane took the author's party through a part of New Guinea crossed only twice before by white men: once by an Australian Government patrol in 1926, and again during World War II by a group fleeing from the Japanese.*

land and bargained with headhunters and cannibals for assistance and food.

"Remember," he cautioned, "we had a train of 36 bearers to help us."

I recalled the letter as we flew in a light plane from Port Moresby northwest to the government post at Lake Murray, our final staging area, and weighed his warning against our own chances.

Bank Accounts Bear Symbolic Names

At Lake Murray we met villagers named for trees, fish, and birds. One man was called "Sawfish" and another "Hornbill." It turned out that this had to do with their savings accounts at the National Bank of Australasia.

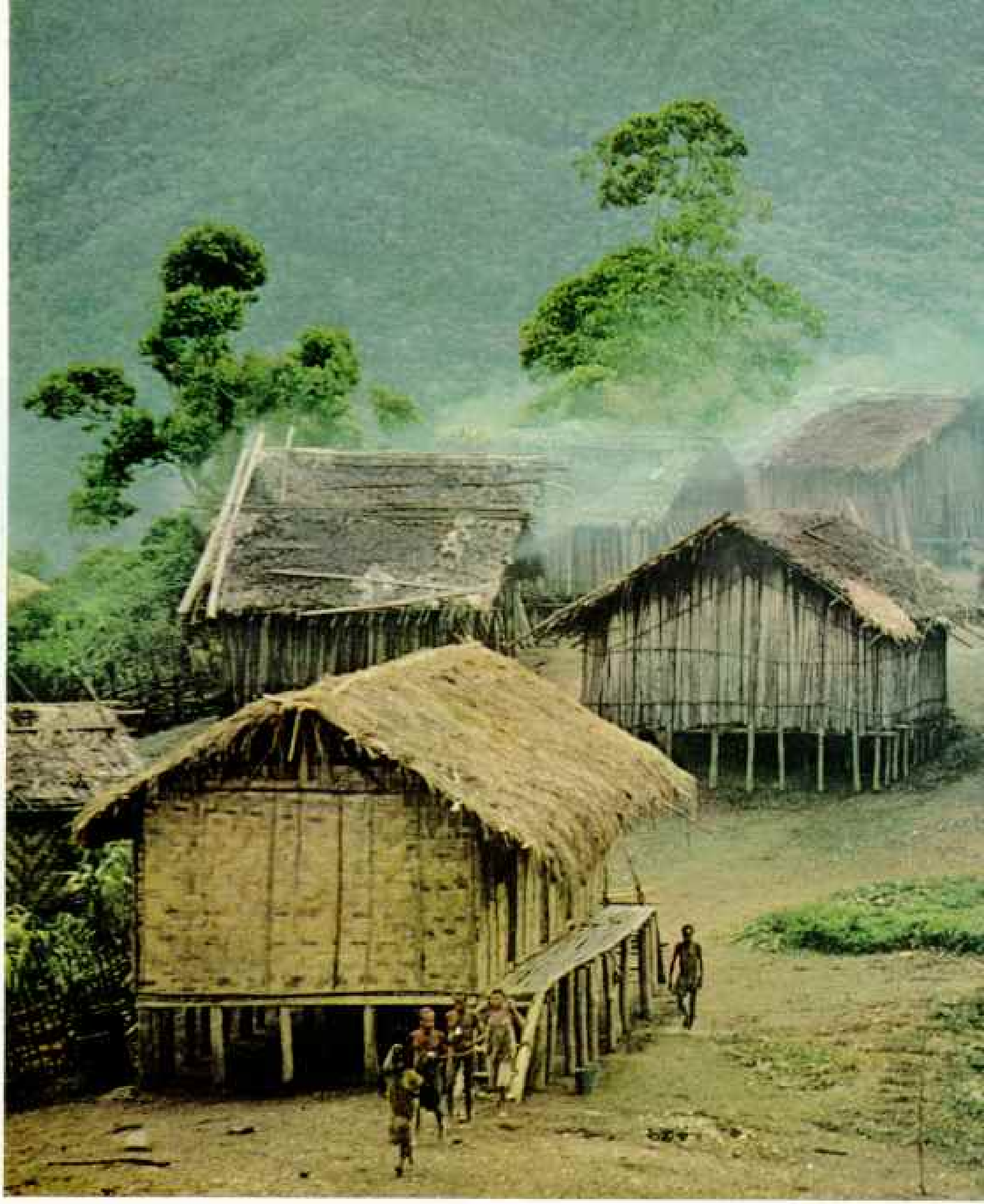
"Instead of a number," explained Ray Entwistle, an official of the bank's Port Moresby branch, "each man picks a familiar symbol and uses its name in his savings book. From then on, that is how the bank knows him. Some start their accounts with the equivalent of a dollar; others with even less."

Wherever we stopped around Lake Murray, we found modern influences spreading

Hitchhiking leeches feast on Skingle's blood. He wore out three pairs of these light rubber-soled boots. Other plagues of the jungle—mites and mosquitoes.

Man, the hunter. A family provider in Kaviananga, a village southwest of Lake Murray, raises his bow and arrow, hoping the fires he has set will drive game within range. He and other tribesmen bagged four wallabies and two snakes. They use prong-tipped arrows for birds and spearlike heads for larger quarry.

Woman, the laborer. A teen-age mother manages to smile despite the burdens of her woman's world. Here she hauls home the family's fuel. Her child sleeps in a hammocklike *billim*, an all-purpose substitute for purse, pockets, and cradle. The author met her in Moian, northwest of Lake Murray.



