VOLUME CI NUMBER THREE

THE NATIONAL GEOGRAPHIC MAGAZINE

MARCH, 1952

New Map of North America
28 by 35 Inches, in 10 Colors

Sixty-four Pages of Illustrations in Color

PUBLISHED BY THE
NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C.

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NATIONAL GEOGRAPHIC SOCIETY

SIXTEENTH AND M STREETS NORTHWEST, WASHINGTON 6, D. C.

ORGANIZED FOR "THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

To carry out the purposes for which it was founded sixty-four years ago, the National Geographic Society publishes the National Geographic Magazine monthly. All receipts are invested in The Magazine itself or expended directly to promote geographic knowledge.

Articles and photographs are desired. For material The Magazine uses, generous remuneration is made.

In addition to the editorial and photographic services constantly being made, The Society has sponsored more than 100 scientific expeditions, some of which required years of field work to achieve their objectives.

The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus crossed the Atlantic. By dating the ruins of the vast communal dwellings in that region, The Society's researches solved secrets that had puzzled historians for three hundred years.

In Mexico The Society and the Smithsonian Institution, January 15, 1930, discovered the oldest work of man in the Americas for which we have a date. This slab of stone is engraved in Mayan characters with a date which means November 4, 321 B. C. (Spinden Correlation). It antedates by 200 years anything heretofore dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, in a flight sponsored jointly by the National Geographic Society and the U. S. Army Air Corps, the world's largest balloon, *Explorer II*, ascended to the world altitude record of 72,395 feet. Capt. Albert W. Stevens and Capt. Orvil A. Anderson took aloft in the gondola nearly a ton of scientific instruments, and obtained results of extraordinary value.

A notable undertaking in the history of astronomy was launched in 1949 by The Society in cooperation with the Palomar Observatory of the California Institute of Technology. This project will require four years to photomap the vast reaches of space, and will provide the first sky atlas for observatories all over the world.

In 1948 The Society sent out seven expeditions to study the eclipse of the sun along a 9,000-mile arc from Burma to the Aleutians. The fruitful results helped link geodetic surveys of North America and Asia.

The Society granted $25,000, and in addition $75,000 was contributed by individual members, to help preserve for the American people the finest of the giant sequoia trees in the Giant Forest of Sequoia National Park of California.

One of the world's largest icefields and glacial systems outside the polar regions was discovered in Alaska and Yukon by Bradford Washburn while exploring for The Society and the Harvard Institute of Exploration, 1938.

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IT'S A "CADILLAC AMONG CADILLACS"

There are many ways in which we could describe the new Golden Anniversary Cadillac. We could say, for instance, that it is the most beautiful Cadillac ever built—and as you can easily see, that would be right. Or, we could say that it is the most *luxurious* of all the Cadillacs—and if you could just open the door and look inside, you'd know instantly that this, *too*, is true. Or, again, we could say that it offers the finest *performance* in Cadillac's great history—and if you could only experience its tremendous power and its almost unbelievable responsiveness and handling ease, you would readily understand that this is likewise correct. But it seems to us that the best way to describe this wonderful Golden Anniversary creation is to say simply that it's a *Cadillac among Cadillacs*. We know, of course, that this is a tremendous compliment to pay a motor car. But we know, too, that it is a compliment most richly deserved. Why not come in today and see and drive this great new Standard of the World? We know you'll agree that it is a fitting climax to fifty years of ever-increasing quality and prestige.

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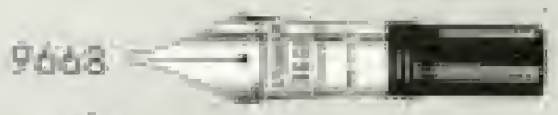
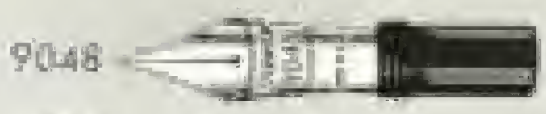


Broad writing

Business writing



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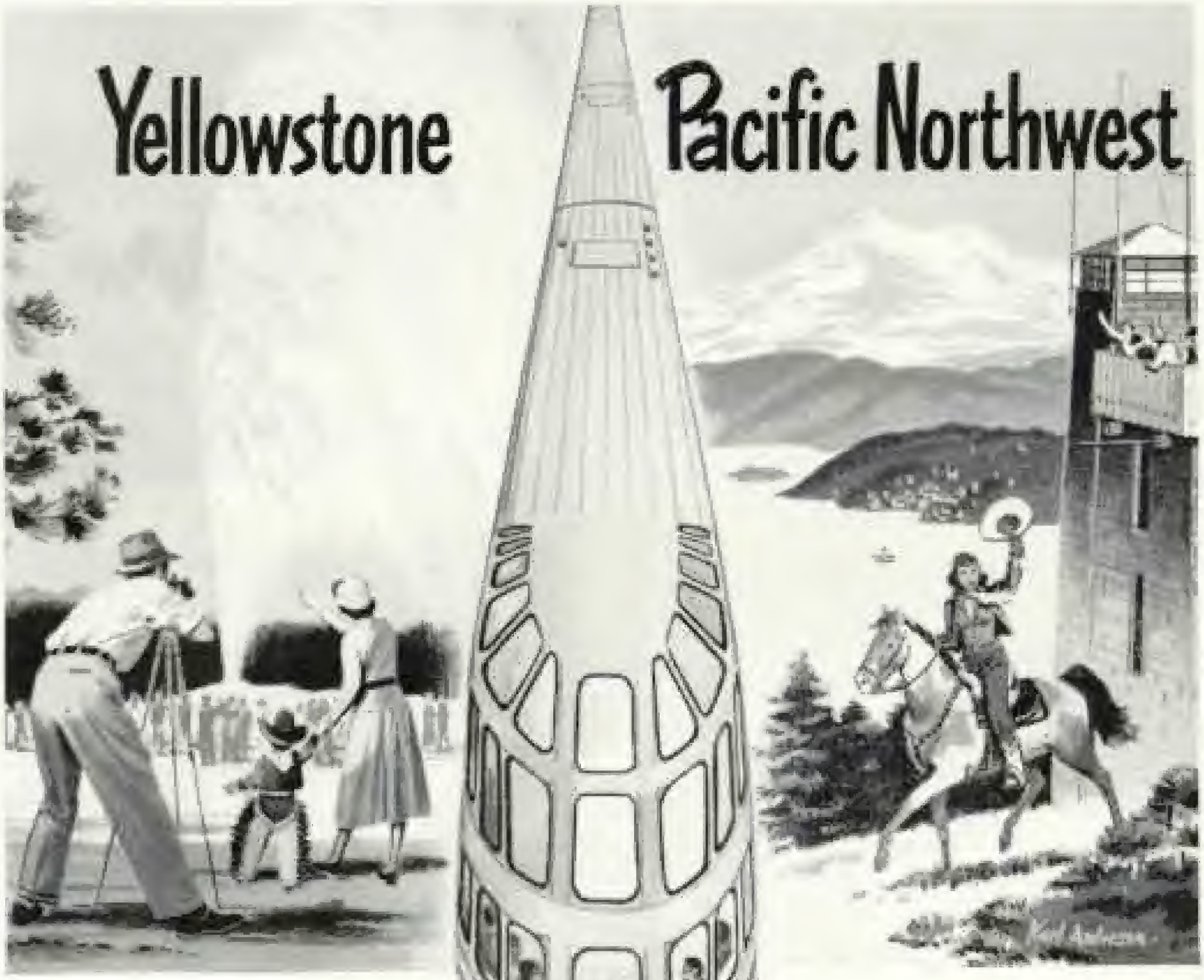

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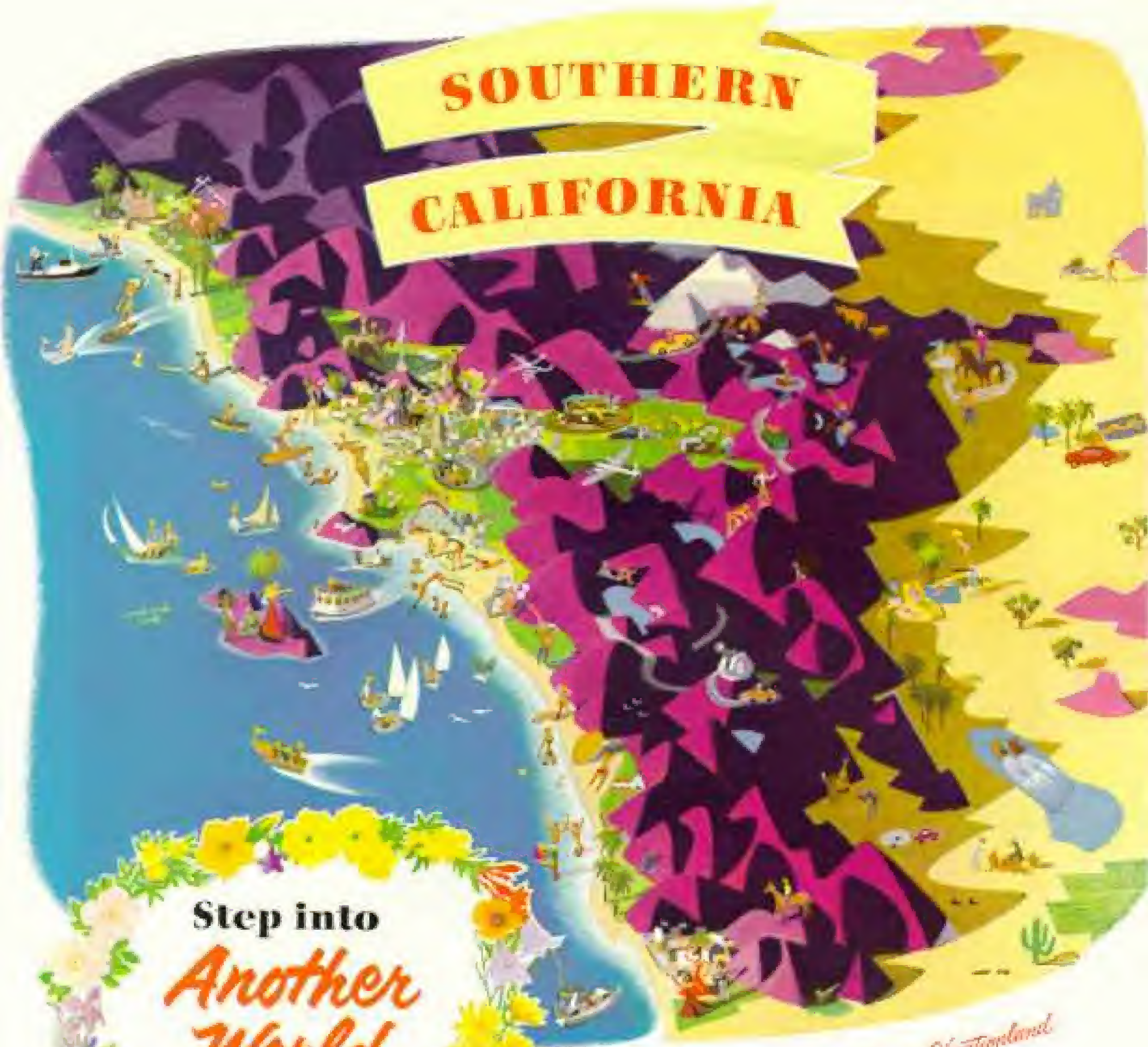

