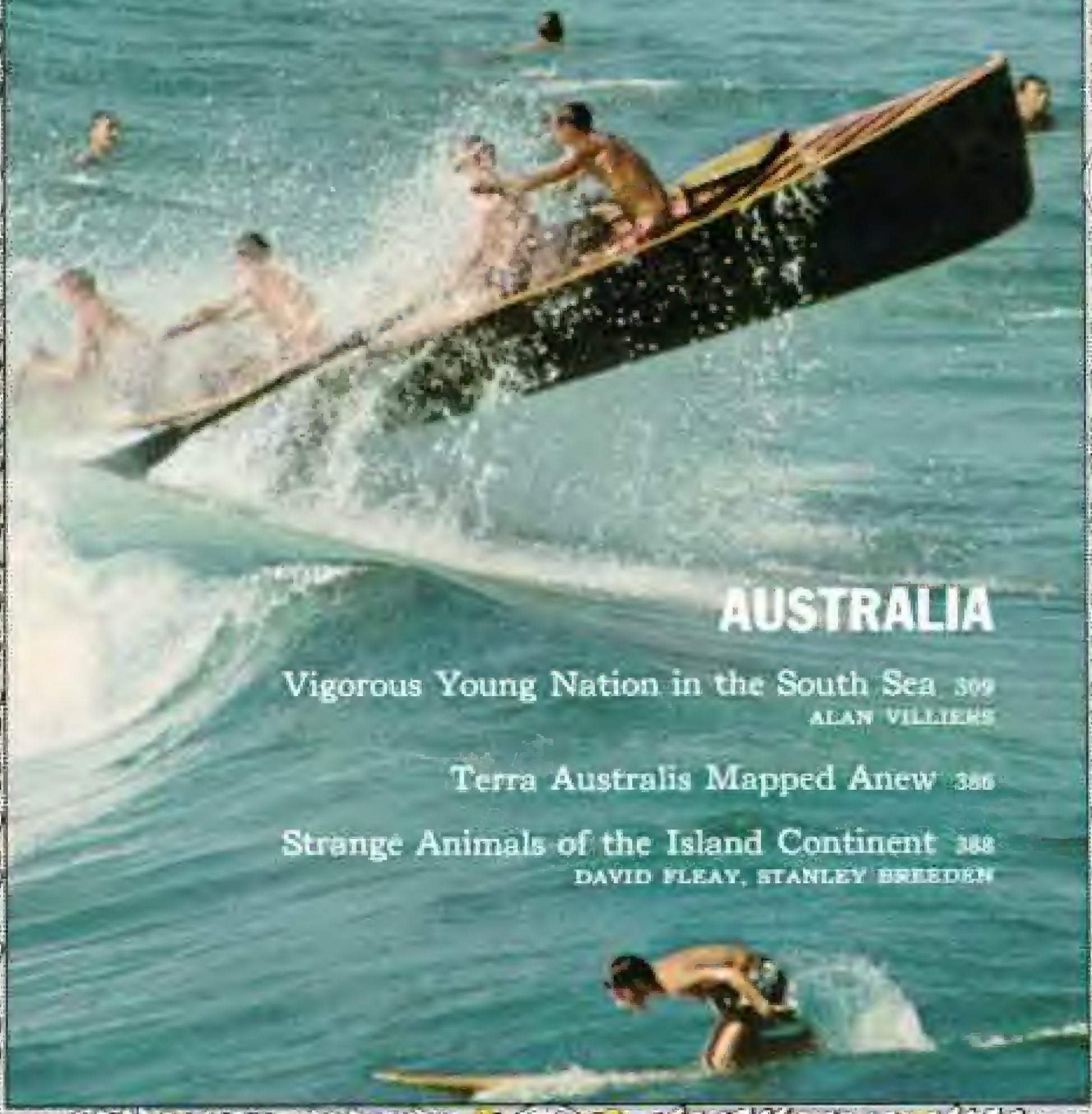
ATLAS MAP SUPPLEMENT: AUSTRALIA

VOL. 124, NO. 3 SEPTEMBER, 1963

NATIONAL GEOGRAPHIC



AUSTRALIA

$8.00 A YEAR $1.00 A COPY

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

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

75TH ANNIVERSARY

1888–1963

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 more than 300 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its journal, MATIONAL GEOGRAPHIC; more than 34 million maps distributed each year; its books, globes, and atlases; 30 School Bulletins a year in color; information services to press, radio, and television; and the publication of technical monographs.

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

COVER: Australian surf-rescue boat leaps into the air after collision with a breaker off Sydney (page 359).

NATIONAL GEOGRAPHIC MAGAZINE

GETTING THE ANSWERS THROUGH RESEARCH

At GT&E, research is solving tomorrow's communications problems today. Example: In advance of the launching of high-altitude communications satellites, our scientists have solved the voice echo problem with an improved electronic device that eliminates the confusing "double-talk." It is now being produced by our subsidiary, Lenkurt Electric. Research such as this — in advance of the need — provides GT&E with an open line to tomorrow.

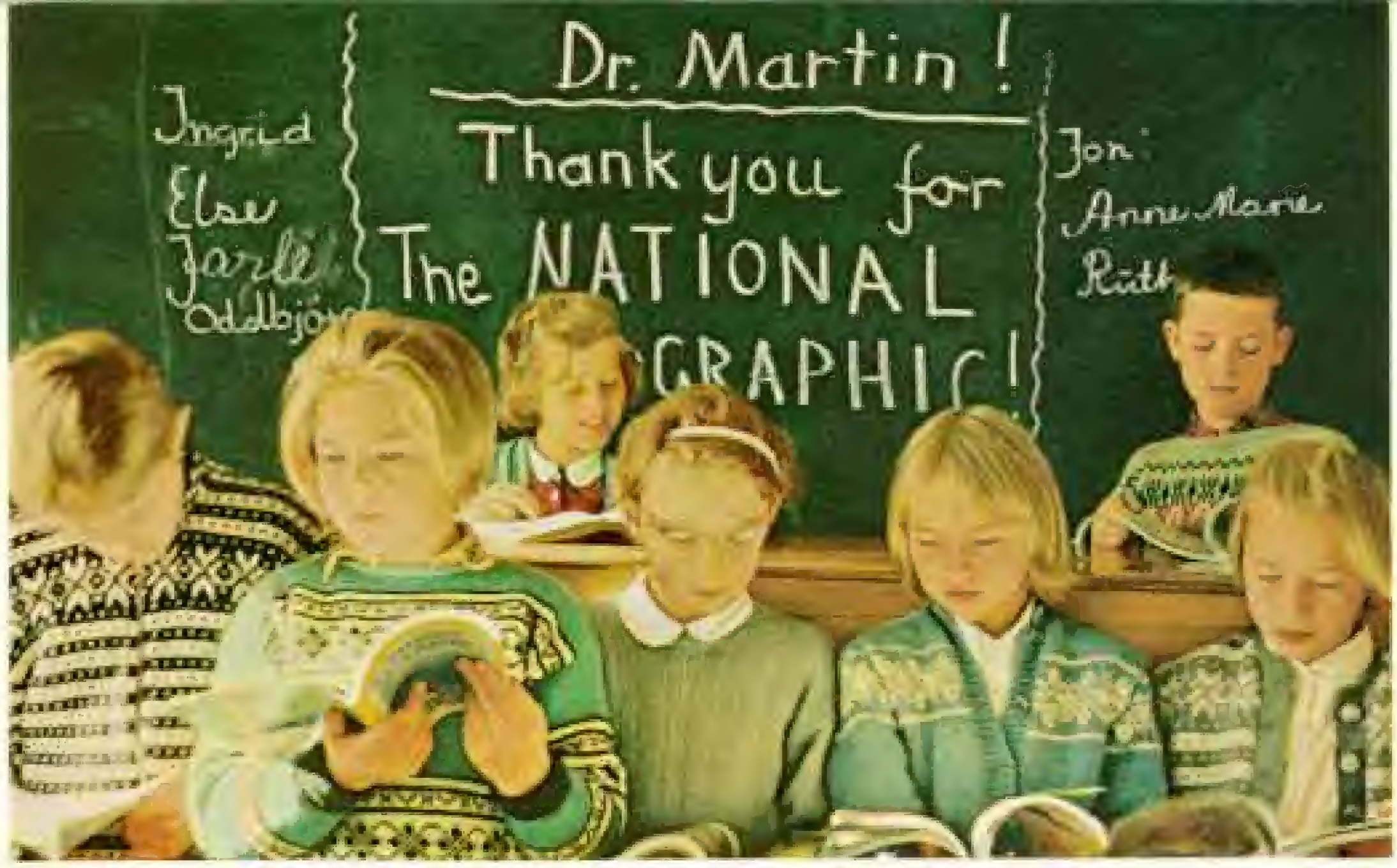
GENERAL TELEPHONE & ELECTRONICS

730 THIRD AVENUE, NEW YORK 17

GT&E SUBSIDIARIES: General Telephone Operating Companies in 32 states · General Telephone & Electronics Laboratories · General Telephone & Electronics International · General Telephone Directory Co. · Automatic Electric · Lenkurt Electric · Sylvania Electric Products

House power for our moon men will come from an efficient new fuel cell developed by Pratt & Whitney Aircraft for the National Aeronautics and Space Administration's Manned Spacecraft Center. The fuel cell will generate life-sustaining electrical power during the Apollo spacecraft's round-trip voyage to the moon. Pratt & Whitney Aircraft provides design and manufacturing leadership in power for many applications, in and out of this world.

Pratt & Whitney Aircraft
U
A



The world comes calling in a Norwegian school

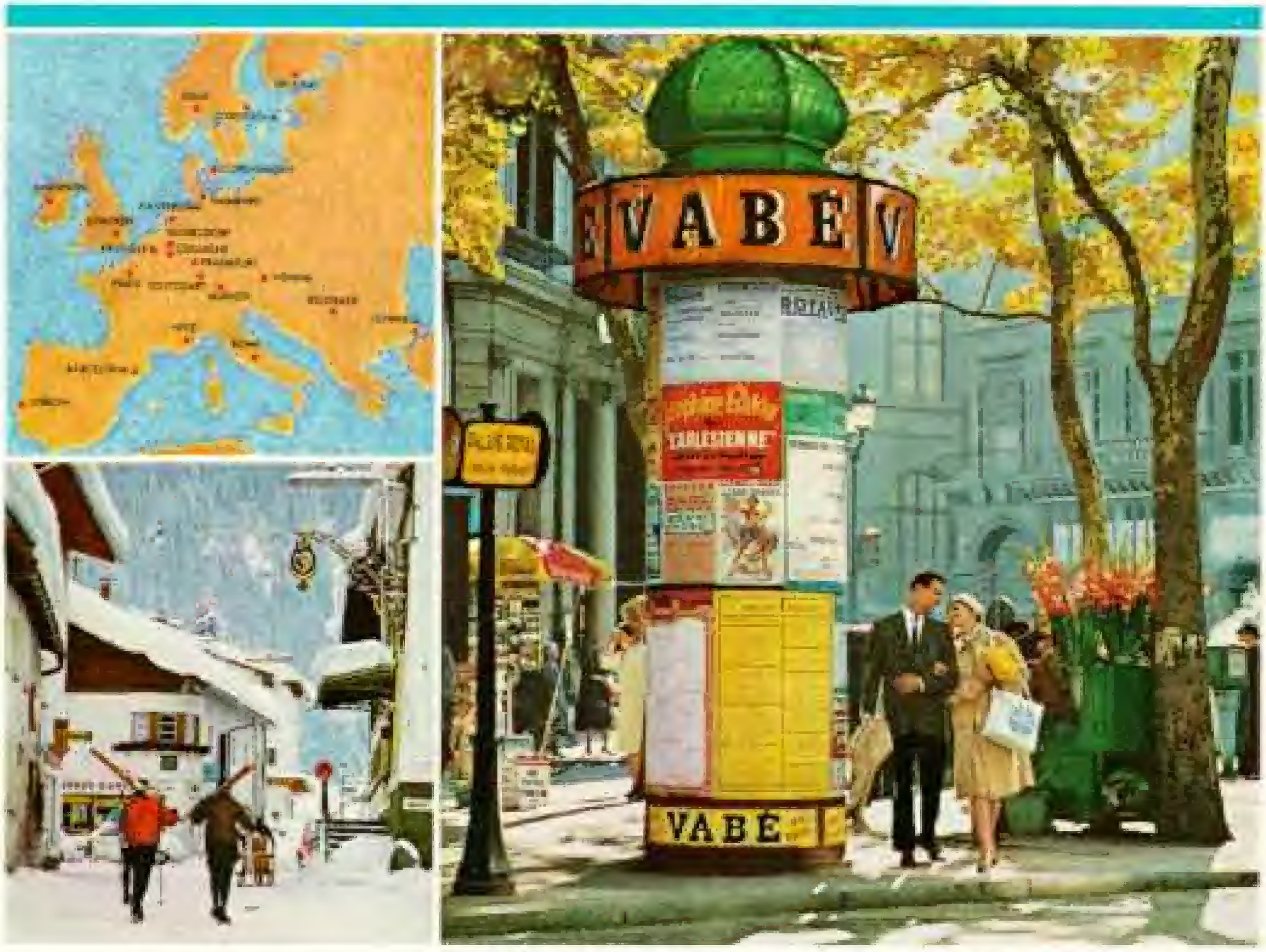
BLACKBOARD thank-you note carries the gratitude of school children from their classroom at Opstryn, Norway, to a benefactor in Berkeley, California. Their faraway friend, Dr. Elinor R. Martin (left), visited Opstryn on a summer tour. After her return to the United States, she nominated the children's teacher for a gift membership in the National Geographic Society. Now, once a month, heralded by the GEOGRAPHIC's familiar gold-bordered cover, the world comes calling in this quiet Norwegian town.

School opens this month. Have you thought of sharing your enjoyment with a group of children? A membership for their teacher will bring them a classroom tool more colorful, more timely than any geography textbook.

Fly Pan Am jet to Europe from any one of 15 U.S. cities. Continental cuisine by Maxim's of Paris en route!

Wherever in the world you travel you're better off with Pan Am —world's most experienced airline!

(See your Pan Am Travel Agent)



See Austria and the Winter Olympics! See Paris, the City of Light!

EUROPE THIS FALL?

Only Pan Am offers you the remarkable new 21-day ticket plus 4 extra benefits

Pan Am's round-trip 21-day Jet economy *Rainbow* ticket* can save you from $140 to $160 over regular Jet economy fares (and *they're* not so expensive). For instance: round-trip New York to Vienna, the regular Jet economy fare is $627. 21-day fare: $478. That's a difference of $149.

From California to London, it's $639 instead of $779. Chicago to Frankfurt, $595 instead of $655. Washington to Paris, $425 instead of $375. Miami to Rome, $609 instead of $772.

The 21-day ticket improves on the old 17-day ticket, too. It's far more flexible. You can plan a trip of 14 days minimum, 21 days maximum, or any number in between.

Those 4 extra benefits?

Extra flights: Pan Am offers you nearly twice as many Jet flights to Europe as any other airline.

Extra cities: Pan Am offers you Jets direct to 22 European cities (twice as many as any other airline).

Extra ideas for itineraries: Pan Am is your easiest way to go to Europe one way, come home another (with no-extra-fare stopovers all along the way).

The Priceless Extra: Experience unmatched by any other airline in the world. It's yours every moment of the way with Pan Am. And you don't pay a penny extra for it.

*Effective October 1.

PAN AM

FIRST across the Atlantic
FIRST across the Pacific
FIRST in Latin America
FIRST 'Round the World

SALTY
(and sodium-free)

SPICY
(and sodium-free)

If salt "doesn't like you" you'll welcome Adolph's Salt Substitutes.

The Regular variety satisfies salt cravings with your first little sprinkle.

The Seasoned is a blend of 12 spices and herbs—perfect for perking up roasts, sauces, all specialty foods. Get both at your grocers. (And live salt-free—without taxing your will power!)

You've heard about it!

The blade that lasts and lasts (for more shaves than you dreamed possible - each one a smoother, more comfortable shave)

Now it's here-

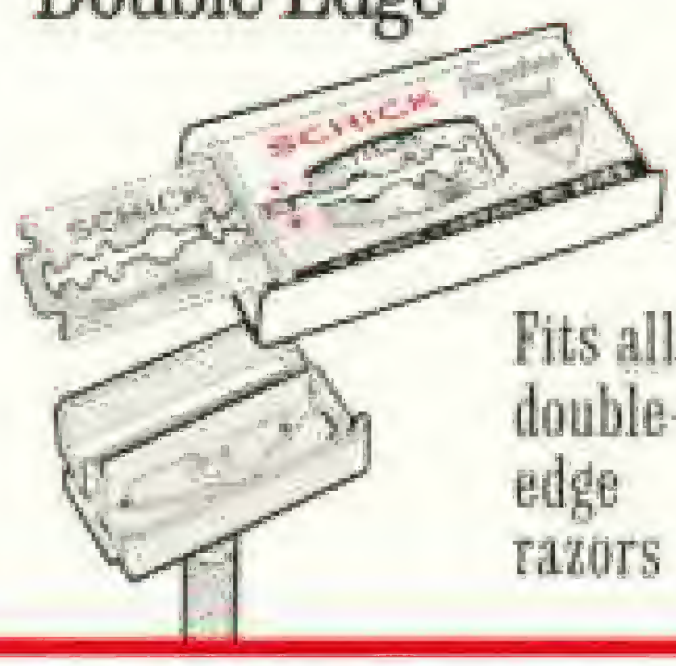
Schick

Stainless Steel

in your choice of TWO GREAT BLADES:

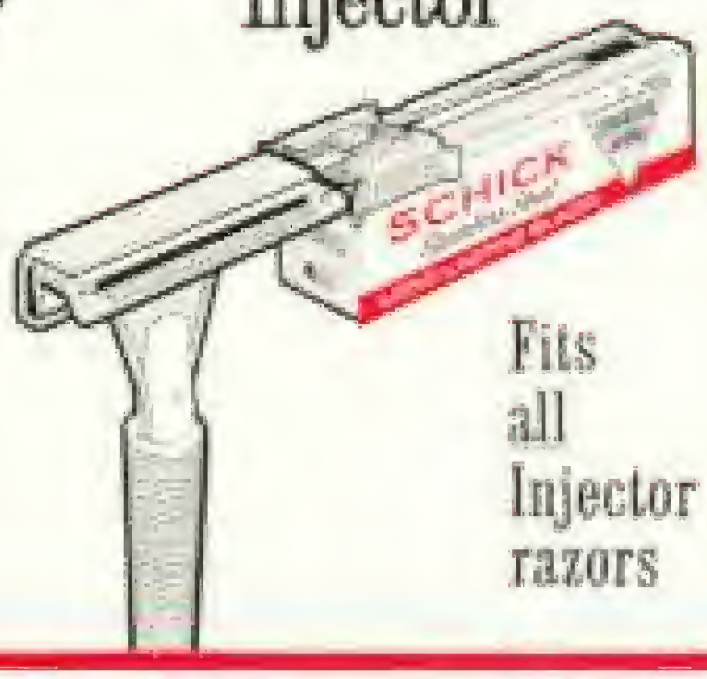
STAINLESS KRONA

Double Edge



Fits all double-edge razors

Injector



Fits all Injector razors

SCHICK SAFETY RAZOR CO., DIVISION OF EVERSHARP, INC.

Schick Quality Around The World / Factories in Italy, Sweden, Toronto, Canada, and Milford, Conn.

One of America's smartest addresses crosses the Atlantic 11 more times this season

and cruises to the West Indies four times this Fall and Winter

To those who know the art of travel, the smartest address in America is a stateroom aboard the world's fastest ship, s.s. United States . . . or the s.s. America.

Whether you're pleasure- or business-bound it's *the* way to get there and back. Both ships excel in the gracious life.

To some passengers, this means leisure: an opportunity to catch up on all the rest you need, to laze away the morning in a deck chair, to linger over the international cuisine and enjoy impeccable service wherever you turn.

To others, the gracious life means a whirl of activity: deck sports in the bracing air, a daily splash in the salt-water pool, dancing to a Meyer Davis orchestra—with expert dance instruction and professional entertainment.

Whichever you prefer, you will appreciate why so many experienced travelers choose these "famous-name" ships—whether crossing the Atlantic or cruising the West Indies.

4 Festive Cruises to Bermuda and the West Indies. You can cruise in the grand manner on either of these ships to colorful, exotic Caribbean ports during the Fall and Winter. October 24: 7-day Autumn cruise by the s.s. America to St. Thomas and San Juan. November 1 and 7: 5-day Bermuda Holiday cruises by the s.s. America. December 27: 9-day gala New Year's cruise by the s.s. United States to Curaçao, Martinique and St. Thomas.

Special Sea-Air European Package Tours This Fall. Sail on s.s. United States. Enjoy your European tour under the guidance of Thos. Cook & Son, and fly back by Pan Am jet. Sailings on August 30, September 13 and 27, October 10 and 23. Accommodations in all classes for both 2- and 3-week tours are still available.

For further information see your travel agent or mail this coupon.

Please send me information on: ☐ Transatlantic crossings ☐ Fall & Winter Caribbean cruises ☐ Special Sea-Air European Package Tours

Name_____

Address_____

_____

UNITED STATES LINES

Dept. N, One Broadway, New York 4, N. Y.

VIRGINIA's
so color-full in autumn!

Revel in Fall's color spectacular. Cruise by car through vivid foliage along more than 300 miles of Blue Ridge Parkway and Skyline Drive in Shenandoah National Park.

Discover Nature's most secret colors, hidden away for ages in the eerie beauty of vast limestone caverns deep beneath Virginia's valley of wonders, the Shenandoah.

History shows its true colors at Colonial Williamsburg. Drive behind a coachman in knee breeches straight into the 18th century world of George Washington and Thomas Jefferson.

FALL HIGHLIGHTS Join the gayety of Richmond's **Tobacco Festival** with its colorful parade, football game, Tobacco Queen Contest and Tobacco Ball, September 28-October 5. • See a broadway hit at Abingdon's world-famous **Barter Theatre.** • Take the **Annual Fall Pilgrimage** through Virginia's romantic Tidewater country, October 11-13 and 18-20, to visit 34 plantations and homes and 9 historic churches, many over 200 years old.

FOR FREE 52-PAGE PICTURE GUIDE. "Carry Me Back To Old Virginia," plus illustrated state highway map, drop us a postcard or note. Ask about special places or events that interest you.

VIRGINIA DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT

811 State Office Building, Richmond, Va. Virginia Film Catalog Available.

Mix fun and history in VIRGINIA, birthplace of the nation.

"OFF SEASON" TOUR?

never!

There's no such thing as an "Off Season" tour anymore.
There used to be though.
When people only traveled in the summer.
Nowadays, Alitalia tours are booked Spring, Fall, Winter and Summer.
Rather economically, too, all year long.
And if some fun moves in-doors? (London in December, don' cha know!)
So what?
Alitalia (with a typically Italian attitude), figures fun loving people will have their good times anyway.

Transatlantic, you'll fly Alitalia's Super DC-8 Jets. Then what? A Mediterranean cruise? The "Grand Tour" of Europe? North Africa? Rome, Paris, Algiers, Israel, Vienna, Cairo, Venice, London? You name it. We've got it.

But get the whole story. Send the coupon to our Tour Director—who is a fun loving type himself.

And fun is never "Off Season."

21 Day Sunny Holiday to North Africa—$859.
Jet to London for 3 days, then to Madrid for three more and fly on to fascinating Casablanca, colorful, exciting Algiers and Tunis. Then to Naples, another 3 days in Rome and back to New York.

21 Day Tour of Turkey, Greece and Italy—From $959.
Jet to Milan. By rail to Venice or Genoa. Then a leisurely cruise to Piraeus, Venice, Naples, Greece and Turkey. Istanbul, Izmir, Athens, Nauplia, Tripolis, Olympia and Delphi.

21 Day African Air-Sea Safari—From $1399.
Jet to Rome. Jet to Nairobi. Safari (by car) to Mombasa and board your cruise ship for Mogadiscio, Aden, Massawa, Suez, Port Said, Brindisi, Venice and Milan. 35 day Air-Sea Safari ($1,599) further includes Johannesburg, Capetown, Port Elizabeth, Durban, Beira, and Dar es Salaam.

All tour prices based on 21 Day Round-Trip Jet Economy Excursion fare from N. Y. eff. Oct. 1, 1963 thru March 31, 1964. All per person prices based on double occupancy. First class accommodations. (Standard and cabin class rates available.)

21 Day Sunny Holiday in Italy—$799.
To Milan by Super DC-8 Jet. Venice, Florence, Assisi, Rome, Naples, Sorrento, Capri. (And you can substitute Paris and London for Assisi, Sorrento and Capri—only $58.50 more!)

21 Day Mediterranean Pleasure Cruise—From $777.
Jet to Rome, then on to Naples. Board the S.S. Stella Solaris for (beautiful) Alexandria, (wicked) Port Said, Beirut, Haifa, Limassol, (classic) Rhodes, Athens, Malta, Messina and back to Naples. Now you can spend a week touring Italy or doing the Rome/Paris/London circuit.

21 Day Tour of Israel, Greece and Italy—From $925.
Jet to Milan, then on to Venice or Genoa. See the sights and you're off by ship to Athens, Hellas, Tel Aviv, Jerusalem, Nazareth, Tiberius, (The Sea of Galilee) Nicosia.

21 Day Tour of The Holy Land—From $969.
Includes the Middle East, Egypt and Italy. Jet to Milan, entrain to Trieste or Genoa and cruise to Venice, Alexandria, Naples, Beirut and visit a dozen fascinating Mediterranean port cities. 3 days in the Holy Land, Jerusalem, Damascus, the Dead Sea, Jericho, Bethlehem, etc.

For information and reservations see your Travel Agent, or send coupon.

TOUR DIRECTOR: ALITALIA AIRLINES
666 Fifth Ave., New York 19, N. Y., Dept. NG-9

Please send me brochures on the following Tour(s):

☐ Sunny Holiday to N. Africa ☐ Sunny Holiday in Italy ☐ Israel, Greece and Italy
☐ Turkey, Greece and Italy ☐ Mediterranean Pleasure Cruise ☐ Holy Land Tour
☐ African Air Sea Safari ☐ Opera Tour ☐ Ride&Safari

Name _____

Address _____

City _____ Zone _____ State _____

ALITALIA AIRLINES

P&O-Orient's Oronsay sails for the South Pacific from San Francisco November 25. You return on Arcadia. Round trip: 54 days.

"The biggest bloomin' ships sailing the seven seas" fly the flag of P&O-Orient. One leaves for Australia November 25.

THIS WINTER, six P&O-Orient liners sail to *summertime* in Hawaii, Fiji, and Australia. They're the largest and fastest sailing round the world.

The *smallest* P&O-Orient liner is longer than two football fields. The biggest carries more passengers than any other ship afloat.

All liners have acres of sunny open deck—far more than other ships. You can play volley ball on a full-sized court. Have parties in your air-conditioned cabin. Swim in an outdoor pool.

The British service is quietly spectacular. It *has* to be—to satisfy the international travelers who sail on P&O-Orient.

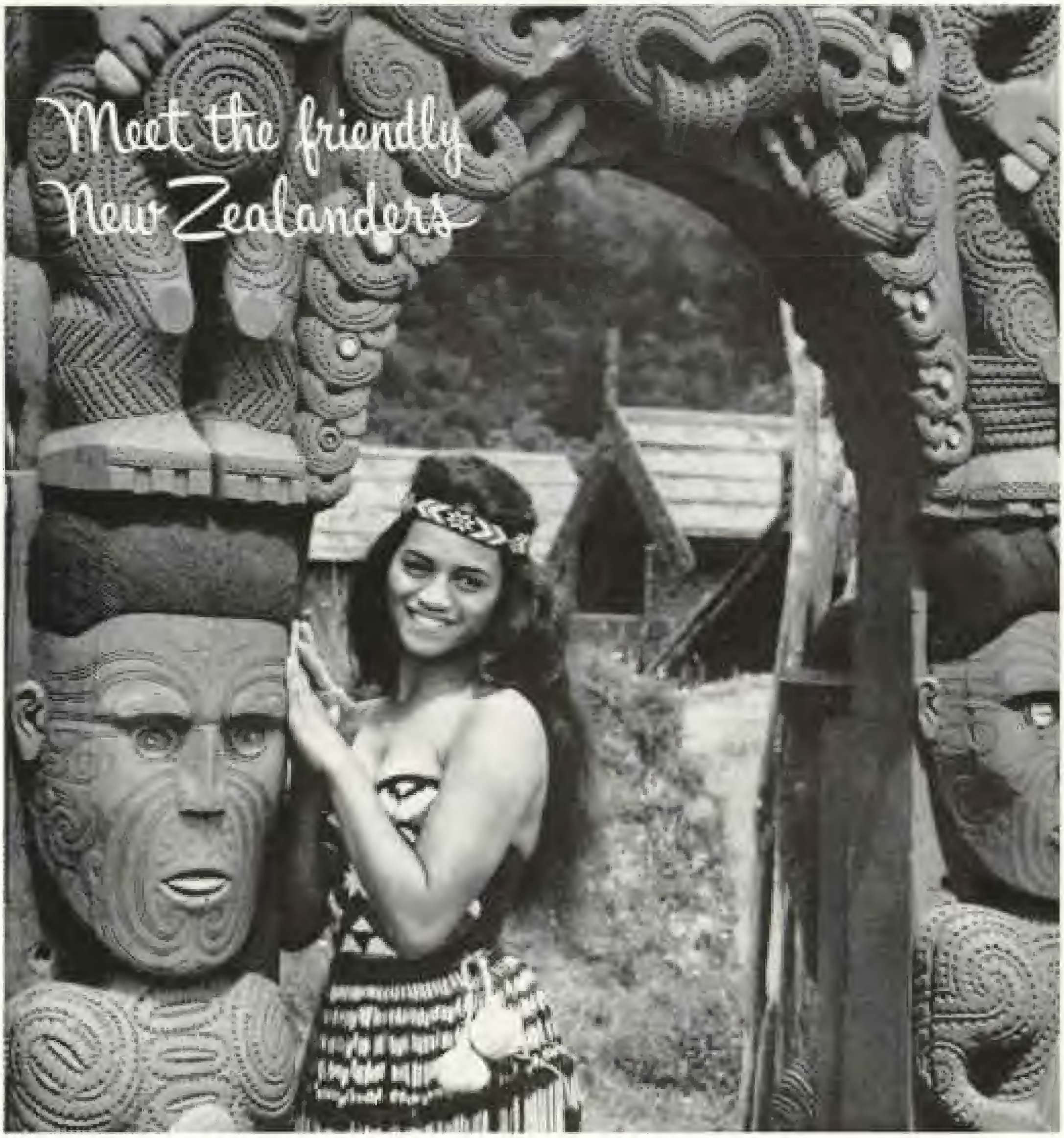
Cost? *Round trips* to Australia start at just $948 in first class, or $776 in comfortable tourist.

You can also sail on to Europe, to the Orient, circle the entire Pacific, or sail *round the world* on a P&O-Orient liner.

For free color brochures on Vacation Voyages, write Dept. C-4, P&O-Orient, 155 Post Street, San Francisco 8, California.

Then see your travel agent—and run away to sea.

P&O-Orient Lines: San Francisco • Los Angeles • Seattle • Honolulu • Vancouver. Elsewhere: Cunard Line, General Passenger Agents.



Rebecca Faulkner will entertain you with Maori songs and dances

Pretty Rebecca Faulkner loves to sing and dance at Maori concerts, but a nursing career is her biggest interest in life. She has completed a year of training and will finish her course after touring England as a member of a New Zealand girls' basketball team.

Rebecca posed for us at the carved gate of a model Maori village near Rotorua which preserves the traditions of this ancient Polynesian people.

This village is just one of the many interesting sights you'll see in New Zealand. This sunny, evergreen land of the South Pacific boasts majestic fiords . . . fine beaches . . . snow-capped alps . . . serene mountain lakes . . . geysers and thermal pools . . . rolling green countryside . . . and some of the friendliest people anywhere.

No South Pacific trip is complete without a visit to New Zealand. Your travel agent will help you plan a trip by air or sea, or a combination of the two.

Dept NG9, New Zealand Government Travel Commissioner
153 Kearny Street, San Francisco 8, or
630 Fifth Avenue, New York 20

Please send literature about New Zealand to:

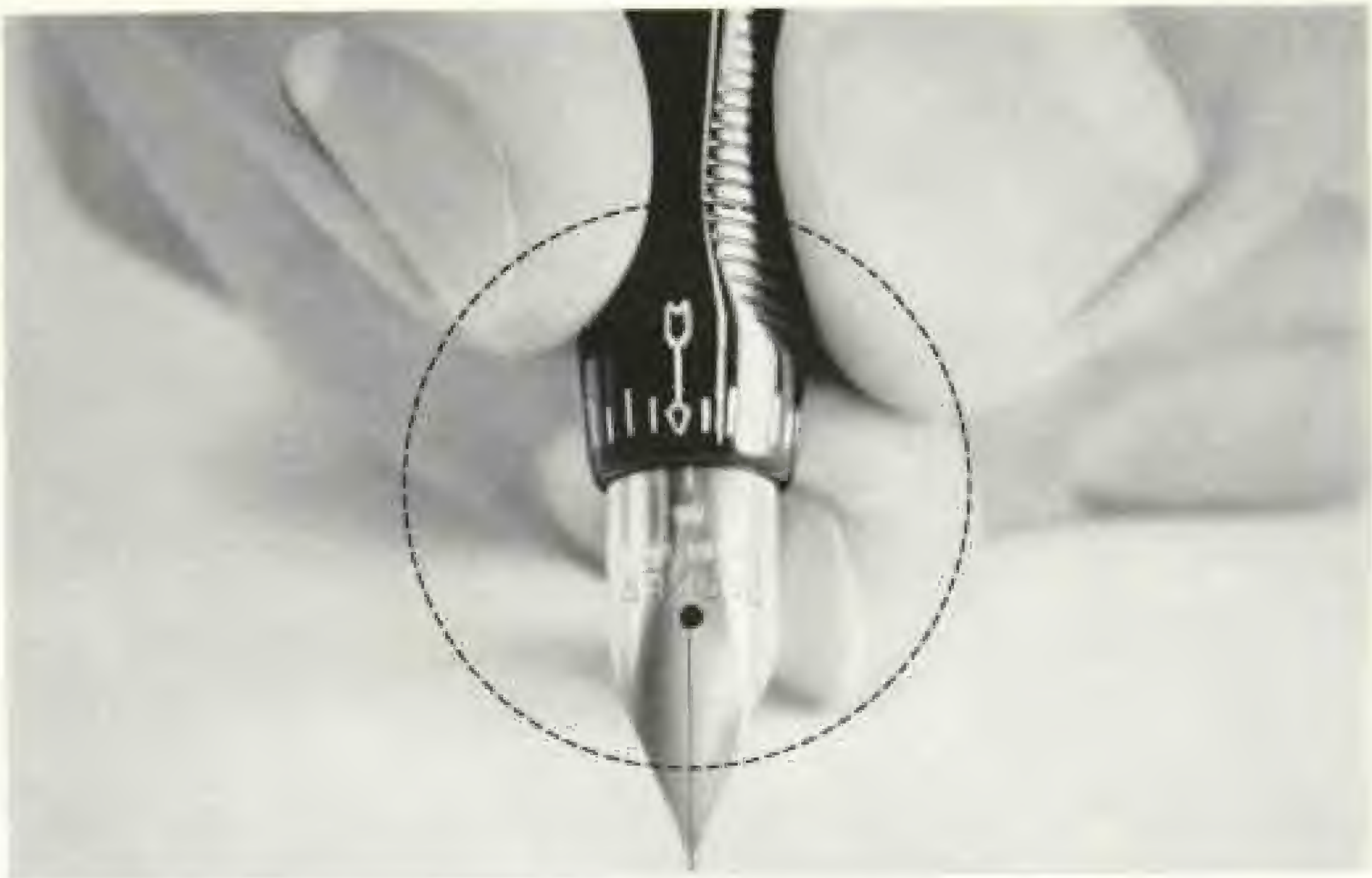
Name _____

Address _____

City _____ Zone ____ State ____

☐ I would also like literature on nearby Australia

COME VISIT NEW ZEALAND AND NEIGHBORING AUSTRALIA



ENTIRELY NEW IDEA IN FOUNTAIN PENS:

Dial the writing angle to suit your style!

Here's how the new Parker VP works:

Pick it up and your fingertips automatically slip into a comfortable position, thanks to the gently contoured grip.