Green-walled hideaway, a smoke-veiled village moves at the pace of a walk—for children, to fetch water; for women, to harvest plots of taro; for men, to roam the forest for wild

in widening waves, like the ripples from our canoe paddles.

There was, for instance, the work of the Australians and New Zealanders at the Unevangelized Fields Mission Station. Bruce and Kathy Shields showed us the mission school (page 591). Keith Dennis, founder and head of the station, took us to the sawmill, where we saw villagers turn mahogany and rosewood into commercial lumber.

"The lake is one of the richest inland fishing grounds in the territory," Warren Dutton told us, "but crocodiles still provide the main income. The villagers have sold as much as $100,000 worth of skins a year."

Villagers Keep Their Old Ways

Warren, a former patrol officer, manages the Lake Murray Cooperative Limited. This new local enterprise set a minimum size for

PAINTING BY MALCOLM S. KEITH © NATIONAL GEOGRAPHIC SOCIETY

game. Komdavip village, harboring perhaps 250 souls, lies only a day's hike from Telefomin, but remains almost totally isolated amid the tumbled, wildly precipitous terrain.

catchable crocodiles to conserve the stock, started rubber plantations, helped the villagers open four trading stores, and brought in Ray to establish the bank.

"Old customs and beliefs die hard on the lake," said Keith over a delicious lunch served to us by his wife Lilian. "Even here, around the mission, some of the people would rather rely on their own remedies than come to our clinic, although more and more of the mothers are having their babies under our care.

"Most of them, however, still go into confinement in those small houses on stilts you can see at the edge of the lake. When a mother dies, the baby may be buried alive with her if there is no one else to look after it.

"In fact, we've adopted a few children that we managed to rescue. Haven't we, Robbie?" Keith turned toward a small brown face watching us wide-eyed from a corner.

Robbie ran up, clutched Keith's arm, and continued to stare at us.

Days later we witnessed the sort of tragedy the Dennises were struggling against. Two lakeside youngsters, a boy and a girl, were admitted to the station hospital with stomach cramps. By radio, a doctor on the coast 200 miles away diagnosed the cramps as food poisoning and prescribed treatment—but the villagers had waited too long before bringing in the children. The girl died at noon; her little brother at sunset. All that night a pitiful wail of voices drifted across the village.

Trail Companions: Leeches and Mites

Somberly we hastened our departure on the journey northward across New Guinea.* "We'll have to get along on what we carry until we reach Kiunga," I reminded my companions as we studied maps that bristled with disturbing warnings: "Relief Data Incomplete. . . . Dense Jungle-covered Swampland. . . . Largely Uninhabited. . . . Position Uncertain."

From Lake Murray we canoed up the June River and found the start of the native pad, or track, to the patrol post at Kiunga.

Once we entered the rain forest behind a pair of native guides, the green canopy of foliage closed over our heads. The trees became bars of some enormous prison (page 572). Occasionally the pulsing whoosh of unseen wings told us that we had alarmed a hornbill. But we were unprepared to find the forest so empty of life. Few birds or animals were visible—or even audible.

As we pushed on, I caught myself staring at my feet, plodding in muffled sequence on the rotting vegetation. We slipped and fell on damp tree roots. We stopped to pick off leeches that continually worked their way up our boots to our bare legs (page 573). We scratched our waists, itchy and sore from the red mites that burrowed under our skins.

Wearily we staggered into a clearing to make our first jungle camp. We blew up inflatable mattresses and pitched lean-tos of waterproof nylon sheets, each nine feet square.

We slept under nets, but mosquitoes somehow found their way inside. "As fast as I swatted the mossies last night," Derek announced the next morning, "a line of ants marched in and carried off the corpses!"

For breakfast we cooked thick oatmeal in Max's "billy"—a blackened bush teapot. Our entire menu soon became memorable for its monotony: ship's biscuits with canned cheese or jam for lunch, and the inevitable billycan of rice and dehydrated beef stew for dinner. About once a week Max would produce a tin of plum pudding. Steamed, it was delicious.

On the eighth day we broke into the open on the banks of a Fly River tributary. Our bodies by then had turned gray in the jungle's smothered light. Ulcerated leech wounds mottled our legs. Our feet shriveled inside wet boots.

We hired canoes at a settlement called Moian and started paddling upstream toward Kiunga. There we found a government launch preparing to take a group of back-country tribesmen downriver, where they would stand trial for cannibalism.

Patrol Officers Bring Western Ways

The Australian administration has established a number of patrol posts throughout the interior. Each post consists of a few buildings and a dirt strip, irregularly served by aircraft. One or two young patrol officers form the station complement. With the aid of native police and a corps of carriers, their job is to contact tribes in the surrounding jungle and gradually introduce them to Western law and education.

Mark Sage, the district patrol officer at Kiunga, listened to the wish we expressed to meet "unspoiled" peoples.

"Nomad River is the place for you," Sage said. "That's where those cannibals came from. The tribes there are among the most primitive in the territory. You can walk a few hours from the airstrip and find people who haven't yet seen a white man."

Two days later we flew the 70 miles east to Nomad. Patrol Officer Graham Dent met us at the airstrip with Bert Voorhoeve, a Dutch

(Continued on page 583)

*See "To the Land of the Head-hunters," by E. Thomas Gilliard, NATIONAL GEOGRAPHIC, October 1955.