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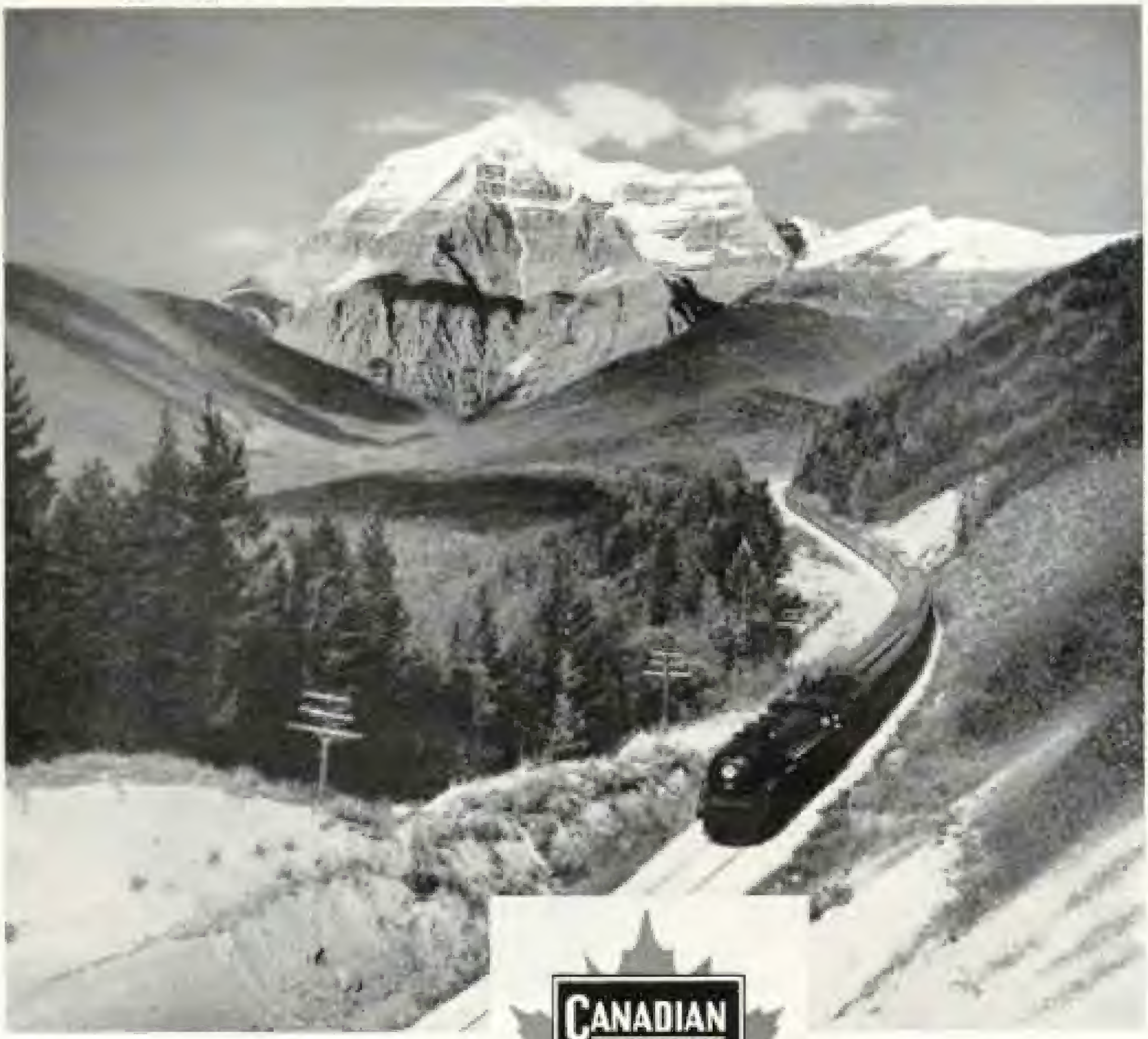
CANADA'S SCENIC ROUTE

TO EITHER COAST



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Choose from this rich variety. Here are Canada's 10 Top Maple Leaf Vacations

1. **Across Canada** — the Scenic Route to California or the Pacific Northwest, to New York or anywhere East.
2. **Alaska Cruise** — ten days, 2,000 miles of protected coastal sailing.
3. **British Columbia** — Vancouver, Victoria, Prince Rupert. A magnificent mosaic and mountain playground.
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5. **Hudson Bay** — "Down North" to romantic frontiers, via Winnipeg.
6. **Jasper in the Canadian Rockies** — glad, color in mountain grandeur.
7. **Minaki (Lake of the Woods)** — swimming, water-boating, golf in a northwoods setting. Wonderful fishing!
8. **Ontario Highlands** — land of lakes and streams; fishing, camping, fine hotels, resorts.
9. **Provinces by the Sea** — beaches, boys, fishing ports, historic old cities.
10. **Romantic French Canada** (Europe over the Seaway) — like taking a trip abroad.

BOUND FOR A GAY HOLIDAY in Europe?...a business conference in a Continental capital? Make *this* trip a thrilling experience in luxurious air travel...at *no* extra cost. Relax in the extra room of a new-type AIR FRANCE Constellation. Enjoy the extra comfort of restful "sky lounger" chairs. Friendly English-speaking stewards and hostess serve you as *only* the French know how. You'll love every minute of it!

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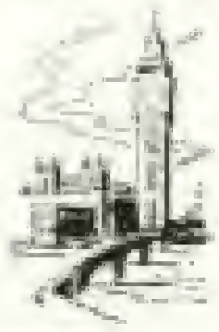

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THE **LUXURY** WORLD-WIDE AIRLINE

I hated to tell her—

what a fool I'd been...

(Based on Hartford Claims #205417, 205418)

At current values, my house was worth $30,000. My household goods, $15,000. So what did I do? Me a building contractor, who ought to *know* how inflation has increased replacement costs. On my own house, I just played ostrich . . . never gave rising prices a tumble . . . left the structure insured for only $12,000, its contents for $4,500. Came that dismal dawn, that disastrous fire, and my loss hit $23,726.56. I had "slept away" more than $7,200 of my family's money. And, believe me, I hated to tell *her* what a fool I'd been . . .

Don't "sleep away" any of *your* hard-earned money.

Find out the *actual* value of your house at today's inflated prices. Your furnishings and personal effects, too!

Then call in your Hartford agent or insurance broker, or write us for Hartford's free "Inventory Booklet." In over 5000 communities, you can locate your Hartford Fire Insurance agent by calling Western Union by number and asking for "Operator 25."

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Solomon at the Steinway

PHOTOGRAPH BY ADRIAN SIEGEL

For your home: the piano chosen by the world's great artists

Even before the artist has struck his first notes, the audience knows that his piano is a Steinway — for this is the exclusive choice of nearly every famous musician on the concert stage, on radio, on television.

Why not choose the Steinway for your home? Children and experienced players alike find the Steinway a constant incentive to more perfect playing. Every Steinway is equipped with the patented Accelerated Action, which helps make mastery easier; and the Diaphragmatic Soundboard, which lends big piano tone to even the smallest Steinway model.

So superior is Steinway craftsmanship that this piano has held the admiration of the music world for almost a century. With proper care, the Steinway will serve your family for generations. In terms of abiding rewards, this is the most economical piano you can buy. For a free copy of our booklet, "How to Choose Your Piano," write to Steinway & Sons, Steinway Hall, 109 W. 57th St., New York 19.

The Steinway is used exclusively by Enesco, Graffman, Kreisler, List, Serkin, Sevitzky, Thomas, Weissenberg and many others. Illustrated is the superb Early American. Now you may purchase a Steinway at convenient terms. See your local Steinway dealer, who is listed in the classified telephone directory.

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THE INSTRUMENT OF THE IMMORTALS

New York Vacation "Chit-Chat"

...with fun as the CENTRAL idea!

I love that magic moment between the acts . . . with everyone chattering excitedly about the play. My, was I glad, that first night, we'd come New York Central, arriving rested and ready for a Big Town big time! Then, too, Grand Central Terminal is so close to the top hotels, Fifth Avenue shops, Broadway shows. We didn't waste a minute!

New York has so many nearby sea-and-sun spots . . . so many surrounding sights to see! We were thankful our New York Central ticket agent had suggested reserving a Drive-Ur-Self car for us. That's really the ideal vacation combination . . . get there by train on the restful, scenic *Water Level Route*. Then get around by car.

FREE! 1952 Year-Round Travel Guide to New York and other exciting playgrounds. Send coupon to New York Central, Room 1356-N5, 466 Lexington Ave., New York 17, N. Y.