Dial the big, handsome, solid 14k gold point until the tip touches the paper at just the angle you want. Then you're all set to write with more ease and comfort than you ever thought possible. It's *that* simple.

The VP gives you a choice of 15 instantly replaceable points. They range from a *needle* point to an extra-*broad executive*.

To help take the guesswork out of picking the right point for yourself or a friend, your Parker franchised dealer has a little booklet entitled, appropriately enough, "How to pick the right point for a VP." Why not pick up your free copy tomorrow?

PARKER—*At 75 Years—Maker of the world's most wanted pens*

New Parker VP*—$10

*VERY PERSONAL

Lima's *Quinta de Presa*, now a museum, has relics from an age of splendor.

This Peruvian palace lies across a bridge built with 100,000 eggs

When you walk from the new section of Lima, Peru, to the old, you cross a stone bridge. It was built by the Spanish in 1610, and they mixed a hundred thousand egg whites with the mortar to make a better binding.

They built well. The past has a way of lingering on in Lima.

Lima is just six hours from Miami on Panagra's El InterAmericano *DC-8 Jets. Round-trip Jet Economy fare is only $401. Or you can enjoy a 3-week tour of five countries for as little as $934 including jet fare.*

You'll discover Lima's past in the Plaza de Armas. Pizarro led his conquistadores to this spot 4 centuries ago and founded an empire. He laid out the city's streets, the government buildings, the cathedral, just where you see them today.

He planted a fig tree in the palace patio. It's still there, still blooming.

Legend of love

Here in a rambling pink palace smouldered a scandalous love affair between a viceroy and a beautiful witty young actress.

Her clothes, bed and carriage are displayed in lavish gilded rooms. Her marble bathtub sits on a balcony overlooking the gardens.

There's Old World charm in Lima's customs, too. Take shopping. In all but the few largest stores you never pay the first price asked. You bargain—for silver, pottery, ponchos, paintings.

Magnificent meals

Take food. Around 6 you have "lunch," an elaborate tea snack. At 9, dinner. And you dine magnificently. Peruvian food is the most imaginative on the continent.

Ready to go? So is Panagra, with the most frequent jets to Peru, Chile, Argentina. There's no change of plane over the routes of National, Pan Am and Panagra.

Panagra is the only U.S. airline that specializes only in South American travel. We can help you stretch your vacation time and money. For reservations, see a travel agent. Or call Pan Am, sales agent for Panagra.

Write for free tour folders to Panagra, Room C-34, Chrysler Bldg., New York 17, N. Y. For our 150-page guide to South American sights, shopping, restaurants, hotels, enclose 25¢.

FLY PANAGRA

WORLD'S FRIENDLIEST AIRLINE

HOW TO **SEE** THE CHANGING MIDDLE SOUTH

Explore the National Parkway along Mississippi's famous Natchez Trace, the old Indian trail that once was the only road between stately Natchez and Nashville, Tennessee, some 450 miles away.

By contrast, modern Middle South interchanges speed you on your happy tour—just as varied transport facilities speed Middle South products by highway, rail, air and water to populous markets.

The Middle South is surrounded by growing markets. It is linked by the Mississippi and the Intracoastal Canal to the great inland ports of the nation. And to the south—via the Gulf—lies Latin America. Accessibility is only one of many reasons why it's profitable to produce in the changing Middle South—where people believe in industry's right to profit.

The Middle South
UTILITIES SYSTEM
INVESTOR-OWNED COMPANIES

Arkansas Power & Light Company, Little Rock, Ark.
Louisiana Power & Light Company, New Orleans, La.
Mississippi Power & Light Company, Jackson, Miss.
New Orleans Public Service Inc., New Orleans, La.

For free colorful guide map, 301 Happy Vacation Ideas—write The Middle South Area Office, 225 International Trade Mart, New Orleans 12, La.

No other cruise experience can give you the grace and charm of the

SOUTH SEAS

Follow the sun to the South Seas with Matson for 42 of the most *delightful* days you have ever known.

Cruise in the relaxed elegance of your beautiful white ship, SS Mariposa or SS Monterey, to the world's most enchanting ports-of-call, visited regularly *only* by Matson.

Meet charming, friendly people. Enjoy pastimes which refresh but never tax you. Laze in the sun. Be at peace with the world.

Be pampered by magnificent Matson services, always at hand, never obtrusive.

Relax in a spacious stateroom with private bath, in a completely air-conditioned, gyro-stabilized ship. Cuisine is marvelous.

Sailings every third week from San Francisco and Los Angeles. See your travel agent, or write Matson.

Matson Lines

215 Market Street, San Francisco 5, California

GO in spite of

Blowouts, Punctures, Heat, Wear: new Goodyear Double Eagle with LifeGuard Safety Spare

New Vytacord, only in new Double Eagle, gives added protection against heat, a tire's worst enemy. At today's high, hot turnpike speeds, tires made with Vytacord run cooler, are stronger than tires made with nylon or rayon.

New LifeGuard Safety Spare is a complete inner tire. Not just a shield or tube, but a fully inflated tire with tread, cord and bead. Spare inner tire keeps going even if outer tire is damaged. 965 round safety cells ride over puncturing objects.

New — Widest tread made. With Tufsyn rubber. Wrap-around design. Outwears any other auto tire made. New radial whitewall pattern adds high styling to your car.

GO GOODYEAR

MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND

September, 1963

NATIONAL GEOGRAPHIC

AUSTRALIA

After roaming the world for 40 years, a native Australian comes home. It's still the only country with a continent to itself, but little else remains the same

By ALAN VILLIERS

PART I: THE WEST AND THE SOUTH

"She's big, cobber. She's big and she's going to be great!"

"GOING TO AUSTRALIA isn't just going to a country. It's going to a continent," said my friend Clive Turnbull when I saw him again in Melbourne last year after 30 years. Clive and I began our writing careers the same day back in 1923 on a newspaper in Tasmania, the Hobart *Mercury*.

And, he might have added, what a continent! Climatic range from tropical north Queensland to the meadows of far Tasmania, physical diversity from lush coastal lands to the burning deserts of the vast inland, cities of two million inhabitants on the southeast seaboard and individual holdings of well over a thousand square miles just to run a mob of cattle in the never-never land back of beyond.

Thirty percent of the world's wealth in wool, a considerable share in wheat and minerals as well, a great and growing secondary industry—all this, and much more, shared by eleven million people in a land of almost three million square miles!

This is Australia, down-under Commonwealth-continent, the farthest away of far-away places. The most ancient land has grown in less than two hundred years to a dynamic new nation after untold thousands of years of cutoff nothingness.

I am a second-generation Australian, born and educated in Melbourne. My Australian wife Nance is from Tasmania, her father born in New Zealand, mother in Tasmania.

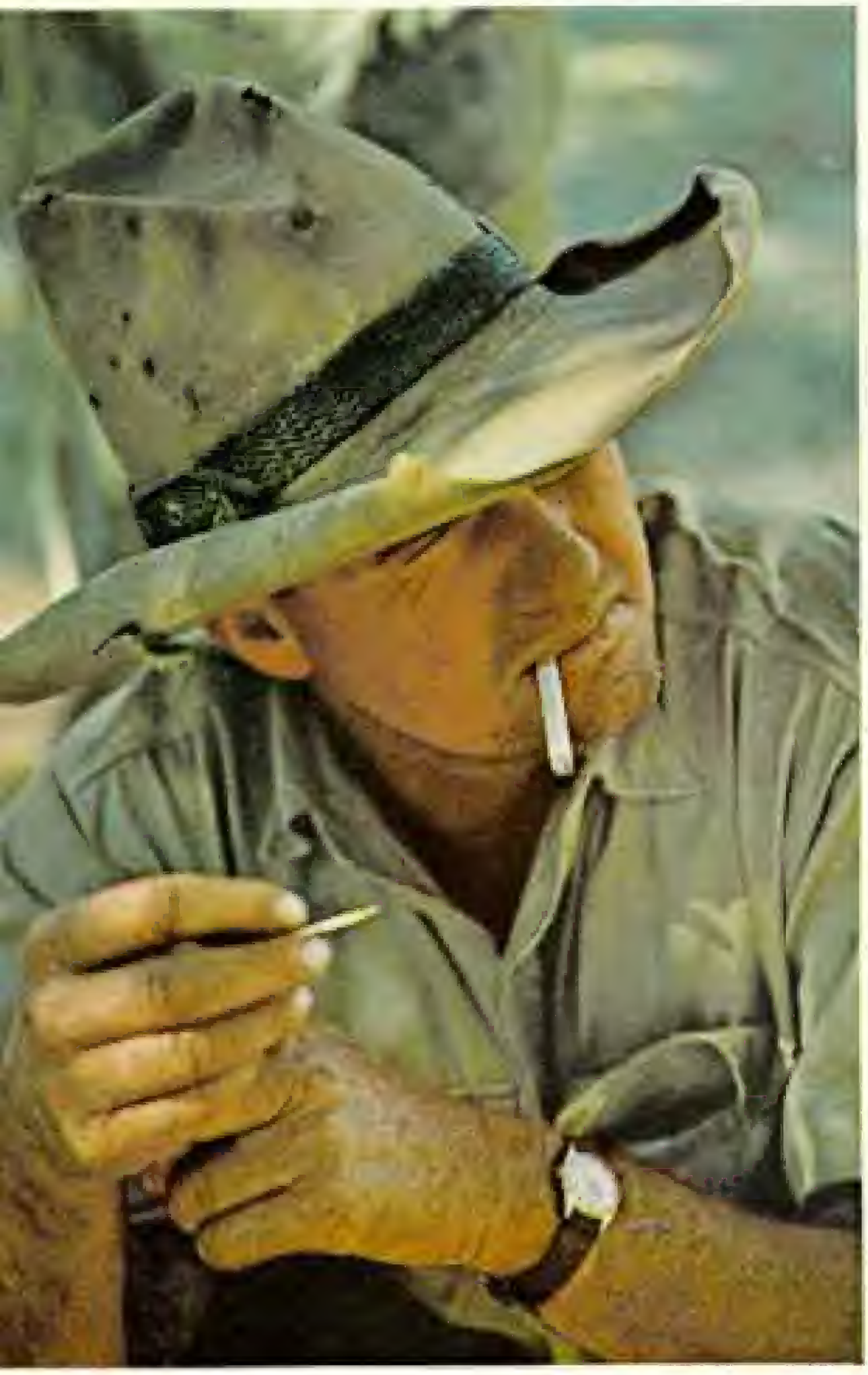
In 1962, Nance and I returned for a real look at *all* Australia. (See the new Atlas Map, **Australia**, distributed with this issue.)

We came from England by sea, the ordinary migrants' way via the Suez Canal with a call at Aden in Arabia, Colombo in Ceylon.

Cosmopolitan City and Dusty Cowboy Point Up Australia's Contrasts

Prince's Bridge spans the Yarra River in mid-town Melbourne. Pioneers laid out Melbourne's heart—the Golden Mile—with geometrical precision, and planted the garden plots that have made it a city of parks.

Rugged man in a rugged land, Peter Smith of Clifton Hills in South Australia epitomizes the cattlemen who struggle to tame the outback—the vast, arid plains.



We came in an air-conditioned 27½-knot P & O-Orient liner, a 42,000-ton queen of the sea called *Oriana*. She had swimming pools and stabilizers and extra hydro-jet motors fitted athwartships at bow and stern to push her sideways into awkward docks.

If we had been genuine migrants, we could have made the trip for a nominal $28 a head under Australia's assisted migration scheme. At least a thousand aboard the *Oriana* did. These streamed ashore at Port Melbourne amidst a babel of excited tongues.

Our first look showed tremendous progress. Melbourne had grown into a mighty sprawl around Port Phillip Bay. Beyond the general layout, we scarcely recognized a thing. Four miles up the River Yarra was a city of skyscrapers. To the west were refineries, oil tanks, and enormous factories. To the east stretched sunlit suburb after suburb, full of spacious

homes from the beach to the bush and the hill country beyond.

All this was new to us. So was the world outlook of our Australian friends. Since the war, in fact, Australia has developed a new place in the world. It has entered into defense agreements with New Zealand and the United States and it has become a member of the South East Asia Treaty Organization, which was formed in 1954.

Australia's Prime Minister, the Rt. Hon. Sir Robert Menzies, K. T. (Knight of the Order of the Thistle), was away in England at a conference of Commonwealth Prime Ministers in which he was a leading light. He was knighted personally in 1963 by Queen Elizabeth II, who is Queen of Australia as well as of Great Britain. Not only in London but in Washington too his voice is heard.

Victoria's Premier, the Hon. Henry E. Bolte,

DIVERSITY MARKS AUSTRALIA: *Girl picks apples in the island state of Tasmania, where Capt. William Bligh of* **Bounty** *fame planted the first apple trees in 1788.*

Aborigine paints himself for a funeral in Arnhem Land.

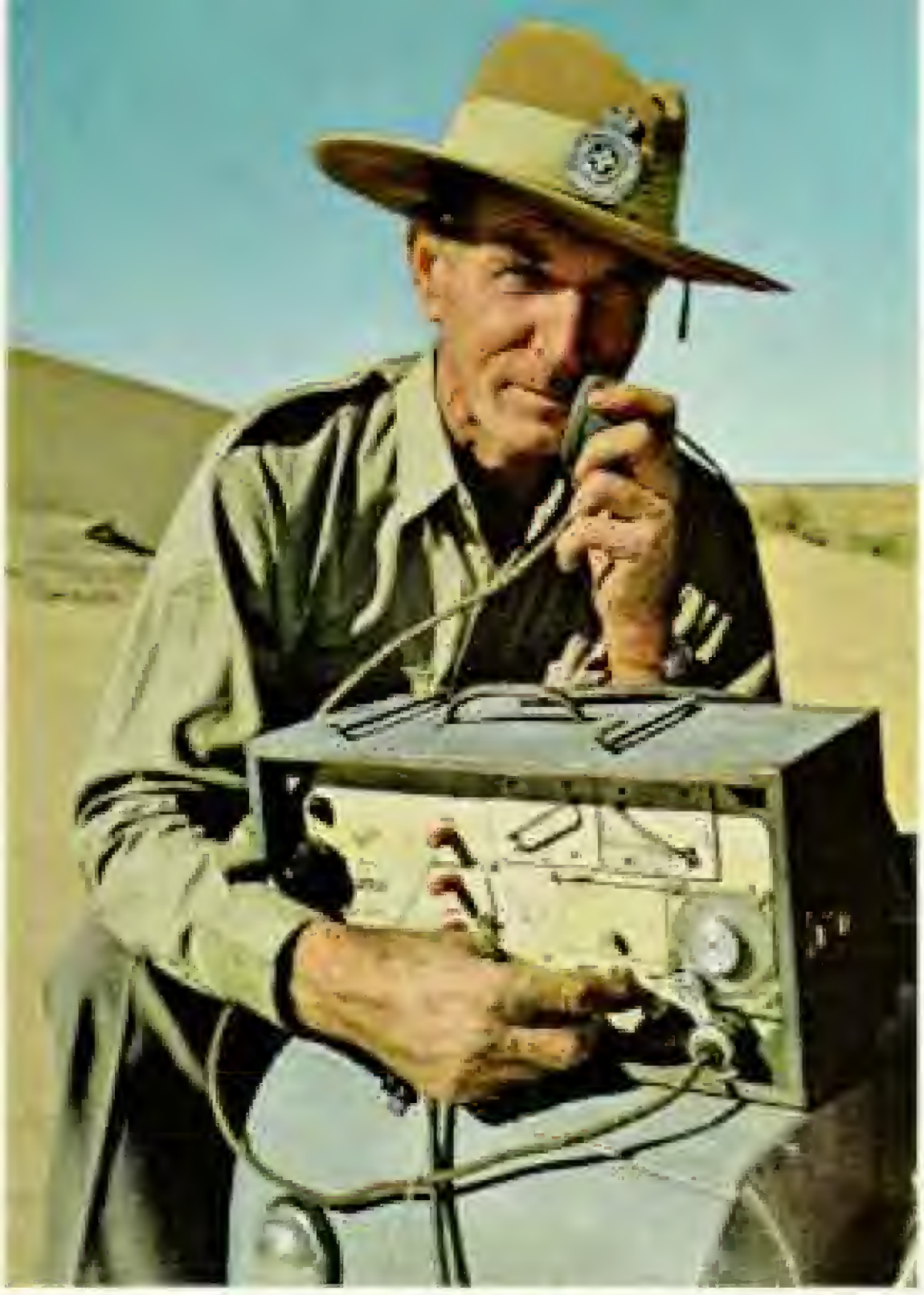
Plumed Governor-General Viscount De L'Isle reviews cadets in Canberra.

PRIDE OF SYDNEY, *Australia's largest bridge vaults the island continent's busiest harbor.* **S.S. Canberra** *(foreground) berths beside the passenger terminal.*

EXTACHROMES BY GORDON DE'ISLE © N.G.S.

ETCHINGS BY MARVIN CLARKE

PORTRAITS BY ROBERT E. GOODMAN



Marshal on the move, Queensland policeman Eric Sammon patrols the bleak, sparsely inhabited outback in his Land-Rover. Two-way radio links him with the base station in Birdsville.

Sheepman and dog run a shorn flock across the plains near Witchelina, South Australia. Light planes are a common sight in the virtually roadless outback, where air taxis link widely separated stations, or ranches. All of Australia has grown increasingly air-minded since World War II.

country boy who has headed that dynamic state since 1955, brought us up to date.

"We live in a new Australia now," he said. "We're no longer a far-off adjunct of some islands off Europe, though we honor our origins. We've had to change our thinking, realize that we are a nation of Europeans on the Asian side of the world. *In* Asia, if you like—a few million of us in the most heavily crowded part of an overcrowded world. The old Far East is our Near North, Alan, and it is challenging!

New Australia Thinks Big

"We accept the challenge. We know we must increase, must pump in people, money, must fill our empty heart. . . . We work toward the immense horizons opening before us. We are bringing people in—all sorts of people—100,000 a year. We do all we can to attract new capital, and it is coming. We go after new markets, in Japan, Southeast Asia, the Pacific—as far away as East and West Africa and South America.

"We push on with great schemes like the Ord River and the Snowy Mountains. I suggest you start your look at the Australia of the 1960's by having a glance at them. Come back here afterward and we will show you your own state then."

Ord River? Snowy Mountains? Now just

where were these? In the Australia of my youth, they had not counted for much. I had never heard of the Ord River, and of the Snowy only in ballads by our bush poet A. B. ("Banjo") Paterson. His "Man from the Snowy River" performed feats of horsemanship that became part of the Australian legend.

Nance had seen more of Victoria and New South Wales than I had. She had been in the Snowy Mountains area. She could take a look there again while I made for the Ord at the other end of the continent.

In the 1950's I would have taken ship to Fremantle first, in Western Australia, or crossed the continent by train. Now there are no coastwise passenger ships in Australia at all, but a good air service could fly me to Perth in a few hours.

From Essendon Airport, which had been open fields when I went to the high school there during the first World War, I winged away in a turboprop across the continent.

In Perth, I called on the Hon. David Brand, M.L.A., Premier of the State of Western Australia. His view was broadly the same as Premier Bolte's, though the two men head vastly different states—Victoria with three million people in a fertile, temperate area about the size of North and South Carolina combined; Western Australia with only three-quarters of a million people in a third of the entire continent—an area stretching from well within the tropics to almost 36° south latitude, a lot of it desert, most of it still tough terrain for tough pioneers.

Outside Premier Brand's window, in his pleasant capital of Perth, skyscrapers climbed into the blue Australian sky. Rivet hammers thundered. Traffic streamed in the wide streets. Orderly citizens—girls and boys in school uniforms, well-dressed men and women, all the picture of stalwart health—waited for "Stop" and "Go" signs.

"We are the only nation with a continent to

SOME AUSTRALIAN TERMS

ABO: aborigine; **BACK O' BOURKE:** great distance inland; **BOUNDARY RIDER:** cowhand; **BULL DUST:** dry silt; **COBBER:** friend; **CORROBOREE:** aboriginal festivity, song and dance; **DINKUM:** the truth; **LAUGHING JACKASS:** kookaburra, a large kingfisher; **MOB:** herd, flock; **NEVER-NEVER:** wild, remote area; **NEW AUSTRALIAN:** postwar immigrant; **OUTBACK:** unsettled inland; **ROAD TRAIN:** livestock trailer trucks; **STATION:** ranch; **SWAGMAN:** man carrying his "swag"—blanket rolled around his personal belongings; **WADDY:** short club; **WOOMERA:** aboriginal throwing stick.

Modern frontiersman Don Hamlyn and his wife operate the Witchelina station in South Australia, where it takes 42 acres to support a sheep.

Australia's 150 million sheep earn some 40 percent of the continent's export income. In a sense, Australia's economy still "rides the back of the sheep," but industry has made giant strides since World War II.

Children in the Outback Get Their Schooling by Radio

At home, the Hamlyn youngsters heed the instructions of a teacher 170 miles away. Mrs. Hamlyn coaches her daughters as they follow a lesson broadcast by the School of the Air in Port Augusta, South Australia.

Radio roll call by Port Augusta teacher Jean Cockburn opens each session of the School of the Air. Her pupils live on cattle stations, in mining camps, and in other isolated settlements. Two-way radio enables them to answer Mrs. Cockburn's questions.

ourselves," said Premier Brand. "But it is not a land that can be developed fast. Of Western Australia's three-quarters of a million people, more than 400,000 live here in Perth. But we're opening up a million acres of arable land every year, and bringing three-quarters of a million acres into use. We're about where the West was in the North America of a hundred years ago.

"Like the West," he went on, "we have a virile, extrovert people, energetic and ready to have a go at anything. And there's plenty for them to have a go at here.

"Another advantage is our geographical position. The great Asian markets are right alongside us, and they are going to grow.

"Our future is in increase of trade with our neighbors of the Indian Ocean."

Premier Brand is determined that the lights of the capital of Western Australia, switched on in February, 1962, especially for Astronaut John Glenn—Perth's friendly gesture made world headlines—and then last May for Astronaut Gordon Cooper, shall not be dimmed again (next page).

As for the Ord River Project, this is primarily an irrigation scheme designed to hasten settlement of a little-used area of northwestern Australia called the Kimberleys—a tropic chunk of 139,000 square miles with 4,500 people and half a million cattle. It is good pastoral land, in the monsoon belt where it can rain a foot in a day. Research shows promising results with such crops as sugar, rice, cotton, safflower and other oil seeds.

Project Too Expensive for State Alone

Trouble comes in the dry season. The project is to dam the river both with diversionary and main dams, provide a 200,000-acre irrigation area, and use the water for hydroelectric power as well. Expensive big dams, power stations, a new town, and some rail extension to the nearby port of Wyndham (to ship the rice to Asia, the nearest part of which —in Indonesia—is less than 450 miles away) will all be necessary.

This will cost a lot of money—more than a state like Western Australia might easily find. So the Commonwealth as a whole comes in, for all Australia has an obvious interest in populating its north.

I set about organizing a safari to the Kimberleys and the Ord River at once. The re-

Perth's blazing lights earned fame during Astronaut John Glenn's space flight in February, 1962. The city's 400,000 inhabitants flipped every switch to let the American spaceman know their prayers rode with him. "Thank everybody for turning them on," Glenn requested from more than 100 miles above the earth during his first orbit. Last May, Perth lighted up again for Astronaut Gordon Cooper's 22-orbit mission.

Divided parkway winds into Perth, capital of Western Australia. Red taillights streak the left lane in this time exposure; Australia, like England, drives on the left.

mote area might, I thought, be hard to reach.

A cattle-boat passage to Broome or Wyndham, a string of camels up there and a couple of Afghan guides? The travel agent in Perth looked astonished.

"Look, mate," he said, "we've got airplanes. Get you there this afternoon."

So, in a Dutch-built jet-prop, we climbed over Indian Ocean beaches and sped north.

The front six seats of the airplane were stacked with freight, parcels, and food for outback stations. My flight companions included tall Western Australians, lean and tanned, with blue eyes crinkled at the corners. All were wearing large wide-brimmed felt hats. With them were an aborigine schoolboy going home on holidays, and some sun-tanned, shapely, and very pretty girls.

Everyone seemed to know everyone else on first-name basis, though they lived hundreds of miles apart. Within minutes that airplane was as friendly as an old local bus.

Twenty Acres Support One Sheep

Between the helpful hostess, vivacious Elizabeth Bartlett from Perth, obliging Captain Jack Murray, and experts of all kinds, I was soon learning things about Australia I'd never known before.

We flew over wild country, burned, bare, old as time. Here and there it was cracked open by deep gorges. And areas as big as Connecticut were pitted with circular brown hills, like small craters, as if the whole land had bubbled up there eons ago and the bubbles had burst and frozen. A few scrub gum trees stood out like quills on a plucked goose.

How could this land be worth anything?

I asked a squatter whose holding was a million-acre "lot" in the Kimberleys: How many beasts could he run to the acre?

"Cobber," he said, "up here we don't talk about beasts to the acre. It's acres to the beast. I run a sheep to about 20 acres. If it was beef cattle, it'd be one to 40 acres. Some blokes run one to 70."

By the time we got to the Ord River, I had learned not to look for much flowing water. There was a riverbed, a few pools.

"She flows when it rains. She can flow 50 miles wide," said the old sheepman. "We get real rains here. The Ord in flood could fill Sydney Harbour in less than a day. The trouble is that all the water rushes into the Indian

Brackish Water and Natural Gas Spout From an Artesian Bore

Most of the outback lakes that appear on maps are dry salt pans much of the year. But wells sunk hundreds of feet yield water, sometimes as hot as 210° F. Often it is too salty for household use or irrigation, though stock thrives on it. For hot, grimy travelers, it provides a welcome bath-in-the-basin. Flammable gas, burned off as it issues from the pipe, provides a reading light for drovers on the trail.

Surrounded by solitude, Angas Downs station freckles the rust-colored flats of the Northern Territory. Lack of water keeps the outback parched. In some areas not a drop of rain falls in a year. More than half the people of Australia live along the fertile coastal strip of the east and southeast.

Ocean so fast we don't get much use of it. Seven million gallons of water a second surge into the Timor Sea in flood time down the Ord—think of it! When we really need water, it isn't there.

"That's what the Ord River scheme is all about."

We flew over the diversionary dam, landed beside it—a big concrete dam on a rock outcrop at a place called Bandicoot Bar.

"Cost us five million pounds so far, but she'll pay it back," the sheepman said. With the Australian pound currently worth $2.25, that came to $11,250,000.

"Nobody's fooling up here," he continued. "Government blokes have already grown cotton, rice—high-grade long grains, good for Asia—safflower seed for oil and cattle cake. We've put in a new town called Kununurra,

with a cinema and all. The first five farms—600-acre blocks—are ready for early 1963, when the diversionary dam will be working.

"Who is going to farm in a tough area like this, you ask? The government's already allocated the first five to good men. They had over eight applications from real blokes for each place. She's big, robber. She's big and she's going to be great!"

Six-foot Venetian Fred Moro, working on the dam, would like to stay up here and farm. I met Fred in the waiting room, a thatched hut, of the hard brown airport, with his cobbers—Bill Bell, a British ex-seaman, and a wiry young Canadian named Jean Lewis from Montreal.

"I missed my ship in Sydney," said Bell, from Liverpool. "Best thing I ever did."

The three of them picked up the airplane for Wyndham to "hit the town."

"Yes, Australia has changed a lot. We used to pay a bonus to drive off the abo cattle stealers along the Ord," an old schoolmate from Melbourne told me at Wyndham. "But you'll have to look hard for 'em now. There are beef roads through the bull dust. One of these days the chant of the corroboree and the howl of the dingo will be all gone."

Australians have been pioneering the Kimberleys these past three-quarters of a century, trying to create cattle empires with the stock whip and the rifle, and the hand of all nature against them.

Road Train Speeds Beef to Singapore

In so vast an area, even the $45,000,000 Ord River scheme—when it comes—is a scratch on the desert. Present intention is to prove the scheme with the first farms irrigated from the diversionary dam, then with more Commonwealth funds, finance the costlier big dam higher up, and go on from there.

I flew on to Broome (see supplement map) "All our cattle come in by road train, except from a few close-by stations," said Dermot Farrell, cattleman, meat packer, and, as President of Broome's Shire Council, responsible for an area of thousands of square miles. Trucks can do in a day what drovers used to manage with luck in a couple of months. "We are treating 10,500 beasts here this season. Most of the beef goes to the U. K., Singapore, and the U. S. A."

I talked with Dermot in his office—an asbestos hut on the outskirts of Broome. At the end of a 2,400-foot-long jetty a government freighter, fast aground at low tide, was loading beef and boxed pearl shell for transshipment at Fremantle to New York.

With me was Sam Male, still in the pearl-shell business—and pearling, too—in this fascinating old port of adventure.

Broome was the one place up there I knew about. I remembered it from school days as a pearling port with a fleet of several hundred swift luggers, manned by Asians who scoured the floor of the nearer Indian Ocean for pearl shell and pearls. Broome lies in the tropic cyclone belt. Cyclone here is another name for hurricane. I remembered the loss of a big coasting steamer in such a storm—she was never heard of again—and pearling luggers wrecked by the score.

Cultured Pearls Grow Big as Marbles

Now Sam Male and Dermot Farrell showed me a different Broome.

"The mother-of-pearl shell business is not too good these days," Mr. Male told me in his office building close by Dampier Creek, where once the luggers jostled in hundreds. "But that's not the end for Broome, by any means. Take a look at these."

From an outsize iron safe he took a cardboard shoe box, and put it on the table with, I thought, some reverence. He lifted the cover. I saw the reason for the reverence.

It was full of magnificent pearls—lustrous, radiant, some as large as small marbles.

"There'll be plenty more where they came from," Mr. Male said. "These are Australian cultured pearls from spots in Camden Sound to the northeast. The conditions seem to suit pearl oysters. Pearls like these grow much faster than they do in Japanese waters, and the quality is superb."

I held a handful—the largest and most flawless palmful I'd ever seen, and I have spent a season with the Persian Gulf pearlers. I was not surprised to learn that a single

Karri Trees of Southwest Australia Rival Redwoods in Size and Value

Native only to this corner of the world, *Eucalyptus diversicolor* grows nearly 300 feet high and 10 feet in diameter at the base. Noted for strength and durability, the karri yields large sections and long straps ideal for houses, wharves, and bridges. Working near Pemberton, this woodman notches a trunk as a guide for sectioning.

strand of Australian matched pearls was recently offered by an exclusive New York Fifth Avenue jeweler for $33,000.

While I talked with Sam Male, I could hear an odd sound, like large dishes being thrown on top of other dishes. This clatter came from the mother-of-pearl shell packers, sorting shell, making up an order for New York. Plastic has forced all but the best shell off the market, but large buttons for women's clothing are still made from the real thing.

"Our trouble is it doesn't pay to market only the best," Terry McDaniel, one of the last of the Broome pearlers, told me. "We've only a dozen luggers still going to sea." McDaniel owns four of them, was born and raised in Broome, a pearler all his life.

He stared at the buttons on my American Dacron-mixture shirt. They looked like pearl shell to me, but they didn't fool him.

I had a look at some of these last Broome luggers—beautiful models, husky and yacht-like, lying on their bilges amid the mud and the mangroves where the tide had receded. Old anchors, their shanks almost rusted through, an old pearl-diver's helmet, and rusted iron rigging still spliced around deadeyes competed with thousands of beer bottles—

Serpentine King River Becomes an Inland Sea When 28-foot Tides Rush in Twice Each Day

Where the north thumb of Western Australia juts out toward the Timor Sea lies a vast wilderness known as the Kimberley Division. Except for families living on scattered cattle stations, the only inhabitants are aborigines.

Elizabeth Bartlett, hostess for the MacRobertson-Miller Airlines, made the picture on one of her frequent flights above the region. "In the wet season," she writes, "Kimberley rivers grow 50 miles wide. Last year a station manager and his wife had to swim three swollen streams to catch our plane."

The sheer desolation of this scene accents the airplane's vital role in Australia. Commercial flights have reduced to mere hours journeys that once took weeks or even months.

most of them broken—for room on the sand.

There was a copper-fastened blue-gum beauty, new built and never used—55 feet over-all by 14-foot beam and 6½-foot draft—lying in a shed for protection against the sun.

"I can't do anything with her now," said the builder. "She's yours for 5,000 pounds."

I was tempted. She had wonderful lines and was fit to sail around the world.

"Lofty" Cavanough showed me through the sunlit town. Lofty is the busiest jitney, taxi, and general delivery man known. I had to fit my tour into his fantastically busy morning. Hailed here, hailed there, running two elderly and very solemn aborigines to a garage after their truck had broken down, running women to hospital, children to school, mail to pensioners, collecting parcels at the airline office, delivering laundry, iced beer by the case, fresh bread from the tin bakery, rushing through the choking dust all day long, and turning no one down—this was Lofty's life.

"Bin here six years," he said. "She's great."

I liked Broome, liked the Kimberleys and all the friendly people. As I left, Sam Male and Dermot Farrell and the rest were talking of government plans for making Broome a

Through choking dust and heat, cattle move to railhead on hoof and by road train. Australia ships nearly 150,000 tons of beef a year to markets half the world away. When summer sun bakes the earth and burns the grass, travelling animals manage to survive on the prickly seeds and leaves of desert plants, such as the goosefoot (below, left) and the saltbush (extreme right). Spread out along the trail, the steers trudge some eight miles a day. Skilful riders hold the mob together.

deepwater port. They spoke of a tourist center on its glorious unused beaches, and of new prosperity from the fisheries, the cattle industry, and the cultured pearl.

I found the same spirit at Port Hedland, a few hundred miles farther down the coast.

"For many years it has been known that our hinterland is full of rich ore, manganese, iron, copper, asbestos, gold, and other minerals," Shire President Angus Richardson told me. "But how rich, and how much?

"All anybody knew was that it would cost millions to do anything about it. We'd have to put in a railroad, build a new port or dredge out this one, build roads, and, of course, do something about water.

"Well, now we're doing it," Mr. Richardson explained. "Out at Mount Goldsworthy, there's 150 million tons of iron ore. U. S., British, and Australian outfits have put 12 million pounds in the project—and that's only one of the things going on around here."

The old Pier Hotel, never a palatial establishment, was jammed. Diamond drill experts, transport experts, contractors, surveyors, engineers, and bush pilots—Japanese, American, Australian—bedded down on iron beds head to feet on all the wide verandas. Bedrooms were offices; surveyors worked happily at plans all over the floors, going full speed.

I shared a room with a contractor up from Perth, working at Mount Goldsworthy.

"I use half a million's worth of American equipment around here and along the Ord," Keith Perron told me. "It's a hard country. The wet season is hell. My toughest job is to keep the labor. I'm paying drillers 80 pounds a week and I can never get enough. The last six I flew in lasted two weeks.

"It's *tough* here, real rough. It'll cost 12 million pounds just to install the equipment to get the ore to the coast and shipped away. There's always the worry, will it work out? We'll be proving iron ore deposits for another two years. They're coming along fine."

Radio Clinic Aids Outback Stations

Port Hedland is one of the oldest headquarters of the famous Flying Doctor Service, now honored by the prefix Royal. The R.F.D.S. has worked out of Port Hedland since 1935—a long time in northwest history.

This branch of the service has one airplane, one pilot, two doctors, one radio operator, and the cooperation of nursing sisters at the township's splendid new 20-bed hospital. Everett Bardwell, who runs the radio side and has had 26 years in R.F.D.S., told me the base looks after some 50,000 square miles. Radio is the core of it all.

First, early each morning, one of the doctors holds a sort of radio clinic. This over, Everett gets busy.

"Every station, every mining camp, every prospector has a transmitter and receiver. There are a few pedal sets still in use. One old boy carries one on his camel. I've heard him over 600 miles—not bad for three watts. Mostly this is good radio country."

A pedal set is worked by pumping away on a sort of bicycle contraption without wheels. You sit on the saddle, pedal for power, and use the mike.

"Every station and camp also has a medicine chest," Bardwell said. "Everything in it is numbered so there's no mistake when the doctor prescribes. Nowadays the doctor doesn't fly much—only in emergencies."

But Dr. Basil Fetwadjieff—a New Australian 12 years with the R.F.D.S.—told me that his colleague had flown off that very morning to treat an aboriginal stockman at a place called Jiggalong.

"The service flew 80,000 miles out of here last year, and we are only one of 12 such centers in Australia," the doctor said. "We brought in about a hundred patients."

A post office lad threw down a wad of telegrams to be relayed by radio. A female voice at a camp a couple of hundred miles away rattled off her weekly butcher's order—"four legs of mutton, half an ox."