Human bird of paradise, decked in bright plumage, will mimic the courtship antics of his famed look-alike. Chief dancer in a Nomad River Biami village wears towering white cockatoo feathers and trails a bustle of plumes and dry grass to simulate a bird's crest and tail. He beats a drumhead of python skin glued on with human blood.

Sorcery's realm

BURNING AWAY A HEADACHE, a Lake Murray villager repeatedly touches a smoldering twig to a sufferer's forehead (left), reflecting the common practice of killing pain with pain. Kirk frequently saw his carriers rub their bodies with stinging nettles as an antidote for fatigue.

At the Nomad River Patrol Post the author met Sodhu, a Biami warrior who claimed a sorcerer had marked him for death. The medical orderly at the post examined the tribesman and proclaimed him in relatively good health; 24 hours later Sodhu lapsed into a coma and died (above). Friends took his body home and let it decompose. Then they hung the bleached bones beside other remains (below) on the wall of the communal house.

Land of luxuriant solitude, the region of Gum Gorge cloaks its hazards with verdure. Following the right-hand ridge above the frothing Feneng River, the explorers constantly risked missteps that could have plunged them into hidden crevices. After 12 hours of trekking, they reached Olsobip Patrol Post, the gray patch in the distant jungle.

Atop the backbone of New Guinea, Smart, left, Kirk, and Skingle brew tea at their highland camp near Oksapmin. Canopy of clouds obscures the forest-shrouded Strickland Valley.

linguist from the Australian National University. Dr. Voorhoeve was studying island languages—of which there are perhaps 750.

"Of the tribes around here," Graham explained, "the most primitive are the Biami and the Gibusi. They're cannibals, but you would never imagine cannibals to be such a likable bunch of people.

"They say that human meat is tastier than the wild pigs and birds they hunt in the bush. One of my interpreters disagrees—but he has only eaten a very tough old woman!"

The Biamis, it turned out, came to us before we could get to them. A small party brought in a man named Sodhu from Unawobi village. Sodhu, who looked rather emaciated and walked with difficulty, claimed that sorcery had been worked on him. The medical orderly at the post found nothing seriously wrong with Sodhu, other than a possible case of malaria, and gave him antimalaria tablets.

Sodhu, unfortunately, became violently sick. "I am going to die," he told his companions, who grasped him and blew their breath over him, possibly to prevent his spirit from leaving the body.

He stretched out on his stomach while fellow tribesmen stroked his back and thighs with stinging nettles

as a counter-irritant to distract him from the nausea. He moaned softly, asked the others to look after his wife and children, and appeared to will himself unconscious. Two hours later, he slipped into a coma and died (page 581).

None of his companions seemed unduly perturbed—sorcery was common and inescapable to them. They would soon decide who the offending sorcerer was. They would kill him, and Sodhu would be avenged.

Silently, his friends covered Sodhu's body with sheets of bark, bound it to a pole with lengths of cane, and bore it back through the jungle to Unawobi.

Funeral Ends With a Bag of Bones

Bert explained how the native people live under the constant threat of raids, killings, and revenge; how they group together for protection in fortified longhouses built on hilltop vantage points.

"As many as 60 people live in one house," Bert said. "The men sleep in the main portion, the women and children in side corridors, and all share a communal living area where meals are prepared.

"The front of the longhouse is fortified with a sliding gate of logs. By day, any intruder has to stoop and clamber through the small entrance, so he's momentarily defenseless (page 571).

"At night, the log gate is dropped to seal the opening. The rear of the house projects over the edge of the hill."

A week later we followed Sodhu's funeral procession in Unawobi, and I took the first photographs ever made of a death ritual that only a few outsiders have seen. As we squeezed through the entrance into the dark interior of the longhouse, we saw Sodhu's remains on the bark mat. The body was hardly recognizable. The hair had been plucked out, the flesh was swollen, and the smell was almost unbearable. Sodhu's friends were inured to it; they squatted around his corpse, touching it and then themselves as a sign of respect.

This was only the beginning of their ritual. After a few more days had passed, mourners would place the body outside on a raised platform of sticks, exposed to the weather. When only the skeleton remained, the bones would be put into a net bag and hung on the wall of the longhouse beside the remains of other revered ancestors.

The Biamis intrigued us, but we had to be careful when we walked into their villages.