Please send me FREE Year-Round Travel Guide

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New York Central

The Water Level Route—You Can Sleep

U.S. PRODUCTION DRIVE TURNS SPOTLIGHT ON TRAINED MEN

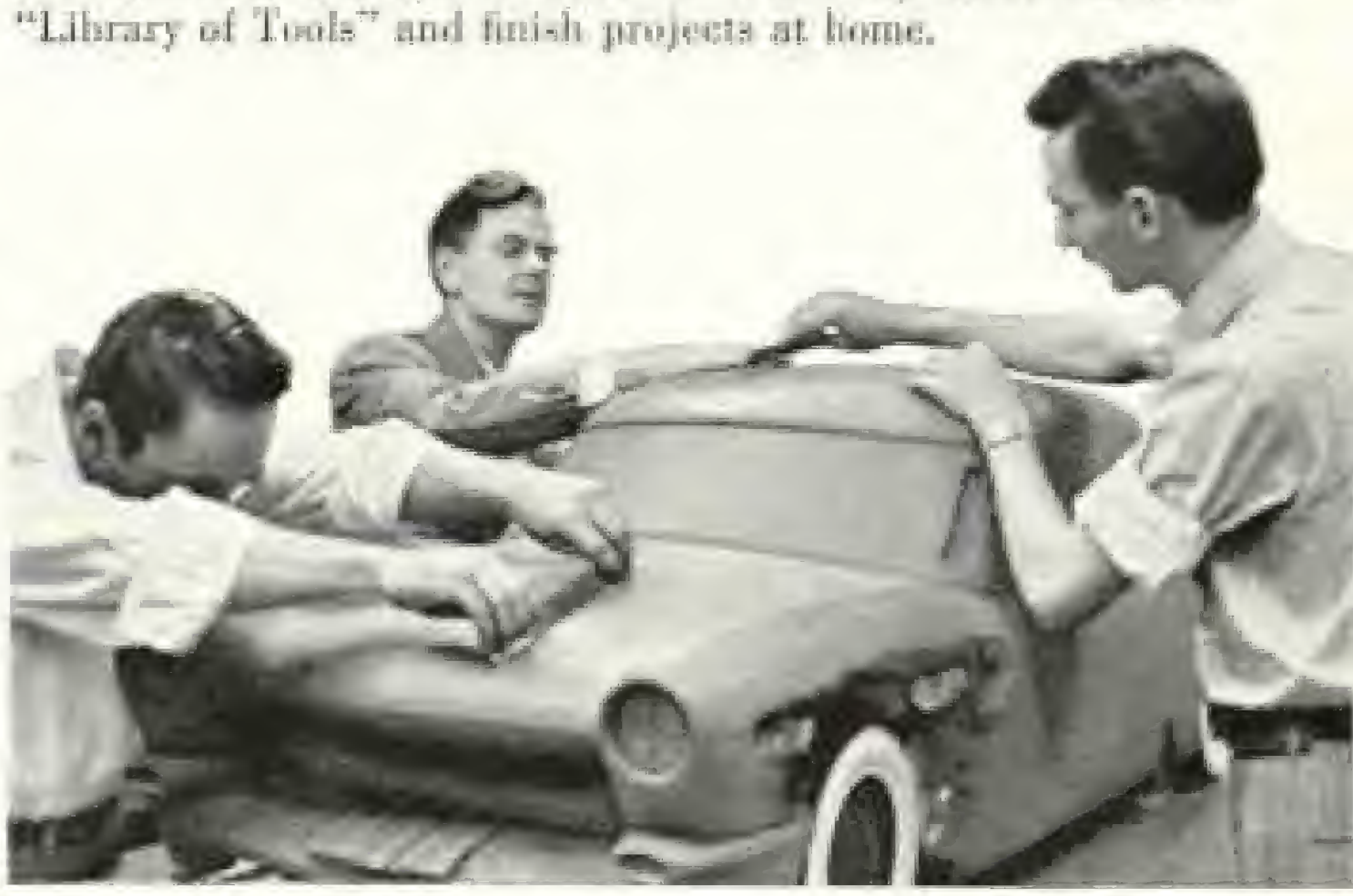
Chrysler Corporation's program helps people build better products and better careers for themselves

George Heyer, noted magazine photographer, turns his camera for this picture story on a program of importance to American production — how people learn to build military vehicles, defense weapons, and the cars and trucks that play a vital part in American life.

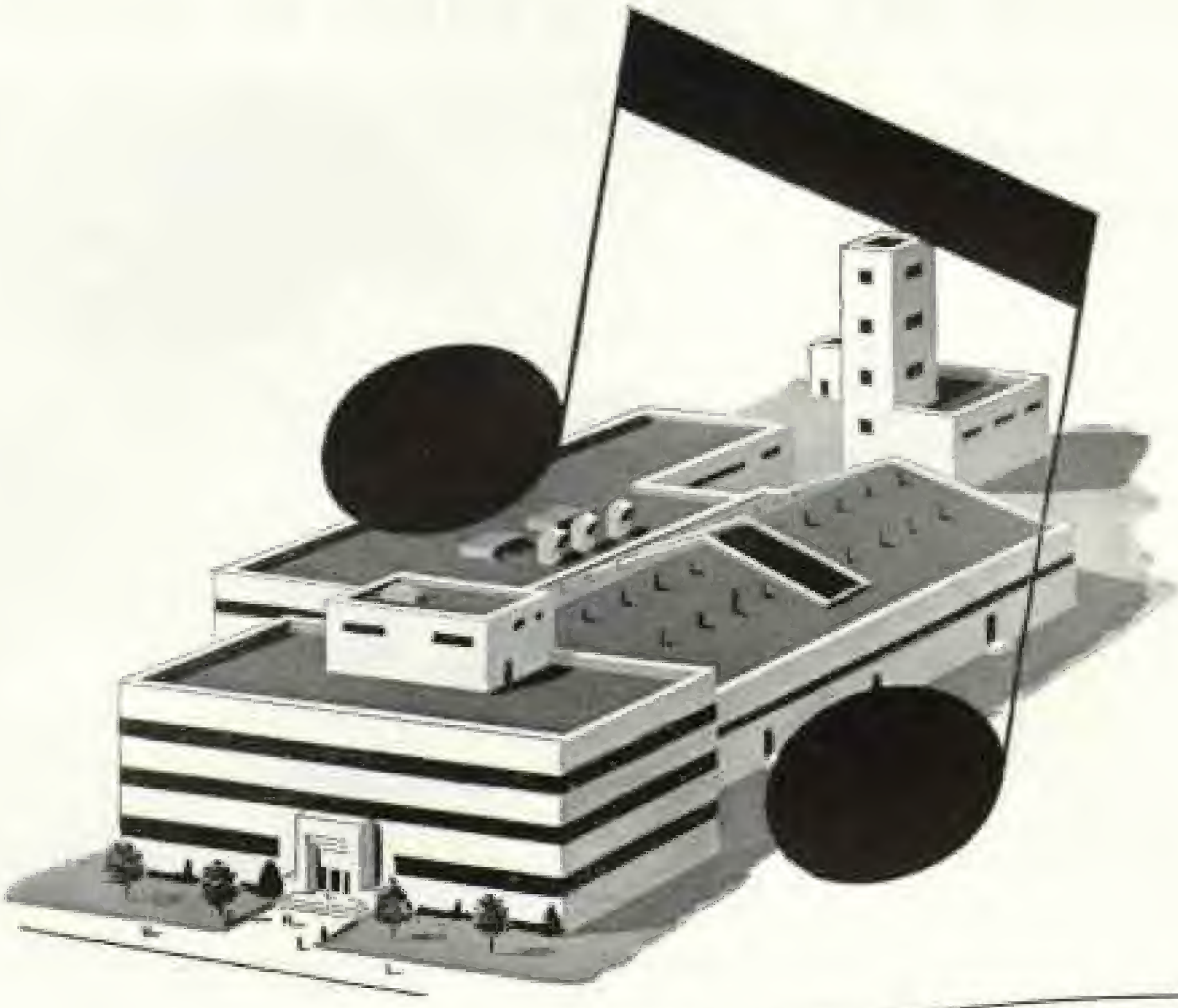
Heyer's pictures were made in Chrysler Corporation factories, classrooms and training shops. He shows a few of the thousands of men and boys now taking part in Chrysler's widespread training and technical education program.

TOMORROW'S CRAFTSMAN. Heyer snapped intent young Robert Churs — son of a Chrysler Corporation employee — during one of his first lessons in how to use tools and make useful things. In special workshops set aside by Chrysler, Robert and other boys work in wood, leather and metal under the guidance of veteran Chrysler artisans. Then they borrow from a "Library of Tools" and finish projects at home.

"A GOOD MACHINE DESERVES A GOOD MAN, SON." Heyer pictures Albert Bazner learning about grinders from veteran machinist H. A. Nelson. For the past year Albert has been in an Apprentice Group in Chrysler's Industrial Education program, learning the machinist trade — at good pay. Chrysler helps ambitious employees move up to better jobs. Even high school and college students can learn jobs before graduation, earning both classroom credits and pay. Good training for good men pays off in better cars and trucks — and in such defense work as jet engines, too.



THEY THINK IN CLAY. In this clay model room at Chrysler Institute of Engineering, employee students D. M. Holiday, 25, *left*, and Paul R. Diehl, 27, *right*, study car body design with Engineer Carl Hood. The Institute is the most advanced part of Chrysler's education and training program. Courses compare with those in leading engineering colleges. At Chrysler, employees find training to improve themselves . . . become more valuable to America now when production need is great.



Yes!...it is true what they say about Dixie!

THEY'RE not "tall tales"— the amazing things you hear about the Southland these days. Big things *are* happening down Dixie way.

Southern industry *is* on the march. Industrial development in the South *is* at an all-time peak.

Today the "song of the South" is the enthusiastic chatter of riveting guns as new factories go up. It's the steady hum of countless machines turning out manufactured products of all kinds.

This is the music of modern Dixie. Come down and listen to it. Come down and *see!*

"Look Ahead — Look South!"

Harry A. McDonald
President

LOOK SOUTH
LOOK AHEAD

SOUTHERN
RAILWAY SYSTEM
WASHINGTON, D. C.

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THE BANBURY.
21-inch rectangular tube. Plug-in for record player. In mahogany or limed oak veneers, also with raffia doors or decorator colors.

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21-inch rectangular tube. Plug-in for record player. In mahogany veneers.

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17-inch rectangular tube. Plug-in for record player. In mahogany veneers or blond finish.

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EXPECT TO BE ENVIED

That's part of owning these wonderful new Du Monts. Here are sound and pictures thrilling for brilliance and clarity. Here are the greatest advances, the highest standards in television. Here, as you would expect from Du Mont, is the foremost in electronics encased in the elegance of bench-crafted cabinetry.