Ron Beresford of Carpentaria Explorations, off on a long trip into the interior, dropped in to check his radio and pick up such parcels as he could deliver on the way. Stations, miners, cooks, prospectors all called in over the air, taking their chances on when or how the stuff might be delivered. Odd parties like Ron Beresford's or passing bush pilots always help.

Brahman Plus Angus Equals Brangus

By this time I felt I had seen a bit of the northwest. I flew back to Perth. Once there, it's easy to fly east. But I was in no hurry. I took the transcontinental train.

Years before, I had traveled that line when it was fairly new. It goes via famous gold town Kalgoorlie and across the Nullarbor Plain, with lots of wayside stops; and the sand, I remembered, blew into the soup.

In this new Australia the old steam train is replaced by a diesel, hermetically sealed against the desert sand, and air-conditioned. But it still runs only part way, onward from Kalgoorlie to a place called Port Pirie near the head of Spencer Gulf in South Australia. There you change trains.

My cabin mate from Perth was an old cat-

Flying Doctor Service Brings Home a Patient

Winging over desolate nothingness and landing on hazardous ground, the flying doctors of the outback bring aid to the sick and wounded. The service, begun in 1928 with one plane, today flies hundreds of missions a year. With doctor and nurse aboard, this plane flew 200 miles southwest from Alice Springs to return a convalescent patient to Ernabella Mission Station.

"Stick with him, son!" Station manager Peter Smith instructs his boy in the art of calf riding at Clifton Hills in South Australia.

WIND-SWEPT RIDGES, *corrugated with deep ravines, provide an inhospitable home for South Australia's aborigines. But, despite restless winds that constantly shift the sands, the red wasteland is an open book to the nomads, who unerringly track mammals, birds, and snakes in their search for food. Naked youngsters (right), seemingly always on the move, dart in search of small game near Ernabella.*

tleman in riding boots and a wide-brimmed felt hat. It was his first trip in a train, he said; he had never been in Perth before.

"I'm easy. Just call me at 4 a.m.," he told the startled porter who looked in to note our morning tea requirements.

The cattleman talked of the old droving days, and big mobs he'd taken down the Birdsville and the Murranji—famous old-time cattle tracks hundreds of miles long—and a queer breed of cattle he was building up, a cross between Indian Brahman bulls and his own Angus. He called them Brangus, and said they were doing fine.

Gold Put Kalgoorlie on the Map

At Kalgoorlie I saw ex-President Herbert Hoover's old home—oddly enough, called the White House from way back—where he lived when he was a mining engineer at the famous Golden Mile in the early 1900's. I doffed my hat to the memory of Paddy Hannan, the pint-size tough prospector from County Clare who'd started it all, back in 1893.

More than 50 years old at the time, Paddy had prospected for a quarter of a century, when he and his partners stumbled on a piece of stone on the outskirts of Kalgoorlie. He picked it up. It was very heavy. Gold!

Since then the Kalgoorlie area has produced gold worth nearly a billion pounds.

"We're still mining three-quarters of Australia's gold," Mayor Sir Richard Moore said.

In his parlor is a painting of Paddy Hannan, and there's a statue of him in the main street. A bearded figure about the size of a jockey, dressed in rough trousers and collarless flannel shirt, tough boots, and felt hat, he holds a canvas water bag. Automobiles in Australia's outback still have fittings to take these water bags.

Hannan Street, Hannan's Club, Hannan this and Hannan that—but poor Paddy did not share in those millions. Somehow, few prospectors ever did. They lacked capital to work really big finds. He died in Melbourne while I was still young, after living his last years on a government pension.

The flame trees were out in the straight, wide streets of Kalgoorlie, and the huge weathered dumps of mullock from the mines surrounded the town, like the bases of a hundred Egyptian pyramids. Not a miner or a nugget of gold was in sight anywhere. The miners were underground, or sleeping; the gold was underground too or safe in vaults.

More than 400 miles of limestone plain, once the bottom of the sea but raised, flattened, and sun-baked for countless million years—this is Australia's Nullarbor Plain over which the transcontinental railroad passes. Nullarbor, *nulla arbor*, no trees. There is one straight stretch of 297 miles where the train just goes on and on and on over a track that never deviates. The horizon stretches away like the sea, except that it is always level—a monotonous level—unlike the sea. No albatross glides, no ship heaves in view.

The Nullarbor Plain looked like desert to

Primitive plainsman dwells on the Amoongana Aboriginal Reserve in the Northern Territory. Scouring the desert, he eats everything edible: grubs, lizards, honey, ants, kangaroos, emus, grasses, and seeds.

Solitary hunter scans the plains near Ernabella for kangaroos. With his spears, the aborigine carries a woomera, a throwing stick that increases the leverage of his arm and the force of the hurled lance.

me, but livestock could feed on the saltbush and bluebush, and some very dry, tough grass.

"Trouble with the Nullarbor," said the guard, "is the water's all under it—in thousands of caves and holes. And it's often salt."

I left the train at Pimba, South Australia, near the missile range of Australia's Weapons Research Establishment in Woomera.

Woomera is an astonishing town on the semidesert. It has three striking churches, splendid modern schools and apartment houses, a shopping center, a fine hospital, an airport, and all sorts of facilities concerned with the most modern weapons research and satellite tracking.*

"Perth made the headlines by switching its lights on for Astronauts Glenn and Cooper—but we helped to keep in touch with them," said the Rocket Range Superintendent, Group Capt. Glen A. Cooper—pure coincidence—of the Royal Australian Air Force.

"There are 200-odd man-made bits and

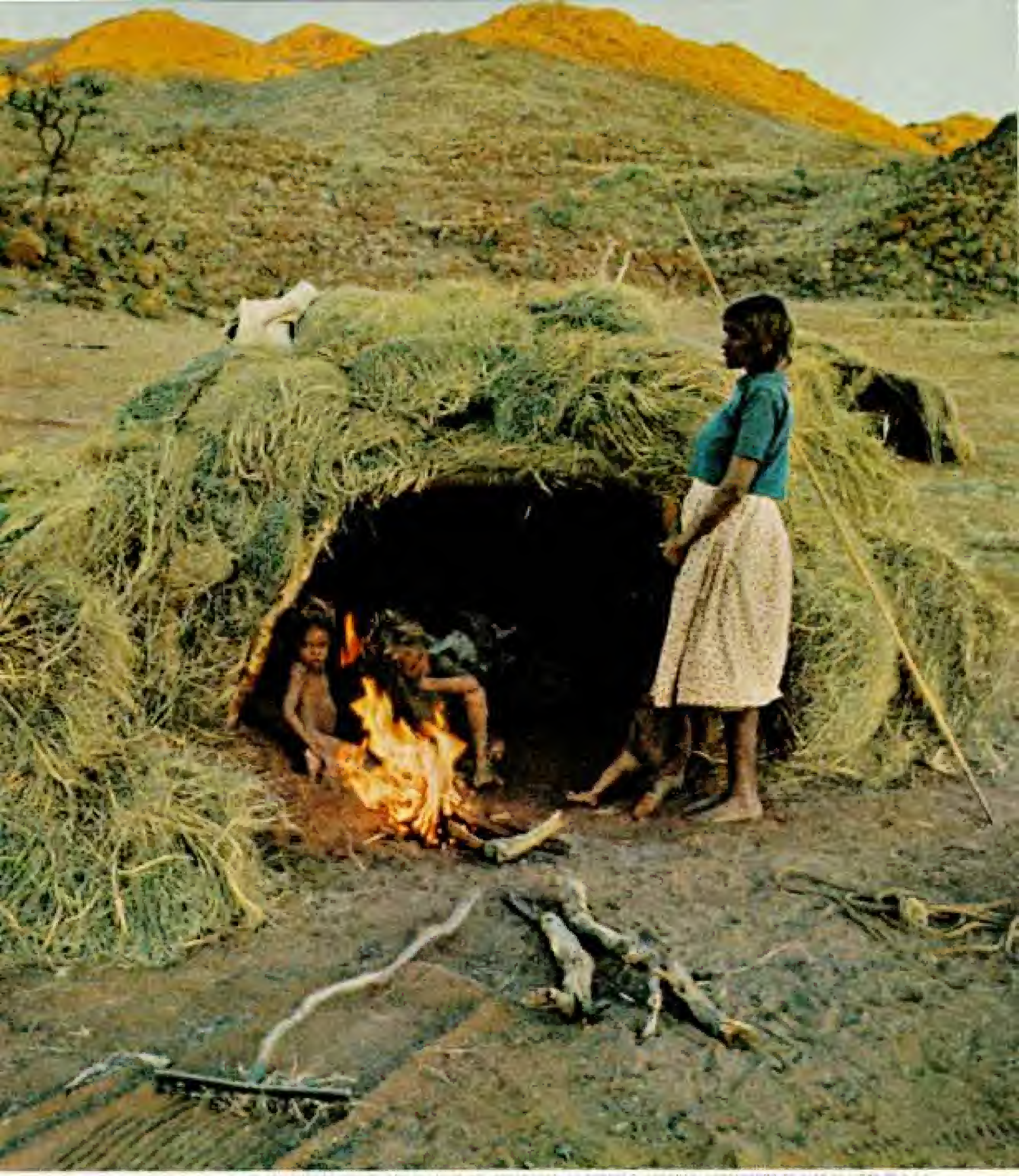
*See in the NATIONAL GEOGRAPHIC: "Tracking America's Man in Orbit," by Kenneth F. Weaver, February, 1962; also "John Glenn's Three Orbits in *Friendship 7*," by Robert R. Voas, June, 1962.

Carefree children skip rope on the grounds of Ernabella Mission Station, where many young aborigines attend school.

Stockmen on a shopping spree visit Alice Springs, an outback town near the geographic heart of Australia. Many aborigines today work on cattle stations and wear Western dress.

Grass shelter houses semi-civilized aborigines in the Northern Territory. "On winter nights the family huddles with its dogs for warmth," reports the author. "They rate the temperature by the number of dogs per man. A four-dog night is *really* cold."

Many nomads spurn shelters and sleep in the open. On cold days they carry fire sticks.



pieces orbiting the earth, 35 of them satellites. We keep in touch with a dozen," said Mr. C. N. Gerrard of the Space Research Station.

"Like Johannesburg in South Africa and Goldstone in California, Woomera takes care of roughly 120 degrees of longitude. The U. S. National Aeronautics and Space Administration finances us, but we operate under our own Australian Department of Supply."

Big words, extraordinary job, but the presence of one of the National Geographic Society's new globes on Mr. Gerrard's desk was a familiar touch in this new world. Its plastic cap is designed—among other things—to help track satellites in orbit.

Outside, an old-man kangaroo loped for the horizon with lazy leaps of 20 feet or so.* The sun burned vividly in the cloudless blue sky. Perfect visibility made the big 'roo look much closer than he was.

In much of the tremendous area from

*See "Strange Animals of Australia," page 358

Baobab tree's rootlike branches make it appear to be growing upside down. Australians know this hollow-trunked giant as the Prison Tree; pioneers near Derby, Western Australia, used it as a jail. Baobabs store gallons of sweet water in summer, a boon to aborigines and thirsty travelers.

Dazzling wildflowers mantle the desert and mountains of Western Australia in the continent's September-to-December spring. Kangaroo-paw (left) is the state's official flower. Succulent at lower left stores water in fingerlike leaves. Scarlet banksia below brightens the Stirling Range.

Woomera to Broome those odd Australian creatures the dingo, or wild dog, the kangaroo, the ostrichlike emu, and the goanna lizard have control, with a few aboriginal nomads still following their Stone Age way of life. Other areas support a few sheep.

Water is one of the area's big problems.

"We have to pipe our fresh water 300 miles from the Murray River," said Mr. L. A. J. Malone, the Woomera township manager. "We are lucky to average five inches of rain a year here. We store 12,000,000 gallons in Woomera, just in case."

We dropped in at Jerry Hlava's opal workshops. A New Australian—formerly Czech—Jerry, in his spare time from satellite tracking, works up beautiful pieces from the opal field at Andamooka, about 38 miles away (following pages).

"A man lives well here," said Jerry, as he showed me some of the lovely jewelry he had created. "There's plenty to do and plenty of good cobbers to do it with."

Already he had the authentic Australian accent, and the words.

Windjammer Seaman Takes to the Skies

I flew on from Woomera's busy airport to Adelaide, reflecting on this new Australia that still took me by surprise. The old image of the wandering swagman, the tough stockman driving his cattle mobs overland along the toughest trails, the laughing jackass chuckling grimly on the high gum trees, the tall, ambling Australians calling England "home," and more land everywhere waiting for the courageous, battling pioneer—where had this Australia gone?

Satellites, guided missiles, deep-space instrumentation facilities, and all those things seemed remote as swagmen as we flew over the salt pan that is Lake Torrens, and the apparently sterile endless brown land.

Our copilot was Keith McCoy, a South Australian who had been a seaman in the Finnish four-masted bark *Pamir* on her last voyage under that flag. Later she was sold to Germany, given an auxiliary engine, and lost. He had rounded the Horn in the grain-ship race from Spencer Gulf to the English Channel, as I had done a few times myself.

"No more windjammers come," Keith told me. "There's more wheat than ever, but the grain ports are mechanized now. So I took up flying. It's the next best thing."

I stopped at Adelaide and took a look at the Spencer Gulf outports with Keith and some other old sailing-ship men a day or two later. The last time I had seen Port Victoria—in 1938—there had been seven big Cape Horners there, part of a fleet of 20 sailing ships all loading bagged grain.

Now there were no ships at all. The grain sheds stood empty. "It all goes in bulk by road to the major ports—right to the ship's side. It's easier," Keith explained.

I flew to Port Lincoln and Whyalla, too. I scarcely knew the places. Port Lincoln's wharves were full of modern motor ships; tuna clippers, big-game fishermen.

"Come and have a look at our Tuna-rama," Mayor Percy Puckridge invited Keith and me. "We sell our canned tuna to America. Or have a go at the white-pointer shark. Zane Grey started it. We get them up to a ton or more here, and 18 feet long."

At Whyalla I found a shipyard finishing a 32,250-ton oil tanker, largest ship ever built in Australia. A big new steel mill was going up. At the long jetty, 16,000-ton ore carriers were loading ore brought direct from the iron hills some 30 miles inland, known as the Iron Knob, Iron Monarch, Iron Baron, and Iron Prince—in the Middleback Range.

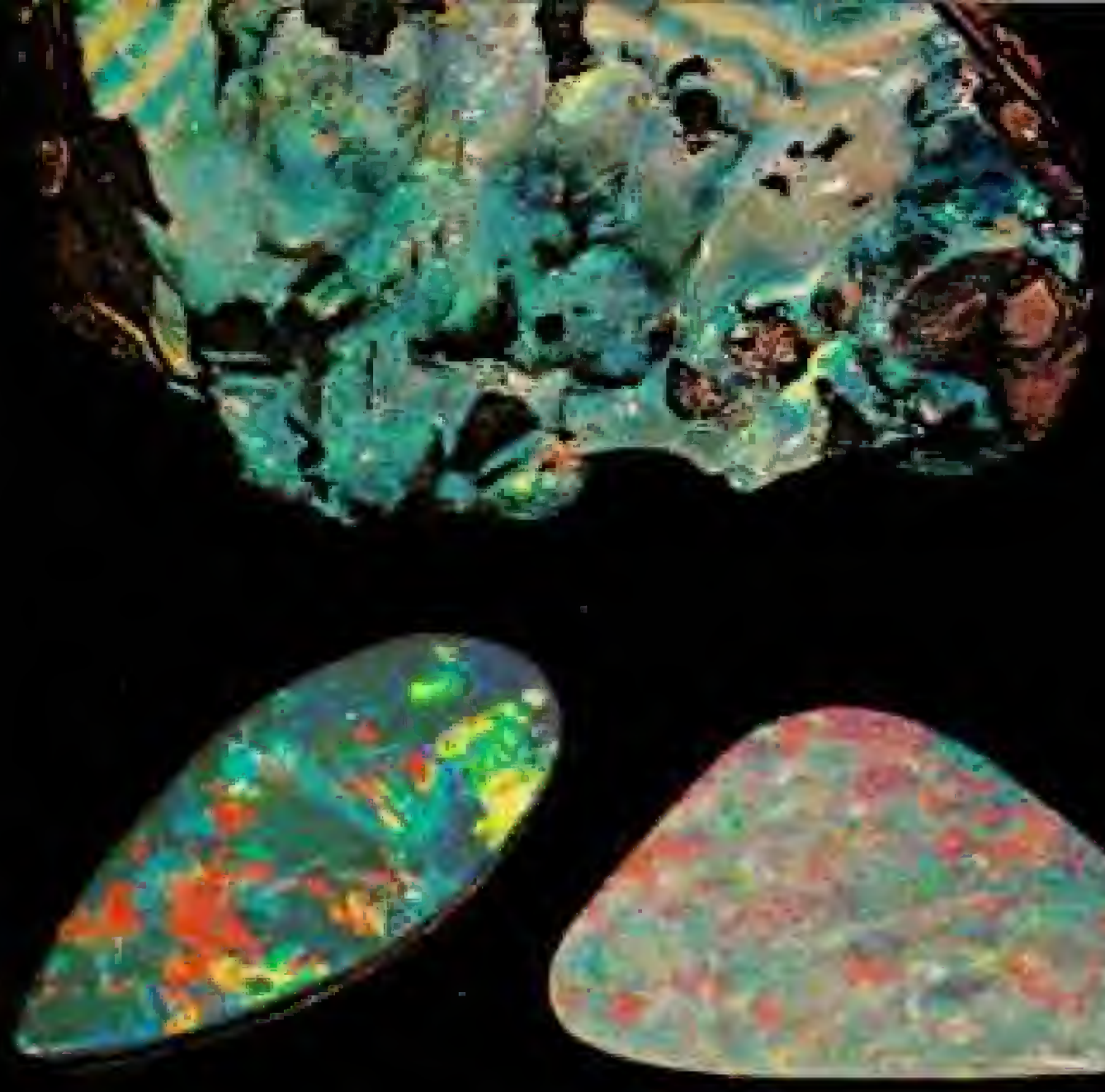
"The four mountains are high-grade iron ore. They put in a railroad and just carry down the hills by the trainload," said Keith. "There's ore there by the hundred million tons. And it averages 60 percent iron."

As we took off, I could see the prominent hills in the distance, rising above the semi-desert saltbush plains. A railroad snaked toward the jetty. A pot-bellied steamship, the same red color as the ore she was to load, disturbed the waters of the blue gulf. There was not a sail in sight.

Adelaide: Music and Fine Wine

The home of a famed Festival of Arts attracting talent from all over the world, Adelaide encourages the extraordinary musical talent of Australians. Youthful Nellie Melbas and Joan Sutherlands jostle in the streets with new Percy Graingers as yet unknown.

I had wonderful views of Adelaide from the foothills of the Mount Lofty ranges, where I visited with Jeff Penfold Hyland at the township of Magill. Below us the checkerboard vision of Col. William Light's garden city basked in the sunlight. We marveled that South Australia's first surveyor-general back in 1837 had laid out streets that are still able



Black opal's rich color and rarity command a higher price than the white stone at right. At top: raw gems as miners find them. Coober Pedy and Andamooka yield majority of the world's opals.

Opal pendant and matching earrings accent the dark beauty of a model.

Molehill heaps of tailings near Andamooka create a moonlike landscape. Miners dig as deep as 50 feet in their search for gem-bearing rock.

Miner and his family live below ground at Coober Pedy to escape sun and flies. Refrigerator adds a touch of luxury to their two-room home.

Gold prospector leads a string of camels into the outback. Descendants of animals imported from India a century ago, the thirst-resistant beasts will go where no horse or donkey could survive.

Wind-blown tufts of buckbush roll like tumbleweeds down a road in New South Wales. Mirage of mountains, beckoning dark and cool on the horizon, is a trick conjured by shimmering heat.

to cope with the era of too many automobiles.

Not far behind Colonel Light, Dr. Christopher Rawson Penfold arrived from England in 1844, bringing vine cuttings from France and Spain. He bought an estate at Magill and planted the vines. Roots deep in the iron and limestone substrata, foliage filtering the warm sunshine, the vines throve (page 365).

The astonishing South Australian wine industry has grown along with them Today production runs to 20 million gallons annually, much of it exported.

We drove along Adelaide's King William Street—wide enough for gay flowering gardens down the center—thence by a four-lane highway toward the north. We passed new factories bearing names that are household words in Detroit, West Germany, the United Kingdom. New bungalow suburbs and the new town of Elizabeth shone among sun-drenched gardens. Gum trees rose gaunt and splendid beside the road. Almond blossoms blew into the windscreen wipers.

We wound toward the hills, now on a bush road. Soon we were in the tranquillity and Teutonic orderliness of the Barossa Valley. In well-laid-out townships stone-walled barns, stone homes, stone churches contrasted with the wood or brick buildings of the average Australian country town.

Lutherans Brought the Vine to Nuriootpa

"A party of Lutherans migrated here in 1838," said Mr. Hyland, as we drove through the peaceful, pastoral scene. "They were driven from Germany by the persecution of the Prussian Government. Others soon followed. Some brought vine cuttings."

From a hall near the community hotel at Nuriootpa rose the strains of a brass band practicing for the Barossa Vintage Festival—a sort of Mardi Gras famous all over the Commonwealth. German bands, a choral group, decorative blondes, brunettes, and redheads by the hundred, wine, music, and song combine to make a memorable occasion.

At Adelaide a day or two later, homeward bound for Melbourne, I joined a bus for the trip to Broken Hill, where four mining companies produce about two million tons of lead-silver-zinc ore a year. This famous mining town is just over the border in New South Wales. It was quite a ride.

Slowly the richer land near the coast gave way to less favored areas, the wheat belt and sheep-grazing land. As the farms became larger, the road became narrower. The asphalt changed to a dirt track. Hamlets spread farther apart and grew smaller.

At long intervals, an ore-laden train from Broken Hill belched along the railway beside the road, bound for the smelters at Port Pirie in South Australia. White cockatoos in flocks up to 50 or so sat in the paddocks, looking in the distance like tall, broken-nosed seagulls. A gay flash of vivid red, blue, and green marked the flight of a flock of rosellas. A large wedge-tailed eagle surveyed the bus as it hurried past in a cloud of dust, but did not move from its telephone-pole perch.

Where were the people?

"They're out boundary riding, or mustering, or maybe loading a lorry," said the driver. "You're in grazing country now."

Outback Traffic Hazard: Kangaroos

Once we passed a big kangaroo, killed by a car. I wondered how many kangaroos were hit like that, and felt sorry for them.

"They're a menace around here," the driver said, to the passengers' general approval. "Other side of Broken Hill a bloke has to put a steel net in front of the windscreen to stop 'em leaping through. They could kill you."

"There's more 'roos than sheep on a lot of these properties," a tough old boy in the usual wide-brimmed felt hat spoke up. "They knock down your fences and eat your best feed. I've got a couple of blokes hunting them on my place. The meat sells here by the ton for pet food."

Still 70 miles from Broken Hill, I visited Radium Hill, which must be one of the best equipped ghost towns in the world. It began life with a flourish in 1952, blossoming out of the sunburned plains on the strength of a newly discovered and very rich uranium lode. A thousand carefully screened citizens moved in. A swimming pool, drive-in cinema, sports arenas, modern hospital, a couple of schools, cold-storage canteen, piped fresh water, electricity—all these came with them.

All are still there. Everything is still there, except the people, for the price of uranium had dropped and the contracts were not renewed. Now a handful of security guards protected the town from vandals until it could be dismantled and moved elsewhere.

I stood next morning on the corner of Argent and Sulphide Streets in Broken Hill. No ghost town this! With 32,000 population, 4,500 of them at the mines, and three cars to

some families, there was nothing ghostly about Broken Hill—or broken either, not even a hill.

"The top was taken off the original broken hill years ago during surface-mining operations," said mines manager R. Pitman Hooper.

Broken Hill was one of the fabulous finds of a fabulous industry. Here lay the apparently inexhaustible resources of the richest ore body of its kind in the world.

"When boundary rider Charles Rasp pegged out the first claim in 1885, he little knew what he was starting," Mr. Hooper told me. "The wealth from Broken Hill triggered Australia's first industrial revolution. When the money rolled in, we built up capital for other big enterprises."

Charles Rasp broke off a piece of outcrop ore on the oddly shaped hill, and thought it must be pure tin. But it wasn't. When this and other specimens in the area were assayed, they proved to be 60 percent pure lead, containing 35 ounces of silver per ton.

One unlucky pioneer sold his share of the mine for ten steers. A year later, it was worth 4,500 pounds, for Broken Hill yielded one-third of the world's silver, and lead by the thousand tons. They were expensive steers.

Shaggy Sheep-dog Story

"Call me Dave. Don't call me driver," announced the coach captain of the bus to Mildura (see supplement map). He had a microphone on a metal arm which he could swing to his mouth when he felt like talking, which was often. There was not much traffic.

Once a big mob of sheep held us up along the road. As far as I could see, one sheep dog was controlling the lot. Two gray-bearded men followed in a horse-drawn buggy.

One of the old men whistled. The dog looked at him, then at the bus. Then he set

Vineyards, citrus and olive groves pattern this Australian fruit bowl, the Mildura region of Victoria. Water pumped from the Murray River produced green acres from land that 19th-century explorer Charles Sturt described as "barren in the extreme." Where irrigation stops, the semidesert begins.

But what is it? School teachers ponder abstract paintings at the Adelaide Festival of Arts in 1962. These exhibits hang in a gallery devoted to Australian art from colonial to contemporary. Later the paintings were displayed in London.

The Adelaide Festival is a major event. The 1962 show featured opera, ballet, jazz, classic drama, and symphonies by the London Philharmonic Orchestra.

Dust storm near Andamooka paints sky and earth an eerie red and forces tire changers to turn on headlights of their automobile. In many parts of the outback, swirling sands often obliterate the tracks, and drivers must rely on compasses to find their way.

Salt flats of Lake Eyre stretch more than a hundred miles in South Australia. Across this desert Donald Campbell of Great Britain hoped last May to better the world's land speed record of 394 miles an hour in his 4,250-horsepower racer, *Proteus Bluebird*. But unexpectedly heavy rains flooded the area and he had to postpone his attempt.

Wave-shaped rock, carved by wind and rain, towers above the plain near Hyden, southeast of Perth in Western Australia.

about getting the sheep to one side—not a bark, not an unnecessary step, hardly a run. Within minutes, the way was clear.

"Clever dog, that," said Dave. "He plays chess with those old boys. But he isn't all that clever. They beat him sometimes."

We crossed the Murray River, which separates Victoria from New South Wales, and trundled down Deakin Avenue, Mildura's main street, past the statue of a man holding a wide-brimmed hat and a walking stick.

"That's W. B. Chaffey," announced Dave. "He and his brother George started all this irrigation. They came here from California. Did us some good, too."

"That's fair dinkum," said the passengers, meaning it was the unalloyed truth.

The Canadian-born, Californian-by-adoption Chaffeys found the Mildura area a wilderness of sand, and left it one of the great fruit centers of the Southern Hemisphere

(page 342). Their original home—now an art gallery—and their first irrigation pump (George was an engineer and had been a shipbuilder) stand as memorials to them.

I saw the pump from the river as I went past in an old paddler named *Mayflower*. The ship was 77 years old, and could float on the water in an average bath.

The Murray and its tributary, the Darling—the only river system worth the name in all the Commonwealth—used to be the Mississippi of much of New South Wales, Victoria, and South Australia. Blue-gum stern-wheelers and paddlers hauled wool, grain, stores.

I remembered as a child seeing the Murray dry, and big teams of horses hauling wool bales in a cloud of dust across its bed.

"She's trained now," said the skipper. "Fixed up with locks and weirs—water's too precious to let it run to waste.

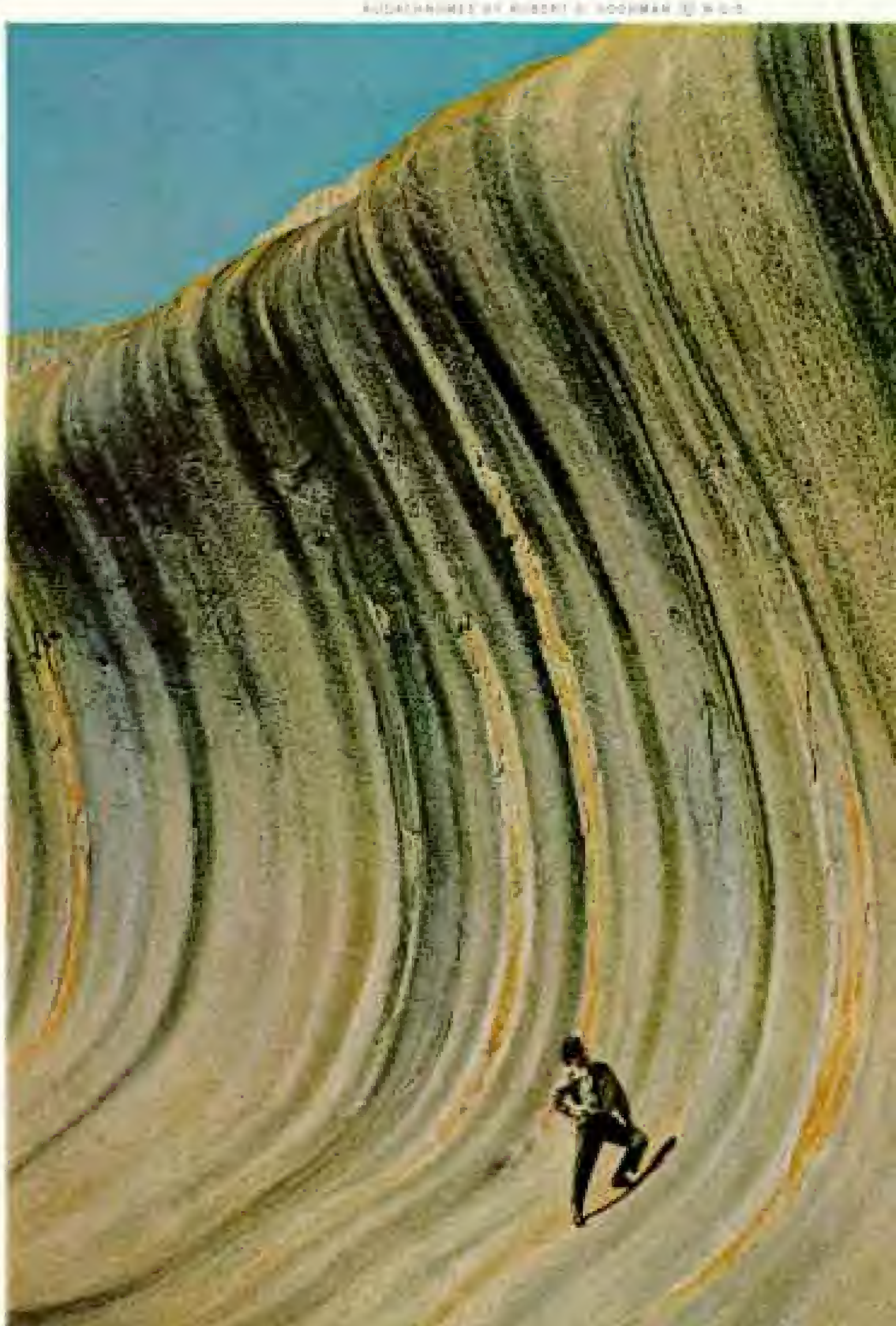
"The Murray's about 1,600 miles long, but she's slow," the skipper went on. "She takes four months to roll a drop of water from her source to the mouth. I've been told she's the slowest, tiredest river in the world. I can believe it, too. Around here she has a fall of about an inch a mile.

"Ever eat Murray cod? It's good eating, but I wonder it doesn't taste like mud. It's as tired as the river—just makes a hole and sits in it, grabbing at what passes by. If it's a hook, that's too bad."

I ate no Murray cod. Used to salt-water fish which get some exercise, I didn't relish the thought of their sluggish bulk.

So far, so good. I was seeing something of Australia, but there was a great deal yet to see. There was no future in turning into a land version of a Murray codfish, to sit pleasantly in the sunshine there forever and let the world and its problems amble by.

END OF PART I



BALLOONING SPINNAKER *and trailing boom skim the waves of Sydney Harbour as a 29-foot Dragon-class yacht takes a knockdown during championship races. Sailing has become almost a national pastime among sports-minded Australians, most of whom live within a few miles of water.*

Australia

By ALAN VILLIERS

PART II: THE SETTLED EAST, THE BARRIER REEF, THE CENTER

"We've got 20 years to fill this place."

"THIS WILL BE THE PLACE for a village," settler John Batman jotted in his notebook, as his Tasmanian schooner anchored four miles up the River Yarra in 1835. For some knives, mirrors, and blankets, he acquired 600,000 acres from a party of astonished aborigines he chanced to meet. Jagajaga, Coolobook, and their companions had no idea what they were doing. It was tribal land; no aborigine had the slightest notion of private land ownership.

The "village" is now Melbourne, a city of nearly 2,000,000; it is increasing at the rate of 50,000 a year, and expects soon to be Australia's biggest.

On my arrival in Australia, I had passed through Melbourne. Now I came back for a longer visit. It was, after all, my home town, and my wife Nance was waiting there for me to return from the wild northwest.

"Already we have passed Sydney in growth rate," said the Lord Mayor, the Rt. Hon. Sir Maurice Nathan, C.B.E. "But we're not interested in that. We just want to make the best of Melbourne—best for our people, best for business and industry. The State of Victoria now has 30 percent of Australia's factories, most of them around Melbourne."

Autos Made by Fourteen Companies

I dropped in again on my friend Premier Bolte of Victoria to thank him for his tip about the Ord River. I found him equally eloquent on his own state—the best place in the Southern Hemisphere for investment, he declared, citing an excellent consumer market, electrical power doubled in ten years, and factory production up threefold.

"Just look at one industry—automobiles."

Australia's Biggest City Crowds the Shores of Sydney Harbour, Gateway to a Continent

Four thousand ships a year enter the port from the Tasman Sea and dock at wharves jutting from the feet of Sydney's streets. With a population of

more than two million, the metropolis holds a fifth of Australia's people. Single-arch Harbour Bridge, called the "coathanger," links the skyscraper-studded capital of New South Wales with its northern suburbs (foreground). Beyond the bridge, Botanic Gardens grace wooded Farm Cove.

he went on. "There are 14 companies making and assembling cars in Australia. Their potential is about 400,000 vehicles a year. We've got more than 2,000,000 cars and 860,000 trucks now. Two out of every three Australian families own a car."

The center of that industry is in Victoria. Ford is spending 30 million dollars on plant expansion (page 377). General Motors-Holden's is spending 40 million. The millionth Holden—a 99-percent-Australian job—rolled off the assembly line last year. Holdens go to 48 overseas markets. Not bad for a state of 3,000,000 people.

"Nearly 400,000 work in Victoria's factories now," Mr. Bolte continued. "This is the new Australia, and we're right along with her. Look at wool. It used to be said that our cities rode on the sheep's back. Well, wool has increased 70 percent since the war, but today it's only a third of Australia's economy."

Australia Attracts U. S. Investors

Premier Bolte warmed to his subject in the lounge of Melbourne's comfortable Hotel Windsor. Outside, electric trams clanged toward spacious Collins Street. Across Spring Street the Treasury Gardens glowed in the bright sunshine.

"But Australia needs people," he said, "still more people, still more capital. We're getting both—100,000 newcomers a year, 300 million pounds of British capital these past few years. And U. S. investment here this year exceeds 100 million dollars."

The truth of Premier Bolte's remarks struck me everywhere. Nance had found the same.

"Places that were one-horse country towns even ten years ago are cities now," she told me. "Like Dandenong. When I was small, we used to go to Sunday-school picnics there on a horse-drawn farm wagon. I only vaguely remember that there *was* a town. Now it has everything but parking meters. It looks as if it's all just *jumped* there."

We were glad to find a fine national parks system that keeps many lovely parts of Victoria for nature. Nance and Katherine—our daughter, aged 17, taking a term off from school in Oxford—were enthusiastic about Mount Buffalo National Park, where they had spent the past two weeks.

"The bush always meant a lot to me," said Nance. "When I was growing up in a Melbourne suburb, the whole family used to go off camping together—anywhere, but preferably in the hills. That's what I really remember—the rolling land and the gum trees, the fern gullies and the mountain streams. Sometimes we'd see a dancing lyrebird, or koalas sleeping in high trees. They were marvelous. So was the bush, and the wonderful smell of it after rain. This was my favorite Australia.