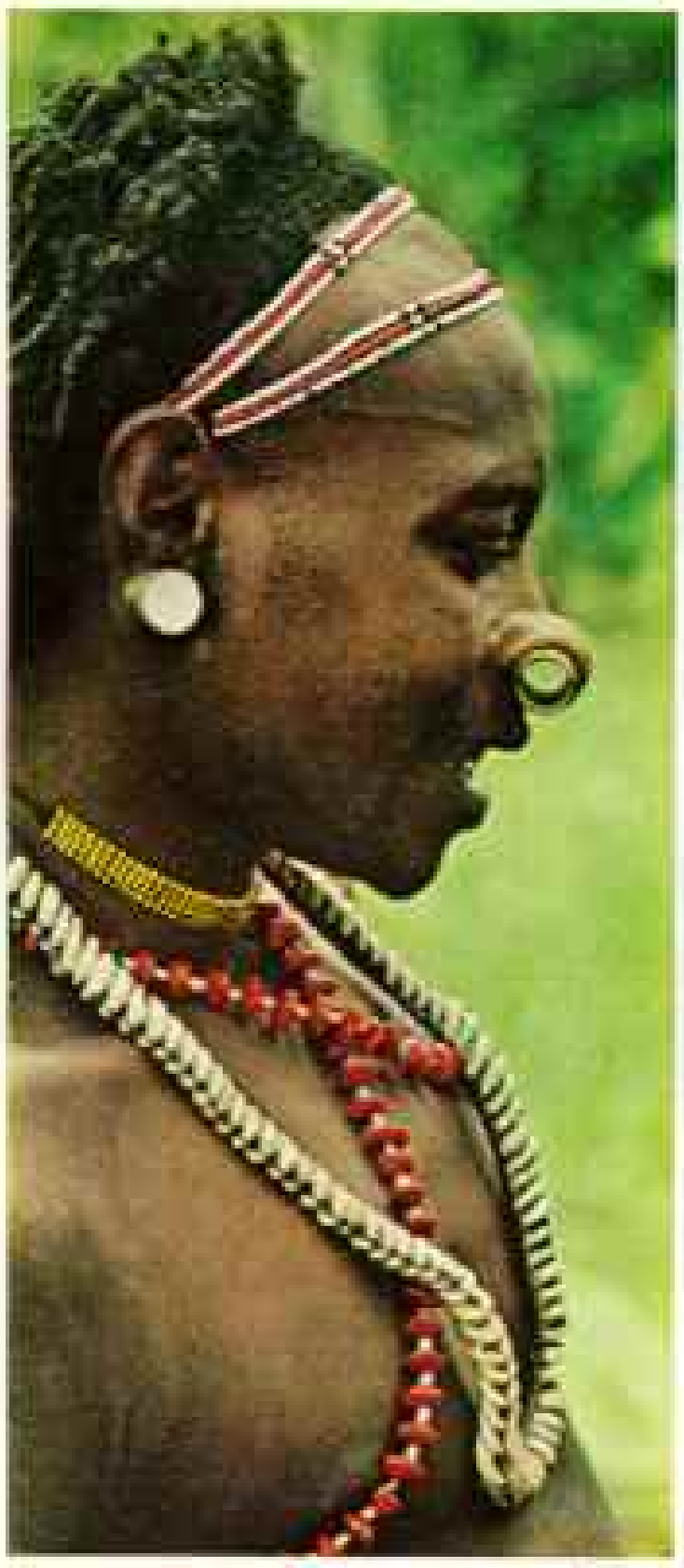
"They are not aggressively hostile," Graham Dent told us, "but they *will* attack out of fear. Every patrol entering a village unexpectedly has its tense moments."

We had ours, too. One day as we approached a village, the Biamis raised the customary alarm—a series of shrill, staccato, birdlike calls. The tribesmen eyed us warily through the trees.

"*Quari!*" we called out to them. "Friend!"

"Quari! Quari!" came their cautious reply. They paused for a moment, then strode into full view.

The warriors carried black-palm bows and bundles of cane arrows, and wore head plumes of black spiky feathers from the shy, flightless cassowary. Their hair fell to their



Shy smiles light the fierce visages of tribesmen in the Nomad River area. A Biami warrior (above) drapes his neck with cowrie shells traded village-to-village from the coast and used as cash in the highland economy. Red seed and yellow bead necklaces are also prized.

Gibusi tribesman (opposite) adds a touch of highland elegance by dressing his hair with tree resin.

Bamboo or bone nose plugs, among various New Guinea tribes, indicate attainment of manhood. Long and bloody coming-of-age rites include the first piercing of the nasal septum. As time passes, the opening stretches wider with the use of successively larger plugs.

shoulders in greasy braids. They wore net aprons with fiber tailpieces that reminded me of kilts. Woven armbands held daggers of cassowary bone.

I realized that most of them—even the young boys peering at us through the bushes—had eaten the flesh of slain enemies, and still were doing it. Finally they smiled, brought out a bag of bananas, and proceeded to shake our hands in the Biami manner.

The handshake seemed to be part game and part greeting: I found my hand grasped and my arm raised to shoulder level. At that point, my welcomer appeared to lose interest and paused to stare at the sky with an expression of complete boredom. Then, without warning, he yanked his hand away and snapped his fingers.

Everyone took part in the ritual, and our hands soon turned black from the accumulation of pig grease, soot, and grime that covers all Biamis.

In their longhouse the Biamis led us to the place of honor—the rear veranda. Pig jaws hung on the walls as reminders of past feasts. Our hosts settled back on their haunches, talked, and chewed betel leaves and nuts, which were flavored with lime drawn from hollow gourds.

Within easy reach I saw stone clubs, bows, and arrows to suit every need: big spear-bladed arrows of bamboo that would splinter

"You mean that's me?" an astonished Biami warrior seems to ask as Kirk points him out in a Polaroid snapshot. Strangers to mirrors, natives often recognized everyone else in group photographs before realizing that the unfamiliar face was their own. Many carried their portraits until proud handling wore them out.

EKTACHROME (ABOVE) AND KODACHROME BY MALCOLM S. KIRK © N.G.S.

A show in themselves, Oksapmin women and children watch the antics of men trying to climb a greased pole. In the high point of a daylong sing-sing, the men finally scrubbed off the slippery coating with moss and conquered the pole, topped with prizes.

in the flesh of wild pigs, multipronged ones for birds, barbed ones for raids on neighboring longhouses.

The tribesmen were vastly entertained as we set up camp. Certain rites—blowing up air mattresses, brushing our teeth—held them spellbound. They poked at our nylon sheets, ran fingers along the edges of our axes, and gazed into our mirrors.

During an evening sing-sing at another village, one proud fellow, arrayed more splendidly than the others, wore a tall headdress of white cockatoo feathers (page 579). Gorgeous bird-of-paradise plumes hung down his back. His whole body was ornately painted in ocher, yellow, and black.