See the complete new 1952 line at your local Du Mont dealer.

DU MONT

First with the Finest in Television

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Someone you know would *welcome* a gift of American Stationery. It is the gift you can give *any time* — in appreciation for favors received; as a gesture of friendship or thoughtfulness.

It is the gift you can give with *pride*. Its size and weight are *correct*. Its paper is quality *rag-content* bond. Its printing is neat and tasteful, in rich blue ink.

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200 NOTE SHEETS (6x7) and 100 NEW, IMPROVED ENVELOPES. Ideal for informal notes and household business correspondence. Printed . . **$1.00**

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SEE MORE...DO MORE...

have much more fun!

...And five can ride for as little as one! Yes, you can have so much more fun on your vacation if you have the convenience of a beautiful new car from HERTZ ... to drive as your own. Costs surprisingly little, too. The rates in most Hertz cities will give you 200 miles in a full week of extra fun and exciting sightseeing, with gas, oil and insurance furnished, for only $46.25 or $9.25 per person if five ride.

Famous Whitehall Hotel in Palm Beach Florida. Perfect beaches, water "as blue as the sky," make Palm Beach a mecca for discriminating winter vacationists.

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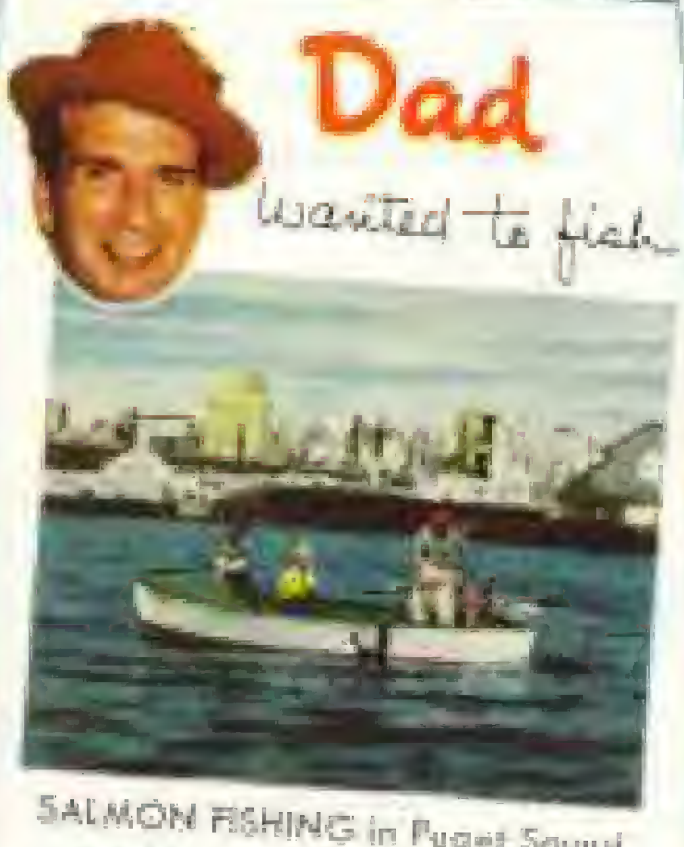
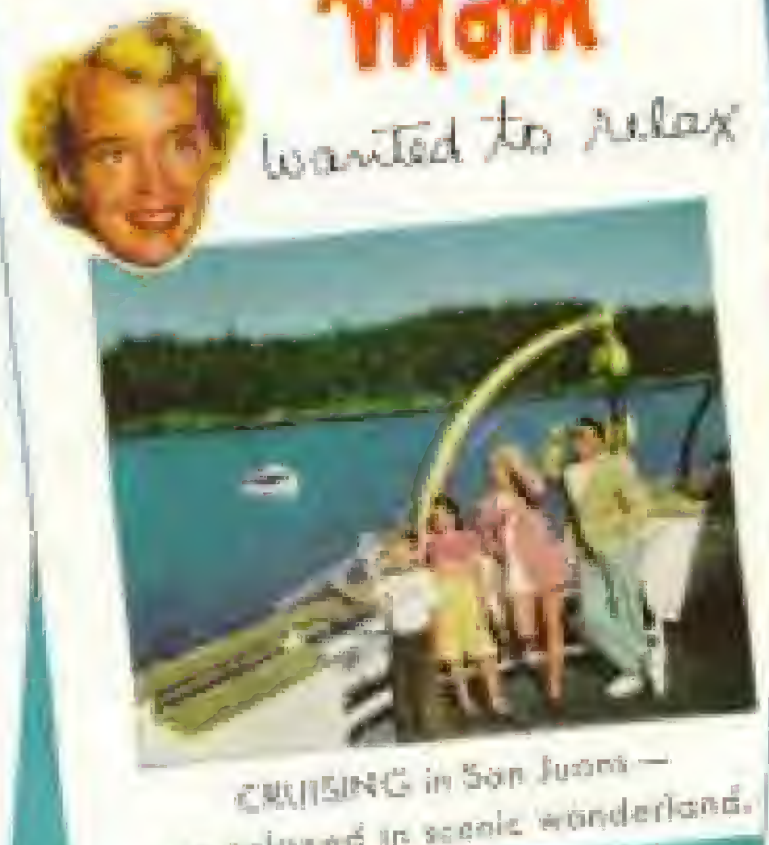
WHEREVER YOU GO . . . WHATEVER YOU DO . . .
YOU CAN RENT A NEW CAR FROM HERTZ AS EASY AS A B C **HERTZ** *Driv-Ur-Self* **SYSTEM**



Dad

wanted to fish

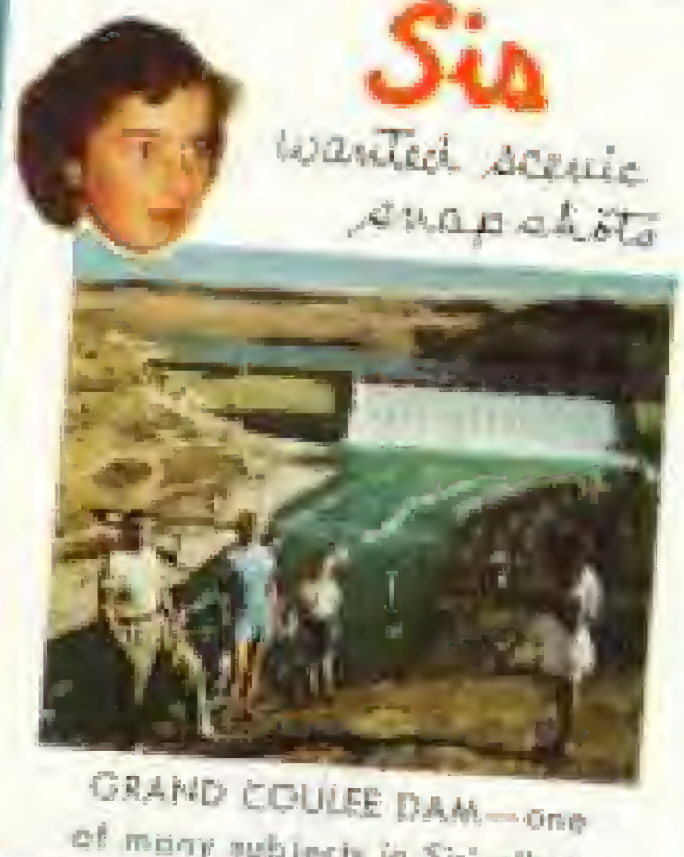
SALMON FISHING in Puget Sound —also trout in lakes, streams.



Mom

wanted to relax

CRUISING in San Juans — we relaxed in scenic wonderland.



Sis

wanted scenic snapshots

GRAND COULEE DAM—one of many subjects in Sis' album.

Bud

wanted the actions

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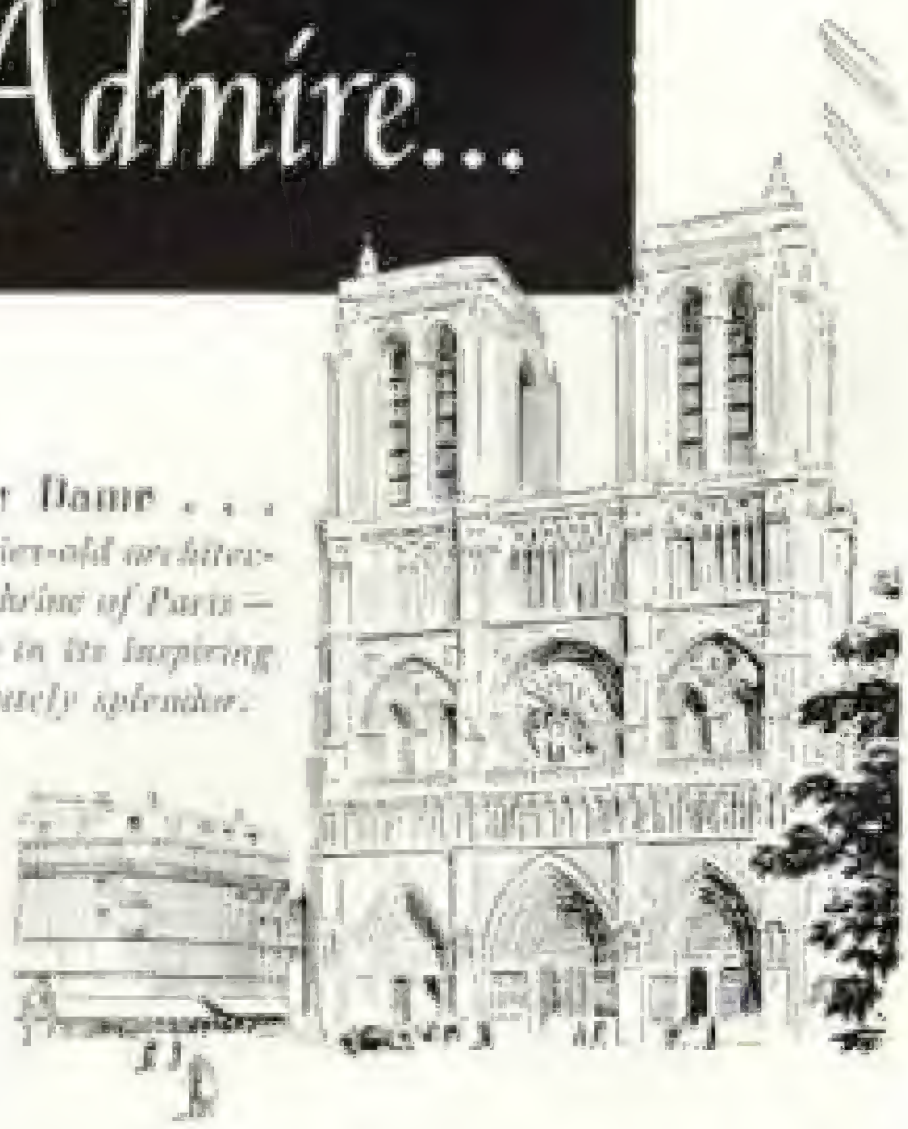

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Summer fun for Everyone in ONTARIO

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"CHEERS FOR CHUBBY"

THE CARTOON characters shown here—Mr. and Mrs. Chubby—are the "stars" of Metropolitan's film, "Cheers for Chubby." This film humorously presents a serious subject—the health hazards of overweight.