"It's pushed out farther now, but you can still get to it. I saw a lyrebird last week near Mount Buffalo. I saw the snows of the Great Divide, around Kosciusko way. We went skiing at Falls Creek, and skated on a lake. I hadn't realized that the southeast was such a good place for winter sports."

Neither had I. It was a surprise to learn that Australia has a larger area of snow than Switzerland, winter sports flourish (page 353).

This was very noticeable in the Snowy Mountains area—another of Premier Bolte's recommendations, though it lies mainly in New South Wales. Both the Snowy Mountains and the Ord River schemes have to do with

Superbly groomed horses wheel past a motionless line of mounted policemen at Sydney's Royal Easter Show. Bearing pennant-tipped lances, stock raisers parade while their cattle file by the grandstand. In some years the 10-day fair—Australia's biggest—draws 30,000 agricultural entries from New South Wales. In 1962 more than a million persons attended.

Calf-back ballet: Riders lob in unison to stay atop bucking calves during the Easter rodeo.

water—Australia's biggest problem.

In this continent almost the size of the United States, the average annual runoff of water is less than half the volume brought down by the Mississippi River alone. Much of this now goes to waste, rushing to sea down the short, swift streams south and east of the Great Dividing Range.

The Snowy Mountains scheme is a bold enterprise to stop some of this waste. It turns the Snowy River and its tributaries back through the mountains and feeds these noisy waters into the Murray and Murrumbidgee Rivers, flowing conveniently inland (see supplement map).

The Commonwealth Government set up the Snowy Mountains Hydro-electric Authority in 1949. Quiet New Zealander Sir William Hudson was the first commissioner. His job was to develop some 3,000 square miles of rugged, mountainous country with a scheme comparable to that of the Tennessee Valley Authority in the U. S. In 1963, Sir William is still there, roughly halfway through. By 1975 he hopes to be done.

When I visited the Snowy scheme, I called on Sir William in the office of the Snowy Mountains Hydro-electric Authority at Cooma. I found his office lined with paintings of clipper ships, for Sir William's father was once Port Medical Officer at Nelson in New Zealand. As a boy, Sir William boarded the big square-riggers calling there. He remembers them still.

"We forget sometimes," he said, "how little time Australia has had, historically. During the American War of Independence, this country reached world maps at last. Our future retention of the land will depend on our carrying a greater share of the population of this overcrowded world. To do that, the No. 1 need is water."

I gathered that Sir William Hudson, K.B.E., B.Sc., Hon. LL.D., M.Inst.C.E., Hon. M.I.E. Aust.—to give the letters he is entitled to use—is a happy man to be doing something about the country's biggest problem.

Already the Snowy Mountains are a world of enormous dams, lakes

Sports flourish on land and water, summer and winter

With only 11 million people, Australia regularly produces masters of tennis, swimming, yachting, track, and golf. In the 1950's, Australians held 56

international records. Beaming blond surfer at Sydney's Bondi Beach reflects the island continent's addiction to play. On Sydney Harbour, 12-foot skiffs compete in state selection races; the midget craft carry so much sail that a sudden squall can capsize an entire fleet. As many as 50 craft take part in a single race. On shore (lower left), a tackled Briton heads earthward at Sydney during a Rugby League match between Australia and Great Britain. Skiers at Thredbo Village, in the Snowy Mountains, ignore biting cold as they prepare to test the slopes of Mount Kosciusko.

Bending intently over examination papers, students at the University of Melbourne fill floor and stage of Wilson Hall. Thirty-foot mural beside organ pipes symbolizes humanity rising from ignorance. Spherical lamps hang in bunches from the ceiling.

Concrete Shells of Sydney Opera House Roof Resemble Breeze-filled Sails

Danish architect Jørn Utzon's design for this model was chosen in a world-wide competition. The 230-foot-high harborside structure, planned for completion in 1963, will house the Sydney Symphony as well as stages for opera, drama, and dance.

that once were pastures, roads where roads had been unknown, and river-bearing tunnels cut through rock—the largest 21 to 23 feet in diameter and 14 miles long (pages 360-61). There are villages, airstrips, and, deep inside the mountains, hydroelectric stations generating 660,000 kilowatts. Eventually the rivers will produce three million kilowatts on their way back through the mountains. Then they will go on to irrigate the fields of New South Wales, Victoria, and South Australia.

Winter sports? There are ski runs, ski lifts, resort villages, and a lake larger than Sydney Harbour. Sixty thousand Australians came here last year on low-price tours lasting from two to 3½ days. Thousands more come on weekends to fish in man-made Lake Eucumbene, generously stocked with brown and rainbow trout. A fleet of motor ferries plies across the lake, with calls at islands where emu and kangaroo roam wild.

When I returned to Melbourne, I went down to the Yarra River to take a nostalgic look at the Little Dock where, as a child, I used to climb in the rigging of Tasmanian brigantines and schooners. There were none. The dock was filled in. I could not recognize where it had been. Car parks, a helicopter port, a new steel bridge and its curving approaches occupied all that part of the Yarra. Downstream the modernized berths were full of streamlined motor ships and steamships from Japan, Germany, the United States, Great Britain, and Indonesia.

Where our old swimming hole used to be, the Merri Creek—a tributary of the Yarra—now flowed placidly through a huge housing estate. In my old school I found the pupils studying not just French and Latin but Indonesian and Japanese. They were drawing detailed maps of Java, Pakistan, India, Malaya in the geography classrooms. When I was there the pupils were 98 percent British stock;

now they are 30 percent European (though Australians as a whole are still more than 90 percent British).

I found New Australians everywhere.* The make-up girl at the Australian Broadcasting Commission's TV station (where I said a few words to my townsfolk) was a pretty German two years out from Hamburg and loving it. Our waitress at the Hotel Windsor was Dutch. We met a cab driver who was an Arab from Beirut. "Australia is fine," he said. "Plenty of work, nice people."

Greeks and Italians run fruit stores and restaurants. Our little home in the Melbourne suburb where I grew up was now surrounded by former Poles, Hungarians, Maltese, Cypriotes. Italian seemed the official language of the market where my family used to shop.

From the airplane taking us to Tasmania, the enormous sprawl of Melbourne and its environs filled the landscape. Spacious suburbs spilled over the plains, all around the bay, up to Mount Dandenong—countless homes, each in its own gardened lot. Australians try to avoid apartment houses; they prefer one-family homes with gardens and room in the sun for the children to play.

Mountainous, sea-girt, beautiful, remote, the island of Tasmania stands in the wild west-winds zone of the Southern Hemisphere, 240 miles south of Melbourne. Its west coast is harsh, wet, and storm-lashed, its east coast soft and balmy.

Tasmania is the smallest and least populated of the six Australian states, and at first sight has little in common with any of the others. One of its leading industries is tourism, providing summer holidays for Australians. They stream over by airplane

(Continued on page 361)

*See "The Making of a New Australia," by Howell Walker, National Geographic, February, 1956.

Breakers Make an Exciting Playground for Bondi Bathers

Surfing, one of the country's most popular sports, captures the Australian imagination. Experienced riders avoid the towering concave wave that breaks too quickly and dumps them under tons of water, they wait instead for the billow that rolls in with a slow break. Popularity of the sport gave rise to the Surf Life Saving Association of Australia.

Bathing suits must be full length and have a skirt, a forgotten Sydney law states. This blonde at Bondi may never have heard of the ordinance.

Feet pounding sand, a lifesaver races through a drill at Lorne, Victoria. Team members pay out the line that will haul in beltman and swimmer.

NEXT PAGE ▶

Bondi lifeguards launch a rescue boat in the teeth of surging surf.

Blasting granite, workers open a link in the Snowy Mountains hydroelectric scheme. When complete, 100 miles of tunnels will pipe snow-fed streams to 10 power stations.

Dam Traps Rivers for Power and Irrigation

Waters of lofty Lake Eucumbene will tumble 2,700 feet through tunnels and turbines. By 1975 the project will irrigate a thousand square miles, and provide power for industries in New South Wales and Victoria.

Yugoslav-born Australians relax over trays of beer at a Snowy Mountains canteen. Workers on the project include men from 30 nations.

SOUTHWARD (NOW) AND ITS EXPLORATION BY ROBERT A. HEINLEIN

and car ferry from the hot mainland. Foreign visitors come for the good fishing and good living, the scenery and relaxation—and to see the grim relics of the days when the island had some of the toughest convicts and harshest prisons in the world.*

I drove along the Huon Valley, center of Tasmania's apple orchards, and on to the little port of Cygnet (see Tasmania inset on supplement map). Captain Bligh planted the first three apple trees in the island when the *Bounty* called there in 1788 on her way to Tahiti for breadfruit—and mutiny.

Tasmania is rich in maritime history and used to be famous for its stout wooden barks and schooners. I went down the Huon to call on Walter Wilson, one of the last builders of the beautiful schooners and brigantines I'd known as a boy.

*Howell Walker wrote of Tasmania, "Australia's Island State," in the December, 1956, GEOGRAPHIC.

There was no sign of the masts of seagoing ships at Cygnet. No one builds schooners there now. Once this valley was full of Huon pine, which, with New Zealand kauri and Burma teak, is among the world's best shipbuilding timber. But wartime ship construction finished up all the accessible pine.

No sawmill now sang its busy song, no graceful hull lay alongside the broken-down old pier, fitting out. The slipway was overgrown, and nobody was in sight at all.

Then I heard a violin softly playing. The sound seemed to come from a neglected old hut, a shack standing by the rigging loft in a grove of waterside trees.

I knocked on the ramshackle door.

It was opened by an old man dressed in rough trousers and a collarless flannel shirt; he had a face of such inner peace and calm as rarely is seen on bishops. He held a violin. And he knew me again, after all those years.

Walter Wilson lived alone in the hut. A wood fire burned low in the small grate. In a corner were some large blocks, part of the tackle of some long-gone Yankee or Hobart whaler. Faded photographs of launchings, keel layings, and of Tasmanian whalers and blue-gum clipper ships competed for the scant wall space with half-models of some of the near-perfect ships he and others of his family, last of the great Tasmanian shipbuilders, had created here. The dynamic new Australia had no place for them. Their successors build yachts.

Ghosts Haunt an Old Shipyard

When we talked of ships, Walter Wilson's face lit up. We walked around the ghost of the old shipyard. It didn't take long. As the old shipbuilder talked, I thought I could hear again the sound of the caulking hammers, the shout of the saw pit, the cries of the riggers setting up a topmast.

The only sounds I could really hear were the lap of the Huon water and the soft sighing of the westerly wind.

Quiet as it all was down south on that nostalgic day, Tasmania has advanced along with the mainland states and in ways of its own.

Lights spill into Derwent Estuary at Hobart, capital and chief port of Tasmania. The largest cargo vessels afloat call here for apples, newsprint, wood, hops, timber, and zinc.

Hulk of the *Otago*, commanded by author Joseph Conrad in 1888, lies awash in the Derwent. Inspiration for Conrad's *The Shadow-Line*, the bark was beached in 1931. Mount Wellington looms above Hobart.

© NATIONAL GEOGRAPHIC SOCIETY

Holding aloft a radiant sun, this statue symbolizing community spirit stands in the City Square of Canberra, Australia's made-to-order capital.

Development of cheap hydroelectric power has attracted electrometallurgical industry. The old days of dependence on fruit, wool, timber, and minerals are gone.

At Hobart the old wharves of the whaling port had grown into a system of concrete piers; upriver the Electrolytic Zinc plant covered acres. A new bridge was being built across the Derwent River. Hobart had spread half up Mount Wellington, across its river, downstream and upstream for miles.

"We may be a backwater, but we don't stagnate," said Hobart's Lord Mayor, the Rt. Hon. Sir Basil Osborne, C.B.E., at a reception he kindly gave for Nance and me.

Lifesaving Teams Use Light Aircraft

From this hospitable and pleasant isle we returned to Melbourne and headed by car for Sydney, Australia's biggest city. On a coastal road in New South Wales, we paused to look at an enormous subsidiary plant of the Broken Hill Proprietary, the Australian Iron and Steel Pty. Ltd. at Port Kembla. It mines its raw materials in Australia, and ships its steel around the world. B.H.P.'s production is four million tons a year; yet Australia has been making steel for barely 50 years.

We paused again at Wollongong, just north of Port Kembla, to admire some of the miles of marvelous beaches along this coast, and to watch a demonstration put on by some of the voluntary surf lifesaving clubs that patrol these shores. It was an operation of almost military precision, involving light aircraft, two-way radios, surf boats, and teams of browned and muscular young men who are surely among the best surf swimmers in the world (pages 357-9).

The beaches are beautiful, but they can be dangerous, too, with undertows and treacherous rip currents. When we reached Sydney, we learned that a surf patrol on Bilgola Beach had saved seven youngsters sweeping seaward in a strong rip that afternoon.

"We passed the 2,000,000 population mark in 1959," said the Lord Mayor of Sydney, the Rt. Hon. Harry F. Jensen, in his parlor at the Town Hall. "The present upsurge of Sydney rests on much more than cold-blooded economic assessment—it shows faith in our future, faith in Australia as a great continental nation, bound to grow."

The American flag stood prominently in a corner of the Lord Mayor's parlor, for Sydney has always felt close to America. Photographs of the Queen and the Duke of Edinburgh looked on with royal interest. Several

Muscat Grapes Cascade Into a Brimming Wagon

The fruit will go to Penfolds winery near Adelaide, where it will be crushed and converted into muscatel wine or a liqueur. The Italian-born workman is one of a hundred thousand immigrants Australia welcomes yearly.

"We're on next!" Girls in costumes of their native Yugoslavia wait to sing at a Melbourne festival.

All-Australian Garments Grace an English Model

Girls from many parts of the world lend charm to fashion parades at Myer Mural Hall, Melbourne, and style shows in other countries often display Australian-made gowns. Victoria leads the nation in production of textiles and clothing

Women bowlers at Burleigh Heads, south of Brisbane, match skills at a club tournament. Not true spheres, the balls take eccentric courses toward the white jack, or target ball. American-style bowling, growing in popularity, appeals mainly to younger Australians

originals by the Namatjiras, the famous aboriginal artist family at Alice Springs, brought a touch of the outback to the walls. A painting of a Cape Horn bark indicated 175-year-old Sydney's close connection with the sea.

Outside, an astonishing building boom was visible on almost every street. Hotels, air terminals, offices, government buildings, great emporiums reached for the sunlit Sydney sky. The stony earth that thwarted the pioneers provides a splendid foundation for them. In the crowded streets the traffic does the best it can. Down almost every city street is a vista of the towering Harbour Bridge and the busy harbor (pages 348-9).

Of all the new buildings, Sydney seemed proudest of her opera house—still very much under construction when I was there.

"In our short history," the Lord Mayor said, "we've had first to look after basic things. Now we can expand and use some of our wealth in a major cultural endeavor."

At the opera house site on Bennelong Point, I found the Lord Mayor's enthusiasm universally shared. I climbed, steel-helmeted, up and down concrete steps for miles, and looked into huge pits and gaping holes where four million dollars' worth of stage machinery will drive multi-scene stages. I saw the beginnings of an elegant restaurant and walked balconies where I could almost lean out and touch passing ocean liners.

I looked in wonder at huge structures which will soon be concert halls, exhibition halls, conference rooms, and stages for theater and ballet, as well as opera. In Australia this concept is something altogether new—a flexible and versatile group of auditoriums in one magnificent complex. The leaves of the fairy-tale roof, 230 feet high, will spread like petals of an enormous flower opening over the harbor (page 355).

Sydney's opera house is an international effort—architect from Denmark, stage consultant in Berlin, machinery from Vienna, tiling from Sweden, foreman and many skilled workmen Australian, labor force from all over the European world.

The cost? Nobody quite knows. Too many new techniques. But estimates run to 30 million dollars and may be exceeded.

Miniature Liner Plies Sydney Harbour

Sixth city of the British Commonwealth—London, Bombay, Calcutta, Manchester, and Birmingham are ahead in population—Sydney remains a friendly, informal place. Despite the bridge, ferries still ply in all directions across the harbor. My favorite trip was the 35-minute scenic run in a miniature ocean liner from Circular Quay to Manly. It costs the equivalent of only 20 U. S. cents, and strangers, seeing me with a camera, suggested angles, shots, and other trips.

I found the same friendliness at Bourke, on the Darling River. In my childhood, "back o' Bourke" was regarded as the utmost in remoteness. Now it's two air-hours from Sydney.

Bourke was full for the annual roughriders' contest, a two-day display of bareback and saddle roughriding, bulldogging, and such, equal to the Wild West. I had to sleep among a dozen or so cowhands on the wide veranda of Bourke's best hotel.

"Machines have put us out of business—road trains do most of the droving and jeeps the boundary riding," the cowboys told me. "So we follow the rodeos. There are enough truck drivers."

At Mount Isa, in the remote west of Queensland, I saw the road trains that had put my cowhand friends into the rodeo business. The trucks were 50-ton, diesel-powered Goliaths (page 327). A group of drivers crouched around an open fire, cooking lunch. Eric Ballard, of Longreach, Queensland—it was his outfit—told me they had just finished a successful season. He had handled 10,000 fat cattle, he reckoned.

Managing road trains is a man-size job on outback roads—often no real roads at all. Bumping over corrugations, potholes, dried creek beds in an endless cloud of dust, loading wild cattle into the big trucks and trying to keep them on their feet while they travel (a downed steer can soon become a dead steer) adds up to a life harder even than the traditional horse-riding cowhand's.

Discovery Credited to Puffing Mare

Australia is a country where you can still easily get back to beginnings. In a bungalow at Mount Isa, a prosperous mining center, I met Mr. John Campbell Miles, cheerful octogenarian from my home town of Melbourne. Mr. Miles discovered the place.

"You can blame it all on my old mare," said he. "I was looking for anything, preferably gold, when I wandered along the Leichhardt River here back in '23. My old mare got the puffs—she'd eaten some green grass—and suddenly swung out of line. By the time I found her, rolling in a water hole, it was time to pitch camp. Then I saw the ore, right there on the hillside. I didn't know just what ore it was, but I stayed. It took weeks to find out what it was—lead."

That was the start of Mount Isa Mines Limited. Five hundred miles from the east coast, Mount Isa was really at the back of beyond then, and development was tough. The company was formed in Sydney in 1924, but

Giant Radio Telescope Maps the Milky Way

Tall as an 18-story building, the new antenna near Parkes, New South Wales, gathers radio waves from stars beyond the reach of optical telescopes. Energy from such waves paints a picture of the heavens and gives new evidence of how stars are born and how they die.

Workmen inspect the steel-plated center of the 210-foot-wide dish. Profiting from experience with earlier radio telescopes, designers predict this instrument will prove to be the world's best.

13 years passed before it made a profit. However, it was apparent that Cam Miles's old mare had stumbled on not only lead, but one of the most important copper-ore bodies in the world. Now a 503-foot stack high over town serves the smelter plant (page 377), which can turn out 80,000 tons of copper a year. The company earns some $43 million in export income annually.

That old mare would find a better place to cool off now than a water hole. I saw Moondarra Lake—17,389 million gallons of beautiful fresh water—built up beyond the dam across the Leichhardt River, just out of town. Dinghy sailing, water skiing, swimming, and fishing are taking their place with cricket, football, soaring, judo, golf, hockey, cycling, tennis, basketball, fencing, table tennis, darts, and bowling—to mention only a few in sports-conscious Queensland—as weekend or evening diversions.

Mount Isa may be in Australia's outback, but it knows how to live.

Oil Story: "Ten Holes, Ten Strikes"

Mount Isa mines are big, like Queensland itself—the second largest state in the country (after Western Australia). It is mainly tropical, noted for its sugar, beef cattle, sheep, minerals, more recently tourism, and now oil.

Until recently natural oil in any useful quantity has been missing from the Australian scene. But the strikes at Moonie in south Queensland give hope of altering things.

I called on Queensland's then Deputy Premier and Minister for Labour and Industry, the Hon. Kenneth J. Morris, at his office in the Treasury Building, a stately edifice of golden-colored stone in the heart of Brisbane.

Founded in 1824 and now a city of some 625,000 people, Brisbane is built on hills along the banks of the river of the same name, a dozen miles from the sea. To American GI's it is probably the best known of the Australian state capitals. In this sunny city they landed on their way to help turn back the Japanese, early in World War II. Queenslanders still treasure their memory, honor the special memorial erected to them, happily greet them when they come again as tourists.

Mr. Morris spoke dynamically of Queensland, and his eyes shone when he mentioned oil, a word Queenslanders now use with a capital "O," and with good reason. He told me that a really useful field had already been established at Moonie.

"Ten holes, ten strikes in just over six months is an encouraging beginning," said Mr. Morris. "This could be the biggest thing that ever happened to us."

Queensland has other assets, too—25 million acres, for instance, of what was once useless "brigalow country," named for a species of acacia that covered the land with scrub. Today it is Australia's new frontier in agricultural development. In the next decade it could be the continent's greatest example of land improvement for pasture and grain cropping.

Government researchers are working on this Queensland project as they did on a similar project in South Australia, between Adelaide and the western border of Victoria. There an area of 3,000 square miles had almost no value at all 15 to 20 years ago. Now, with improvements, it brings $45 an acre.

Then there is tourism. Overseas tourists alone spent something like $50,000,000 in Australia in 1962, much of it in Queensland, where islands along the 1,250-mile Great Barrier Reef are becoming international resorts, as well as havens for winter-dodging Victorians and New Zealanders. Mr. Morris spoke of plans for making the great reef more accessible with hovercraft or hydrofoils.

Paradise Beckons on Barrier Reef

Everyone urged us to have a look at the Barrier Reef.* By this time our son Peter, aged 14, had flown out for vacation from his school. Nance took him and Katherine to Green Island on the Barrier Reef, a 16-mile launch run from Cairns in the north of Queensland, while I explored the outback.

"I chose Green Island because it is a real coral island, not a piece of the mainland cut off near the reef and left weathered by time," Nance wrote me. "There are comfortable cabins. When the daily launch has gone, the little island is peaceful and undisturbed."

"It's the most marvelous place I've ever been," Katherine said later. "The beach wasn't sand. It was tiny pieces of coral. If you picked up a handful, you could see all sorts of patterns and shapes. Just a couple of feet away in the clear water were the most wonderful fish. They had beautiful colors and they all played around like friends.

"You just had to put on a bathing costume, flippers, mask, and snorkel, get in that water, and you were in paradise. At dawn thousands

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

of sea birds called us. At night I just lay awake, listening to the silence."

What they couldn't see by snorkeling, they saw from Green Island's underwater observatory, at the end of a concrete pier. This is run by a bearded man named Lloyd Grigg. He and his partner Vince Vlasoff designed, built, towed, and placed it there—47 tons of steel, reinforced with concrete, moored in some 20 feet of water.

"You could spend a lifetime just learning about corals and clams and the fish life around here," Lloyd said. "Our observatory lets visitors see something of it, fast."

It certainly does. The place is fascinating (pages 374-5). Giant clams take their fat ease a foot or so from human noses jammed against the windows. Minute coral polyps—little

High-hat occasion: Girl and escorts wear matching headgear for the Melbourne Cup, Australia's annual horse-racing classic.

Merino ram tows owner Philip Russell on the grounds of Mawallok, 8,766-acre station a hundred miles northwest of Melbourne.

star-shaped flowers waving gossamer arms in the blue-green water—rub shoulders with strange anemones that are able to shoot out poison threads like darts. Yet little fish snug up to them, apparently immune. And these little fish fight off other fish that swim in to attack the anemones.

"We saw giant clams from glass-bottomed boats," Nance said. "They look like granite boulders with a serrated mouth wide open, and they pump sea water through a couple of openings. This appears to be their life's work. They eat by siphoning the water and straining off its microscopic sea life."

"No wonder those giant clams take decades to grow," said Katherine. "I expect some of them may even have been there when Captain Cook sailed past in 1770."

They may have been, at that.

As for the idea that giant clams could swing their stony jaws together and hold a bather by his feet, Lloyd Grigg said there was no recorded case of such a thing ever happening.

"Maybe nobody has put his foot in a clam's mouth," said Pete. "And I'm not trying it."

The Barrier Reef is fantastic. My family voted it one of the sights of the world.

Homes Built on Stilts

Cairns is a busy port in a sugar-producing area. It is a bush-pilot's center as well as a hopping-off place for the Barrier Reef and cool and pleasant Atherton Tableland in the hinterland. Pearl divers from Torres Strait and Thursday Island walk the garden-lined streets. Homes on stilts, with beautiful orchids blooming in their gardens, offer cool retreat. Bougainvillea and poinsettia bloom gloriously everywhere.

The trouble with all these places, from Tasmania's Huon Valley north to Cairns, westward to Broome and southwest to Perth, across the continent, was that we could have stayed six months in any of them, and written a book on each.

While Nance and the children were at Green Island, I made for Darwin in the Northern Territory. From an airplane stop called Tennant Creek, I bowled northward along a first-class road, beside six-foot-eight Clive Keetley in the front seat of his taxi. I asked Clive how the territory was doing.

"She's come a long way since the last war," he said. "Nearly 45,000 people now, 15,000 of them right around Darwin, 17,000 or so aborigines—not that anyone knows exact figures for them. There are still wild nomads. White population is increasing 7½ percent a year. About time, too."

He took a moment to point out—and name with botanic precision in English, aboriginal, and Latin—some beautiful wild flowers by the roadside.

Corroboree Marks Cathedral Opening

"We don't fool ourselves up here," Keetley went on. "We've got 20 years to fill this place. What's only 30,000 whites in half a million square miles? And now Indonesia on the borders of Australian New Guinea. Twenty years! Darwin has only been a city since 1959. There's only been a territory here for just over 50 years. Down south they still think we're a sleepy backwater."

No sleepy backwater greeted me as we drove along the straight streets of Darwin, lined with new shops, banks, and business buildings. Overlooking the fine harbor, heavily bombed by the Japanese in World War II, rows of new three-storied office buildings were models of tropical architecture.

Darwin is cosmopolitan. Along the pavements hurried Japanese, Chinese, Malays, and Portuguese from Timor, in addition to sun-tanned Australians in shorts, black aborigines, mahogany islanders. Clive pointed out the joss house, where Chinese burn incense to their gods.

At the shady Botanical Gardens on the outskirts of Darwin a civic reception was in progress for the opening of the territory's Catholic cathedral. I mingled with the crowds in the big gardens—bishops in purple, priests and nuns in tropic white, women in gay cotton dresses, aborigines by the hundred, most of them dressed up for the occasion.

A group of primitives from Bathurst Island performed a corroboree, wearing loincloths and what looked like war paint. Their beards heavily dressed with ochered clay, their bodies

River, Highway, and Sea Almost Touch on Queensland's Gold Coast

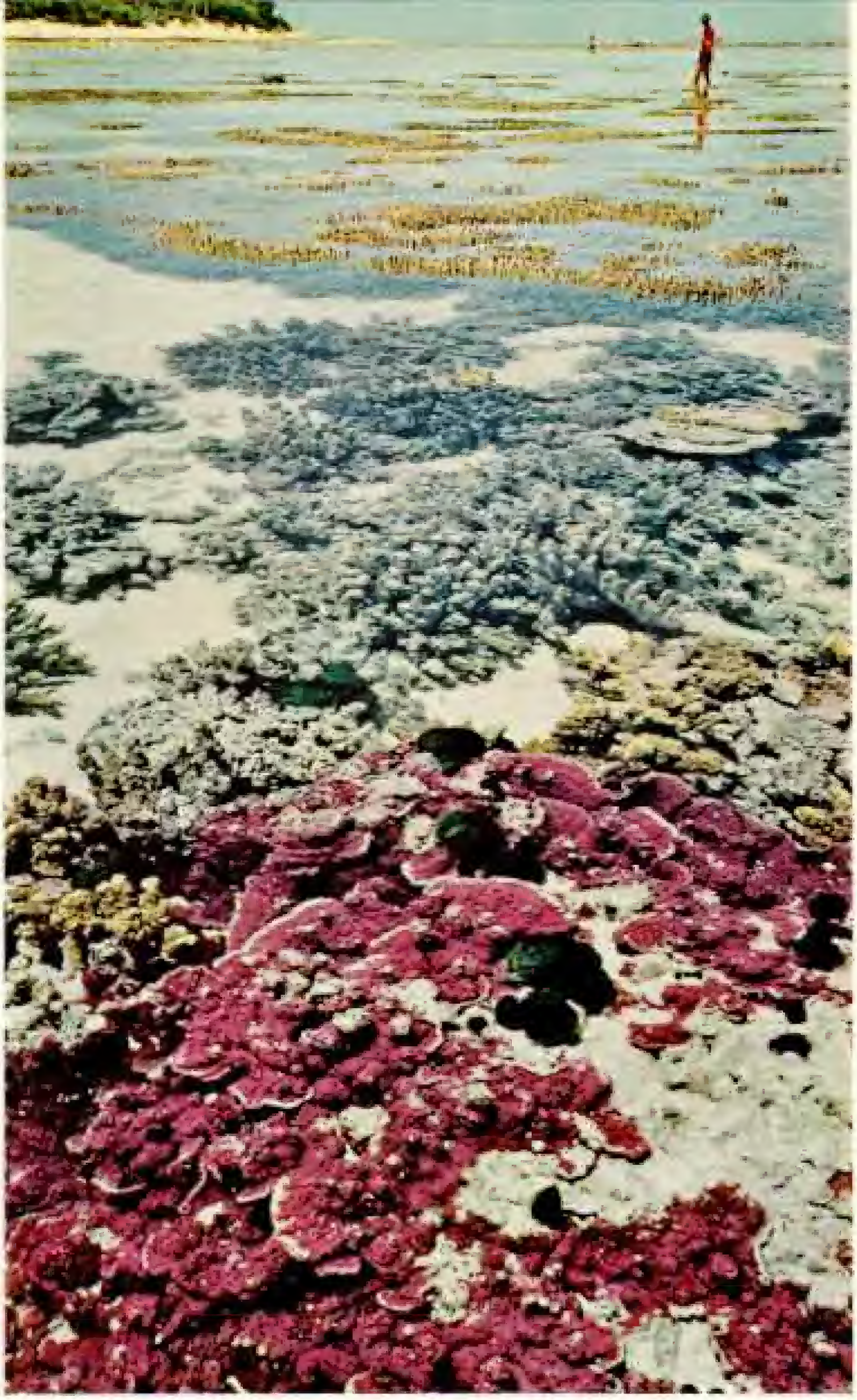
Cost of real estate gave the cottage-studded shore its name. A strip of land 50 miles south of Brisbane separates two year-round resorts, Surfers Paradise (foreground) and Broadbeach. Nerang River flows north (bottom) to join the Pacific at nearby Southport.

patterned with traditional designs, and their hands gripping long, sharp spears and waddies, they seemed, at first, a wild lot.

I jostled with the bishops, laymen, and school children to see them dance. Close up I noticed that their eyes were gentle, their features mild, their aspect cheerful. They chanted in low voices while they performed weird dances, acted out hunting scenes on the grass. They hopped like wallabies, then pretended with a lively imagery to be birds, warriors, and oarsmen in a longboat—perhaps rowing the captain of the *Beagle* (Darwin is named for Charles Darwin; the famous *Beagle* called there). Their choreography was really astonishing.

"They're not as primitive as they look," Kettley said. "There are 60 million acres set aside in the territory as reservations for aborigines, but the policy is to make them full citizens, the same as anybody else. It could take time, but it's working."

On the Sunday when the cathedral was officially opened, I listened to an address in perfect English by a full-blooded Tiwi tribesman from nearby Bathurst Island, named Edmund.



Outside the cathedral a bearded black man in long trousers and neat shirt leaned against the fence with a little chap, aged three, seated on his shoulder. In the cathedral is a striking painting of the Madonna and Child as natives. The little chap looked like the Child.

Rain Actually Falls on Alice

It is a long way by road down to Alice Springs, called the Alice (or just Alice) by the locals—almost a thousand miles. I flew.

Nance and the children were already there.

"We *love* Alice," was my greeting from Kath. "Please, may we have a long stay here?"

"At least a month," said Pete. "I want to go on a cattle station and out with the stockmen, and I'd like to climb Ayers Rock, and fly with the flying doctor."

Nance wanted to learn about the Namatjiras and the other aboriginal artists, to see the ghost gum trees that Albert Namatjira painted, and to picnic in Standley Chasm, where the noon sun strikes 250 feet down a cleft in the Chewings Ranges, turning the canyon a brilliant gold.

"Stay in this dry place?" I asked. "We have to visit Canberra, see the Melbourne Cup, do all sorts of things."

"But it isn't dry," they all shouted. "It *rained* last week—real rain. The Todd River had water in it! Flowing on top! All Alice turned out to see it."

Coral protrudes at Heron Island on the Great Barrier Reef, which fringes 1,250 miles of Australia's northeast coast.

School of trevally and two white-tailed angelfish swim before a window of Green Island's underwater observatory. Orange-and-white clownfish is mysteriously immune to poison tentacles of the giant anemone

Giant clam, *Tridacna gigas*, displays its strength. This specimen of the world's largest bivalve weighs 80 pounds.

"There's plenty of water here," said Nance, "though the Todd may flow only about once or twice a year. The water is underneath. And Ayers Rock is the biggest pebble on earth. It turns red in the sunset, and it takes three days to get out and back to see it properly."

An outsize rock that blushes crimson all over in the sunset, a colony of artist aborigines, center for a dozen fantastic sightseeing trips, a frontier town full of dark cowboys and friendly folk of all hues—why, I guessed we could stay there a while.

The small town of Alice Springs, 2,000 feet up on its mountain-surrounded plateau, is still a frontier town though it celebrated its centenary three years ago. Its population now is about 5,000; it took a mighty long time to grow after a dour and determined Scot named John McDouall Stuart first passed by there in 1860.

Alice has a fine winter climate, accessibility through convenient gaps in the surrounding ranges, and a permanent spring of good water. It became—in time—an important base for Australia's overland telegraph.

Slowly a railroad crept from Adelaide, almost a thousand miles to the south, but Alice slept on: camels brought the mail once a winter. The railroad arrived in 1929, but two things really put Alice on the map: World War II (when the territorial administration moved there from bombed Darwin), and a

AUSTRALIA

REMOTE AUSTRALIA has to itself the smallest, oldest, flattest, and driest continent of all—but it is losing its sense of isolation. Four out of five Australians live in growing cities or towns; the arid interior supports few men. All strive to build a stronger Australia.

It is the last continent settled by Europeans, and the only one occupied by a single nation. On its Near North lie the countries of the Orient with more than a billion people.

The "White Australia Policy," designed a century ago to check Asian immigration, has been modified.

Now a trickle of Japanese, Chinese, and other Asians are permitted to take up residence each year. Though still underdeveloped, Australia enjoys one of the world's highest living standards. The number of factories has more than doubled since 1940; electric power has increased from five billion kilowatt hours to about 26 billion; ingot steel production has more than trebled, to four million tons annually.

Men strike oil in Queensland's Great Artesian Basin; discover bauxite in remote, wild Arnhem Land; tunnel through mountains to divert rivers for irrigation and power.

Manpower for these projects comes largely through immigration—100,000 people a year, mainly from Europe. The Snowy Mountains hydroelectric scheme, for example, uses labor from 30 different nations.

But the basic problem remains: a vast land, few people; only 3.6 persons per square mile—compared to India's 349.

OFFICIAL NAME: Commonwealth of Australia. **GOVERNMENT:** Independent parliamentary democracy in British Commonwealth; six states, two internal territories, nine external territories. **AREA:** 2,974,579 square miles. **POPULATION:** 11 million, predominantly of British stock. **RELIGION:** Largest denominations are Anglican, Roman Catholic, Methodist, Presbyterian. **ECONOMY:** World's leading wool producer, also a major exporter of cereals, meats, dairy products, fruits, and sugar. World's largest producer of lead, third largest producer of zinc. Manufacturing employs some one million persons, more than one-fourth of the total work force. **MAJOR CITIES:** Canberra, federal capital (pop. 56,440); Sydney, port, industry (pop. 2,183,231); Melbourne, port, manufacturing (pop. 1,912,355). **CLIMATE:** Famed as a land of sunshine; more than a third of Australia is desert with 10 inches or less of rain yearly. Tropical north, and center, temperate south. Sydney's mean annual temperature is 64.2° F. Perth leads Australia's major cities with an average 7.8 hours of sunshine daily. **INFORMATION:** Australian News and Information Bureau, 636 Fifth Avenue, New York 20, N. Y.

novel by English author Nevil Shute called *A Town Like Alice*. Americans read it under the title *The Legacy*.

The apparent desert all around, oddly enough, abounds in good cattle fodder—grasses and herbage—when enough rain falls. So the cattle industry has been important there for more than half a century.