This was the chief dancer. He carried a long wooden drum; the sounding head was stretched python skin. The other men began to whoop and twang their bowstrings. Then the dancer beat his drum, slowly, monotonously—and shook his body, rattling a tail of dried crayfish pincers. Moving around in a small circle, he made short, birdlike hops.

Now a group of women sitting to one side took up a chant—one voice followed by a chorus. Bert Voorhoeve translated for us:

Down near the Gayame River a girl is wandering,
She is listening to the murmur of the water, alone . . .
High up in a sago palm a bird is calling. . . .

"Many of their songs are romantic," Bert told us. "They evoke a mood, rather than tell a story, and they reveal a genuine sensitivity."

According to local belief, when a man dies he becomes a hornbill; a woman is embodied in a bird of paradise. But these are spirit birds; they are never seen.

Mark Sage flew us back to Kiunga, where we picked up a dozen

Wondrous menagerie

NEW GUINEA abounds in such strange birds as the goura (left). Measuring 23 to 29 inches in length, it is the largest pigeon in the world and one of the most beautiful.

Two-foot-high tree kangaroos (below) possess sharp claws for climbing and stout tails that help them balance on tree limbs.

Three-foot-long green tree python (right) was a villager's gift to the author. Tribesmen relish the serpent's flesh and use the skin for drumheads.

Performing a colorful courtship dance, the Count Raggi bird of paradise bobs as if bowing (lower right). New Guinea, surrounding islands, and northern Australia are the principal habitat of the 40 known species of the spectacularly feathered birds of paradise. Plume hunters killed great numbers of them before the trade was forbidden in the 1920's.

carriers. On one part of our trek we got by with only two; on others the column swelled to 25. Usually we had more than we needed.

We started north again toward Olsobip, 70 miles away on the lower slopes of the mountains, padding along old footpaths that curled and dipped through thatch-roofed hamlets. Their names slid by in syllables that delighted our ears and tripped our tongues: Saisukurime . . . Somaebinkia . . . Horihori.

At times the difficult country captivated us. When we came to the Feneng, a tributary of the Fly, the spectacle was magnificent: The river flowed around a sweeping curve and disappeared with a roar into a limestone chasm. Bathed in spray, the rock was slippery as ice.

Our route to Olsobip Patrol Post lay along the spectacular sheer-sided Gum Gorge (pages 582-3). At the top of the gorge, curtains of moss festooned the trees and creepers. The air was a gray film of cloud which condensed on the leaves and dripped continuously to the ground. The rock itself was shattered, like some gigantic icefall, into pinnacles, jagged blocks, and deep fissures.

The very ground underfoot was hollow, carpeted with a fabric of tree roots and sodden moss. Occasionally we broke through up to our thighs.

The air grew quiet and dank. The only sound was the panting of the bearers. Twice, through the trees, we had glimpses of Gum Gorge. It was at least 1,500 feet deep. At last the carriers pointed through another clearing and shouted, "Olsobip! Olsobip!" And there, snuggled in the valley far below, we saw the faint scar of the airstrip.

Bearers Brave a Treacherous Current

To reach the post, we had to cross the Feneng on a suspension bridge woven from cane and vines. It hung 30 to 40 feet above the river. The vine cables looked dangerously frayed, but I was impatient to get across.

The bridge swayed under me like a sagging tightrope. My eyes focused alternately on my feet, then on the dizzily swirling waters below. Finally I reached the other side, and two of the carriers began to follow.

As they started across, a cable parted with a crack. They shouted with fear as the bridge tilted wildly. Slowly, inch by inch, they managed to work their way back to the bank.

A young carrier named Kawadi waded into the rapids under the bridge and fought his way across the current toward me. He disappeared several times in the white water that foamed over his head, then emerged shaking

and exhausted. He carried with him a line from the opposite shore. The others struggled across the rushing water in the darkness, clinging to the rope.

Our carriers risked their lives for us that night. It was not the first, nor the last, demonstration of such loyalty and courage.

At Olsobip and later at Telefomin, Barbara brought us supplies by plane.

Now we turned to face the next obstacle before us—the Hindenburg Wall, a 25-mile-long sheer limestone face that rises perhaps 2,000 feet above the surrounding terrain. The name recalled the time when Germany ruled Northeast New Guinea as Kaiser Wilhelmsland, from 1884 to 1914, before losing it to Australia at the outbreak of World War I.

Jungle Barrier Yields at Last

The Olsobip tribesmen wore little more than gourds; the women, sketchy grass skirts. These were the Faiwolmins, a short, stocky mountain people with powerful legs. Several men offered to act as guides and carriers.

They were drawn to us partly by the pay (the equivalent of 15 cents a day plus food), and partly by the novelty of joining three white-skinned idiots with the extraordinary aim of walking through the wilderness.

The march to the foot of the Hindenburg Wall was a nightmare. We had just fought our way chest-deep across one rain-swollen creek, when, unknown to me, a carrier named Keli was knocked off his feet and swept away.

Pandemonium followed. All the others dropped their loads and ran downstream, shouting, to try to save their friend. After half an hour, we feared Keli had been drowned.

To our surprise and relief Keli, battered and shivering, limped back through the jungle. The others clustered around him, stroking him and wailing, "Keli, Keli! *Whee* Keli!"

The forbidding face of the Hindenburg Wall lifted above us, the flanks curving away in an unyielding arc. The problem was to find a break in the barrier.