Medical authorities report there are some 25 million Americans who, like the Chubbys, are overweight—or who tip the scales to a point at least 10 percent higher than is best for their physical and mental health.

Today, doctors are urging all overweight people—especially those beyond age 30—to bring their weight down to normal and *keep it there throughout life*.

This is because excess pounds may place a burden on vital organs, particularly the heart. Obesity may also shorten life as it is closely associated with heart and circulatory diseases, gall bladder trouble, diabetes, arthritis, and other disorders.

Here are some facts that the Chubbys learned about reducing—facts that may help everyone to get the greatest benefit from a weight-reduction program.

1. Avoid all "quick and easy ways to reduce." Chubby tried exercise only—and found that he had to run 36 miles to shed *one pound!* Mrs. Chubby tried the latest reducing fads with even poorer results. They found that so-called "simple ways to reduce" do not work—and that self-treatment with reducing pills may actually be dangerous.

2. Consult the doctor for advice about reducing. The doctor helped the Chubbys to lose weight safely. He prescribed a balanced diet that would not only remove excess pounds, but would also allow the Chubbys to eat a variety of appetizing, nourishing foods. He also helped them to develop a new set of permanent eating habits.

3. Follow a balanced diet while reducing. The Chubbys' reducing diet was planned so as to protect their health while reducing. They found that they could eat a variety of foods—lean meats, fish, vegetables, butter, fruit, milk, eggs, and whole-grain or enriched breads. These foods provide the protein, vitamins and minerals needed for building and repairing the body.

4. Develop new eating habits. The Chubbys learned to avoid those dishes that teem with "hidden calories," such as gravies and sauces. By firmly adhering to their new eating habits, they lost weight safely—from two to three pounds a week. They also increased their chances for additional years of happier, healthier living, *because they knew that—the shorter the belt line, the longer the life line!*

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Please send me a copy of your booklet, 352N, "Overweight and Underweight."

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Iroquois scare-devil

Iroquois medicine men wearing horrible masks like this crawled into the tribe's lodges twice each year—jumping and moaning and rattling their turtle-shell noisemakers.

As a part of the ceremony, they scattered ashes on the floor. And that particular Iroquois dwelling was supposed to become a safe place in which to live.

A wonderful idea—chasing out evil spirits that might later harm you and your family. But it won't work for you any better than it did for the old-time Iroquois.

But mishaps around the house, or personal injury accidents anywhere, needn't be a heavy burden on your pocketbook. Just call in your Travelers agent and let him tell you about Travelers Accident insurance.

VOL. CI, NO. 3 WASHINGTON MARCH, 1952

THE NATIONAL GEOGRAPHIC MAGAZINE

Work-hard, Play-hard Michigan

BY ANDREW H. BROWN

With Illustrations from Photographs by the Author

LOW in the water, the Great Lakes ore boat *William G. Mather* churned downstream in the St. Marys River toward the locks at Sault Ste. Marie, Michigan.

Inside the white blockhouse of U. S. Coast Guard Lookout Station No. 6, perched on a rock on the Michigan side of the stream, the lookout and I watched the long, low-slung vessel draw abreast.

The captain of the *Mather* stepped from wheelhouse to bridge and put megaphone to mouth.

"*William G. Mather*," he called. "I'm drawing 22 feet."

The lookout watch waved in acknowledgment, picked up the telephone, and advised the locks at "the Soo," five miles downriver: "*William G. Mather*, drawing 22 feet, just went by me." In an aside to me he added, "She's bound for Cleveland with 14,000 tons of upper Michigan iron ore."

Great Lakes Make Michigan Mighty

The deeply laden vessel felt the tug of current as Lake Superior's brimming outflow urged her toward the locks that overcome the obstacle of St. Marys River rapids.

Two men could sprint 100 yards from either end of the *Mather* before they met. Here were 600 feet of steel vessel gliding along 600 miles from the nearest Atlantic salt water.

Standing right where we were, night and day, from April to December, we could have watched 22,493 ships go by this spot. Not all were different vessels, of course. Many of them were the same ships, retracing their route. Some of the cargo carriers make up to 40 round trips a season, carrying iron ore, coal, grain, pulpwood, automobiles, and fuel in the Great Lakes trade (pages 284-5).

During the eight months of open navigation, Great Lakes shipping carries nearly two-thirds as much tonnage as the total annual offshore trade through all United States salt-water seaports (pages 290 and 312). Michigan, embraced in four of the five Great Lakes, is deeply involved in this stupendous traffic. Most of it skirts her shores. Her lighthouses, locks, and foghorns guide it. She brings mail to the endless procession of ships.*

Without the "American Mediterranean," iron ore could not move by boat from Michigan's mines to mills, nor could her requirements in grain, fuels, and raw materials be shipped in so cheaply. Fifteen percent of the Detroit area's automobile output travels to markets by ship.

These Lakes give Michigan inland seaports. Detroit alone had 109 general cargo sailings to foreign ports in 1951, compared with 68 in 1950. A firm shipping machinery from Muskegon, on Lake Michigan, to England or Scandinavia saves $10 to $18 a ton by the all-water route as compared with movement by rail to New York and transfer to ocean vessel. Construction of the St. Lawrence Seaway would greatly swell this direct trade.

Lakes Superior, Michigan, Huron, and Erie give Michigan a shore line only 100 miles shorter than the United States' entire Pacific coast (map, pages 282-3).

Cool Forests Lure Vacationists

Especially in summer's time of holidays, the Great Lakes provide Michigan with priceless air conditioning. Water-moderated breezes extend the Lower Peninsula's fruit belt far north along the Lake Michigan coast.

Michigan has many thousand inland lakes,

* See "*J. W. Westcott*, Postman for the Great Lakes," by Cy La Tour, NATIONAL GEOGRAPHIC MAGAZINE, December, 1950.

Detroit Celebrates Its 250th Birthday with a Fireboat's Watery Five-gun Salute

The 47-story Penobscot Building (left), topped by a television antenna, is the city's highest.

hundreds of them set in wilderness. North of an imaginary east-west line between Saginaw Bay and Lake Michigan the State is largely forest-clad, a sportsman's and vacationist's realm of alluring spaciousness and varied appeal.

Michigan's people are concentrated south of this area; about nine-tenths live in the southern two-fifths of the State. Upstate, in the north of Lower Peninsula and throughout Upper Peninsula, thinly inhabited wooded reaches are little changed from the days of French missionary-explorers, Revolutionary skirmishes, and the pioneer "landlooker."

With all this play space, tourism in Michigan naturally is a leading source of income; it vies with agriculture for second place to automobile making, unchallenged king

251

Here 100 Frenchmen Built a Fort in 1701

1,850,000 Americans make the city our fifth biggest.

among the industries of this diversified State.

Michigan sold more than a million fishing licenses in 1951 and about 400,000 permits to hunt deer. Forty cents of every tourist dollar is spent by State residents.

Among its natural wonders and resources, Michigan counts antique water—a third of a billion years old. In tunnels of a salt mine, 1,130 feet under south Detroit, I dipped one hand into a tank of soapy-looking liquid.

"That's 'fossil' water 300 million years old," my guide prosaically announced. "It's handy for washing cuttings from drill bits."

Every now and then probing pick or drill releases a gush of this aged-in-the-salt H_2O. The manager of the mine, an International Salt Company property, gave me a transparent cube of salt. In tubelike channels within it, two tiny globules of ancient sea water—gleaming captives of eternity—slipped back and forth, like bubbles in a carpenter's level.

Michigan Could Salt the Whole World

Waters of a shallow Silurian sea that eons ago engulfed Michigan left riches in thick salt deposits. Today the State leads all the 48 in salt production. Layers of sooty-white sodium chloride underlie much of the Lower Peninsula.

Geologists say Michigan's known salt reserves could supply the entire world's needs for millenniums to come.

Humdrum salt is a basic raw material of the fast-expanding chemical industry; rich brine deposits located the huge parent plant of the Dow Chemical Company at Midland, Michigan. Michigan farmers spread salt with fertilizer on sugar beet fields; salt increases the yield of beets and makes them sweeter!

Last summer, on a swing through Michigan, I drove first to dynamic Detroit. Symbol of America's productive capacity, Greater Detroit makes 9,000 motor vehicles every 24 hours and, in addition, a swelling volume of defense goods. Its automobiles, trucks, and buses have changed human habits and reshaped the face of the earth.*

Detroit's family income surpasses that of any other large city in the world; Detroiters drive more cars, in proportion to population, than any other major United States city except Los Angeles. The Detroit area supports nearly half Michigan's people; her industries and businesses account for 54 percent of the State's income.

University's 107th Commencement

Not Detroit, however, but the rest of Michigan was my goal on this journey. After a brief visit in the amazing motor city, I set out to explore the great State beyond.

Driving west to Ann Arbor, I attended the 107th commencement of world-renowned University of Michigan. To accommodate 3,814 candidates for 47 different degrees, as well as parents, faculty, and friends, Michigan staged the ceremonies in the football stadium, capacity 97,000.