The difficulties are immense and obvious. No permanent water flows in the center; subartesian water must be tapped. For example, the 1,300-square-mile station of Hamilton Downs—52 miles from Alice on a good dirt road—has at least 16 bores, each costing, with its piping, tanks, and troughs, an average of $9,000. Drinking water alone will not sustain cattle in drought, when they can find no forage. Feed must be provided too. No rain, no feed: the cattle die. And distances to market are enormous. It can be heartbreaking country.

Teen-agers Climb "World's Largest Pebble"

"Visitors are big business in the center now," Bert Palmer of the Trans-Australia Airlines Travel Service told us. "And Ayers Rock is attraction No. 1."

As we flew from Alice Springs to Ayers Rock, we marveled at the weird shapes and colors of the Macdonnell Ranges (page 378). While the little plane droned pleasantly along, pilot Raymond Hammond spoke of some of his experiences. In unusual heat three years before, he said, a search party went out to find some missing men. They found the dried body of one man lying beside a tree with a trunk about an inch in diameter—the only shade he could find.

There is nothing quite like Ayers Rock, an enormous red monolith (pages 380-81). It is 1,100 feet high, 1½ miles long, and six miles in circumference. Some 200 miles southwest of Alice Springs, its lonely hump rises against the sky—a huge red Moby Dick of a mountain mysteriously alone in a flat, sealike expanse. Smooth-sided except for lightning and erosion scars and some pitting here and there, the huge pebble is classified by scientists as Cambrian sandstone. Aborigines trace it to the "dreaming time" when things began.

We stayed at the pleasant rest camp and flew over the rock close by, bumping in the turbulent air. We watched it turn crimson at sunset. Teen-age Katherine and Peter climbed to the top, reported a cairn up there, an expansive view, and little else.

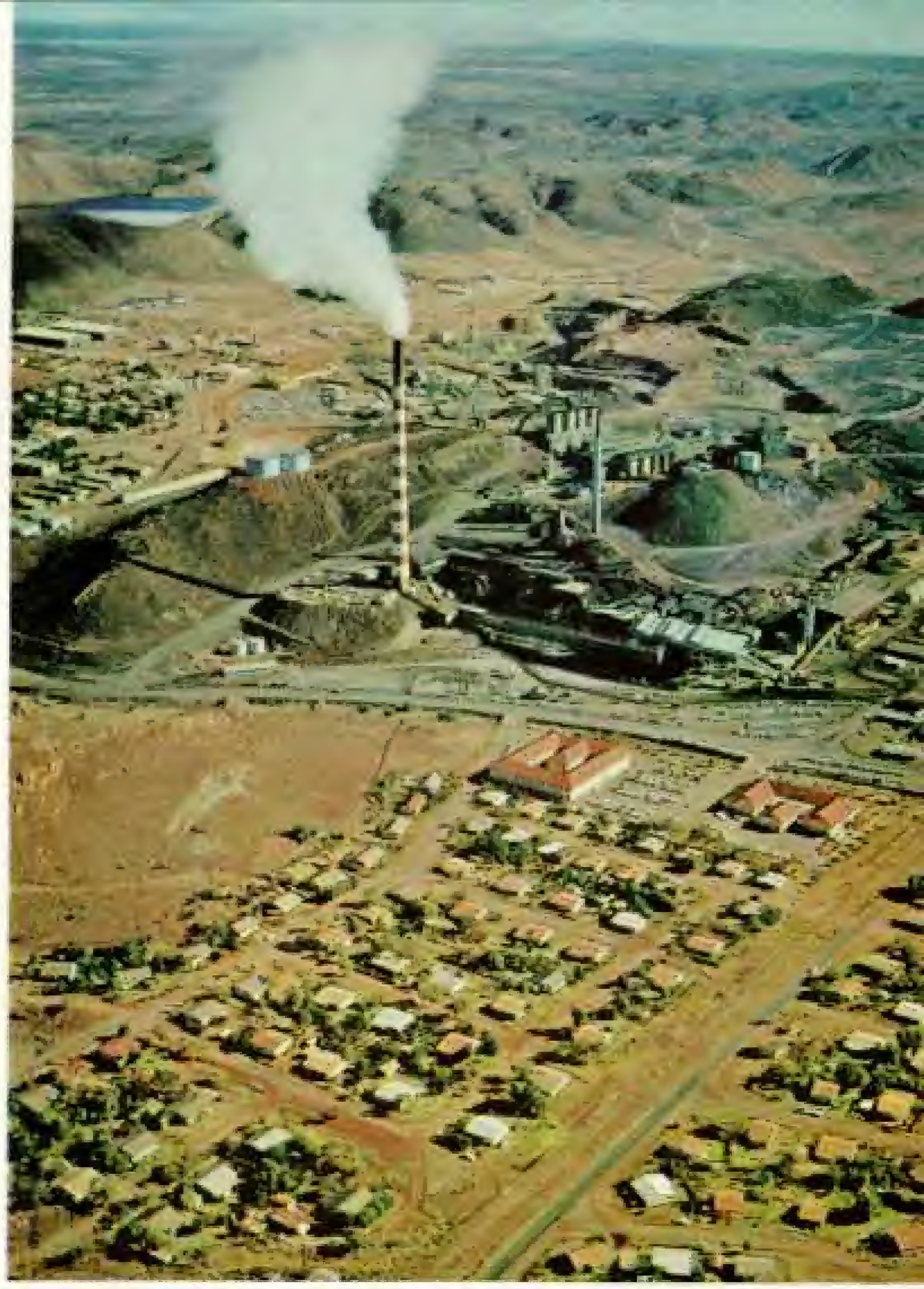
By night we saw a dingo prowling, and thought of the days not long ago when this

grim bulk was still the active repository of aboriginal mythology. In the far-off dreaming time, aborigines say, their remote ancestors, the snake men and the lizard men, lived and fought here.

At Ayers Rock it is easy to believe in that dreaming time. Indeed the workaday world of ordinary civilization seemed to me distant and unreal.

After our stay at Alice the family flew back to England. I watched a Qantas Boeing 707 hurl them into the sunset sky from Sydney's Kingsford Smith Airport, bound first for the Hawaiian Islands by way of Fiji, thence across the United States and on to England.

I flew finally to Canberra, Australia's capital, to clarify my impressions of the pulsating new Commonwealth-continent, and to ask the questions which by now crowded my mind. After six months and 30,000 miles of travel around a homeland



Banded stack rises 503 feet above a copper smelter at Mount Isa Mines Ltd., a joint U. S.-Australian venture in northwest Queensland. Workings, which can produce 80,000 tons of copper a year, also yield silver, zinc, and lead.

Sparks dance as sander smooths a station wagon for painting in the Ford assembly plant at Broadmeadows, near Melbourne. Ford Motor Company of Australia is one of 14 automobile firms in the country that together can produce 400,000 vehicles a year.

Parallel ridges of the Macdonnell Ranges furrow a 240-mile stretch of the Northern Territory. Finke River, chief waterway of the continent's vast red center, slices through eroded folds on its southward course.

Dried-mud islands in a sea of salt pattern the bed of Lake Amadeus, a 90-mile-long wasteland in the Northern Territory. Rains fill the basin about four times a century; then a few days of sun all but dry it out.

that had altered almost out of recognition, these were many. Beneath all the bustle and the astounding progress, there were some obvious problems.

"We are a nation—the only such nation—of Europeans permanently settled in Asia," an Australian friend already had pointed out. "Our forefathers found a continent, virtually empty, which had been here a long time. We have made something of it, and we will make a great deal more."

This was new thinking to me. We had learned at primary school about our country as part—the principal part—of Australasia, which also included New Guinea, the nearer Pacific islands, and New Zealand. Then the word somehow dropped out of fashion. We did not think of ourselves as "Australasians" or any kind of Asians. Asia then seemed thousands of miles away.

In the 1960's, I found Australians taking a fresh look at themselves—a rich white civilization with a high standard of living, in an underpopulated continent, a jump away from more than a third of the population of the world. Asia, bursting at the seams, is not next door but on the doorstep—the awakened giant where aspirations rise, numbers explode, and Communism lurks ready to exploit troubles or stir some up if need be.

"Our eyes are on Peking, not on Moscow," Premier Bolte of Victoria had told me. "We are well aware of the challenge and we must

Maze of channels in Queensland forms an irrigation system that waters 10 million acres of black soil and sand in good seasons. But intermittent rivers fill Channel Country watercourses only during rare floods.

Pool-fringed Ormiston Gorge cuts through the Macdonnell Ranges to the Finke River. Daily, as the sun's angle changes, colors in the chasm range the spectrum from red and orange to emerald and sapphire.

Carved and gullied by storms of its own making, Ayers Rock thrusts skyward from a sandy plain in Northern Territory. Soaking up an enormous store of heat during the day, the mile-and-a-half-long monolith quickly releases it by night; the rising air pulls roaring winds up the steep sides. As the mass cools, the drafts reverse and sweep downward. The rock's temperature varies as much

KODACHROMES (UPPER AND LOWER) BY NATIONAL GEOGRAPHIC PHOTOGRAPHER ROBERT S. GOODMAN AND EXTACHROMES BY GORDON DE'LISLE © N.G.S.

as 75° daily. When a rainstorm bursts, potholes and clefts on its top overflow and white billows of water cascade a thousand feet. At day's end the sun sets ablaze the rock's face of micalike feldspar (center). The three photographs were made only a few minutes apart. Grotesquely eroded caves undercutting the base (below) shelter a rich gallery of primitive rock paintings.

show that we can develop our huge continent effectively."

As a city, Canberra itself has come a long way. Designed by the American architect Walter Burley Griffin—an associate of Frank Lloyd Wright—Canberra grew piecemeal on the beautiful plain. For years it looked like a disorganized scattering of suburbs. Civil servants worked in temporary buildings around a collection of foundation stones.

All that is changing now. The complex plans are coming to life as the man-made lake that Griffin visualized takes shape. The large artificial lake was planned to knit the place together, and it will give Canberra's 57,000 citizens a sense of belonging to their own shapely and attractive city at last.

Nation Gambles on Industrial Revolution

I found an alert awareness of Australia's needs—and differing points of view on how to meet them.

"Forty percent of Australia has only four percent of its people," said the Hon. Arthur A. Calwell, Leader of the Opposition. As Minister for Immigration in the vital postwar years, he worked out the bold program that jumped Australia's population up from seven to about eleven million.

"Melbourne has 66 percent of Victoria's population; 67 percent of New South Wales's people live in and around Sydney. Those two cities alone absorb two-fifths of all the people we've got, and they grow every year. Only one Australian worker in eight is now employed in primary industry. We are gambling everything on a great industrial revolution.

"We fill this continent, or we lose it."

Australia's Prime Minister, the Rt. Hon. Sir Robert Menzies, is well aware of the problems. A former country boy from the wheat-growing plains of Victoria, he has headed the government since 1949.

"Make no mistake: our primary industry—agriculture—is responsible for the welfare of this country," Sir Robert said.

But there is not great scope for employing more people on the land, he explained, because of the efficiency of mechanization; for better use of more land, the obvious answer is more capital.

"With a population increase of a quarter of a million a year, it is essential to build up industry," the Prime Minister emphasized.

"We have a five-point charter for Australia's future. To achieve full employment and best use of all our resources; to restrain inflation; to develop a growing manufacturing industry; to preserve our export costs level in competition with the rest of the world; and to reduce our production costs by increasing the level of our efficiency."

After 14 years of the Menzies government, Australian credit has never been so high.

In Canberra I talked with earnest young scientists of the C.S.I.R.O.—the Commonwealth Scientific and Industrial Research Organization—about problems they were studying. One is soil erosion. Another is the appalling evaporation rate; in the interior it could steal four times the annual rainfall.

Weather Created in "Climate Machine"

I visited the unique Academy of Science, founded by Royal Charter in 1954, and spent a morning at the amazing phytotron. Canberra has one of the world's half dozen of these expensive "climate machines," in which weather conditions can be simulated, concentrating years of intensive field research into a few months.

"Canberra's phytotron contains 200 cabinets in one building," Dr. Lloyd Evans of the C.S.I.R.O. told me. "In each we can produce whatever climate we need by varying temperature, humidity, day length, atmospheric composition, light intensity. What we find out must be checked in the field, of course. But a phytotron is an enormous help."

The phytotron and C.S.I.R.O. are helping other countries solve their problems, too. A scientist from India was finding out how climatic conditions affect the yield of several Indian wheat varieties. A Japanese scientist was establishing how light determines the yield of corn and cotton crops.

C.S.I.R.O. researchers have achieved much, some of it spectacular—rabbit control, the

Ballet Dancers in Melbourne Perform the Nutcracker Suite Under TV Lights

Only seven years old, Australian television will soon carry programs within reach of 90 percent of the population. Government-supported stations charge all TV owners a fee of five pounds a year and offer mainly Australian productions; commercial stations broadcast many American shows and depend on advertising for revenue.

Shoppers stroll Gorey's Arcade in Alice Springs, shipping point and market center for a vast cattle district in the Northern Territory.

Alice Springs spreads toward Heavitree Gap in the Macdonnell Ranges, where railroad and highway funnel through a gateway to the south. Taillights trace parallel paths in this time exposure at dusk.

Shouldering a boomerang, an English immigrant rides beside an Alice Springs teacher during Bangtail Muster, the town's annual revel.

ESTABLISHED BY GEORGE H. GALLUP AND SOCIAL RESEARCH, INC., BY ROBERT S. ADAMSON © N.E.A.

improvement of soils which has changed much semidesert into good farmland, the increase in pasturelands.

There are plenty of problems remaining. How to increase Port Lincoln's tunafish business? Where to find more tuna? Why, in an average year, do only two ewes out of three produce lambs? Australia already leads the world in sheep, but could do better. What makes white wool turn yellow with repeated washings? Is there a practical future in artificially induced rain?

Hundreds of young men and women in white coats or bush shirts—geologists, geomorphologists, soil agronomists, specialist biologists, botanists, and physiologists of all kinds—in laboratories and scattered through the remotest areas of the back of beyond, work steadily toward the answers.

But Australia is still a difficult continent, much of its agricultural zone a fringe on the great mass of arid land. Less than a fourth of the country has rain enough to support any plant growth at all for more than five months each year. Less than a third even of this can be readily improved, and all of it can suffer devastating drought.

The scientists, the researchers, the phytotron will never be short of problems to solve, or the man in the field short of work.

"Potential" is a word one hears a great deal in Australia. The "population potential," they told me, is 40 million. Some even put it as high as 60 million.

Best Place in the World for Kids

Nance's brother Alan Wills in Canberra gave his verdict on Australia:

"She's tough. She's challenging. She's different. But she's wonderful, too—best place in the world to bring up the kids."

Before we left, Nance and I arranged to buy land on the east coast of Tasmania. Somehow we felt that we would like our children and our children's children to be among Australia's future millions. THE END

AUSTRALIA ON MAPS—OLD AND NEW

GEOGRAPHERS invented Australia long before the first Europeans discovered it. In a spinning world, they reasoned, such a land mass *had* to exist—to balance the great weight of the Northern Hemisphere. So they put it on the map.

A fanciful 1587 concept of the land down under (opposite page) contrasts strangely with the most up-to-date map available: Atlas Plate 59, **Australia,** accompanying this issue of NATIONAL GEOGRAPHIC.

The new map, scaled at 110 miles to the inch, vividly depicts a unique continent-country and its major problems: Australia is dry. It is three-quarters empty. Its vast terrain holds abundant natural riches.

How can space and natural wealth be problems? Look at the top of the new map. Along the left lies the southern edge of Indonesia, a crowded country of 96,000,000 people hungry for land, food, and resources. Beyond sprawls Communist China, the world's most populous country—and one of its poorest.

To these crammed millions, Australia's emptiness is an invitation; its prosperity glitters enviably. In this issue, Alan Villiers describes a six-month trip through the continent. Everywhere, Australians told him in effect: We must fill this land or lose it.

Australia's emptiness shows dramatically on the map. Look at the place names above the word "WESTERN" in "WESTERN AUSTRALIA": Poonda, Ethel Creek, Walgun, Balfour Downs. These are not villages. They, and hundreds of other names, pinpoint homesteads on sheep or cattle stations, represented by a small hollow circle. On a map of a nation almost as big as the United States, cartographers can label individual farmhouses!

Australian place names themselves are worth reading. Based often on aboriginal words, they show a musical fondness for double "o"s. In New South Wales, you may live in Woolgoolga; or in Western Australia,

Visiting monarch, Queen Elizabeth II receives a bow from Sir Maurice Nathan, ceremonially robed Lord Mayor of Melbourne. Prince Philip watches parading Scouts during the city's Moomba Festival. In

PHOTOGRAPH BY GORDON W. GAHAN © NATIONAL GEOGRAPHIC SOCIETY

Mythical southland girdles the world of 1587. Not content with a vast Terra Australis Nondum Cognita—Southern Land Not Yet Known—Flemish cartographer Abraham Ortelius added a land mass at the top of his world map. New Guinea appears at left.

choose between Boolaloo and Boologooro—neither of them far from Mount Moogeeloo.

One double-o name, now world famous, is Woomera, the missile launching and tracking base. A red rocket symbol locates it in South Australia. Missiles fired northwestward toward Eighty Mile Beach fly over 1,250 miles of virtually uninhabited land.

As the missiles start their flight, they pass a lake with the name Cadibarrawirracanna (place to get gum-tree scoops for honey). Like most of the lakes that spatter the map with blue, this one is dry, a barren salt pan most of the year. The map shows why: Along the east coast, in Queensland and New South Wales, rise the mountains of the Great Dividing Range, including Australia's tallest, Mount Kosciusko, 7,316 feet.

City Wealth Brings Water to Outback

The prevailing easterly wind drops most of its Pacific moisture here—as much as 170 inches a year—and blows dry on the rest of its 2,000-mile way across the country. The monsoon season brings rain—40 to 60 inches annually—only to the northern quarter.

Australians are hard at work fighting this perpetual drought. Six insets on the map enlarge the continent's major cities: Perth, Adelaide, Melbourne, Canberra (the national capital), Brisbane, and Sydney. A seventh charts the island state of Tasmania, of which Hobart is capital. Money from these burgeoning centers and from the backs of 150 million sheep pours into massive water-control, hydroelectric, and irrigation systems.

The map shows a splash of blue just south of Canberra that did not exist five years ago—35,840-acre Lake Eucumbene, created by a dam across the river of the same name. This is part of the $900,000,000, 26-year Snowy Mountains scheme. Tunnels, bored through mountains of rock, divert water inland, westward into the Murray River to irrigate thousands of dry acres all the way to Adelaide, South Australia. Eventually it will generate millions of kilowatts as it flows.

Far to the northwest on the Ord River the map marks another new dam, at Argyle Downs. It will irrigate vast areas in the high, fertile Kimberley plateau for farmers and cattle ranchers, many of them postwar immigrants—New Australians.

Old Australians? The first European colonists settled in Sydney in 1788; far older are the aborigines, numbering some 40,000. The map shows their reserves, chiefly in the federally administered Northern Territory.

The aborigines have been offered the rights of citizenship and the vote whenever they want them. Until they do, they may continue to live the wild, nomadic lives of their ancestors, fishing, and hunting kangaroos and wallabies with spears. For without permission of the government, no white man may enter their reserves.

THE END

ALL THINGS considered, it did seem at times a discouraging quest. We shivered in the bitter chill of Australian autumn nearly a mile high on a mountain slope in northeastern Victoria.

It was wild country. An airliner had crashed in this thickly forested region once; it lay undiscovered for 30 years. And the night was dark. As we picked our way among great, ghostly woollybutt trees, a struggling half moon glimmered only at brief intervals through the veil of mist.

We were combing the last known whereabouts of a dainty ball of fur called Leadbeater's possum. This nocturnal, tree-loving relative of Australia's curious "flying" possums had not been reported in half a century; only five specimens had *ever* been discovered!

As a naturalist, I had been on too many such expeditions to be confident that this one would turn up Leadbeater's possum. Still, from my years of roaming this old land of wattle and gum trees seeking, capturing, and studying specimens

Parachuting squirrel glider soars from a treetop on a canopy of skin stretched by spread-eagled legs. *Petaurus norfolcensis*, one of Australia's marsupial phalangers, may volplane 50 yards, then race up another tree for a repeat. The majority of Australia's cavalcade of curious mammals are marsupials, primitive creatures that carry their babies in pouches.

Strange

Animals of Australia

By DAVID FLEAY *Photographs by STANLEY BREEDEN*

Blasting off from a dead limb, an airborne greater glider soars for nearly 100 yards to a feathery clump of eucalyptus leaves. Like North America's flying squirrel, the cat-size marsupial puts on the brakes near flight's end by swooping upward for an almost vertical landing. Such graceful performances inspired the greater, or dusky, glider's scientific name, *Schoinobates volans*, which means flying ropedancer.

of its unique and wonderful wildlife, I rather suspected we would find something else.

As it developed, we did.

Nowhere else in the world, I think, can one find as strange a collection of creatures as those that inhabit Australia and its neighboring islands. Among its species, perhaps the strangest of all are the marsupials. Here are mammals seemingly forgotten by time—still primitively equipped with pouches to carry and nurse their tiny, helpless young. They run an incredible range from towering kangaroos and cuddlesome koalas to wire-whiskered Tasmanian devils, lumbering wombats, and dainty pouched mice.

Before the arrival of introduced foxes, domestic cats, hunting dogs, and their white-man patron, Australia teemed with bright-eyed and furry folk, most of them marsupials. Some lived among the rocks and grass of the plains; some inhabited the arid, sandy interior; still others belonged to mountainous bush or tropical forest. Nowadays only a scattering of the hardier species survives, to the dismay of zoologists like myself, which is why we were working across a bitterly cold mountainside in Victoria that autumn night, in search of one of the lost ones.

As we advanced stealthily, spotlight beams dimmed by the fog, we heard the unmistakable sound of claws on bark. Shadowy figures with long tails shot swiftly into space in a soaring leap between trees. I looked up to see two beautiful gliding possums, strange to me, clinging to the trunk of a manna gum.

Gliders Grounded After All-night Chase

"Never saw those fellows before," remarked Tom Hunter, a long-time bushman and prospector. Neither had my other companion, Charles Brazenor, director of the National Museum in Melbourne.

Now gliding possums, or possum gliders, are a specialized group of pouched animals which, like the flying squirrel, volplane or parachute from tree to tree (above). They range in size from the 40-inch leaf-eating greater glider down to a 5½-inch pygmy that feeds on nectar and insects (pages 392-3).

By elimination of four other species known to us, we thrilled to the fact that at long last we were face to face with the least known of all. These lovely creatures, perhaps two feet long over-all, must be the rare fluffy, or yellow-bellied, gliders (*Petaurus australis*).

"There's only one thing for it," I said to my mates. "We've got to follow these beauties until they take us right to their homes."

The Author: Zoologist David Fleay, M.B.E., B.Sc., Dip. Ed., C.M.Z.S., has been eminently successful at keeping unusual animals in happy captivity. At Fleay's Fauna Sanctuary in West Burleigh, Queensland, and at other Australian zoos he has bred for the first time in captivity 20 wild species—among them, the fur-bearing, egg-laying platypus. His observations have led to numerous scientific papers as well as to five books, in which portions of this article originally appeared.

Greater glider's luxuriant coat, appearing in many shades from black and brown to creamy white, stirred the interest of furriers until they found the pelt lacked durability. Unsought by man, *volans* remains the most plentiful of the gliding possums. In 1770, Captain Cook described a "possum" in his journal. The word has come to be used by Australians to differentiate between their phalangers and American opossums. 391

The long-eared animals, however, decided to soar off in different directions. Brazenor and Hunter trailed one while I stumbled along after the other.

My possum had begun a most active journey, and often I lost it. Each time the animal took off, it uttered a low, whirring moan. The flights from tree to tree averaged 35 to 40 yards. (I did not realize then how much the fog was working to my advantage. Later, on a clear night, I was to watch a fluffy glider maneuver among mighty eucalypts, or gum trees, on a flight of more than 100 yards!)

Curiously, although the animal surpasses its relatives in gliding, it proved to be a somewhat poor climber. Whenever it alighted on the bole of a tree, I noticed that it struggled up in awkward, spread-eagled fashion.

My fluffy glider was apparently making tracks to some favored feeding ground and, earth-bound, I was hard put to it to keep it in sight. But about midnight the glider's 19th flight took it into a slender gum tree, evidently its goal. Here my companions, having lost their own quarry, rejoined me.

Glider Dines on Sap and Nectar

Hanging head down on the trunk and ignoring our flashlight beams, the pink-nosed animal began a methodical licking which it maintained without interruption for 45 minutes. The reason was apparent: Sap had exuded in small sugary masses from pits the animal had chewed into the bark all the way up the tree.

Finally our glider became suspicious and

Pygmy Glider, Elfin Sprite of the Forest, Laps Nectar From the Flower Cone of a Bottlebrush

Padded toes muffle the movements of this smallest glider. From tree to tree the pygmy flits as silently as the shadow of a cloud. Less than six inches from nose to tail tip, well-named *Acrobates pygmaeus* can leap 30 feet or more, steering with its featherlike tail. The versatile tail is also used to carry leaves when the creature builds its ball-shaped nest.

Palm of a hand provides room enough for a pygmy glider and her brood. Mother can sleep in a pillbox, one of her babies in a thimble. In the wild these minuscule possums eat nectar, insects, and sugary exudations from gum trees; in captivity, they thrive on termites, sugar, and honey. Colonies doze by day in hollow tree limbs or knotholes in trunks, emerging only at night.

volplaned on again. After several soaring jumps, it alighted in a heavily flowered manna gum. Between drifting clouds of fog we caught occasional glimpses of its long-tailed dark form amid the lofty branches. We lit a fire to ward off the bitter cold and settled down to a long vigil, at intervals lying flat on our backs to ease the strain on aching necks.

So the hours dragged by in the quiet of the tall timber. Once a boobook owl called, catlike and clear in the stillness, while at times we heard the far-off crackling sounds made by wandering wombats and the occasional thumping of wallabies. Still the possum glider scurried along the limbs, feeding greedily on the nectar in the blossoms.

At 4:30 a.m. the marsupial apparently decided it was time to glide off and retire to its nest. It alighted well up on a big gum tree, only 25 yards away! Crawling 10 feet higher, it cast a last suspicious glance at our weakening torches, neatly rolled its long bushy tail, and disappeared into a hole. Within moments a bubbling shriek rang out close by, and another glider, evidently the elusive mate, crawled into the same opening.

Our long, cold vigil on the mountain slope ended with the first streaks of dawn. Two hours' work with an ax brought the old hollow gum crashing to the ground—and two prize specimens into our hands.

It had been quite a difficult and tiring night, but well worthwhile. The capture of these fluffy gliders would give many Australians an opportunity to see one of their country's rarest species, and would give us our first chance

Leadbeater's possum, believed for half a century to be extinct, was rediscovered in 1961 within 60 miles of Melbourne. On an April evening, naturalist H. E. Wilkinson glimpsed a small gray possum with a long tail bushing out at the end. He recognized it as the long-lost Leadbeater *(Gymnobelideus leadbeateri)* and soon confirmed his discovery with color photographs.

Other naturalists later visited the site and captured several Leadbeaters by dazzling them with spotlights. They soon were scrambling about human shoulders and thriving on bread and honey. Squirrel-size, this adult uses its long tail to help balance on tree limbs.

KODACHROMES BY STANLEY BREEDEN, COURTESY FISHERIES & WILD LIFE DEPARTMENT OF VICTORIA © N.G.S.

Hairless and blind, a three-week-old possum clings to a nipple in its mother's pouch. Gentle manipulation of the pouch permitted this first photograph of a baby Leadbeater.

to study this splendid creature's life history.

To one concerned with keeping, breeding, and studying unusual animals in captivity, any day may bring a delightful surprise.

There was, for example, the time some years ago at the Sir Colin Mackenzie Sanctuary near Healesville, Victoria, when a young female marsupial was sent to me by air from across the continent.

Christened "numbat" by the aborigines, this dainty, gloriously colored creature is also known as the banded anteater (*Myrmecobius fasciatus*). Nowadays it occurs only in the southwestern corner of Western Australia. Roughly the size of a wharf rat, the furry, rust-red numbat is Australia's greatest connoisseur of termites.

For a whole day our rare new arrival worried us by refusing food: termites, ants and their eggs, mealworms, beetles, grubs, earthworms, raw eggs, bread, milk, even honey and jam. But when finally she did eat, it was a true spectacle. Her pink, sticky tongue—it was a good four inches long—flickered into every hole of termite-riddled wood, its tip appearing out of the other side at all angles.

The smaller termites were gathered in and swallowed whole, but the larger insects were rapidly and audibly chewed. Though the numbat's teeth are classed as degenerate, she possesses 52 of them—20 more than her human observers! We estimated with some astonishment that our little anteater consumed ten to twenty thousand termites daily!

Perhaps the strangest thing about Miss Numbat was her mealtime. In direct contrast to the nocturnal habits of practically all other marsupials, she frisked about and fed by day, sleeping soundly all night long.

Spider Ends Numbat's Termite Feast

As would happen in the wild among the white gums and acacias of her habitat, she chose a hollow log in which to build her nest of dead leaves and dry grass. She was a girl of few words; only an occasional series of soft staccato "*tut-tut-tuts*" punctuated her incessant search for termites.

Her stomach packed to the limit, she was in the habit of resting spread-eagled in the sun atop a broad log, with tail extended, jaws open in a set yawn, and tongue fully extended in a graceful, ribbony arc. At such times I marveled, too, at the effective camouflage of the white bands across her back.

Inescapably, one grows attached to such fascinating creatures. The untimely death of this gentle numbat some months after arrival

Last Tasmanian wolf in captivity yawned when its picture was taken at Hobart Zoological Park in 1933. A few of the species, *Thylacinus cynocephalus*, may survive in the wild; the author almost captured one in 1946. Ferocious if cornered, this predatory but dull-witted marsupial has been described as a "kangaroo masquerading as a wolf."

was a dreadful blow. We concluded that she had been bitten by a venomous red-backed spider (cousin to the American black widow) we later found sharing her nesting log.

Few non-Australians, I suppose, have ever heard of the numbat, but the reverse is certainly true of the island continent's two monotremes. In 1884 scientists were stunned by proof that the duck-billed platypus and the spiny anteater—both furred creatures that suckle their young—laid eggs, and thus were far more primitive than kangaroos and their kin. Here were creatures having characteristics of both mammals and reptiles!

When I began a day-by-day study of platypuses 30 years ago, I realized that a complete life history could be recorded only if a duckbill produced eggs and hatched young in captivity. Thus I set about a rather heartbreaking task that was to take unbelievable effort and 10 years of experimentation.

Apart from its extraordinary temperament, the platypus has an enormous capacity for special food, devouring each night the equivalent of half or more of its own body weight! I found that to keep a pair of the animals in good health and breeding condition, each 24 hours I would need 1,200 earthworms and 50 fresh-water or burrowing crayfish. Added to this were tadpoles, grubs, and beetles in season.

Our earliest attempts to breed the animals began in 1934 in the then-new Australian section of the Melbourne zoo, which I had been commissioned to design and build. In 1937 the scene shifted to the Sir Colin Mackenzie Sanctuary, where late in 1943, after years of trial and plenty of errors, our platypus Jill laid eggs and reared the first and famous baby, Corrie.

Angry Jill Ejects Nest and Young

Whenever I think back on this grand and still unique event, the highlight centers on the day we first inspected the burrow. How cautiously we dug that morning! We opened the long nesting tunnel inch by inch. Suddenly in a bend of the passageway dry leaves showed up. There was a shrill sustained growl of annoyance as Jill's beak and head projected. We were both horrified and delighted when Jill in her rage turned her back and ejected nest and earth—and a fat, wrinkled babe with short satiny fur.

"We've done it!" I whispered to my deputy, Cecil Milne, hardly believing what I saw. "We have really bred the platypus!"

But all our calculations of growth rate had been wrong. We had hoped to find a foot-long, lively youngster at eight and a half weeks of age; this baby was only nine inches long, quite blind, and entirely helpless. Our burning curiosity had brought about premature investigation. Wonderful Jill, however, carried matters to a successful conclusion in a patched-up burrow. Corrie left the nest herself, a healthy, one-pound duckbill, at the age of 17 weeks.

With the historic hatching, Jill taught us much about the platypus's gestation and incubation period; how she maintained vital humidity by plugging the tunnel into the nesting chamber with earth; and how she consumed her own weight in food each 24 hours to provide milk for the baby. These and many other secrets gave us material for a book, *We Breed the Platypus*, and led us eventually on several trips to the United States and to meetings with famous biologists from many lands.*

If the unique platypus represents Australia in the minds of people around the world, so does the kangaroo.† But few realize how large and varied a family these leaf- and grass-eaters comprise.

They range in size from the huge red kangaroo of the inland plains and the great gray

Hatched from an egg, this month-old spiny anteater lives in mother's pouch until emerging spines (visible as black dots amid the wrinkles) give her pain. Mature *Tachyglossus aculeatus* laps up ants and termites.

Platypus shows the "duck's bill" that led early scientists to label the furry animal a hoax. Males of egg-born *Ornithorhynchus anatinus* carry poison spurs on hind feet.

BOTH PHOTOGRAPHS BY STARLEY BREEDEN (C) N.G.S.
BLACK AND WHITE BY CHAS. TUNNY

*See "Flight of the Platypuses," by David Fleay, NATIONAL GEOGRAPHIC, October, 1958.

†See "The Incredible Kangaroo," by David H. Johnson, NATIONAL GEOGRAPHIC, October, 1955.

Adventure-bound, Six-month-old Joey Hops Out of Mother Kangaroo's Pouch

In the first photograph of a remarkable series (left) a baby great gray kangaroo (*Macropus major*) seems to be taking a bow after climbing out of his snug retreat. Despite his size, the 12-pound youngster still commutes between pouch and outside world.

Joey stands before the pouch and nurses. He may continue to suckle even after a blind, bumblebee-size brother inherits the pocket.

Enjoying the best of both worlds, junior somersaults into the pouch, then contentedly sticks his head out to graze like an adult.

of open forest lands—both measure nearly nine feet from muzzle to tail tip—through the wallaroos and rock wallabies of rough country, to the beautiful brush wallabies. Even lower on the scale, some no bigger than hares, are the pademelon wallabies. The smallest of all are the little rat kangaroos (page 408). Australians persist in calling these midgets kangaroo rats, never thinking of them as kangaroos at all.

Menaced in older times by dingoes, tiger cats, eagles, and hawks—and nowadays by advancing settlement—the rat kangaroos total nine different kinds. They dig shallow bed holes where they doze during daylight, camouflaged by a mass of specially collected grass. Usually a pink nose projects through the screen, ready for a rocket take-off; the rat kangaroo's very life depends upon its agility and speed.

A most self-possessed rufous rat kangaroo named George came to us some years ago as a wobbly joey—as Australians call young marsupials—and is now undisputed boss of his run. To warn intruders, he stands to his full height of 15 inches, snarling and tap-dancing first on one foot and then on the other, gradually advancing close enough to kick and bite.

He also has a fascinating habit of picking up his bed with his prehensile tail and hopping off to rebuild elsewhere. It almost seems that he tires of the view and wants to watch the sunset from a different angle.

Tree Kangaroos Leap 30 Feet

Australia's pouched animals are all thought to have originated from opossumlike arboreal ancestors. And among the strangest of the kangaroos are those that have gone back into the trees, perhaps forced by the need for food, shelter, and safety.

So we find tree kangaroos (*Dendrolagus*) in the jungles of north Queensland (two species) and New Guinea (at least a dozen). They reflect their unusual jump backward in evolution in more evenly matched limbs, a slimming of the tail into a monkeylike balancing organ, and heavily padded hind feet fitted with hooked claws.

But once a kangaroo, always a kangaroo. Though awkward on the ground, these treetop dwellers perform prodigious sure-footed leaps among the boughs.

Tree kangaroos dwell in rainy forests, and sleep in a more or less hunched-over position. Nature, therefore, has provided them with a unique water-shedding device. A whorl divides the coat in the mid-back region; the fur below it lies toward the rump, and that above it radiates forward toward ears and nose, giving a natural runoff for rain drops. And that's why if you

stroke a tree kangaroo, you may find it disconcerting that the upper fur refuses to lie down, and actually bristles against the touch.

Associated with the tree kangaroo in the thick cover of jungle scrubs in north Queensland and New Guinea is the cuscus (pages 402-3), a tropical possum of sturdy build with such well-defined rims about its eyes that it appears to be suffering from a chronic hangover. Like the koala (page 410), it has a worn rump patch due to constant pole-sitting.