On the fifth day out of Olsobip we came to a rough track slanting across an almost sheer cliff. Enveloped in swirling mist, we began to climb, holding to the wall with our hands. Now and then I could make out our carriers and hear them shout to each other.

At 9,000 feet we found a pass and edged into an opaque world of muted greens and purples. Contorted trees draped in moss rose out of the mist like ghosts.

We emerged on the north side of the range to find a high, open basin—the divide between the Fly and Sepik watersheds. To our right loomed the 10,000-foot bulk of Mount Fugilil. Here was the perfect spot for our highest camp.

Hugging my knees in front of the fire and sipping a mug of scalding-hot soup, I had a delicious feeling of achievement. We had crossed the main barrier and were camped at last on the roof of New Guinea. Myriad bright stars twinkling in the crisp night air hypnotized me into peaceful sleep.

The next day we clambered down through cloud forest and shattered rock to where the air felt warm and drier, the trees grew taller. We heard birds singing. Suddenly we broke out of jungle into a sunbathed sea of waist-high grass. Smoke rising lazily from many hamlets led us to Telefomin and the final stretch to the Sepik.

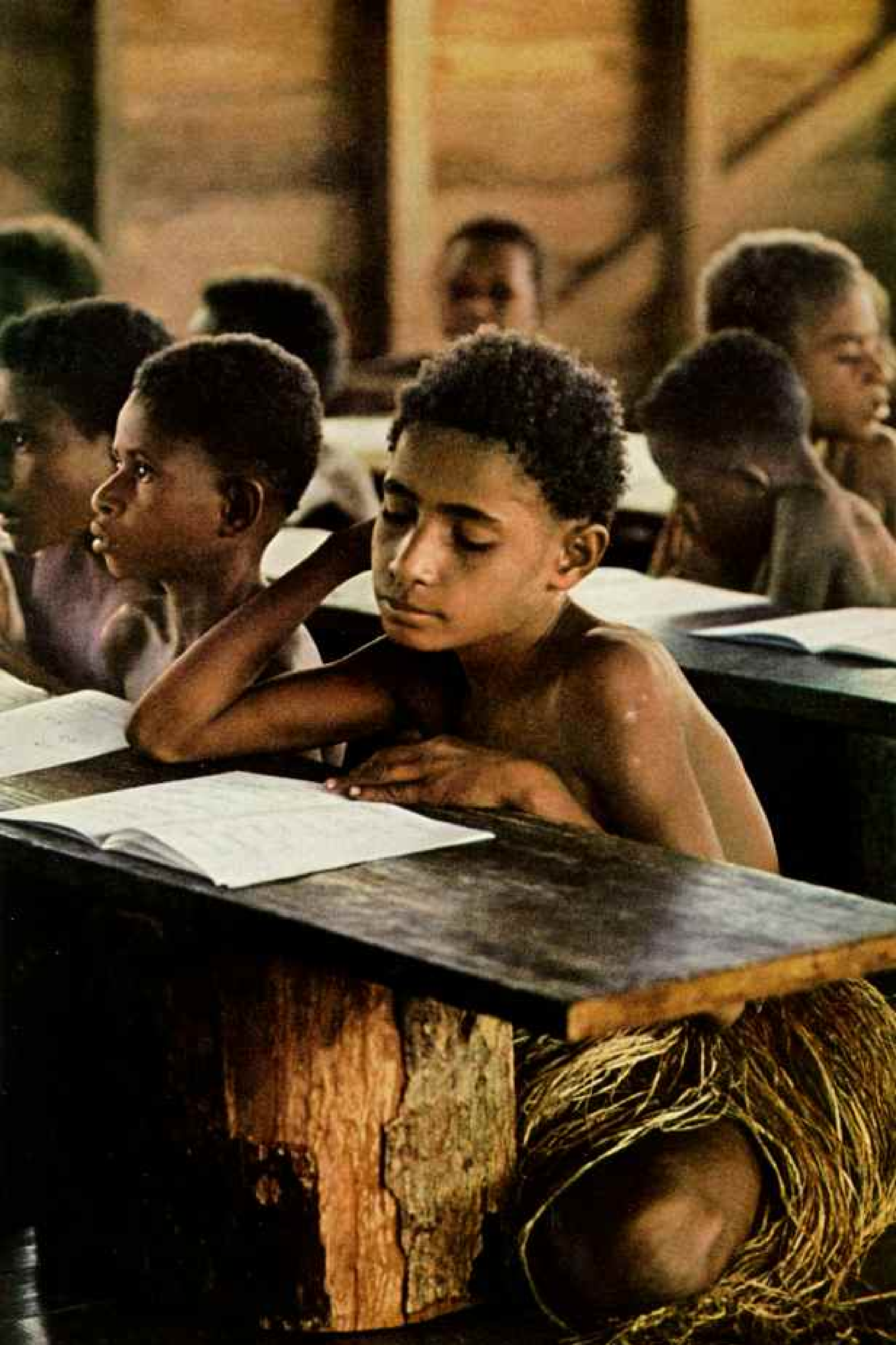
Pain Remedy: Hurt Somewhere Else

We spent three weeks at Telefomin and at Oksapmin Patrol Post 50 miles to the east. This last was near Tekmin, where we saw the skulls that were holding up construction of an airstrip. Derek used the time to collect and prepare medicinal herbs. By the trip's end, he had gathered native remedies for fever, pain, lesions, diarrhea—practically everything from headaches to difficult childbirth. One cure seemed constant: to use another form of pain to distract the senses from the original ailment (pages 580-81). Our carriers, I had noticed, employed the principle by brushing themselves vigorously with a handful of stinging nettles whenever they felt tired.