The University of Michigan began its career in Detroit. Public-spirited men pushed through

* See "Michigan Fights," by Harvey Klemmer, National Geographic Magazine, December, 1944.

the Territorial legislature in 1817 "an Act to establish the Catholepistemiad, or University, of Michigania." ("Catholepistemiad," absent from dictionaries, was a "made" word meaning, roughly, "place for acquisition of a wide range of knowledge.")

In 1821 the name was changed to University of Michigan, and in 1837 a gift of 40 acres of land sent the school to Ann Arbor (page 291).

The University, with 17,155 students enrolled in the fall of 1951, was the first major university west of the Appalachians to set up professional schools for the study of medicine (1850) and law (1859). More than half of all who ever have received Michigan Law School diplomas are still alive.

A research leader, Michigan worked out a large-scale method for production of RDX, World War II superexplosive. The late Dr. Max M. Peet of the Medical School developed "miraculous" surgery to relieve high blood pressure by operating on the sympathetic nerve supply to the kidneys and adrenal glands.

With its new giant synchrotron that energizes electrons up to 300,000,000 volts, the University strives to learn more about the mysterious forces that hold together the subnuclear particles composing all matter.

Where the Republican Party Was Born

West of Ann Arbor I stopped in Jackson, factory town fringed with parks. There I sought out the corner of West Franklin and 2d Streets to read a bronze tablet: "Here, under the oaks, July 6th, 1854, was born the Republican Party, destined in the throes of civil strife to abolish slavery, vindicate Democracy and perpetuate the Union." President William Howard Taft dedicated the tablet in 1910.

Gracious farmlands led to Lansing, the State capital, equidistant from Detroit and Lake Michigan. As I explored the high-ceilinged capitol, it was hard to comprehend that Lansing was a capital site suggested in jest.

Michigan's 1835 constitution stated that the capital "shall be at Detroit . . . until 1847, when it shall be permanently located by the legislature." Detroit, on the border, was felt vulnerable to invasion.

283 Drawn by Harry P. Olivet and Irvin E. Alleman

Four Great Lakes Clasp Michigan in a 2,302-mile Embrace

The State's shore line exceeds Florida's and almost equals those of California, Oregon, and Washington combined. During wartime the five Great Lakes carried more tonnage than that sent abroad by all our salt-water ports. River and canal float ocean cargoes to Lake ports, but international shipments cannot reach maximum scope unless Canada and the United States complete the deep-water St. Lawrence Seaway (opposite page).

Legislators rejected one after another lower Michigan locality. Finally, in joking mood, someone proposed the wilderness township of Lansing. The legislators laughed—but for want of a better choice finally settled on it. So Michigan's seat of government moved to a frontier clearing with one log house and a sawmill (page 296).

Today the capitol's 267-foot dome is overtopped by near-by Olds Tower, 25 stories high (page 294). Here I sat at the desk of the late Ransom E. Olds, automotive pioneer, who died in August, 1950, at 86. Swinging in Mr. Olds's swivel chair, I looked out the window across Lansing's rooftops to the great Oldsmobile auto plant he brought into being.

Among the first to build a practicable automobile (in 1896), Olds gave his name to the Oldsmobile and later his initials (R.E.O.) to the Reo. Early in the century, Olds was the world's largest motorcar producer, and "In My Merry Oldsmobile" was a theme song of the era.

In Lansing I learned why Michigan is known as the Wolverine State.

"There's no authentic record of a wolverine ever being seen or killed in Michigan," State game biologist F. W. Stuewer told me. "But in the early fur trade days Detroit shipped furs not only from Michigan but also from a wide reach of territory to the west and north.

Passage Island
International Boundary
Eagle River
Eagle Harbor
Copper Harbor
Keweenaw Point
Brockway Mountain
Keweenaw Peninsula
Keweenaw Bay
Lake Superior
Middle Island Point
Grand Island
Marquette
Ishpeming
Negaunee
Marquette Iron Range
Munising
Miner's Castle
Pictured Rocks
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Seney
Newberry
Sault Ste. Marie
New Canals
Sault Ste. Marie
Duluth
Superior
Soo Canals
Burnt Creek
Seven Islands
Ottawa
Montreal
Proposed St. Lawrence Seaway
Ontario
Rochester
Buffalo
Boston
Welland Ship Canal
New York
Erie
Detroit
Toledo
Cleveland
Chicago
Pittsburgh
Baltimore
Washington
Norfolk
Atlantic Ocean
Michigan
Huron
Keweenaw Peninsula
Iron Range
Iron Mountain
Escanaba
Gladstone
Manistique
Menominee
Marinette
Oconto
Peshtigo R.
Menominee R.
Green Bay
Peshtigo River
Car ferry in ice free months
Straits of Mackinac
Mackinac Island
Bois Blanc Island
Mackinaw City
Cheboygan
Beaver Island
Grand Traverse Bay
Burt Lake
Petoskey
Indian River
Washington Island
Leelanau Peninsula
Sleeping Bear Sand Dune
Glen Haven
Glen Lake
Old Mission Peninsula
Bayne City
Gaylord
Traverse City
Sturgeon Bay
Frankfort
Manistee
Manistee River
Cadillac
Grayling
Roscommon
Hartwick Pines State Park
Au Sable River
South Branch
Houghton Lake
Tawas City
Au Sable Point
Saginaw Bay
Pte. Aux Barques
Harbor Beach
Alpena
North Point
South Point
Thunder Bay River
Thunder Bay
Hubbard Lake
Rogers City
Indian River
Cheboygan River
Mullett Lake
Hammond Bay
Lake surface 580 feet above sea level
Lake surface 580 feet above sea level
Manitowoc
Sheboygan
Little Sable Point
Big Sable Point
Pere Marquette River
Ludington
Big Rapids
Mt. Pleasant
Muskegon River
Muskegon
Grand Haven
Grand River
Grand Rapids
Holland
Kalamazoo River
Standish
Hope
Midland
Bay City
Saginaw
Saginaw River
Caro
Alma
Chesaning
Flint
Owosso
Lansing
East Lansing
Pontiac
Birmingham
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Windsor
Lake St. Clair
Belle Isle
Detroit River
Lake Erie
Pelee Island
Port Huron
Sarnia
Milwaukee
Racine
Kenosha
Great Lakes Naval Training Station
South Haven
Kalamazoo
Battle Creek
Olivet
Albion
Jackson
Ann Arbor
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Willow Run
Dearborn
Wyandotte
Monroe
Toledo
Fremont
Sandusky
Bryan
Portage
Benton Harbor
St. Joseph
Dowagiac
Niles
Coldwater
Hillsdale
Adrian
BERRIEN COUNTY
Evanston
Chicago
Cicero
Indiana Harbor
Gary
Hammond
Elkhart
South Bend
Michigan City
Saginaw Bay
Lake Michigan
Lake Huron
Lake Erie
Lake Ontario
Ohio
Indiana
Michigan
Wisconsin
Ontario
Upper Peninsula
Lower Peninsula
Blind River
St. Joseph Island
North Channel
Drummond Island
Manitoulin Island
Cockburn Island
Lake surface 580 feet above sea level

184

Ice Packed by an April Gale Traps 28 Ships in Lake Superior's Whitefish Bay

Ship jams used to be common, but icebreakers, ship-to-shore radio, and regular weather reports make them rare today. These carriers keep steam up for quick starts when the pack opens up.

285

© The Detroit News

Frozen-in Vessels Suggest an Explorers' Convoy Locked in the Antarctic

Rafted floes have studded Whitefish Bay as late as mid-May. Ice in December, 1926, pinched 247 ships in St. Marys River; sellers drove food-laden sleds up to ships' sides. So much wheat was tied up that markets grew panicky.

"Wolverine skins were so numerous in these shipments that eastern buyers, having no way of knowing that most came from beyond Michigan, called it the 'Wolverine State.' The nickname stuck in defiance of the facts."

East Lansing, next door to the capital city, hustles to keep step with its pride, joy, and meal ticket, Michigan State College, oldest land-grant agricultural college in the United States. Of its co-educational enrollment of about 15,000, four-fifths are native Michiganders.

Back in 1855 students built Michigan State's first building out of bricks they made themselves. It was the first agricultural college building in the country.

State's faculty, led by President John A. Hannah, teaches in eight main schools. Most courses offer graduate degrees. So Michigan State actually is a great university; it keeps "College" in its name to avoid confusion with the University of Michigan.

At the college's Agriculture Hall I called on Ernest L. Anthony, Dean of the School of Agriculture.

"Partly by accident," Dean Anthony told me, "this is an ideal spot for an agricultural school. From the area within 125 miles of East Lansing comes more than four-fifths of our State's farm income."

Ancient glaciers, I learned, strewed Michigan with morainic deposits. They run the gamut of soil types. On the 3,000-acre College Farm, 27 kinds of soil challenge agronomists.

Mucklands Become "Black Gold"

For decades Michigan's wet, black mucklands frustrated farmers. Drainage finally converted them from soggy wastes into "black gold"; 5,000,000 muckland acres now produce millions of dollars' worth of celery and onions every year.

Acreage still is under development, but a specially evolved muckland blueberry in 1950 yielded one-and-a-quarter million dollars from only 1,500 acres!

Dean Anthony has charge of this plant-breeding research at State agricultural experiment stations.

"We're mighty proud, too, of our Haven peaches, developed for the sandy soils of the Lake Michigan fruit belt," the Dean told me. "Four of the Haven varieties account for 55 to 60 percent of Michigan's great crop of choice table peaches.

"Our experimenters have found that today's 'wonder drugs,' effective in treating humans, promise equally dramatic applications to agriculture," said Dean Anthony. "Each year dairy farmers discard good heifers because of failure to breed. Now our research scientists find that proper hormone treatment causes sterile heifers to give milk without calving.

"Other tests by our Agricultural Experiment Station show that pigs gain 40 percent more weight when antibiotics and vitamins are added to the basic ration," Dean Anthony explained.

Source of Cherries, Beans, Sugar Beets

Not a leading agricultural State, Michigan nevertheless stands yearly in one of the first ten places among the 48 States in 30 farm products. In 1950 it ranked first in navy beans, fourth in sugar beets, fifth in dried milk, seventh in dairy products, second in peaches, first in red tart cherries—and so on (page 304).