By day a cuscus sleeps balled up in the branches of trees, the strongly prehensile tail rolled into a neat millipedelike ring. Though slow moving, it can bite most effectively—not from sheer playfulness and curiosity, as does a tree kangaroo, but with intent to teach its annoyer a lesson.

Python Panics a Sluggish Cuscus

There are at least 16 kinds of these brightly colored creatures—two species in north Queensland and the rest on New Guinea and neighboring islands. The spotted cuscus's ears lie almost hidden under thick woolly fur. This rounded, earless appearance, with the yellow-rimmed popeyes and large nose, has often led people to report "monkeys" in northern jungles.

The only time I ever saw a cuscus jolted out of its usual sluggishness occurred when a big amethyst python, quite invisible to him, slithered slowly across the roof of his enclosure. Possibly the cuscus smelled his natural enemy; but the unmistakable sliding sound of the python appeared to be the main reason for his panic.

Heavyweights Box With All Four Feet

Standing on tails, dark wallaroo and lighter wallaby grapple with sharp-nailed paws and kick below the belt, slicing with a daggerlike claw on each middle toe. They bend heads back to save eyes and ears. Pretty face (right), as *Wallabia elegans* is called, gets its nickname from facial markings. Scientists know the roan wallaroo as *Macropus robustus erubescens*.

Valuable fur coat endangers the rare ringed-tail rock wallaby, raccoon-size *Petrogale xanthopus*.

Pensive Cuscus Resembles a Monkey But Behaves Like a Sloth

Australians know rare white *Phalanger maculatus* as the spotted cuscus, though only males have spots. Thick fur hides this female's tiny ears. Despite a sluggish demeanor, she can emit startling barks and snarls.

Two species of cuscus, spotted and brown (right), occur in northern Queensland. In neighboring New Guinea, where a dozen kinds live, natives ornament their eight-foot spears with strips of cuscus fur.

Anchored by its prehensile tail, a brown cuscus swings out from a sapling to feed on succulent shoots. Like its spotted cousin, *Phalanger orientalis* lives on fruit and leaves.

Tasmanian brush-tail possum angrily brandishes razor claws. Australia's largest possum, two-foot-high *Trichosurus vulpecula fuliginosus*, along with his mainland cousins, is perhaps the only marsupial to exploit man's encroachment on the forest. He happily hunts leaves, fruits, and flowers in city parks, gardens, and even on housetops. Scent glands rubbed against stumps advertise his presence to others of his kind.

Common wombat emerges from a 15-foot burrow to nibble grass. The powerfully built marsupial, *Phascolomis wisinus*, can crush an invading dog against the top of its burrow, yet makes an affectionate pet. Fossil relatives grew as large as hippopotamuses.

In sharp contrast, another native marsupial has been known to attack—and devour— the deadly black tiger snake.

This is the carnivorous, fox-terrier-size Tasmanian devil (page 411). With his outsize head, wirelike whiskers, and wet nose, this purely Tasmanian survival looks quite repulsive. On top of this, the strongly built animal has a most peculiar odor, and a habit of sniffing and uttering long, whining snarls—the loudest sounds made by any marsupial.

These "hyenas" of Australian fauna are sleepy in daytime, often indulging in prodigious yawns. When it comes to eating, however, they canter out of their nests, meeting jaw to jaw, sniffing, snorting, snarling, and screaming at one another. But it is all bluff. None suffers the slightest harm—though during the performance a deceased fowl may be torn to pieces and eaten so completely that only odd feathers remain.

Down along the icy Erebus River in rugged western Tasmania we once camped for three and a half months in devil country, setting drop-door cage traps among the thickly growing myrtles and tree ferns. We baited them with bacon or wallaby meat and created scent trails from trap to trap by dragging scorched meat on a string. On the following mornings we often noted a devil's tracks superimposed on our own. Most were wary of entering the traps for two or three nights, but in all we caught 19 of the animals.

Mr. and Mrs. Devil, living at our fauna reserve in Queensland, are shining black in color with white shirt fronts and rumps, ears that flush red any time the animals become hot, and, of course, outsize teeth. When the whim strikes them, they charge with open mouths, and woe betide any attendant who fails to vault promptly from their enclosure.

Without doubt the most spectacular of all

pouched animals is the Tasmanian devil's larger cousin, the Tasmanian wolf. This extraordinary creature is known variously as marsupial wolf, tiger, hyena, and zebra wolf. Even now it may possibly be written down as "recently extinct." Periodically reports raise hopes; but for the thylacine, as scientists know it, time has practically run out.

Settlers Feared the Zebra Wolf

Tawny gray with distinctive stripes on lower back and tail base, the marsupial wolf was not often seen even in the days when it was moderately plentiful. Many settlers regarded zebra wolves with superstitious dread, killing them at every opportunity and nailing the heads to barn doors.

Early observers marveled at the creature's huge jaws, "opening almost to the ears." Some idea of this is conveyed in the photograph I took of the last one ever kept in captivity (page 395). This male specimen, fed on horse meat and hungry for variety, sidled up to me as I knelt in his cage and slyly attempted to add my leg to his bill of fare.

In November, 1945, I led an expedition in search of thylacines into the uninhabited Frenchmans Cap-Jane River area in western Tasmania. Not until early February, 1946, did we find an unmistakable, fresh set of tracks matching the plaster cast we carried.

We lost no time setting out a variety of traps, and enclosed two live sheep, a wallaby, and a brush-tail possum in small protective stockades to act as decoys.

Then came the tedious jobs of laying scent trails and replacing stale bait such as sheeps' hearts and livers. A whole month elapsed before our thylacine—or another of its kind—came by the traps at last.

But instead of being held by a paw in the trap, the marauder was evidently gripped by

Upside-down Flying Fox Rocks Baby to Sleep

Only a keen eye can spot the infant clinging head down, protected by mother's wing. Russet neck fur (left) gives it away.

Australia's largest bat, *Pteropus poliocephalus* has a four-foot wingspread. Traveling enormous flocks and shrieking like banshees, these creatures can destroy a fruit crop overnight.

Haunt of oddities: the rain forest on Mount Glorious, near Brisbane. Flying foxes, marsupial mice, and squirrel gliders live here among plants almost as strange as themselves. Large leaves at right belong to a poisonous Gympie stinger (*Laportea moroides*). Human skin brushing a leaf develops a painful rash lasting a week or more.

Naturalist Kay Breeden, among the ferns, strings out an almost invisible mist net to capture bats.

LIKE A FIREMAN *sliding down a pole, the goggle-eyed frog at left grasps a stalk in its search for insects. Australians, who know thumb-sized* **Hyla gracilenta** *as the Graceful Tree Frog, often keep it as a pet.*

ORANGE-AND-BLACK *corroboree (top), whose name is the aboriginal word for festival, wears a coat that outdoes the gayest tribal dancer's. Because of its habit of hiding under sphagnum moss in Victoria's alpine region,* **Pseudophryne corroboree** *escaped scientific description until 1953.*

HARD-TO-SEE BUMP *on a leaf, another Graceful Tree Frog blends into foliage as it settles for a day-long sleep.*

LIVING WATER BAG, *this bloated toad wins no beauty prizes but can save lives. A dweller in semi-desert,* **Notaden bennetti** *stores water in its body during rain. In drought it burrows deep in hardening mud and remains there for months. Aborigines in parched central Australia have survived by squeezing water from its body. Pattern of warts prompted its popular name, Holy Cross Toad.*

BLUE SKIN *marks this Graceful Tree Frog as a melano, antithesis of an albino. Such darkening of skin often occurs among amphibians.*

Catlike in manner, northern quolls battle over a grasshopper. *Satanellus hallucatus*, not a feline but a nocturnal, carnivorous marsupial, helps to control rodents and insects. It lives in caves, hollow trees,

World's smallest marsupial, a planigale tries to bite the author's thumb. Mr. Fleay is the only man to breed *Planigale ingrami* in captivity. Weighing less than a fifth of an ounce, the voracious midget sometimes rides a jumping grasshopper until the insect falls dead.

Three inches of furred fury, the fat-tailed marsupial mouse (*Sminthopsis crassicaudata*) kills spiders, centipedes, and lizards, eating more than its weight each night.

Rufous rat kangaroo hops to safety. Threatened by imported foxes, *Aepyprymnus rufescens* survives only on the northeast coast.

and even stoves in abandoned houses. A mother may carry eight babies in her pouch.

Yellow-footed marsupial mouse attacks a cicada. Nocturnal *Antechinus flavipes* likes to surprise sleeping insects. Shy, the animal darts away at the slightest suggestion of noise. House cats have made it rare in settled regions.

an elbow or lengthwise along one leg. We found nothing but hair and footprints. There was never a sign of it again. In my lifetime the loss represents the ultimate in frustration.

Any popularity poll among Australia's furry creatures still rates the charming koala in No. 1 position, and on our 65-acre timbered reserve in Queensland we are fortunate to be amid a free-living colony.

"Gee, Mum," our young visitors call, "look at the bear with a baby on its back!"

For each fastidious koala has a round of favorite trees, and at any time mother with pick-a-back baby may take it into her head to change. Walking unconcernedly across the ground, she passes visitors in that inimitable splayfooted gait, with never a blink of her black shoe-button eyes. Vitally concerning her, however, among Australia's 500 species of eucalyptus are those special ones from which she chews some two pounds of leaves each day.

At night the males are frequently vociferous, and their characteristic braying flouts across the gullies. With patent-leather noses pointed skyward, they inhale wheezily, following up with guttural rumbling grunts.

Thirty years ago Queensland numbered its koala bears in millions. Today only a few thousand are left. Trees and scrub are fast giving way to houses and farms, and our attractive koala is too hopelessly specialized in anatomy and diet to adapt to changing conditions.

There are other hazards: widespread fires in the dry periods; highways on which many unwary koalas are run down; and of course diseases such as kidney trouble, and conjunctivitis, which often causes blindness and consequent starvation. And there is the demand for furs; as late as 1924, two million koala skins were exported from Australia. The harmless little fellows have never recovered from this blow.

Greasy Wombat Scatters a Crowd

At first glimpse Winkie, the small silver-gray wombat at our fauna reserve, is often mistaken for a koala. Little wonder really, for it is possible that a long way back both tree-loving koala and burrowing wombat had a common ancestor. Winkie consistently chews carrots, roots, woodwork, shoes—anything that will keep her constantly growing teeth ground down to size. Wombats are the only pouched animals with teeth like a rodent's (page 403).

Ten-year-old Winkie is more fun-loving than her solemn face indicates. Often she follows at one's heels, or rolls upon her back, or butts like a goat. She loves to be picked up, and like an eye-shutting doll she is soon fast asleep.

Australian "Teddy Bears" Thrive on Leaves of Favored Eucalyptus Trees

Hunters once killed hundreds of thousands of koalas a year. Today only some 50,000 survive, chiefly in areas of Victoria, where conservation authorities have re-established *Phascolarctos cinereus*. These marsupials shun young eucalyptus leaves, which sometimes contain deadly prussic acid.

Tasmanian devil screams at the photographer. Fierce appearance and jet-black fur give this fox-terrier-size marsupial its sinister name. A demoniac growl, followed by a snarling cough, adds to its reputation. Yet when taken young, *Sarcophilus harrisii* proves as affectionate as a kitten. In the wild, the devil preys on mammals, birds, and even deadly tiger snakes.

The wombat is born with a distinct tail, which later all but disappears; the animal simply grows around it. As with the Tasmanian devil and the koala, the wombat's pouch opens to the rear, almost between the hind legs. The single joey spends four months in the pocket, thus protected from snags as mother wombat trundles about the country.

The grass- and root-eating wombat is the bulldozer of the marsupial clan. Its fused pelvic girdle and lower backbone can crush an invading dog against the roof of its burrow. I have actually been knocked unconscious when dragged off a bush road at night, hanging fast to the ankles of a wombat I was trying to catch.

Found at Last: Leadbeater's Possum

Many animals have worked their way into my life—and my heart—since I pursued that burly wombat years ago. But much as I should like to say that the prize among them all has been the furry, elusive Leadbeater's possum, the honor of rediscovering this long-lost creature belongs to another. For, incredibly enough, after more than 50 years during which naturalists believed it extinct, Leadbeater's possum *has* been found (page 394). And not in some remote, unpopulated part of Australia—but within 60 miles of Melbourne!

It was on the evening of April 3, 1961, when Henry E. Wilkinson, engaged in a mammal survey of the densely wooded Healesville-Warburton-Marysville ranges for the National Museum of Victoria, glimpsed a small gray possum in the foliage of a blackwood acacia. It might have passed as the pretty little sugar glider, but for a long thin tail bushing out

When Winkie went to Government House in Brisbane to meet Queen Elizabeth II in 1954, she intrigued Her Majesty with her husky voice, her pigeon-toed amble, and the nonchalant way she pushed past everyone's ankles. Winkie terminated her royal performance by rubbing her ever-itchy back against the handiest solid overhang—the oil-leaking sump of an automobile. Then she rushed toward Her Majesty for further frolics, unaware of the scatter she caused as spectators side-stepped her grease-covered back.

toward the tip. He later returned to see three of the animals. He kept one under observation for some 25 minutes, producing the first color photographs ever made of the species. Eventually, several were captured for study.

The general structure, form, and dentition of Leadbeater's possum are such that both the nongliding striped possum of north Queensland and all the better known gliders of the genus *Petaurus* are considered to be derived from it. In other words, it is an ancestral type from which much can be learned.

Mr. Wilkinson's notable discovery must rank as one of the highlights in the history of fauna-surveying in Australia. What stumps me is that the long-lost animal was found in an area that time and again has been ravaged by frightful bush fires. How has a small creature of limited mobility managed to survive in such a region? I do not know the answer.

Still, when one views the cavalcade of Australia's wonderful wildlife, much of it unique in this corner of the globe, perhaps it is not so strange after all. THE END

DIVERS EXPLORE THE WATERY HIGHWAY OF CANADA'S

IT ALL STARTED when Dr. E. W. Davis focused his telescope on a diving operation in the harbor of Silver Bay. From his home overlooking a mammoth taconite processing plant on Lake Superior's Minnesota shore, he had often watched the activities below, but never before had he seen a crew of scuba divers.

Three men were working out of a small boat, diving in about 100 feet of water. Time after time they sub-

Diver grapples in the Granite River, on the Minnesota-Ontario border, for relics lost by voyageurs who traded guns and axes for beaver pelts. Europeans prized the fur as they did gold. Holding his beaver-fur top hat, chief trader Archibald McDonald (inset) braves dangerous rapids on a Hudson's Bay Company expedition in 1828.

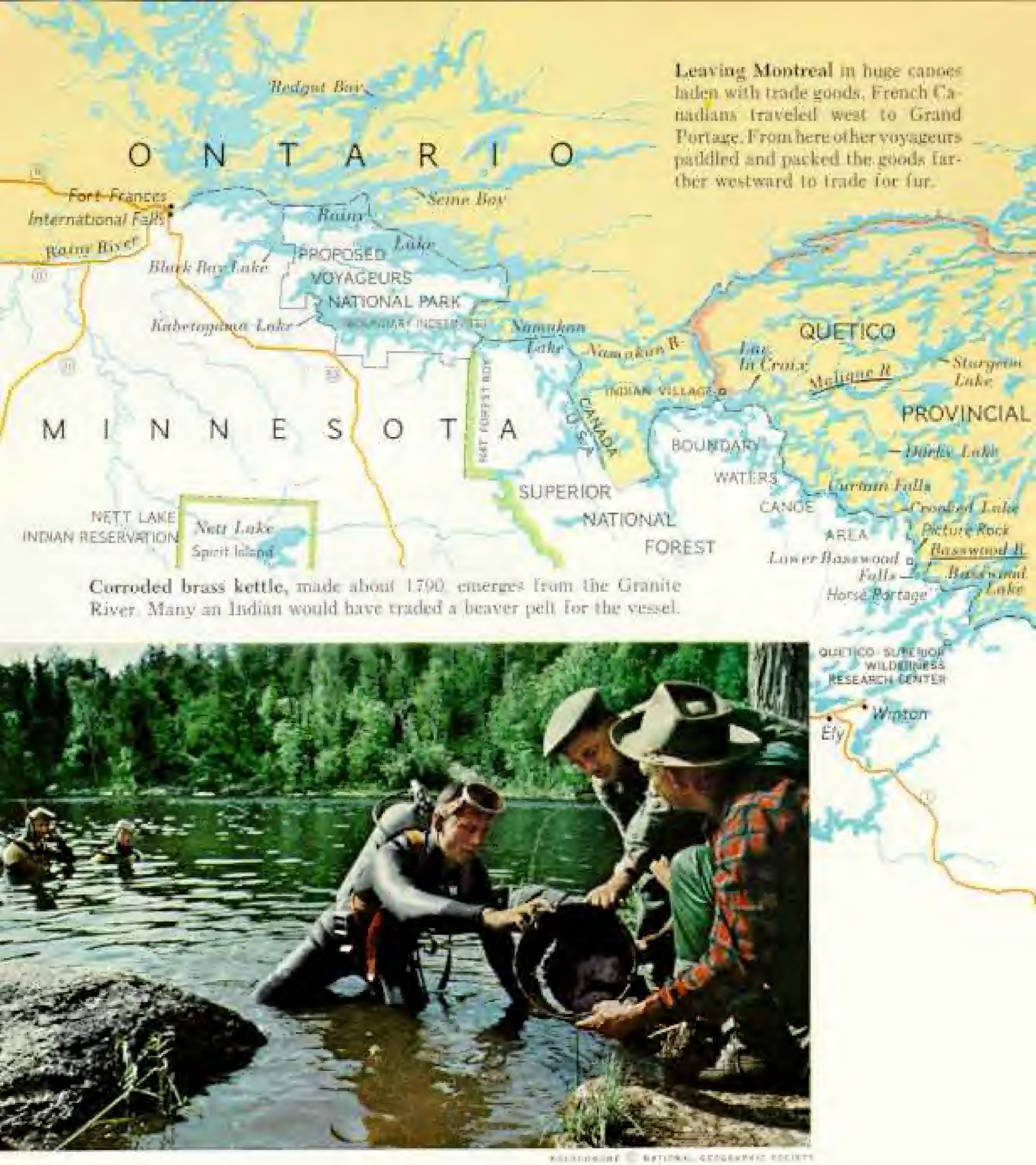
RELICS FROM THE RAPIDS

By SIGURD F. OLSON

Photographs by DAVID S. BOYER
National Geographic Staff

merged, surfaced, and went down again as they searched for the remains of a shipwreck.

As Dr. Davis studied them, an idea struck—why not such divers to explore the famous waterway of the fur traders and voyageurs? From the late 1600's to the mid-1800's, these adventurers had paddled from Montreal



Leaving Montreal in huge canoes laden with trade goods, French Canadians traveled west to Grand Portage. From here other voyageurs paddled and packed the goods farther westward to trade for fur.

Corroded brass kettle, made about 1790, emerges from the Granite River. Many an Indian would have traded a beaver pelt for the vessel.

deep into the unknown vastness of North America to seek out furs for the European market. If divers could plumb the mighty lake, couldn't they also search out artifacts lost when the voyageurs' canoes upset?

Rapids, fast and lethal, scar the entire length of the voyageurs' highway—that 3,000-mile network of rivers and lakes that snakes from the St. Lawrence River in the east to Lake Athabasca in the northwest (maps, above). The passage was always perilous and the voyageurs paid a terrible toll in capsized canoes and lost lives.

Dr. Davis, who developed a process to convert low-grade taconite into useful iron ore, was no man to let an idea die a-borning (page 424). That very day he enlisted the divers in his enterprise, and an exciting chapter in the archeology of North America was under way.

Later, following several preliminary dives, I stood with Dr. Davis on a smooth, glaciated ledge of granite overlooking the Basswood River, some 100 miles northwest of Lake Superior. Altogether, there were six of us, united in the conviction that probing the wild waters along the Minnesota-Ontario border would bring long-lost trade goods to light.

We focused our search for relics upon

Iron axheads and ice chisels reward a diver in the Basswood River. French voyageurs first penetrated the American interior in the latter part of the 17th century. Until rails were laid, their canoes provided the main link between industrial Europe and the Stone Age economy of the Indians.

rapids swift enough to be dangerous, but not too swift to daunt experienced boatmen such as the voyageurs. Standing on that ledge, we were confident we had found just such a site.

As I stared at the white water snarling and thundering among the rocks, my imagination framed a 25-foot birchbark North canoe edging nervously into those churning rapids. Its painted bow looms high; the eight paddlers tense as the craft knifes toward a narrow gap between massive boulders. The current takes hold. The red-capped voyageurs shout—in exultation? in fear?—as the fragile canoe shoots forward.

Suddenly something goes wrong. The bow veers sickeningly. The paddlers fight to avoid the rocks. The canoe swings, brushes one boulder. Spun broadside, it yaws crazily in the raging river, then smashes into another rock. For an agonizing moment the canoe rises in the water and shudders. Then, in the space of a long sigh, it sinks.

The voyageurs clutch what little they can and scramble for the shore. Gone are food, tobacco, weapons, almost all they own. Gone are months of work in the wilderness and, with winter closing in, death by freezing or starvation becomes a bitter possibility there

Rusty flintlock muskets contrast with a flint spearhead (on hat). Both were in use when voyageurs paddled the wilderness rivers. Salvagers hold a clay pipestem from Scotland and a block of flint found in the Granite River.

Lost and Found: Tools of the Voyageurs' Trade

Axheads, ice chisels, brass kettles, and barbed spearpoint recovered from streams are identified at the Minnesota Historical Society in St. Paul. The Society's director, Russell W. Fridley (top), and museum curator Alan R. Woolworth examine the collection.

on the lonely banks of the Basswood River.

Had it happened that way 150 to 200 years before? Did that precious cargo still lie beneath the rushing water?

Below us, four divers, resembling denizens of some distant planet with their face masks, air tanks, and orange-and-black suits, darted among the rocks. I followed the trails of air bubbles that marked their progress. Powerful currents, treacherous undertows, and whirlpools clutched at them as they combed every crevice, every niche.

"These chaps are good," Dr. Davis said. "They've got to be, what with continually shifting currents, boulders, and the possibility of entanglements with submerged trees and stumps, or a foot getting caught in crevices in the bedrock. There's always the danger, too, of something going wrong with their outfits—a stuck valve, a loose connection. Notice that they never work alone. When visibility is bad, they keep in touch by tapping signals on their air tanks."

Soon the divers began to concentrate on a dark, foam-laced whirlpool toward the base of the rapids where the water was from 8 to 12 feet deep. If the North canoe crashed as I had imagined, that was the place to search.

The author, Sigurd F. Olson, puzzles over a nodule of rust around an unidentified piece of iron retrieved by divers in the Granite River

Mr. Olson is a consultant on wilderness preservation to the Secretary of the Interior and to the Director of the National Park Service, the President's Quetico-Superior Committee, and the Izaak Walton League of America. His books, *The Singing Wilderness*, *Listening Point*, *The Lonely Land*, and *Runes of the North*, describe the voyageur country.

Sure enough, diver Donald Franklin was swimming our way. We scrambled down the slope and met him at the water's edge. With a grin, he handed us a badly corroded movie camera. Divers Curtis Anderson and Dennis Dalen followed with a tackle box, a pair of sunglasses, and a Boy Scout camp ax, but nothing even remotely resembling what we had come so far to find.

A short time later, however, Don yelled, "I've got something!" He was out of the water now, carefully studying a blackened object he had brought out of the pool. We four on the ledge jumped into canoes and paddled swiftly across to where he rested. Don handed the object to Frank B. Hubachek, who supports the Quetico-Superior Wilderness Research Center on Basswood Lake.

"A trade ax," Hub announced triumphantly. "A wrought-iron ax!"

He handed it to Robert C. Wheeler, Assistant Director of the Minnesota Historical Society. Bob examined it with an expert's eye. "The real thing," he said at last. "There must be more below."

Don dived again and we watched with new excitement. In a short time he surfaced with several chisels and spears.

"Lots of stuff down there," he panted. "Couldn't tell just what, but between the rocks are several strange-looking mounds."

Don had hit a bonanza. That day he recovered 36 trade axes of various sizes and 24 chisels and spears—proof that some canoe of long ago had sunk there.

A short time later at this same site, divers found more than a thousand musket balls, a deposit of black and white beads, three masses of vermilion paint, brass buttons, thimbles, gunflints, a flat piece of pewter, and two sections of an Indian-style pipe that fitted perfectly together. It had loops to hold feathers; burned-out tobacco still caked the bottom of the bowl.

These goods had begun their ill-starred journey at Montreal. Carefully stowed in large canoes, they had passed up the St. Lawrence River to the Ottawa River and thence into Lake Nipissing. Subsidiary routes fanned southward into the Mississippi Valley and

Canoe-borne Canadian Rangers Demonstrate the Perils of Swift Water

Asked to show how river men tackle rapids, Bruce Littlejohn (in stern) and Gary Isberg overcame misgivings and drove through the spume below Curtain Falls at the west end of Crooked Lake. Sporting gay feathers in voyageur fashion, they bear down hard on paddles. To steer effectively, they must keep the canoe moving faster than the racing water around it.

Clinging to the canoe: Ranger Isberg shows why park officials discourage the running of rapids.

"As a ranger in Ontario's Quetico Provincial Park," writes Littlejohn, "I am supposed to protect equipment from needless risk and set a good example to campers who might recklessly try swift water with disastrous results. I hope no one thinks we do this for kicks before breakfast. It is not safe sport for anyone."

north toward Hudson Bay. But the main westward route traversed the rapids of Sault Ste. Marie into Superior, the greatest fresh-water lake on earth. Four hundred miles along its north shore, the canoes beached at Grand Portage (map, pages 414–15).

Here the voyageurs left their canoes, shouldered their goods, and trudged northwest nine tortuous miles to the Pigeon River. There they exchanged their loads for furs brought from the interior by other traders. This was the most difficult carry on the continent; even the tough voyageurs spoke of it with awe.

Alexander Mackenzie, the great explorer who first penetrated the Canadian Northwest and followed the river bearing his name all the way to the Arctic Ocean, described their incredible hardihood in his *Voyages:**

"When they are arrived at the Grande Portage . . . each of them has to carry eight

*See "Across Canada by Mackenzie's Track," by Ralph Gray, NATIONAL GEOGRAPHIC, August, 1955.

Grand Portage's reconstructed stockade on the shore of Lake Superior rises on the site of the original post. Voyageurs toiled for six to eight weeks to paddle here from Montreal, then hauled their packs nine miles farther to the Pigeon River. In summer, hundreds of traders and Indians met at the old fort for a noisy council. In the early 1800's, threat of U. S. taxes on their wares drove the traders to Fort William, Ontario.

packages of such goods and provisions as are necessary for the interior country. This is a labour which cattle cannot conveniently perform in summer, as both horses and oxen were tried by the company without success. . . .

"I have known some of them set off with two packages of ninety pounds each, and return with two others of the same weight, in the course of six hours, being a distance of eighteen miles over hills and mountains."

Grand Portage was the scene of the famous rendezvous where each summer hundreds of canoemen, traders, and Indians gathered to exchange furs for guns, ironware, trinkets, and rum. It was a vital funnel for all trade with the Northwest until the early 19th century. And from this isolated spot, well known in the courts and banking houses of Europe, expeditions sallied forth to Rainy Lake, Lake of the Woods, Lake Winnipeg, and by way of the Saskatchewan and Churchill Rivers to Fort Chipewyan at the west end of Lake Athabasca, 2,000 miles away.

Frenchmen First to Tame the Northwest

In 1763 England finally won the long struggle for possession of the Canadian West. But until then the trail into the interior had been French. Frenchmen had opened it and they had followed it deep into the continent, and the names they bestowed linger still—Eau Claire, Wisconsin; Belle Fourche, South Dakota; Coeur d'Alene, Idaho.

History tells us what manner of men these French pioneers were. They spoke the Indian languages and often adopted Indian ways. And they had a flamboyant audacity that takes the breath away.

There was Nicolas Perrot, one of the greatest of the French woodsmen. In the winter of 1683, Perrot strode arrogantly into an Outagami village to reproach the savages for murdering some missionaries. "I have learned that you are very desirous to eat the flesh of Frenchmen," he told them. Then he drew his sword and showed them his body. "My flesh is white and savory, but it is very salt; if you eat it, I do not think that it will pass the Adam's-apple without being vomited."

Cowed, the Indians begged forgiveness. "What child is there who would eat his father, from whom he has received life?" moaned the chief to Perrot. "Thou hast given birth to us, for thou didst bring us the first iron."

Earlier, in 1660, Pierre Esprit Radisson and his brother-in-law, Médard Chouart, Sieur des Groseilliers, had organized a canoe flotilla to travel down the St. Lawrence. Five hundred

Indians buy a musket at an old-time trading post. They also purchased powder, lead shot, and bolts of calico, paying for them with furs.

Fur buyer (left) appraises a beaver hide at Port Arthur, Ontario. Flexible rule quickly measures the skin; fingers determine its grade.

Canoeists on Lesser Cherry Portage, Ontario, follow a path created by Indians perhaps thousands of years ago. Voyageurs, bent beneath 180-pound loads, loped along the trail from one resting place to the next. *Poses* (rest stops) occurred every third of a mile or so, depending on terrain.

Hurons were to man the canoes, jammed to the gunwales with tons of beaver pelts, the fruit of two years in the wilderness.

Just before departure, news arrived that Hurons down the river had been massacred by the warlike Iroquois. Radisson's terrified Hurons refused to set out.

With all hope for their voyage nearly gone, the two Frenchmen held a council among more than 800 savages. Radisson rose and slapped a Huron chief across the face with a beaver skin. In his *Voyages*, he recorded the incident, strangely enough, in English.

"Doe not you know the French way?" he wrote. "Shall your children learne to be slaves among the Iroquoits for their Fathers' cowardnesse? . . .For myne owne part, I will venter choosing to die like a man than live like a beggar. . . ."

Shamed by the Frenchman's wrath, the Hurons embarked.

"We weare Cesars," Radisson wrote proudly. But he himself was a very human Caesar who wondered sometimes why he did it, why he went back again and again to "worke whole nights & dayes, lye down on the bare ground, & not allwayes that hap, the breech in the watter, the feare in ye buttocks, to have the belly empty, the wearinesse in the bones and drowsinesse of ye body. . . ."

Lives Spiced by Danger

Even after 1763, when the fleurs-de-lis of France was seen no more in the back country, the Hudson's Bay Company and the English and Scottish founders of the North West Company relied upon the voyageurs to transport their goods. For two centuries these wiry little French-Canadians—seldom more than five feet six in height, rarely weighing more than 150 pounds—literally carried the fur trade on their backs.

They paddled their great canoes from dawn until dark, packed enormous loads, faced storms, wild uncharted rivers, hostile

Indians, and ruthless rivals with joy, abandon, and pride in their calling. A breed apart, they wore a distinctive, colorful costume—moccasins topped by high leather leggings, a breechcloth, a shirt belted with a gaudy sash, a pouch, a blue hooded cloak, and a red cap sporting a feather. These were the men who sang as they fought gales in their fragile canoes.

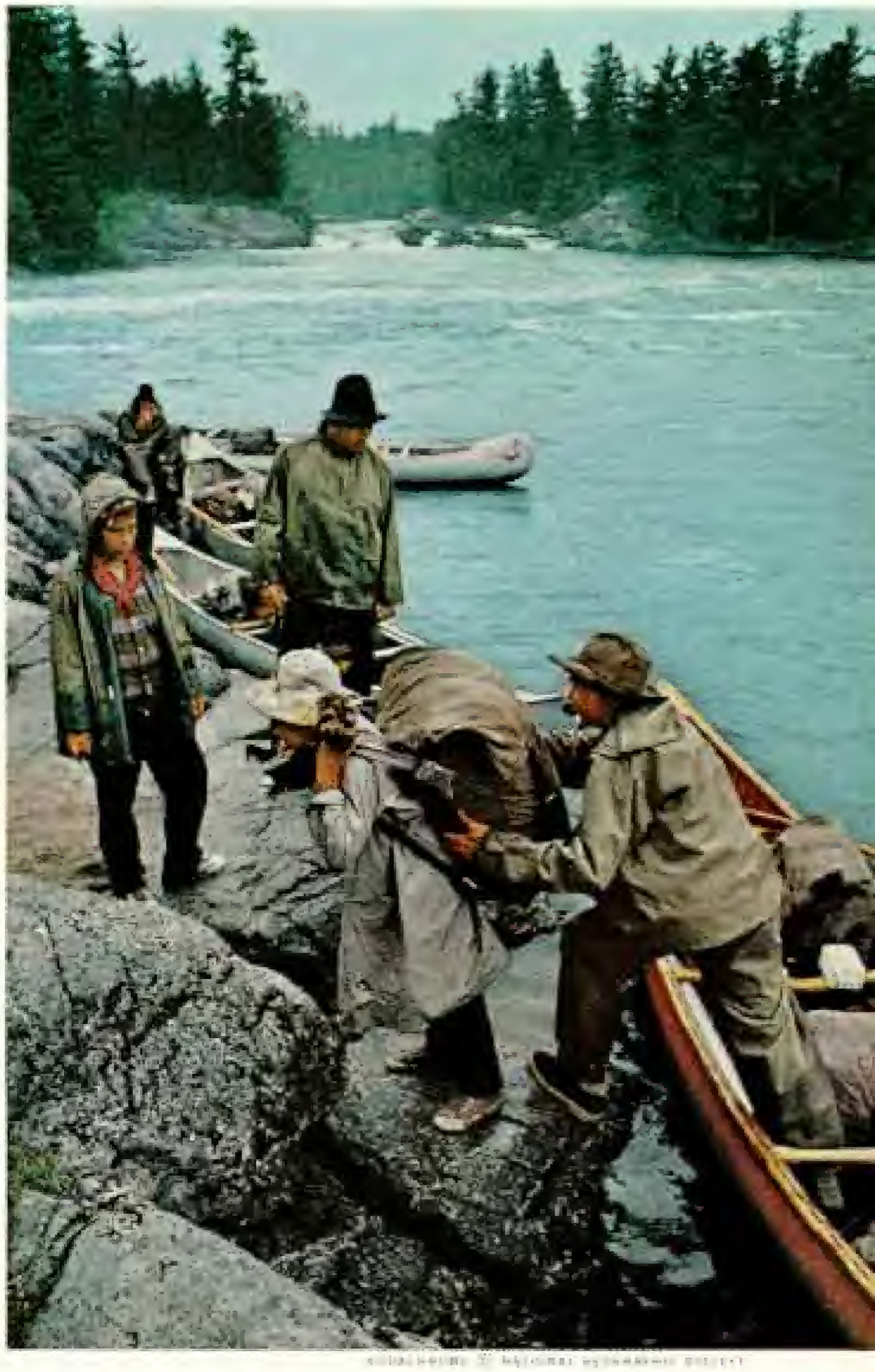
More than a century ago Canadian fur trader Alexander Ross talked with one of the last of the voyageurs. "No portage was too long for me," the old Frenchman told him. "I could carry, paddle, walk, and sing with any man I ever saw. No water, no weather stopped the paddle or the song. I spent all my earnings in the enjoyment of pleasure; although I have not now a spare shirt to my back, nor a penny to buy one. Yet, were I young, I should glory in commencing the same career again. There is no life so happy as a voyageur's."

And none, perhaps, so dangerous. Daniel Harmon, a Vermonter who served the North West Company in its far-flung outposts, first went into the interior in 1800. Twenty-five days out of Montreal, he recorded in his journal:

"The Canadian Voyagers, when they leave one stream to go up or down another, have a custom of pulling off their hats, and making the sign of the cross, upon which one in each canoe, or at least, in each brigade, repeats a short prayer. The same ceremonies are observed by them, whenever they pass a place, where any one has been interred, and a cross has been erected. Those, therefore, who are in the habit of voyaging this way, are obliged to say their prayers more frequently perhaps, than when at home: for at almost every rapid which we have passed since we left Montreal, we have seen a number of crosses erected, and at one, I counted no less than thirty. . . ."

The fur trade was a by-product of a conviction long held in Europe that somewhere in the far northwest of America lay a passage to the Orient. So convinced of this were the early explorers that the starting point near Montreal was called Lachine (China) and many voyageurs hoped that somewhere in the back country they would find the open blue waters that led to Cathay.

It was a dazzling occasion when the fur brigades left Montreal on their annual trip to Grand Portage. Guns boomed as the canoes sprang upriver—the Montreals of 35 feet carrying a crew of 14; the bastard canoes—between the Montreal and North canoes in size—with a crew of ten. Colorful designs



Young Adventurers Retrace the Voyageurs' Route

Camper in raincoat delivers his pack after portaging around Lower Basswood Falls on the Basswood River, boundary between Minnesota and Ontario. One foot in the canoe, C. Roy Terry, Jr., Director of the Quetico Voyageurs, leads the lads on a summer expedition into the wilderness.