I kept trying to uncover some of the secrets of sorcery. At Oksapmin, a tribal leader agreed to show me the village spirit house. With a group of natives we set off through the bush, but at a certain point the rest of the men stopped and refused to go farther. Kasim, the headman, motioned me to follow. We pushed our way through a clump of scrub to an old hut, carefully concealed.

Kasim opened the entrance and beckoned me to the carved poles at the door for a look

On the edge of change, a girl at the Pangoa Mission School on Lake Murray wears the grass skirt of her ancestors while studying the ways of the world beyond her homeland. Seven years old, she can already recite in simple English. Australia hopes to give each of its New Guinea wards seven years of schooling and thus help shorten the leap they must make from the Stone Age to tomorrow.



into the darkened interior. A row of skulls lined the floor at the far end. They belonged to past leaders whose spirits now watched over the village. Such spirit houses also are used to initiate young boys into manhood.

If a person dies unexpectedly, everyone suspects sorcery. I asked Neil Robinson, the patrol officer at Oksapmin, how a sorcerer is found.

"Quite simple," Neil said. "In this area female sorcerers are supposed to stuff the victim with grass when he dies, but in such a way that the grass remains invisible. If the body takes a long time to rot, the sorcerer is a woman; if the body rots quickly, then the sorcerer is a man. Having learned that much, the villagers set off with a sort of forked divining rod that taps the ground. When it stops dipping, they grab the nearest person, and that's the end of that!"

I thought back to Sodhu's death in Nomad and wondered if he had been avenged yet.

Dangerous Tribe Proves Eager to Please

We left Neil, returned to Telefomin, and started toward blue-green ridges that receded in the haze like the swells of a roughening sea. The rocky folds seemed even more like an ocean when a driving rain, whipped by wind, caught us at about 8,000 feet. We spent a miserable night under our slapping shelter sheets, soaked, chilled, and too tired even to build a fire. Our hardy carriers sat almost naked in the storm, baking taro cakes over a sputtering fire and telling jokes.

Taro, rich in starch, is a staple of the highland tribes, along with sweet potatoes. It tasted a bit like bread—something we desperately craved—and we, too, ate it often.

The rugged country between Telefomin and the May was Mianmin territory. Of all the tribesmen we met, the Mianmins were regarded as the most dangerous. Only recently Laurie Bragge, officer in charge at Telefomin, had investigated a raid in which 10 people had been ambushed and murdered by Mianmins. So we loaded our rifles, distributed a few machetes and axes among the carriers, stifled our misgivings, and walked along sharply on the alert. But, as it turned out, we found the Mianmins, despite their reputation, as friendly toward us as the Nomad cannibals had been.

One day I observed that our carrier line had doubled; now we had 20 men. The pied piper in the lead was Dringsep, a Mianmin unlike any other we had seen. Tall and scrawny as a beanpole, with a face fiendishly crafty, he was always leering and sounding off.

The orderliness of our progress now was shattered by Dringsep's ceaseless chatter and periodic yells directed toward the jungle. He would frequently drop back to check on the white men, and whenever our eyes met, the event convulsed him into a gleeful cackle. Somehow we never got the joke. Perhaps we looked as funny to him as he did to us.

Leaving the last of the high mountains behind, we reached the banks of the May River, a beautiful tributary of the Sepik. Pools of cool, clear water bubbled amid the moss-covered rocks.

We followed the May's winding course until it broke through a cleft in the hills. Once more we found ourselves on level ground, picking off leeches in a jungle that was familiarly hot and humid. "I feel sticky as an old jam tin again," Derek lamented.

Eight days after leaving Telefomin, we met the canoe sent to take us to the May River Patrol Post. As we loaded our equipment aboard, Dringsep and the other carriers clustered around, sadly shaking our hands.

River Ends a Four-month Walk

We pushed out into the current and watched the waving figures on the bank grow smaller. They turned to set off back toward the mountains to which they belonged.

At the patrol post we met Barbara, who had come upriver by canoe. Next day we moved on to the fork where the May merges with the wide, gray waters of the Sepik.

After four months and 600 miles in the bush, we looked back a last time at the peaks we had crossed, still faintly visible through the palm branches.

I thought back over what we had done. Derek had collected specimens of 39 different medicinal herbs. If only one turned out to be genuinely useful, that would be achievement enough. Max had led us without mishap through some of the most difficult terrain any of us had confronted. I had been able to photograph a scattering of tribesmen who cannot long remain unaffected by the press of change.

I stared at the pit-pit grass along the Sepik's banks. But it soon gave way to villages, then settlements, until the river echoed to the intrusions of outboard canoes, launches, and traders' boats up from the sea. Our walk through the Stone Age was over. THE END