Michigan grows practically all the United States' chicory and wormwood. Most of the chicory is blended with coffee in Louisiana; oil of wormwood is used in medicines.

State Route 78 led me northeast from Lansing to Flint, Michigan's third largest city, made rich by the automobile industry. Nine-tenths of Flint's industrial population works in General Motors Corporation plants—the Buick and Chevrolet Divisions, two Fisher Body factories, and the AC Spark Plug Division.

Northward from Flint productive farm lands, shaped like a crescent moon, curve inland from Saginaw Bay. Newly planted bean and beet fields reached on either side to flat horizons.

Between Saginaw and Bay City, humming industrial towns, the road paralleled the Saginaw River. Placid now, the stream knew rip-roaring action 80 years ago when red-sashed lumberjacks urged pine logs down its current (page 304).

During the '70's and '80's Bay City's whining sawmills lined both riverbanks for miles. The smell of fresh-sawn lumber "was strong enough to flavor food." Lumber piles made wooden walls along the Saginaw.

Upstate from Bay City, wilderness still crowds close. Pine and spruce walled the roadsides as I drove north to Roscommon, headquarters of Region II of the State Department of Conservation. The Department is responsible for Michigan's natural resources.

Charles F. Welch, regional education supervisor, took me to visit George A. Griffith, Conservation Department commissioner, at his Au Sable River home. On the way we counted a dozen deer.

Game and fish were subjects of our talk.

"From our hatcheries," Mr. Griffith said, "we're planting over a million legal-size trout every year. That points up the pressure on our streams; yet fishing still is excellent—

Kodachrome by Andrew H. Brown

Blooms, Wooden Shoes, and Windmill Say It's Tulip Time in Holland, Michigan

Half a Million Visited the 1951 Tulip Festival at Michigan's Holland

Nine-tenths of the city's residents trace descent to the Netherlands. Four tulip-tinted days each May they put on Dutch costumes and dance in wooden shoes on hand-scrubbed streets.

Opposite: Flower lovers inspect a tulip farm. Many visitors order bulbs to be shipped in planting time.

→ Pipe-smoking doctor and storekeeper wear the red jackets, baggy wool pants, and black astrakhan hats of Old World Volendam. Below: Boy and girl sweeping the streets dress like their elders.

↓ Michigan's Governor, G. Mennen Williams, in *klompen* and farmer's cap, lives up to his nickname, Soapy, as he scrubs in the company of jolly *huisvrouwen*.

Kodachromes by Andrew H. Brown

Ships on the St. Clair River Chug in Endless Procession Past a Tranquil, Cottage-lined Lagoon

St. Clair and Detroit Rivers, draining the upper Great Lakes into Lake Erie, carry more tonnage yearly than the Rhine, Thames, and Seine combined. Here a deep-laden ore boat churns downstream between Michigan and Ontario (far shore).

Doric Columns Admit Michigan Students to Angell Hall

From an original classroom building standing virtually alone in 40 acres, the University of Michigan has grown to 90 major buildings on 700 acres. Chartered at Detroit in 1817, the institution moved to Ann Arbor in 1837. Enrollment has swelled from seven to the 1948-49 peak of 21,363, and the faculty from two to some 1,300.

Admitting women in 1870, Michigan was a pioneer in introducing coeducation. It took that bold step in the face of protests that "to admit ladies to the University would be . . . destructive to its character and influence, and ruinous to the ladies. . ." Today some 5,000 coeds prove the decision wise.

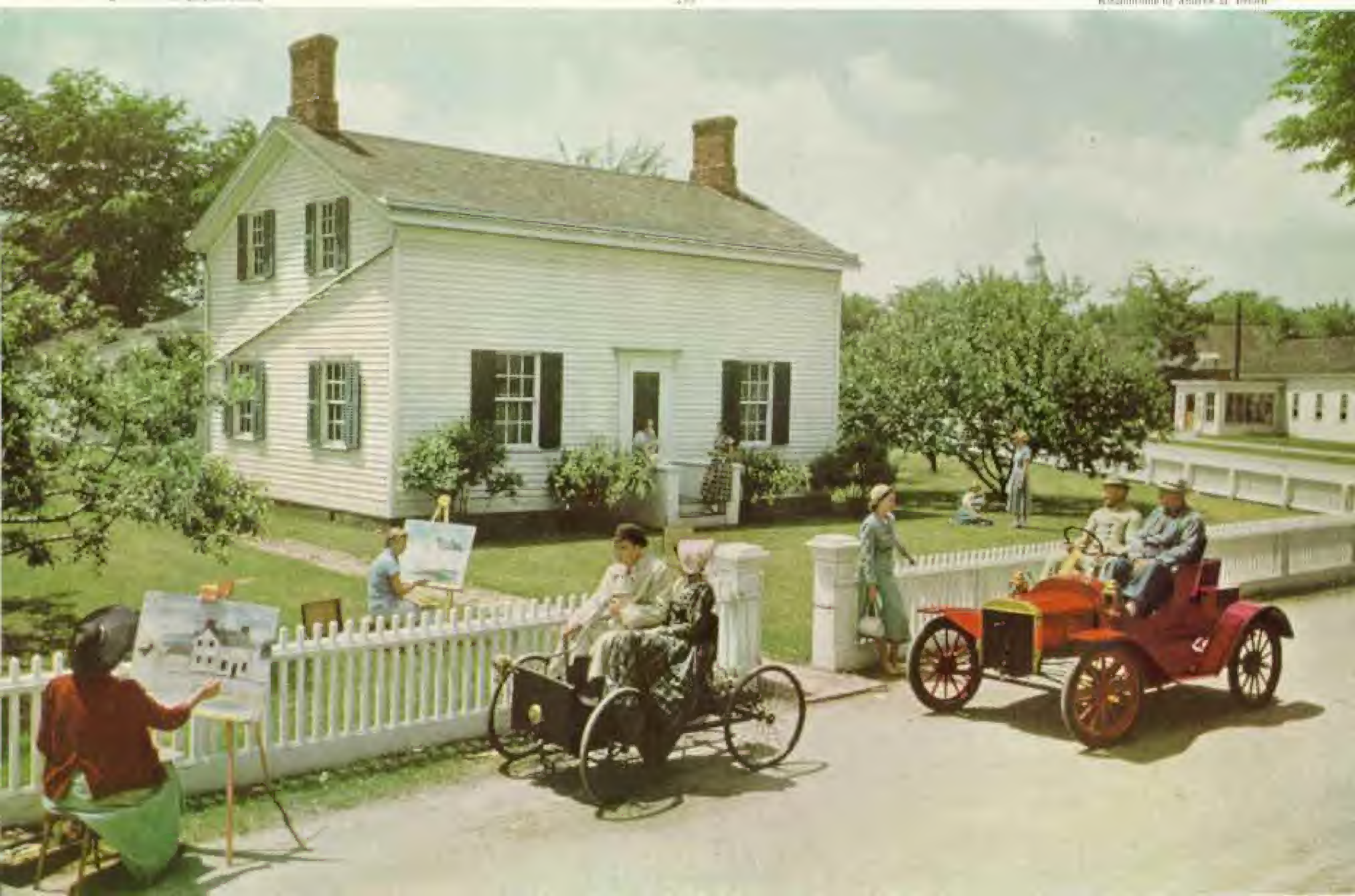
Angell Hall, symbol of the university, was named for President James B. Angell, whose administration (1871-1909) built many additions. Now being enlarged, Angell Hall is the main building of the College of Literature, Science, and the Arts.

Michigan State College in East Lansing is entirely independent of its traditional rival in Ann Arbor. Both are supported by the State.

Kodachrome by Andrew H. Brown

Suwanee Steams Past Stephen Foster's Home (Left). Both Are Attractions in Greenfield Village, Henry Ford's Dearborn Museum

From Lawrenceville, Pennsylvania, came the home of Foster, who sang of "Way down upon de Swanee Ribber." The stern-wheeler duplicates one that used to ply the Florida river for which this craft is named. Opposite: An 1895 Ford, the first ever built, and a 1903 edition halt before Henry Ford's Dearborn birthplace.



Kodachrome by Andrew H. Brown

Michigan a Century Ago Built Its Capital in a Wilderness. Look at Lansing Now!

Broad Michigan Avenue, bridging the Grand River, leads to the domed seat of government. Twenty-five-story Olds Tower and adjacent Hotel Olds were named for Ransom E. Olds, pioneer automobile manufacturer.

if you know your stuff. These old browns and rainbows are fly-wise and crafty!" (Page 307.)

Mention of fish sent Griffith to his home freezer. He pulled out three rainbows and fried them for us as we talked.

"Venison from the freezing locker is mighty tasty, too," Welch put in, "but it's a tough job keeping deer plentiful. The hunter wants his buck. And of over 125,000 Michigan deer shot in 1950, resident hunters killed more than 118,000."

Hunting the Hard Way—with Arrows

Bowhunting has taken firm hold. In 1951 nearly 20,000 game seekers in Michigan were armed with bow and arrow. One out of every ten got his buck. The archer must get within 60 yards—and preferably nearer 30—of the deer to have much hope of a kill.

Grayling straddles the upper waters of the Au Sable River. Its clear, cool waters now sweep fishermen, instead of logs, from pool to pool in canoes and native longboats. Each September canoeists from all over the United States and Canada race nonstop the length of the winding Au Sable, some 200 miles, in the grueling Michigan Canoe Championship.

On a summer afternoon I floated down the Au Sable, idly flipping a fly into eddies and beside snags. Some stretches of the stream were wild; at choicest sites bungalows and cottages peeped from pine groves or clung to the riverbank (page 305).

At the helm was conservation officer Clarence Roberts. Without effort, he did three things at once: poled and steered the canoe with a sawed-off broom handle; cast a dry fly with unerring accuracy; and chatted about river people, poachers he'd nabbed, angling lore, and his two sons.

We caught two trout—a small brook and a nice brown.

North from Grayling to the Straits of Mackinac the road wound through logged-over lands, past sawmills and pretty lakes, through few towns. Then the land dropped away, farms appeared, and silvery Burt and Mullett Lakes called a halt for admiration.

From neat Cheboygan on Lower Peninsula's tip I turned southeast to Hammond Bay to visit scientists studying the murderous sea lamprey (*Petromyzon marinus*).