"Mr. Taconite"—E. W. Davis—compares a kettle found by divers with one borne atop trade goods in a painting that shows a voyageur canoe of the mid-1800's. Dr. Davis discovered the process for treating low-grade taconite to make it suitable for steel production, thereby prolonging the life of Minnesota's Mesabi Range.

Along the voyageurs' route, a Canadian park ranger runs rapids on the Basswood River. Traders were more apt to risk this cascade than the dangerous water just below Curtain Falls (pages 418-19).

covered the craft, and each bore its own insignia. Vermilion-tipped paddles flashed to the rhythms of old *chansons*, and cheers rang across the wide St. Lawrence.

Thrilled by such pageantry, captivated by prospects of adventure, hundreds of young men abandoned their farms and settlements in Quebec Province to join the fur trade. So great was the outpouring of manpower into the wilderness that in 1696 the Governor of Quebec forbade citizens to leave their land. But the call of the brigades was stronger; the Governor's edict had little effect.

These, then, were the men, this the era, that we sought to illuminate through underwater archeology.

After completing our work on the Basswood rapids, we gathered around a fire to frame plans for the next season. In preliminary dives about a year earlier Dr. Davis had recovered 18 brass kettles from the waters just below the Granite River's Horsetail Rapids. Experts of the Minnesota Historical Society pronounced them authentic and dated them at approximately 1790. Dr. Davis briefly outlined the results of other explorations in the Granite River as well as an unsuccessful dive off the beach at Grand Portage.

Where, then, should we concentrate our efforts? At Grand Portage?

"The chances that canoes were sunk by storms at Grand Portage are pretty good," I said, "but it's also possible that Lake Superior's constant wave action has destroyed everything that went down with them."

"We'd better stick to the Granite," offered Bob Wheeler. "There's a lot of white water that I'm sure the voyageurs ran at times. That nest of kettles at Horsetail Rapids was only part of a load."

"Let's not forget the rapids below us on the Basswood River," said Frank Hubachek, "all the way down to the Lower Falls to the northwest."

"There are places right here," I added, "that have never been touched. When I trav-

eled through here years ago, we followed a loop of the river just above us that has three separate rapids. Horse Portage bypasses them now, but they might be worth investigating. They're part of the series of rapids the traders spoke of as 'dangerous waters.'"

Old Account Details Voyageur Perils

Bob Wheeler had been thumbing through the writings of David Thompson, the explorer and fur trader who mapped the Northwest. "Here," he said, "Thompson tells about shooting just such rapids 'with careless gaiety,' when suddenly a huge butt of a tree rose to the foaming surface only a few inches from the canoe 'which gave us a fright that put an end to our cheerfulness.'"

Another volume, the journals of Alexander Henry, the younger, produced a pertinent entry dated August 9, 1800: "I perceived the canoe on the N. side coming off to sault [shoot] the rapids. She had not gone many yards when, by some mismanagement of the foreman, the current bore down her bow full upon the shore against a rock. . . . The canoe we found flat upon the water, broken in many places . . . The loss amounted to five bales merchandise, two bales new tobacco, one bale canal [pipe] tobacco, one bale kettles, one bale balls, one bale shot, one case guns. I was surprised that a keg of sugar drifted down about half a mile below the rapid as its weight was 87 lbs.; it proved to be but little damaged. The kegs of gunpowder also floated a great distance and did not leak. . . ."

No wonder Charles Grant, an important trader and Nor'wester, wrote to the Governor of Quebec in 1780 that "Indian trade by every communication is carried on at great expense, labour and risk of both men and property; every year furnishes instances of the loss of men and goods by accident. . . ."

According to the Colonial Office Papers of 1786, 67 licenses were granted that year covering 163 canoes, 163 flat-bottomed, wooden *bateaux*, 2,139 men, 56,324 gallons of rum,

Canoeists seek Indian paintings on Picture Rock, a voyageurs' rendezvous in Crooked Lake.

Cow moose and calf march across a rock beside Darky Lake, Ontario. The artist, probably an Indian, drew the animals with a pigment made of iron ore.

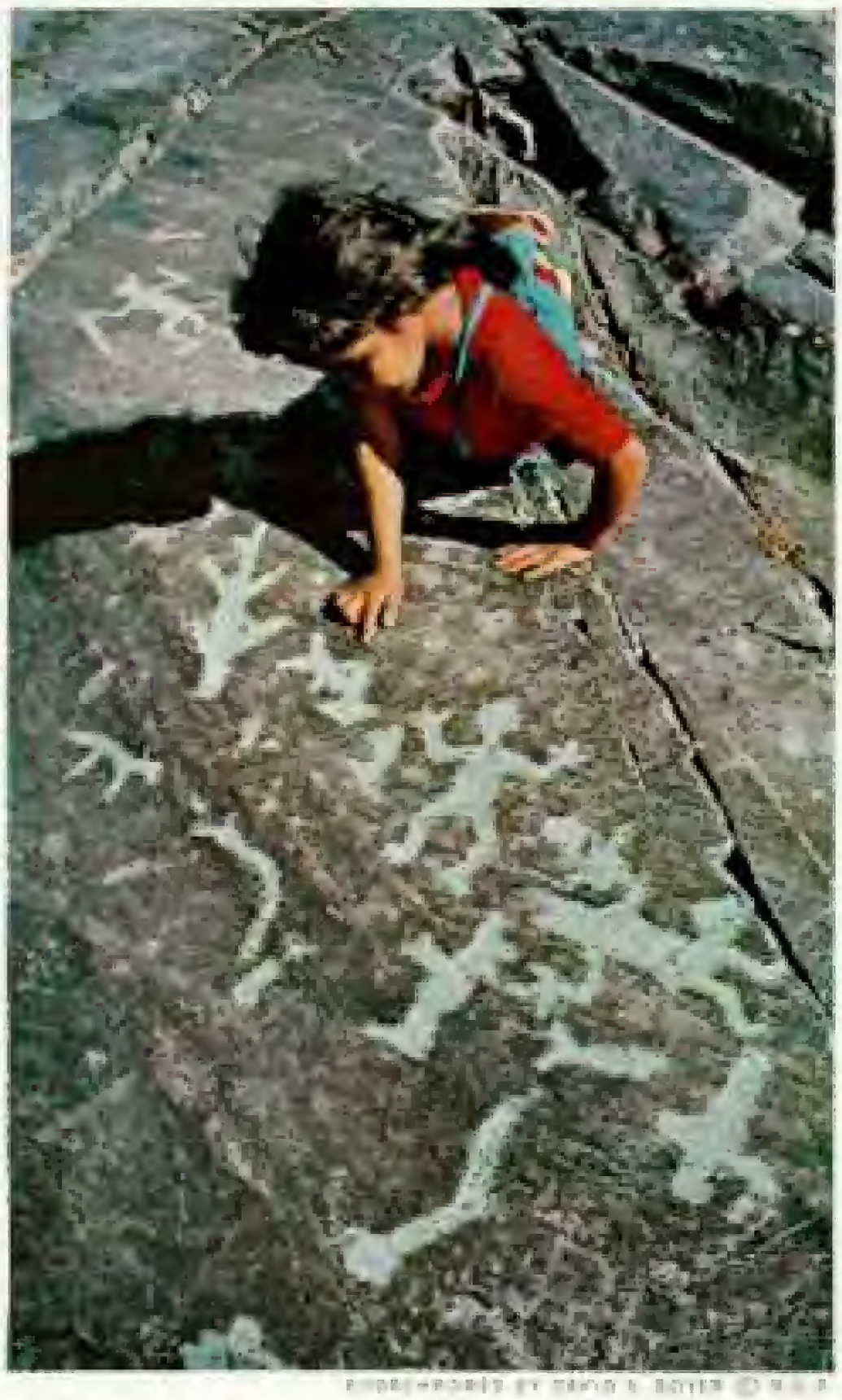
66,207 pounds of powder, 899½ hundredweight of ball and shot. In addition, the usual packets of ironware, kettles, beads, calico, and trinkets had gone upriver.

The axes, spears, and chisels we had taken from the Basswood River that afternoon, though corroded by more than a century of oxidation, still remained in a remarkable state of preservation. Such items had been transferred into North canoes at Grand Portage for the inland trade. Alexander Henry recorded the cargo of a typical canoe headed northwest for the Red River country on July 20, 1800:

Merchandise, 90 pounds each,	5 bales	Leaden balls,	2 bags
Canal tobacco,	1 bale	Leaden shot,	1 bag
Kettles,	1 bale	Flour,	1 bag
Guns,	1 case	Sugar,	1 keg
Iron works,	1 case	Gunpowder,	2 kegs
New twist tobacco,	2 rolls	High wine [distilled], 9 gallons each,	10 kegs

. . . Equipage for the voyage: Provisions for four men to Red river, 4 bags corn, 1½ bushels in each, private property belonging to the men, consisting of clothing, tobacco, etc., for themselves and families for the year; so that when all hands were embarked, the canoes sunk to the gunnel.

"Seems like an awful lot of high wine," said Bob, "particularly in view of its effect on the Indians." Alexander Henry also left us an account of that.



Carved figures dance on rock smoothed by ancient glaciers. No one knows the origin or age of these petroglyphs on Spirit Island in Nett Lake, Minnesota. Young Chippewa girl puzzles over their meaning.

"Indians having asked for liquor," he wrote, "and [having] promised to decamp and hunt well all summer, I gave them some. Grand Gueule stabbed Capot Rouge. Le Boeuf stabbed his young wife in the arm. Little Shell almost beat his old mother's brains out with a club. . . . I sowed garden seeds."

I picked up one of the rusted chisels and a small two-barbed spear still sharp and dangerous. Such tools were invaluable to the beaver trade, the chisels for cutting holes in the ice, spears and hooks for pulling the animals out of their holes. Samuel Hearne, a great trader and explorer, the man who eventually paddled down the Coppermine River as far as the Arctic Ocean, described their use:

"Persons who attempt to take beaver in Winter should be thoroughly acquainted with their manner of life . . . because they have always a number of holes in the banks, which serve them as places of retreat when any injury is offered to their houses. . . .

Dancing Chippewa boys shake feather headdresses. Their people have adopted modern fashions but revert to Indian dress at powwows on the Nett Lake reservation.

"Each man being furnished with an ice-chisel . . . he then walks along the edge of the banks and keeps his chisel against the ice. Those who are well acquainted with that kind of work well know by the sound of the ice when they are opposite to any of the beavers' holes or vaults . . . They then cut a hole through the ice big enough to admit an old beaver. . . . While the principal men are thus employed, some of the undertrappers, and the women, are busy in breaking open the house . . . When the beaver find that their habitations are invaded, they fly to their holes in the banks for shelter; and on being perceived by the Indians . . . attending to the motion of the water, they [the Indians] block up the entrance with stakes of wood, and then haul the beaver out. . . ."

According to the Moose Fort journals of 1784, one beaver skin could buy two chisels; spears no doubt were worth as much or more. One beaver could also purchase 9 arrowheads, or 12 awl blades, or 2 bayonets, or half a pound of beads, or a one-point blanket (the cheapest kind), or half a yard of cloth, or 12 dozen buttons, or 2 combs, or a kettle. The price of a four-foot gun was 12 beaver skins.

After a season on the Basswood River, we decided to schedule our next year's dives in the Granite River, which had already so richly rewarded Dr. Davis's early efforts.

Ghosts Stalk Grand Portage

The following season, on my way to our rendezvous point along the Granite River, I stopped at Grand Portage. Climbing Mount Rose, I found the site where lookouts had once scanned the horizon for the first of the brigades to round Hat Point.

Below me sprawled the rebuilt North West Company stockade (page 420) and across the water, in the blue distance, I could descry the shadowy outline of Isle Royale.

The scene had changed little since the day in 1732 when French trader, explorer, and nobleman Sieur de la Vérendrye crossed it for the first time on his way to the Rainy River country to the northwest.

Indians on Big Rice Lake, Minnesota, harvest wild rice, which their ancestors traded to the voyageurs for beads and tools. Today *Zizania aquatica* is so scarce that a pound often retails for as much as $4. Aluminum craft have replaced birchbark canoes, and cottons substitute for deerskin. But Chippewas reap the crop in the time-honored way, bending stalks over the gunwale and flailing the grain into the boat.

Chippewa braves, descendants of men who traded with voyageurs, play the moccasin game in a village at the source of the Namakan River, Ontario. Bob Geyshick wields the stick used in guessing the location of a hidden ball (opposite) in this Indian version of the old shell game.

Mists began rolling in from the open lake, and as they covered the beach, it seemed to me I could see the haze of forgotten fires lying like a wraith over rows of canoes and wigwams along the shore.

Westerners Scorn Easterners

Once hundreds of men had gathered at Grand Portage during the summer rendezvous. And on that beach the Nor'westers had fought many a tipsy battle to prove to the *mangeurs de lard*, called pork-eaters in English—men from the east who never got any farther west—that they alone were the true *hommes du nord*.

I could see the ball before the brigades of canoes took off, the great hall within the stockade lit with candles, the fireplace ablaze, the fiddlers sawing their instruments. Voyageurs, traders, and Indians in all their finery crammed the fort. Rum flowed freely and there was food for everyone. For the men of the north, this was the last chance to boast, the last brush with civilization, a glorious *regale* to remember through the cold and lonely nights of the Northwest.

I recalled a canoe trip between Grand Portage and Rainy Lake, a distance of 250 miles over a part of the historic old waterway where every lake, rapids, and portage had its story to tell, and other expeditions when I had explored the Churchill-Athabasca-Great Slave country 2,000 miles beyond.

From there Grand Portage seemed a world away. No wonder the men who came down from that country for the annual rendezvous looked with scorn on the "pork-eaters."

Voyageurs Were Old at Forty

When our archeological party gathered last year, it boasted two new faces. Keith Denis, President of the Thunder Bay Historical Society, had come down from Port Arthur, Ontario, and NATIONAL GEOGRAPHIC photographer Dave Boyer had been assigned to cover our activities.

At the source of the Granite we made our first portage. As we carried our equipment around Little Rock Falls, I thought of the two ninety-pound packs that formed the standard load of every voyageur. And I thought of some who had carried three packs, and even four. One voyageur, the legendary Bonga, is reputed to have carried five such packs, for a total of 450 pounds.

Our own packs were never more than 60 or 70 pounds. The voyageurs, proud of their strength and endurance, would have laughed at such puny loads. Tough as steel, they gloried in what they could do. Records show, however, that they were often old at forty, suffering from rheumatism, arthritis, strained muscles, and torn ligaments.

The Granite is a beautiful stream and well named. Its channel cuts through solid rock, and its rapids are clean sluiceways lined with spruce, cedar, and pine. We made such carries as Cheval du Bois, a rough half-mile of enormous boulders and slippery ledges. Gros Pins, once evidently grown with huge pines but now lined with aspen and birch. (Today these names appear on the map as Wooden Horse and Pine.) We passed through a series

of widenings in the river, which on the map are called lakes, and camped at last between two of them known as Clove and Granite.

By the time the old voyageurs had reached this point, there had already been many stops to boil pitch to seal leaky canoes whose seams were sewed with watap—stringy spruce-root fiber. Our aluminum vessels were virtually trouble-free, but for the voyageurs, patching was a never-ending task: merely grazing a heavily loaded canoe on a rock or stub could start the water oozing through.

Baptism Initiates a Man of the North

Well east of us now was the Height of Land Portage between North and South Lakes, on the continental divide. From this divide, some waterways flow west and north into Hudson Bay, others southeast to Lake Superior and the Atlantic. Crossing it was an important milestone, for it started the brigades on their way into the far Northwest. Here a solemn ritual of baptism was performed.

A trader named John Macdonell described it in his diary: "... Slept at the height of Land where I was instituted a *North man* by *Baptême* performed by sprinkling water in my face with a small cedar Bow dipped in a ditch of water and accepting certain conditions such as not to let any new hand pass by that road without experiencing the same ceremony which stipulates particularly never to kiss a voyageur's wife against her own free will the whole being accompanied by a dozen of gun shots fired one after another in an Indian manner. The intention of this Baptême being only to claim a glass I complied with the custom and gave the men . . . a two gallon keg as my worthy Bourgeois Mr. Cuthburt Grant directed me. . . ."

Once baptized a man of the North, a trader could boast of it to the end of his days.

The following morning we decided to explore one of the rapids above Granite Lake. A dive there the year before had netted—of all things—a brass shoe buckle. "Surely," observed Bob Wheeler, "if a shoe was lost, something must have happened either in the rapids or just below."

So we sat on another barren ledge that day—Dave Boyer, Bob Wheeler, Keith Denis, and I—again watching the divers at their dangerous work. Leaving Louis Zgonc to explore the pool further, Don Franklin and Curtis Anderson worked their way up into the rapids. They had to drag themselves between the boulders, for the current was very strong. We watched them struggle around a bend.

Guessing game, here played with four mittens, requires players to raise the one that conceals a steel ball. An Indian guesses by lifting a mitten with his stick. If he is right, his side wins a chance to hide the ball by sleight of hand. Originally, moccasins were used instead of mittens.

Dave and Bob were also in diving suits. Soon they took to the water to photograph strange rusted objects between the rocks.

A yell from upstream announced that Don and Curt had found something. I ran along the bank and found them out of the water, clutching several long objects.

Divers Find Flintlock Muskets

"Look," said Curt, grinning broadly. He handed me a trade musket with part of the stock still intact, then a beautiful flint spearhead about four inches in length, as well as a trade ax with half the handle in it.

Don showed us another flintlock musket,

PAINTED BY FREDERIC REMINGTON FROM *Our Canada's Frontier*

Indian builds a shelter of twigs above his mink trap to protect it from snow and birds. Trappers continue to roam Canada's wilderness as did the Indians and French of bygone centuries. Methods remain unchanged; some men still construct these little houses.

Weary Sled Dogs Take a Rest as a Trapper Retrieves His Catch

Near a moundlike beaver house on Bemar Lake, Ontario, Irvin L. Benson chops out his underwater traps with the long-handled ice chisel at his side. He found two beavers —one shown in his hand, the other on his toboggan. He will sell the pelts; the flesh will feed his dogs.

Woodsman notches his bait, a poplar log. He hopes a beaver, seeing this bright spot in its favorite food, will stop to gnaw.

also with part of the stock intact, and two square blocks of flint. They had reason to be proud as they pointed out the surprisingly good state of preservation of each gun.

Our supper that night was ham, potatoes, fruit, bread, butter, and coffee, and we were gay because of our good fortune.

"Listen," said Keith, as we sat around a big fire, "this is no food for voyageurs. We should have pea soup as they did, with perhaps a spoonful of fat. For men of the *pays d'en haut* —the upper country—this isn't right."

It was true, we were living in luxury. Day after day, month after month, the voyageurs had subsisted on a monotonous diet of peas or hominy. If lucky, they supplemented it with wild rice in the country ahead, or with pemmican—dried buffalo meat—on the plains. But often they had only *rubbaboo*, a soup made from pemmican.

Occasionally, cut off from all supplies by the bitter Northwest winters, they were driven to eating candles and moccasins. And sometimes their diet took an even more sinister turn. Daniel Harmon's journal notes that "several Canadians have lost their lives by famine, in the vicinity of Great Slave Lake. Those who survived, were under the necessity of subsisting, several days, upon the flesh of their dead companions. . . ."

Canadian Archeologists Share Task

Despite the auspicious beginning, our re-exploration of the Granite proved none too fruitful. The divers probed other rapids and other pools, but little of interest came to light. This does not mean that nothing lies there beneath the surface; it only means that the light on a particular day was bad or that muddied waters reduced underwater visibility to zero.

Archeologists are unraveling history all along the old waterway, and their explorations will continue through years to come. In the Quetico-Superior region, divided by the international border, research is now a cooperative effort between the University of Toronto's Royal Ontario Museum and the Minnesota Historical Society. To the east, in the Georgian Bay area, Canada has made dramatic discoveries on the French River, which flows out of Lake Nipissing. Two hours of diving at Double Rapids, 12 miles below Nipissing, produced a gun, axes, musket balls, brass kettles, gunflints, firesteels, awls, ice chisels, and knives—a fair sampling of what any trade canoe would carry.

Mr. Walter Kenyon, an archeologist for the Royal Ontario Museum and supervisor of

Sunset Silhouettes Trapper and Dogs Crossing Saganagons Lake, Ontario

Trapper Benson spends a long day on the trail and is just as eager as his Siberian-Malemute dogs to reach the next cabin on his trap line. Mr. Benson uses the lake as his refrigerator, caching home-

canned moose meat and other tinned foods under the ice. A former bomber pilot, he learned trapping from his wife, who inherited a trap line from her Indian forebears.

Canadian operations in this joint research project, spent a month in early 1962 exploring the rapids of the Namakan River between Namakan Lake and Lac la Croix. His divers found only a copper kettle. He wryly terms it "the most expensive item the museum owns."

All that is left of the fur trade now are such relics as we have found, the crumbling foundations of old forts and posts, and names like Maligne, Deux Rivières, Lac la Croix, Grand Marais, Lac des Mille Lacs—names that suggest the sound and the smell of the wilderness and the feel of the unknown.

Voyageur Survives as Northwoods Symbol

Moss-covered stones in forgotten burial places beside the voyageurs' route still record such names as Jean and Baptiste, François and Pierre. They and their laughter are long stilled, but there is something that will never be lost—the voyageur as a symbol of the deep love that North Americans have felt for 300 years for this wild and magnificent complex of lakes, rivers, and forests.

As evidence, thousands of canoeists now paddle down the historic waterway, pack over portages that once felt the tread of moccasined feet, pitch tents on ancient campsites. Theirs is the spirit of the past. They are the heirs of the voyageurs and in them the tradition lives on. They are discovering the same freedoms and challenges the French voyageurs knew in this wilderness and they are sharing some of the same hardships that men did when the land was unexplored.

The scene has changed little since those days of long ago. There are the same mysterious vistas of plunging rivers, lakes dotted with rocky islands, the same smells of balsam and pine, the same sounds—loon calls, thrushes, and whitethroats in the morning and at dusk, the roar of rapids, the crash of waves against the shores. It is still as it used to be, for those who cherish this land have preserved its character.

The stockade in Grand Portage National Monument now protects the once-famous rendezvous on Lake Superior (page 420; the Boundary Waters Canoe Area of the Superior National Forest and adjacent Quetico Provincial Park, Ontario, keep the heart of this unique wilderness unchanged.

There is even hope that the United States Congress will recognize the great significance of the wilderness waterway of the voyageurs between Superior and Lake of the Woods by the establishment, in the Kabetogama-Rainy Lake region, of a Voyageurs National Park.

THE END

Disaster in Paradise

Two National Geographic reporters describe the eruption of Bali's sacred Mount Agung and its tragic aftermath

Illustrations by National Geographic photographer ROBERT F. SISSON

PART I

By WINDSOR P. BOOTH
Chief, National Geographic News Service

LAST MARCH 16 I realized a lifelong dream of visiting the fabulously beautiful island of Bali. The day after I arrived, Bali's most sacred volcano, Gunung Agung, which islanders call the "navel of the world," exploded in my face.

Before Mount Agung simmered down, it had destroyed much of northeastern Bali, made a wilderness of a paradise, and killed more than 1,500 of some of the world's handsomest and most talented people. Countless homes and farms were demolished or grievously damaged.

Killer in action. Smoke billows from Mount Agung following an eruption that devastated northeastern Bali and took more than 1,500 lives. The author was the first newsman to bring out an eyewitness account.

It was a catastrophe to make the heart sick. Green, fertile Bali, ninety miles long and not more than fifty-five miles wide, never had enough arable land to support its growing population of nearly two million. There is even less now.

I saw the eruption from about 25 miles away—but even at that distance I was *in* it.

When I first became aware that Agung was blowing its top, I was five miles north of Denpasar, on my way to the sacred forest of Sangeh with a Balinese friend. There was a gentle tapping, as of rain, on the roof of our car. Oddly, no drops appeared on the windshield. Then the sky suddenly darkened.

I stepped out of the car to find that the "rain" was volcanic ash mixed with cinders.

No longer was the landscape a joyous rhapsody in green. Now all was bathed in an unearthly saffron light, because ash and clouds had blotted out the sun. Familiar objects, like trees and houses, took on grotesque shapes.

Monkeys Hide From Dry Volcanic Rain

Pigs, chickens, geese, and ducks, always part of the island scene, had disappeared. Frightened, they had found refuge somewhere from the sky's strange, dry downpour. Hidden too were the Sangeh forest's monkeys, which usually swarm out to meet visitors.

Among people the instinct was first to hide, then to pray. All over the island, as I learned later, the devout Balinese implored their gods to save them from this disaster. But

Tongue of death—a swath of hardened lava—scars Agung between gray beds of cinder and ash. Clouds hide the crater's lip. Torrential rains washing volcanic debris down the steep slopes proved more destructive than the lava flow.

Graveyard of 200 people, Subagan met its doom when a hot wall of ash and boulders, triggered by rain, roared through the streets. These boys, picking their way over the wreckage, walk past half-buried shops and homes in the deserted village.

BALI

Abode of gods, Mount Agung slumbered for more than a century. Then, last February, it stirred. On March 17 the mountain blew its top. Lava and ash blanketed 125,000 acres. Even as the Balinese adjusted to one disaster, Agung struck again. On May 16 avalanches enveloped villages on the northwest slope and killed more than 100 persons. Mottled slopes of Agung and Batur indicate disaster areas.

In comforting arms, baby gets a four-way injection against cholera, typhoid, and paratyphoid A and B. Indonesian Army medics inoculated 500 at Kintamani in two days.

for all too many the prayers were in vain.

Bali had been its serene, emerald self when I left Djakarta for the three-hour flight along the mountainous spine of Java. When I arrived at Tuban Airport on the little peninsula south of Denpasar, Bali's capital, I found the paradise island all that a million visitors have said it is. The air was soft and sweet. The rice fields were incredibly green.

Driving toward Denpasar, I had my first sampling of the breath-catching sights that every visitor to Bali remembers forever—bronze goddesses, many bare from the waist up, walking like queens along the roadside, laughing and chattering; small, merry-eyed children playing in the paths.

Balinese Youths Study English

In the clear streams and narrow canals, snowy ducks standing on their heads foraged on the bottom. Farmers, wearing only loincloths and broad, round straw hats, plowed the rice fields with water buffaloes.

At Denpasar's old Dutch-built Bali Hotel, I bought a ticket for the evening's program of dancing and gamelan music. Then I went out to look for I Gusti Ngurah Sindhu.

Little oil lamps were beginning to glow on roadside refreshment and tobacco stands tended by saronged women. I asked a boy whether he knew where Mr. Sindhu lived.

"Mr. Sindhu, the teacher?" He certainly did. He led me down side streets and past well-swept compounds to a small house with a large porch. A dozen Balinese, listening intently, sat under a naked light bulb. Mr.

Scarred for life by Agung's hot ash, a 40-year-old woman in the Klungkung hospital bears her pain silently. She survived a searing cloud that enveloped the village of Sorga.

Writer Samuel W. Matthews of NATIONAL GEOGRAPHIC's Senior Editorial Staff interviews refugees in a camp at Rendang.

While Agung sleeps, twelve-year-old beauties in gold brocade dance at Ubud. With the poetry of stylized movements, they recount a Balinese folk tale.

Sindhu, a tall, straight man with an ascetic face and crisp graying hair, was just finishing a class in English. I introduced myself. I had known his younger brother in Djakarta.

Mr. Sindhu offered to show me Bali the next day. He remarked that he had just returned with his family from the temple of Besakih, halfway up Mount Agung. They and thousands of others were worshiping in the holiest of ceremonies, the Eka Dasa Rudra, held not more than once every hundred Balinese years. (A Balinese year has only 210 days.)

Agung had been dormant since 1843. Neighboring Gunung Batur, whose 5,633-foot height is half that of Agung, erupted six times between 1921 and 1926—but not Agung.

And yet, as my friend would remember as long as he lived, in the midst of the ceremonies Agung stirred. The earth trembled, and black smoke boiled from the crater. Volcanic cinders rained on the worshipers, and small livid streams of lava coiled down the mountainside. Truly the gods—Brahma, Vishnu, and Siva, the Hindu-Balinese trinity—were manifesting themselves.

Mr. Sindhu said the priests called out to the worshipers, "Are you not afraid?"

"No, we are not afraid," the people responded with a mighty shout.

The ceremonies continued and the volcano seemed to quiet down.

Girls Dance to Gamelan Music

I said good night to Mr. Sindhu and walked back to the hotel for the dancing. The dancers, girls no older than 12 or 13, wore golden sunburst headdresses atop glossy hair. Their lithe bodies were wrapped tightly in cloth of gold and green and scarlet.

Out on the lawn, members of the gamelan, or orchestra, tuned up their handsomely carved instruments—all percussion, like xylophones or marimbas of various tones and sizes. There were two drums, the larger a male, the smaller naturally a female. The musicians wore dark-red sarongs. Their bare, tawny torsos glistened in the lamplight.

The slim girls danced out the age-old tales of Bali—of gods and demons and witches, and of beautiful princesses in peril of their virtue.

It was the next morning, soon after Mr. Sindhu and I set out, that we noticed the tapping on the roof. A rain of volcanic gravel—gray like salt and pepper mixed—was falling. A volcano was erupting, and its ashfall reached nearly

Delight in the dance brightens the face of a spectator at Ubud's village festival

Demon wears hibiscuses. Soft stone erodes quickly; new images are made often

Sword in hand, a dancer re-creates war's drama. Tiara and armlets are gilt leather.

to Denpasar, 30 miles from the craters of Agung and Batur.

While we drove on along a narrow, nearly deserted highway, the curious rain rattled the tree leaves and gathered in little drifts at the side of the road.

We stopped and stepped out to examine the ashfall, which grew heavier. The grime and gravel got into our hair and ears and noses. There was a smell of brimstone. We decided to see whether we could find the source of the ash, almost certainly either Agung or Batur.

We had driven but a few miles north when we encountered a roadblock, guarded by soldiers with machine guns. The ashfall was now heavy and mixed with rain. I picked up two handfuls and smelled the ash. It stank of sulphur. Reluctantly, we turned back to Denpasar. There was no alarm in the city. We drove the four miles to Sanur beach, passing the place where bulldozers have scarred the earth to begin a ten-story hotel.

People stood along the beach in little groups looking toward Agung. An enormous black cloud of smoke boiled into the sky. It was like an atomic bomb's mushroom cloud

Stunned islanders at the pilgrims' compound of Besakih Temple "just poked about," the photographer reported. "They lifted sections of huts, put them down, and then moved on forlornly." A rain of volcanic gravel flattened bamboo-and-thatch shelters, but the stone temple survived (page 457).

Food sacrifices to the gods ride atop pilgrims' heads during the Eka Dasa Rudra, a festival of purification usually held once every Balinese century. When Agung, home of Hindu gods, erupted in the midst of the ceremonies, Balinese judged the disaster a punishment for their sins. These camera-shy women, bound for a temple near Bangli, walk a road banked with volcanic sand that rained from the sky 15 days earlier.

cut in half vertically. The wind blew the smoke westward and, we learned later, turned day into night throughout northern Bali and as far west as Java's second city, Surabaja, more than 200 miles away.

We stood watching the eruption, glancing occasionally at a family of about 20, kneeling in the sand facing Agung. They had intended to go that day to the temple at Besakih to make their prayers. Like us, they had been turned back by the roadblock. Our beach, looking toward the mountain, was the most appropriate place they could find.

The eldest member of the family, serving as priest, dropped three flower petals into a vase of water, sprinkling part of it over his flock and pouring what was left into their hands cupped in supplication.

There was no wailing or show of emotion, only a score of faces looking intently at the sacred mountain in eruption. On the ground in front of the group, the women had placed baskets of viands to tempt the gods—sweet cakes piled in artistic designs, bright red peppers, intricately plaited palm fronds, and masses of fragrant frangipani.

A dog strolled up to sniff the offerings, but no one paid him the slightest attention. The minds and hearts of the worshipers were on Mount Agung, home of the gods, and their

Sacrificial feast tempts the Hindu deities as a worshiper (center) dances her supplication at Besakih, Bali's holiest temple, only four miles from Mount Agung's crater.

eyes did not stray from it or the deadly black cloud it was spawning.

The same cloud forced at least one Java-bound plane to turn back that day, but next day I was able to fly out to keep urgent commitments in Djakarta. Two GEOGRAPHIC colleagues, Sam Matthews and Bob Sisson, were soon to arrive to cover the tragic aftermath.

PART II

Devastated Land and Homeless People

By SAMUEL W. MATTHEWS
Senior Editorial Staff

WHEN PHOTOGRAPHER Bob Sisson and I flew into Bali 14 days after the eruption of Gunung Agung, we found the volcano still quietly smoking. The extent of its devastation was only beginning to be realized.

The terror had continued for days. Showers of hot gravel rained onto mountainside villages. Waves of *lahar*—boiling mud and ash—swept down from the volcano under torrential rains. Rivers ran black and left their banks, carrying away bridges and burying terraced rice fields in muck. The island's northeastern end, where some 400,000 people lived, was cut off (map, page 440).

We found refugees clustered in thatched huts in makeshift compounds. They had little food. Many did not know whether they would see members of their families again.

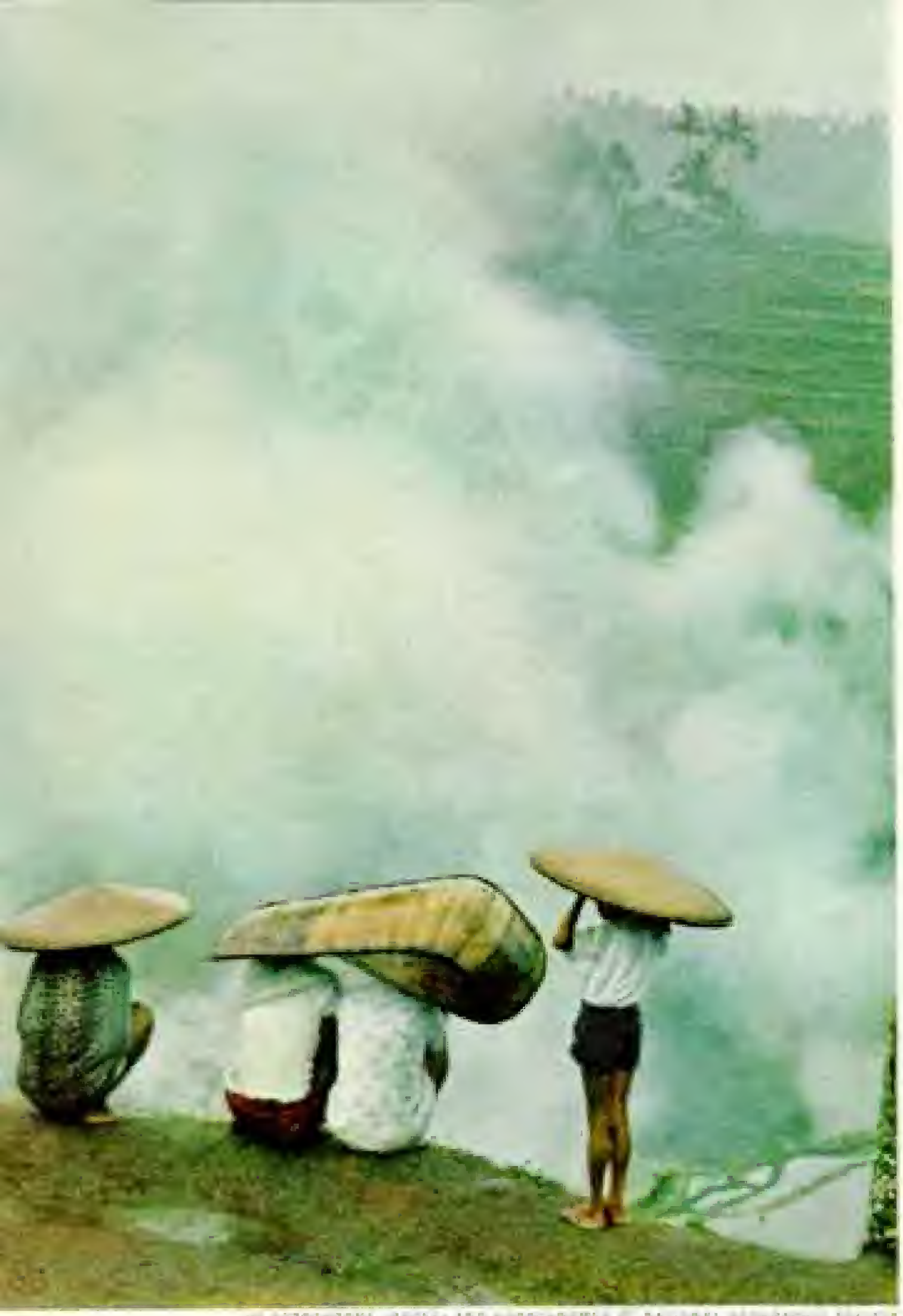
"I have not seen my wife and children since Agung became angry," one man told me. "Where they are I do not know."