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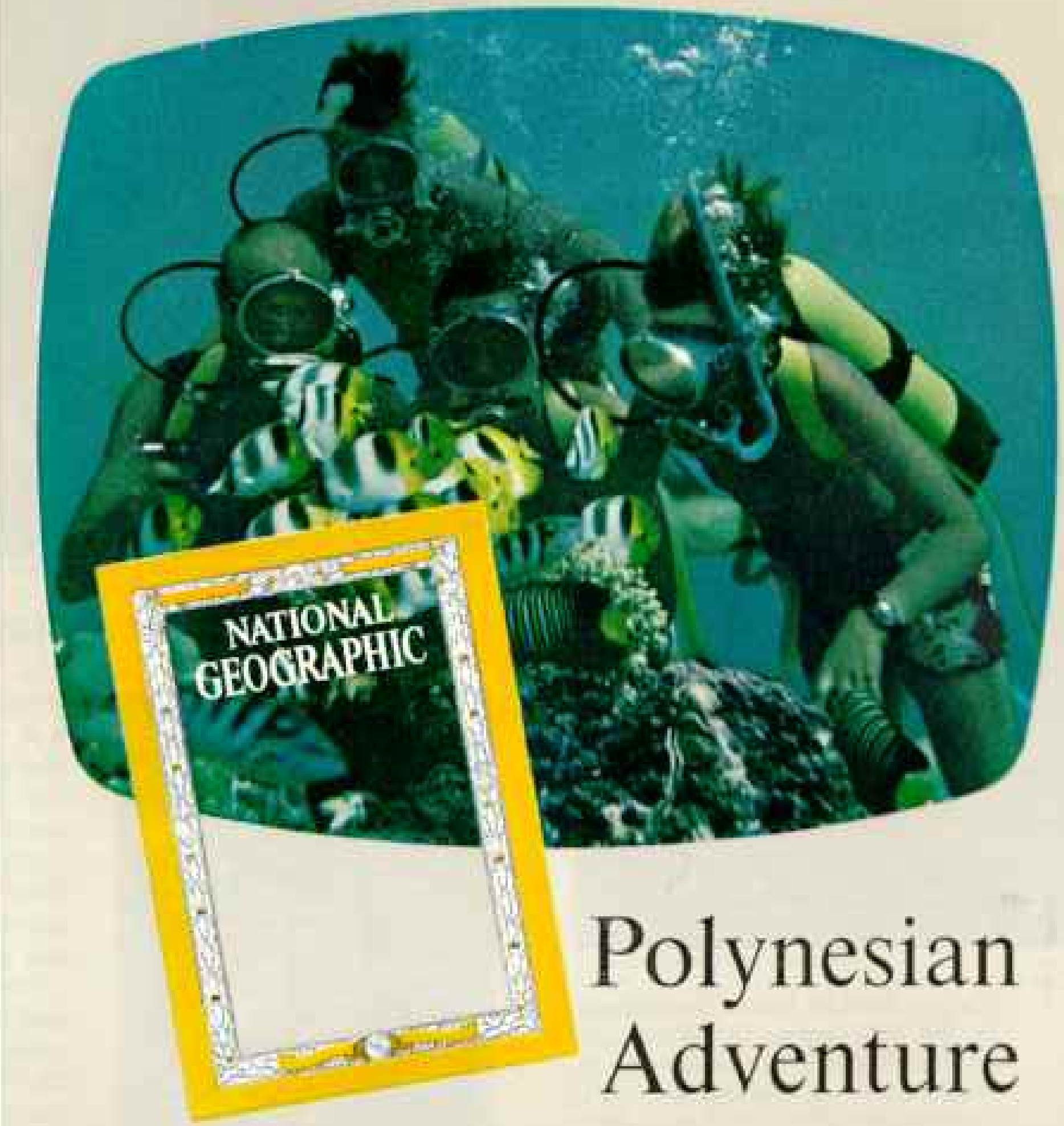

Polynesian Adventure

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Tahitian spear throwers take aim at a coconut on a pole. They test their marksmanship on Bastille Day in Papeete, the capital.

KODACHROMES (ABOVE AND RIGHT) AND EKTACHROME (LOWER RIGHT) BY STANTON A. WATERMAN © N.G.S.

South Seas saga, family style

KODACHROME BY ERWIN CHRISTIAN © N.G.S.

Eating freshly baked breadfruit as the first course, the Waterman family sit down to a *tamaaraa* in their honor on Toahotu Islet. TV camera crew films the feast, which also features banana poi and *poisson cru*—raw fish marinated in lime juice. Gar Waterman (right) finds a tiger cowrie on the reef at Bora Bora.

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GOODBYE PRINCETON, hello Papeete! For the wife, daughter, and two sons of New Jersey photographer Stanton Waterman, his project to film South Pacific isles made a family's dream come true. One and all packed up and moved 6,500 miles to the Society Islands—Tahiti, Moorea, Bora Bora, Raiatea, Tahaa. For a full year they shared the islanders' life, discovering wonders that only such a live geography lesson could give.

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Cloud-rimmed spires of volcanic Moorea soar above a blue lagoon sheltered by the broad barrier reef.

To ride a manta ray is no easy feat, Gordy Waterman discovers off Bora Bora. Flapping 10-foot wings, the giant fish proves much too elusive. Moments later, five huge rays swam straight toward the camera, before peeling off like delta-wing bombers.

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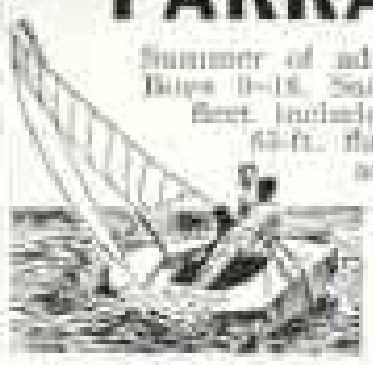

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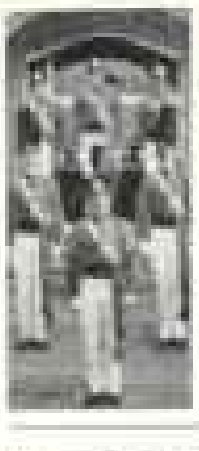

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