We visited hospitals where badly burned men and women lay without enough blankets, bandages, or even beds. We walked across the remains of villages that had been smashed or buried by ash, mud, and stones, or swept away by floods. The count of dead was only guesswork, for patrols had yet to reach many buried villages high on the mountainside.

Yet in other areas, where ash had not fallen, village compounds along the roads seemed normal. Most stand behind crumbling stone walls, reminders of days when Bali had to defend itself against invading Javanese kings.

These villages, each with its temple and farmers tending rice fields, seemed the Bali

Samples of island delicacies go to the gods at Besakih; the food is eaten later by worshipers. Plaited palm fronds decorate bowls of rice, bamboo shoots, and fried cakes. Barbecued fowl and a bowl of bananas, spiny durians, and other fruit are unadorned.



Steam billows from a river near Muntjan. Fearful villagers take protection from the rain, hoping that it will not wash more ash from Agung onto their farms.

Pitiful remnants of a destroyed home—baskets of food, tricycle, and pieces of roofing—leave Selat.

Reeking of sulphur, steam formed by hot ash and water rises from ruined riceland. Acrid muck, 30 feet deep in spots, buried much of nearby Selat. Walking on its thin crust, photographer Sisson hit a soft spot and sank to his waist.

I had read about—a paradise of smiling people, a green and fruitful island of the gods.*

In Denpasar one would scarcely know that a tragedy had occurred. Hotels entertained tour groups with lavish Indonesian dinners and Balinese dancing. Vendors hawked wood and bone carvings, and horse carts, harness hung with bells, jingled along the streets.

Temple Stands Amid Ruin

The morning after our arrival we drove to Besakih, site of the principal temple of Balinese Hinduism, high on Agung's southwest slope. For most of the way little seemed amiss. Rice fields glowed a luminous green in the sun. Sarong-clad Balinese streamed along the roadsides, men trotting under heavily laden shoulder poles, women balancing baskets or water jars on their heads, hips swaying gracefully (page 445).

As the road twisted upward to the temple, the landscape suddenly changed. Here trees had lost their

*For other accounts of Bali in the NATIONAL GEOGRAPHIC, see "Indonesia, the Young and Troubled Island Nation," by Helen and Frank Schreider, May, 1961; and "This Young Giant, Indonesia," by Beverley M. Bowie, September, 1955.

leaves; fields lay gaunt and gray. Only occasional banana plants, bursting through the black ash deposited two weeks earlier, made green splashes against the desolation.

And then we came to Besakih, only four miles from the crater. Here as much as six inches of gravel and sand had fallen. Houses and shrines of bamboo and thatch sagged or lay flattened under the weight (page 444). But the many-towered stone temple stood, black and forbidding on the mountainside.

Fortune Favors the Frightened

In the shrine to Brahma I found a Balinese praying alone. His name was Katuk, he told me when he had risen. Yes, he and his family had been in their house and had heard the eruption's great noise. They had been too frightened to leave. The house escaped damage, and now he was thanking the gods for sparing him and his family.

A low ridge stands between Besakih and Agung's crater. Perhaps the builders of the first temple here, 1,000 years ago, had deliberately chosen this site for protection from the volcano's ire. But many devout Balinese were convinced that the temple had been spared because of the Eka Dasa Rudra, most august and significant of Balinese-Hindu rites, which had begun five months earlier at the foot of Agung and reached a climax nine days before the March 17 eruption.

Although these ceremonies, by tradition, occur once in a Balinese century, it had actually been 200 Balinese years, or 115 Western years, since the last Eka Dasa Rudra at Besakih. Mount Agung last erupted 120 years ago, in 1843.

In Bali's Hindu-animistic belief, the balance of nature may occasionally be upset by the sins and passions of men. Only sacrificial offerings to the gods will restore the proper balance. Now the time had come again.

In February, as the priests purified the temples and made ready for the final ceremonies, Gunung Agung began to shudder and smoke.

Heartbreak of the homeless comes to the people of Karangasem. Shouldering their possessions, they cross an ash-clogged river. In all, 85,008 Balinese lost their homes.

Flash flood of hot mud swept away this bridge on the only road between Rendang and Muntjan. But life resumes. Villagers once again go to market with coconuts.

There were frightening reports of ash flows and avalanches on the nearly uninhabited northeast face.

On March 12, mud and stones flowed down Agung's southeast face. Five days later, as hundreds of Balinese prayed in mountainside shrines, the volcano erupted.

By far the worst havoc struck a group of villages due east of Besakih (map, page 440). So sudden and complete was their destruction that even two weeks later officials could not be sure what had happened. Many places, cut off by avalanches and lahar flows, were still too hot to be entered. Bodies were buried —or eaten by dogs—where they fell.

"For those villages, we have taken the last census figures and simply subtracted the number of hospital patients and refugees we know about," Prince Anak Agung Gede Agung, chief of the Bali information office, told us. "The difference is our count of the dead—about 1,500."

Glowing Cloud Brings Death

I talked to several victims in Denpasar's Sanglah Hospital, through Dr. Oey Tiang Bok, who spoke English. Sepek, a 25-year-old villager from Sorga, near Besakih, said he had been in the village temple, with about 100 others, just after sunrise on March 17.

"Suddenly it was dark again," he told me. "I ran out of the temple, but a cloud that was very hot came toward us, and I went back and prayed with the others.

"There was no noise at first, but then the *duk-duk-duk-duk-duk* of falling stones. Some people in the temple seemed to be sleeping. I tried to wake them, but they would not answer—they were dead. There were children, too, but they could not cry. They made strange wailing noises, because they had ashes in their mouths."

Sepek fled as the temple roof began to burn, before it fell on those still inside. He raised his sarong to his face, and was burned only on

Bali, the Island Paradise, Smiles Beneath Agung's Angry Clouds

New rice turns terraces emerald green, and flooded acres serenely mirror the sky. But where gray ash shrouds the soil, life has ceased. Here refugees walk along a road leading from the devastated area.

legs and arms as he raced through the glowing ash. He ran about nine miles to the village of Selat and told what had happened. A doctor put tea on his burns and sent him down the mountain in a car.

Fortunately, Sepek said, his wife and child had left Sorga two hours before the glowing cloud had come, and thus had been saved.

"The gods made them go," he said.

Of the hundred who prayed in Sorga's temple that morning, more than 70 perished in the searing cloud.

Silence Cloaks a Stricken Village

Several days later, a flood of lahar swept over Selat. When Bob Sisson hiked nine miles up the mountain to photograph the village, he found it all but deserted (page 449).

"Starved-looking dogs were prowling through the ruins," Bob said. "There wasn't a sound—not even a bird. Smoke rose here and there from the ash. The ground was almost too hot to touch, and the smell of sulphur made me dizzy."

When a patrol led by two Indonesian volcanologists entered the abandoned village of Lebih, the men were told by their Balinese guide that he had been there nine days earlier, looking for his belongings, and had heard someone crying.

Following the sound, he found a lame, blind youth of about 20, who apparently had been abandoned by his family when Agung erupted. The guide said he had given the youth two rice cakes and left him.

"Maybe he is still alive, maybe he is dead," the guide said.

Shocked, the patrol searched and found the youth. He was conscious but barely alive, unable to move. The patrol got him to a hospital in time to save his life.

Lebih was one of the villages highest on the mountain, and a doctor told me its people felt they were servants of Agung.

"That's why it was so hard to get them to move away when the mountain first started to rumble," the doctor said. "Without the great mountain, there would be nothing in life for these people."

His life changed overnight, a refugee's face reflects fears for his family's future.

Chanting Farmers Near Kubupenelokan Move a House Across Ash-gray Desert

Leafless trees rise gaunt as skeletons; ash and cinders lie a foot deep. Shoulder-borne, the roof frame goes to a more fertile spot.

Walking across the mountainside near Muntjan, Bob and I came upon a group of villagers standing in heavy rain on a bluff, watching the waters of the Unda River eat away their precious fields (page 448). In the gloom, with the fields all around black with ash, it was a moving and terrible sight.

A day later we walked five miles into Karangasem, Bali's third largest town. Karangasem had not been hit by ashfall, but it was cut off by three rivers which had washed out bridges on the coastal road. Without normal supplies, its people were hungry.

Long lines of townspeople carried belongings on their backs across a river. Others clustered in the town square waiting for supplies to arrive by helicopter.

Small amounts of food were being flown to Karangasem. But it was not nearly enough for the thousands who had poured into the town from stricken settlements in the region.

At Klungkung, on the road to Karangasem, we saw refugees drawing rations at a distribution center. Each received about a pound of corn or rice as subsistence for one day.

"This is barely enough to prevent starvation," a doctor told me, "but it is all we can give them. There is no more."

40,000 Refugees Must Leave Bali

Bali's Governor Anak Agung Suteđja later said: "We have to feed 85,000 refugees, and we simply have not the food to do it."

Eking out a living from Bali's remaining farmland poses the greatest problem facing the island's two million people. Governor

Suteija told me. About 40,000 of the 85,000 refugees would have to go to Sumatra, the Moluccas, or Celebes, he said.

"There just isn't enough arable land left to support them," the Governor declared.

He pointed out that more than 25,000 acres of farmland had been permanently ruined, and that an additional 100,000 acres must be considered unproductive for years to come.

Also in the wake of disaster came the danger of disease. In the village of Kintamani, high above Lake Batur, we found an army medical team inoculating hundreds against typhoid and cholera (page 440). Women with babies in their arms lined up for the injections. I was surprised at their willingness to submit to the needle.

"We had cholera in this area only last month, and they know what it can do," Dr. Kho Soen Liang explained.

Below Kintamani, in a region covered by a foot of ash, we found a large group of villagers busily moving a house simply by carrying sections of it on their shoulders.

200 Villagers Swept Away

Subugan, near Karangasem, had been a town of some 5,000 people, with many substantial buildings. Now it lay buried in deep black ash and debris. Boulders as big as automobiles littered the streets, which stood even with roof eaves (page 439). Subagan was abandoned, save for a few patrolling soldiers and boys wandering among the ruins. Its sense of death was real: Here 200 people, praying in their temple, had scarcely heard

the rumble of approaching lahar before they —and the temple—were swept away.

As we returned toward Denpasar, we found the Unda River transformed by afternoon rains from a placid brook into a torrent. Beneath a high suspension bridge, water the color of chocolate raged over giant stones being rolled along the riverbed with a dull mutter like thunder. The ground shook, and steam rose from the river.

Curious, I dipped my hand in the water —and jerked it back, fingers tingling from the heat. Yet Mount Agung's peak was at least 15 miles away.

Aid Comes From Many Lands

Help was already coming. The United States Embassy in Djakarta sent three planeloads of medical supplies. The Netherlands, Great Britain, Italy, India, Japan, Australia, and the United Nations, through Secretary-General U Thant, offered aid.

A team of 36 doctors and paramedics from the Philippines flew in and set out for eastern Bali to establish aid stations.

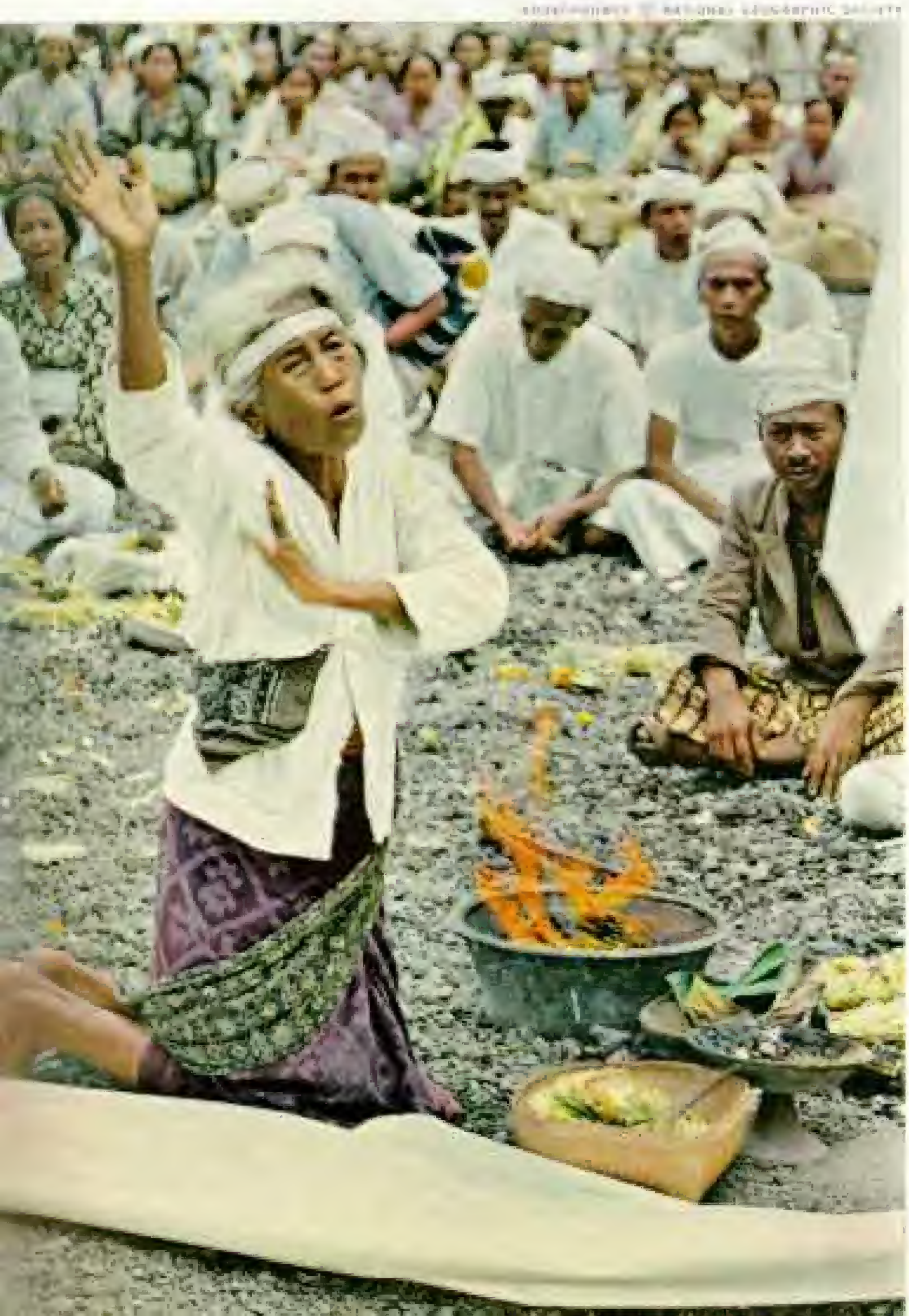
Indonesia itself had declared Bali a disaster area and promised relief. Two naval ships had been sent to evacuate isolated coastal villages, and two helicopters had flown to Denpasar. But officials seemed not to know how to proceed.

When President Soekarno arrived by jet, he found supplies still on the beaches. The bridges to Karangasem were not yet repaired, and few patrols were out on the mountain.

Two weeks after Agung erupted, the first planeloads of Indonesian Army doctors and medical corpsmen arrived. Twenty teams fanned out across the island to give cholera and typhoid injections and set up field stations in remote villages.

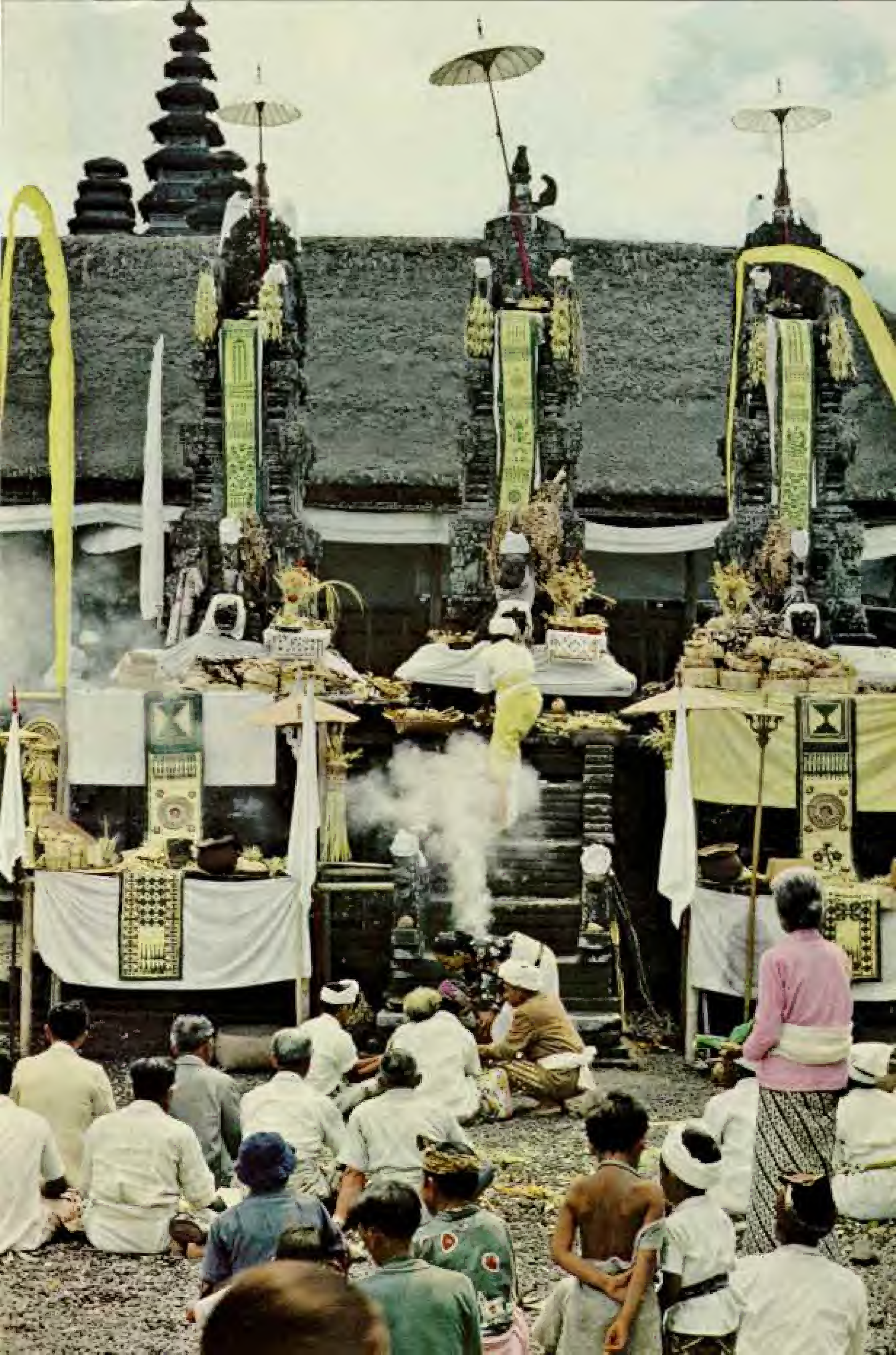
We drove by Indonesian Red Cross jeep across the mountainous backbone of Bali to Tianjar on the north coast. Beyond Tianjar, lahar had swept to the sea. As we picked our way up the swath of soft, warm mud and tumbled boulders, we saw smoke rising from a steep cliff face ahead of us. Here lava, pouring out of the crater, had stopped in its downward course.

"That lava is nearly 250 feet thick and 400° Fahrenheit at its base," we were told later by a volcanologist whose only name was Soerjo. Mr. Soerjo's job



Risking their lives, Hindus gather at Besakih Temple to worship under the very eye of fiery Agung; not even the threat of another eruption could keep them away. Thrones of the gods—Vishnu (left), Siva (center), and Brahma—tower above the congregation.

Swaying and chanting, a celebrant at Besakih (page 446) implores Bali's gods to expel demons she believes caused Agung's explosion. At the ceremony's climax, the woman lifted glowing coals with bare hands and let them fall in a fiery shower. Faith, priests said, protected her from burns.



Hands raised in prayer, priest blesses food prepared by pilgrims for presentation to the gods at Besakih. From this pavilion the offerings moved to the altar.

was to keep watch on Gunung Agung and eventually to examine its crater.

"But that can't be done safely for at least two months more," Mr. Soerjo said. "The chief danger is the ash. It can avalanche at the slightest trigger, and if there is a rain, it can come down as lahar.

Agung Erupts Again

"Most of the victims," the volcanologist went on, "were killed by clouds of explosive gases mixed with pulverized ash and lava. The glowing clouds came down the mountainside at very high speeds, searing everything in their path.

"It could happen again," he warned. "That's why we have recommended that everyone within ten kilometers of the crater be evacuated." Mr. Soerjo was right. Agung erupted again on May 16, causing more than 100 deaths and heavy property damage.

When Governor Sutedja closed the area to all habitation, he found himself with a difficult problem at Besakih.

"Besakih is our mother temple, the holiest in Bali," the Governor told me. "We have not had much trouble in persuading villagers to leave their homes; but the priests do not like to leave the temples—particularly Besakih."

Two days later came the day of the April full moon, with another key ceremony of the Eka Dasa Rudra to take place. The Governor announced that Besakih would be forbidden to the people, and that he himself would go there alone to pray for the entire island.

But on the holy day we found him waiting beside the road to Besakih, helplessly watching lines of worshipers making their way up the mountain. The Governor scanned the peak with binoculars. For the first time in a week, it was clear. A high column of smoke billowed from the crater.

"I am told it is safe today," he said plaintively. "Who knows? But there is nothing I can do to keep the people away."

The ceremonies went on while Mount Agung streamed its plume of roiling smoke across the troubled sky of Bali.

SIX-MONTH INDEX AVAILABLE

As one of the privileges of membership in the National Geographic Society, members who bind their GEOGRAPHICS as works of reference will receive upon request an index for each six-month volume. The index to Volume 123 (January-June, 1963) is now ready.

First name
in photography
is "Kodak"

The last word
is "Retina"

Kodak Retina 35mm cameras are among the finest in the world. Yet, along with their great precision, they provide an ease of use rarely found in cameras of this class. The KODAK RETINA Reflex III Camera has full-area ground glass through-the-lens viewing that lets you compose life-size and right side up. Shutter settings go up to 1/500 of a second. Optional lenses go from extreme wide-angle to 200mm telephoto. And your dealer's demonstration will tell you even more! That's the KODAK RETINA Reflex III . . . from less than $230. Others from less than $140.

Prices subject to change without notice. EASTMAN KODAK COMPANY, ROCHESTER 4, N.Y.

Kodak

This little girl can expect to live until the year 2036

Her life expectancy is 73 years. A little boy's is 67 years. This gift of a long life hasn't just happened.

One reason for it is immunization against many diseases that once took thousands of lives every year—including polio, whooping cough, tetanus, and diphtheria.

Antibiotic and antibacterial drugs have lengthened life expectancy, too. Infections that once caused weeks of pain and confinement often can be controlled.

Today, as throughout its history, Parke-Davis continues to devote a large part of its resources to creating new and better medicines. The goal is a longer, happier and healthier life for you, for your children, and for people everywhere.

PARKE-DAVIS

BETTER MEDICINES FOR A BETTER WORLD

Move it safely— call DAVEY—now!

Now's the perfect time to move that treasured tree to the very spot where you've always thought it should be — to really show off its splendid fall coloring.

Also, moving in big new trees — now — means you can enjoy the luxuriant shade and beauty of sizable trees without waiting years for them to grow. But remember — only experts can move large trees safely. It's a job that needs experienced, trained men, working with modern techniques and special equipment. Davey provides all this, to your economical satisfaction.

Davey deep-root feeding, expert pruning and cabling your trees now, too, will help keep them vigorous and beautiful for a fine spring showing.

NEW DAVEY SERVICE – LAWN FEEDING While Davey is servicing your trees, let us give your lawn its last feeding of the year, with Da-V-Green, the special Davey lawn food. Next spring your lawn can be a deeper, richer green than ever before.

Call

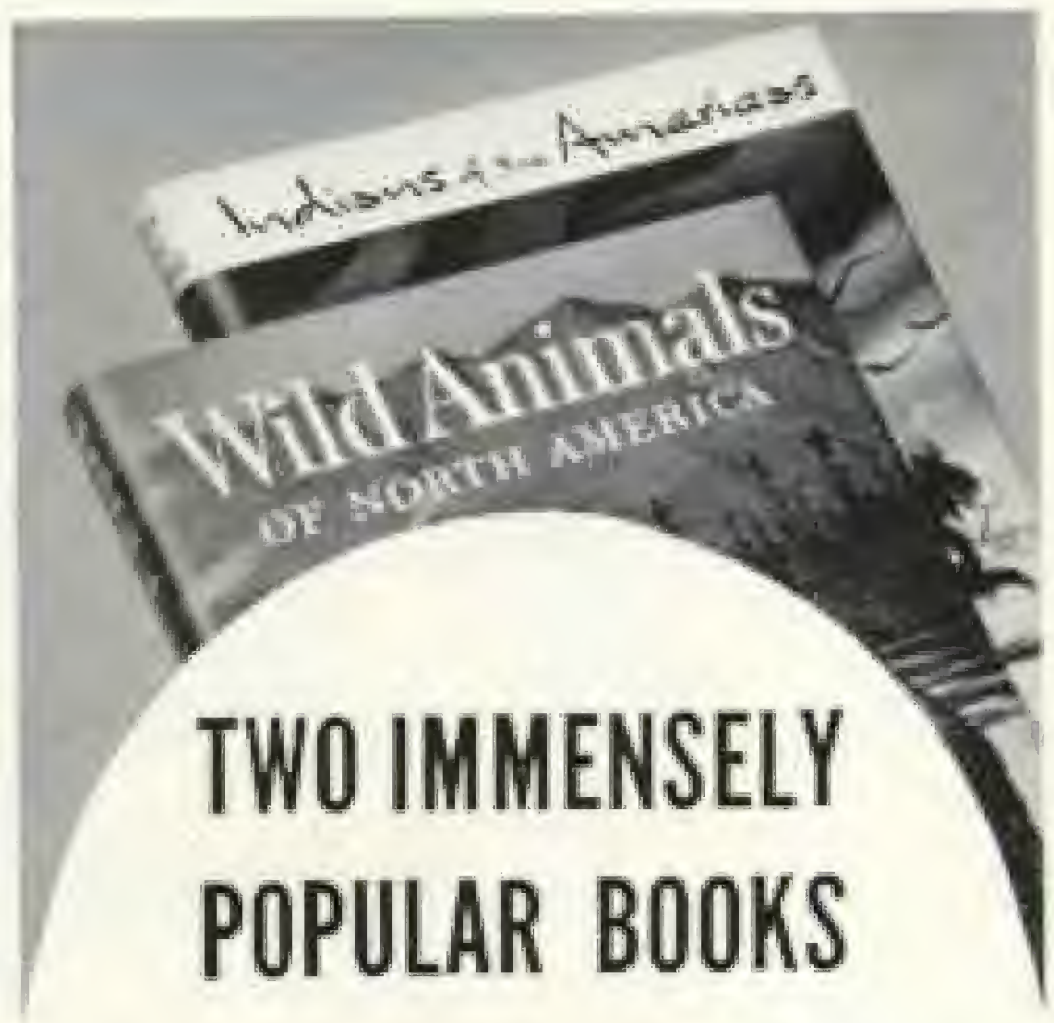
DAVEY TREE SERVICE

or write

The Davey Tree Expert Co.

Kent 11, Ohio

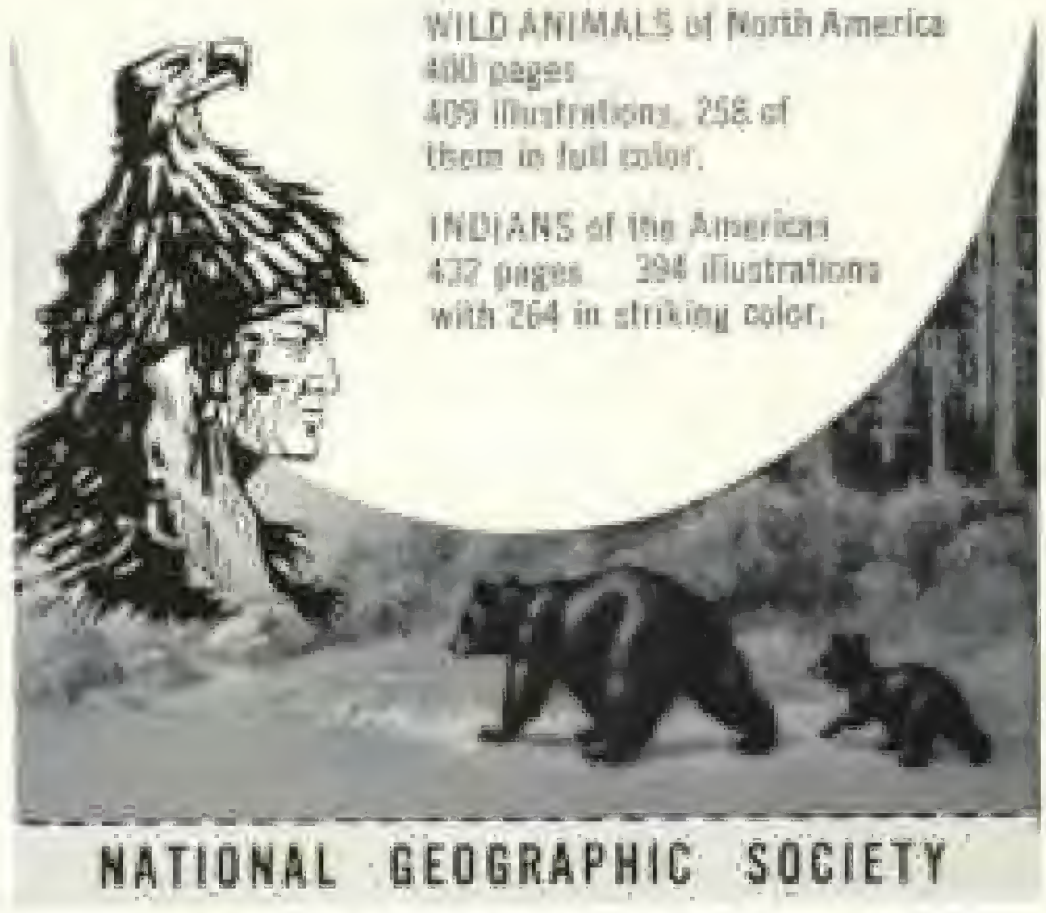
THE OLDEST AND LARGEST TREE SAVING SERVICE IN THE WORLD



TWO IMMENSELY POPULAR BOOKS

Highly entertaining—filled with glorious color and rarely revealed facts—these two books will serve your family for a lifetime. Both cover their subjects comprehensively. Both are charged with drama that will captivate readers of any age.

Add them to your library, if they are not there already. And, if you *do* own them—wouldn't they make outstanding gifts?



WILD ANIMALS of North America
400 pages
409 illustrations, 258 of them in full color.

INDIANS of the Americas
432 pages 294 illustrations with 264 in striking color.

NATIONAL GEOGRAPHIC SOCIETY

Dept. 129 Washington, D.C. 20036

Please send me the following volumes, postpaid.

- ☐ WILD ANIMALS of North America . $7.75
- ☐ INDIANS of the Americas $7.50
- Combined price of both books. $14.75

Name_____

Address_____

City, Zone, State_____

Modern compact van.

Automobile Transporter

KNOW YOUR TRUCKS!

MEMBER

ATA FOUNDATION INC

AMERICAN TRUCKING INDUSTRY

Washington 6, D.C.

Today there's an especially-designed type of truck for just about every kind of cargo from fresh fruit to new cars. Among larger trucks, nearly every one is custom-built to carry its particular load most efficiently and at lowest cost. This tailor-made transportation directly benefits you — by effectively *lowering the delivered cost of nearly every product or service you buy!* What, for instance, do you own today that *didn't* come by truck?

INTERNATIONAL HARVESTER COMPANY

World's largest maker of heavy-duty trucks

Puts the "Gee!" in Geography

Strange lands and peoples—the wide world of nature—Your child can explore them each week with his own SCHOOL BULLETIN. Now in brilliant color, with more pages for stories and features—yet subscription rates remain the same! 30 issues (one each school week) just $2.00 in the U.S. See coupon for other rates.

Features like these add a new zest to learning:

"THE OLD EXPLORER" talks conversationally to Bulletin readers about the exciting world they live in.

GEO-GRAPH—a quickly solved crossword game that teaches as it amuses.

LOOK AROUND—an invitation to be alert to the small wonders of a big world.

GLOBAL NOTEBOOK—little-known facts about well-known subjects.

WORD OF THE WEEK brings special meaning to words and where they come from.

NATIONAL GEOGRAPHIC SOCIETY Dept. 310, Washington, D.C. 20036

All remittances in U.S. funds or equivalent. Enclosed find $_____. Send School Bulletins to:

☐ **1 Year $2** ☐ **3 Years $5**

30 issues:
Canada, $2.25
Elsewhere, $2.50

90 issues:
U.S. only

For other children on your list, please use a separate sheet. Indicate grade _____

NAME _____

STREET _____

CITY _____ ZONE _____ STATE _____

Two advanced physics students are producing a solar-powered, transistor audio-oscillator—the "From Sun to Sound" experiment—provided by the Bell System. The experiment requires students to calculate and design as well as construct some of the basic electronic components.

"Just give 'em the facts and get out of the way!"

How the Bell System is helping to develop gifted young scientists and engineers

Tomorrow's top scientists and engineers are hidden in high school classrooms today. The problem is to find them, inspire them. And the Bell System is helping this national effort with a unique series of teaching aids.

One of these units is illustrated here and five more described at the right. They are already being used in thousands of high schools.

Now in its third year, this science program has aided busy teachers and spurred eager students. As one Bell Laboratories man remarked, "Just give 'em the facts and get out of the way!"

The program will continue, with the cooperation of leading educators, as long as it serves a useful purpose. And the Bell System will benefit only as the nation benefits—from better teachers and abler young scientists and engineers.

Three other aids offered to America's schools:

Wave Motion Machine, which illustrates behavior common to sound, light, electricity. Unit also includes film, books, lecture.

Ferromagnetic Domains, a basic approach to the study of magnetism, including books, a motion picture and four demonstration units.

Solar Energy Experiment for advanced students, containing all the materials necessary to turn silicon slabs into working solar cells.

Aids to be offered this Fall:

The Speech Chain, various classroom materials for physics and biology teachers on the interdisciplinary study of speech and hearing.

Speech Synthesis, for advanced students. Circuitry, electronic components, biology. Completed unit simulates speech sounds.

BELL TELEPHONE SYSTEM

Owned by more than two million Americans

Every two weeks

a great President Liner

sails from San Francisco to the Orient.

We're all packed. Including a swimming pool, fifty pounds of caviar, 6,144 choice steaks and two orchestras. Enough—and more—to last one third of the way around the world and back. En route we stop in Hawaii, Japan, Hong Kong and the Philippines. From October to January. First Class round trip tickets cost 25% less. Book your stateroom now—for as little as $979—on the SS Presidents Roosevelt, Cleveland, Wilson or Hoover. And start packing a few things of your own. *See your travel agent or American President Lines.*

AMERICAN PRESIDENT LINES

Rx: for the new doctor's first office...

DESK SET by Sheaffer

The brand new doctor (lawyer, CPA or architect) will never receive an office-warming gift more handsomely packaged than this Sheaffer Desk Set. The gift case is new, a Sheaffer exclusive.

Inside, the real reasons Sheaffer Desk Sets are the choice of selective gift-buyers: richly styled bases, designed to complement any office; and famous Sheaffer fountain pens with cartridge filling-action, superbly crafted with 14-karat gold points, kept writing-moist in exclusive humidor-sockets.

When the occasion calls for a distinctive gift, choose Sheaffer, the most-given desk set in America.

SHEAFFER'S®

. . . all you need to know about a pen

Choose from a wide variety of Sheaffer Desk Sets at your dealer's, or write for free catalog: W. A. Sheaffer Pen Company, Department G-9, Fort Madison, Iowa. (Set shown in rich jet crystal, with perpetual calendar, $35.00. Also available with personalized name plate.)