The Lamprey, Fish Enemy No. 1

In glass aquariums lampreys hung like tentacles from trout serving as guinea pigs (page 301). At stake in these researches is a $3½–4,000,000 fishery. In the battle, the U. S. Fish and Wildlife Service is collaborating with the Michigan Department of Conservation.

Between 1935 and 1949 the lake trout catch in United States waters of Lake Huron fell from 1,743,000 pounds to a scant 1,000 pounds! In Lake Michigan the drop during the same years was from nearly 5,000,000 pounds to 343,000 pounds.

The predatory sea lamprey gets the blame for this appalling decline.

Dr. Vernon C. Applegate, in charge of the Hammond Bay Fishery Laboratory, plucked an eellike lamprey from a tank and turned its grotesque mouth parts toward me. Knife-sharp teeth rimmed the creature's mouth; more cutting blades tipped its tongue.

With this razor-edged arsenal the lamprey, about 17 inches long when adult, attaches to a fish, rasps through scales and skin, and sucks out its victim's lifeblood and vital juices.

The sea lamprey, infesting the upper Great Lakes through canals, has traded its fresh-and-salt-water life for a completely fresh-water existence. Lake trout and whitefish have been its favorite game, but all other species, too, are attacked.

"The problem is to keep the lamprey from spawning, or to destroy its young in the streams," said Dr. Applegate. "Lampreys ascend streams to spawn in spring and early summer. The young lampreys stay in the streams about four years, then drift down to the Lakes."

Applegate showed me experimental control works on near-by Ocqueoc River. Rows of metal posts spanned the stream. Wires led from power poles on the bank to the posts nearest shore.

A Shocked Lamprey Turns Away

"This is a 'shock treatment' fence," Applegate explained. "During the lamprey run we shoot a 110-volt AC current into those electrodes. Current flows through the water between the aluminum posts. The 'hot' water stuns or otherwise repels the lampreys. This method is close to 100 percent effective. At this point we stop between 18 and 25 thousand sea lampreys each year."

Applegate pointed out that one man can tend several electric weirs. But costs must still be pared before widespread installation can be justified.

The hen lamprey, I learned, spawns about 61,500 eggs. Adults of both sexes die after spawning.

Lampreys have attacked swimming humans, but they don't hang on very long. One theory is that man's skin is distastefully warm to the greedy creatures.

Between Mackinaw City and St. Ignace, ferries linking Michigan's two peninsulas ply the Straits of Mackinac all the ice-free months.

Michigan Honors Its Battle Flags in the State Capitol

These cases display regimental banners. A War Relic Museum houses other flags, weapons, uniforms, and documents from the Civil, Spanish, and World Wars.

Lansing was picked as the capital city in 1847 by a whim. More in jest than in earnest, one lawmaker proposed Lansing, consisting then of a sawmill and a log cabin in a wilderness. Lansing became known as the "capital of the woods" (page 282).

Completed in 1878, the capitol building stands close to the business center (page 294). Glittering lights outline the 267-foot dome by night.

Bob Towers

An Animal Portrait by George Shiras

Patiently stalking animals and birds in remoter parts of Michigan, Minnesota, and Canada, the late George Shiras 3d pioneered in flash photography of wild creatures in their native haunts. He was the first to make wilderness denizens take their own pictures by touching trip lines or pulling baited cords attached to the camera. Though 60 years have gone by, no one has excelled him in capturing wildlife drama.

Mr. Shiras wrote and illustrated *Hunting Wild Life with Camera and Flashlight*, published by the National Geographic Society, of which he was a life Trustee for 23 years. Many articles by Mr. Shiras have appeared in the NATIONAL GEOGRAPHIC MAGAZINE.

Twin Fawns Snap to Attention at the Photographer's Whistle. Flash Powder Lighted This Scene in the Michigan Wilderness

288 National Geographic Photographer J. Baylor Roberts

Michigan, Making Medicines, Serves the Nation's Health

Detroit, home of Parke, Davis, was a drug center 40 years before it became the automobile capital. Midland, site of Dow Chemical plants, is the world capital for aspirin and many other pharmaceutical chemicals. Kalamazoo's Upjohn Company was founded in a basement 67 years ago; now a single production plant covers 23 acres with one roof (page 319). One of its machines here counts vitamin tablets—250 to each revolution of the perforated disk—and drops them into 1,000-unit bottles.

Other boats serve storied Mackinac Island, north of the Straits (map, pages 282-3).

On the voyage to Mackinac Island (the Indians' Michilimackinac, the "Great Turtle"), the long colonnade of the Grand Hotel came into view, then walls and blockhouses of Old Fort Mackinac (pages 308 and 309).

At the dockhead, carriages waited to receive guests. No automobile may intrude on Mackinac Island—well, only three, an ambulance, a fire truck, and an emergency vehicle. On this tranquil outpost of the State that makes more automobiles and automobile components than all others put together, the horse-and-buggy age survives (page 310). With 400 horses, 300 carriages, and hundreds of bicycles, island transportation is abundant, but hurry is impossible—and no one misses it.

A coachman in scarlet livery handed me into Grand Hotel's carriage, pulled by red-plumed horses. We clop-clopped past hotels and homes of gleaming white, under massed lilacs in full bloom. No hint in this peaceful setting of the half-forgotten truth—that this little island once was starred with bursting shells and striped with soldiers' blood.

Old Fort Mackinac induced reverie. Below its walls, ore boats furrowed waters that bore canoes of early French explorers—Nicolet, Allouez, Marquette, and La Salle.

Americans Cornered the Fur Trade

The British, victorious in the French and Indian War, fortified Mackinac Island. After the Revolution, Mackinac was ceded to America, but the British did not evacuate it until 1796. In the War of 1812 they retook it by storm before word of the new conflict had reached the Yankee garrison. The British, after repulsing an American assault, had to withdraw from Mackinac under the terms of the Treaty of Ghent.

The Americans locked up a monopoly of the fur trade. In 1817 John Jacob Astor centered the operations of his American Fur Company at Mackinac. The Astor company, employing 2,000 *voyageurs* and 400 clerks, cleared $3,000,000 worth of pelts in a single year, 1822.

During its heyday as a trading post, Mackinac fostered a colorful and boisterous society. Rough backwoodsmen rubbed shoulders with highborn European adventurers. Along the beach, as many as 3,000 Indians used to camp at once, their wigwams two and three rows deep.

After withdrawal of the military garrison in 1894, the greater part of the island became a State park.

Old Fort Mackinac's most gripping interest to me lay in the monument to Dr. William Beaumont, American surgeon at the fort early last century.

In 1822 Beaumont treated Alexis St. Martin, a young French Canadian apparently mortally hurt by an accidental gunshot

Painstaking Hand Labor Makes Grand Rapids' Name a Synonym for Fine Furniture

Furniture got its start here in days when the log-floating Grand River tapped virgin forests of pine, oak, beech, and maple (page 302). Only scatterings of these woods remain, but imports from all parts of the world now supply the city's 77 furniture makers. Pennsylvania cherry went into this French Provincial chest at the John Widdicomb plant. Twice a year some 5,000 furniture buyers attend the city's furniture markets.

wound. His stomach had been laid open.

Dr. Beaumont devotedly tended his patient several years, but the wound would not heal. Beaumont saw a rare chance—here was a window on an important organ! The doctor won St. Martin's consent to study the digestive processes, including functions of the gastric juices. Some 238 experiments in eight years, part of them in the post hospital, led later to the discovery of pepsin and its action. Beaumont's report, published in 1833, revolutionized theories of alimentary digestion.

Most amazing of all, perhaps—St. Martin lived on unhampered by the hole in his stomach and died at a ripe old age.

Ashore on the "U.P."

Returning to Mackinaw City, I picked up my car and rode the Straits ferry to St. Ignace, front door to Michigan's Upper Peninsula, known as the "U.P."

At Sault Ste. Marie (French for "St. Marys Leap") the Michigan town faces Ontario's city of the same name across St. Marys River. Between the two, the stream drops Lake Superior's overflow in a foaming rush.

Here at the world's busiest locks—obviously a strategic spot—I found the word-of-the-day was "Forbidden!" No photographs—not even through fences that sealed off the lock area. Within the restricted zone armed troops manned guard posts.

Ore boats were squeezing through the locks. Other vessels, including grain boats and tankers, steamed upriver or down in the approaches. On both banks industrial plants smudged skies that not so long ago knew only Indian campfire smoke.

Eighty-five percent of American iron ore passes through the Soo locks en route from Michigan, Wisconsin, Minnesota, and Ontario mines to steel plants of eastern Canada and the Great Lakes States.

Called the "most important waterway in the world," the Soo locks carry more cargo than the Panama and Suez Canals combined.

Yet ice closes the giant water elevators about 120 days each year!

Westbound from the Soo across the U.P., I drove through almost continuous forest to Munising, jump-off point for Pictured Rocks. Cliffs on the Lake Superior coast have been wondrously carved into pinnacles and caves that echo the waves' thunder.

From the promontory of Miner's Castle I watched sunset gild a wide sweep of cliffs and send shimmering lights across Lake Superior (page 315).

Here most particularly I felt the spell of Gitche Gumee, the Big-Sea-Water of Hiawatha. Michigan's Upper Peninsula provided most of the setting of Longfellow's *The Song of Hiawatha*. The poet mentions ". . . the Pictured Rocks of sandstone, looking over lake and landscape."

On 13,000-acre Grand Island off Munising the late George Shiras 3d made many of his extraordinary night photographs of wildlife, first of their kind. He took dramatic pictures of deer, bear, moose, and other wildlife all over northern Michigan (page 297). In quest of game portraits, he explored Isle Royale, Michigan's island outpost in Lake Superior, now a national park.*

Marquette, Gateway to Iron Country

Marquette, midway along the north shore, lies at the threshold of Upper Peninsula's iron country. The landscape changes, level woodlands and sandy soil giving way to terrain wrinkled into hills, ridges, and gorges.

Marquette occupies a key position in Michigan commerce. Marquette, and Escanaba 60 miles to the south on Lake Michigan's Green Bay, are the State's two great iron-shipping points. Thirteen percent of United States iron comes from Michigan mines.

The bulk of Marquette-shipped iron ore comes from underground mines at Negaunee, Ishpeming, and other mining towns on the Marquette Range. This is the easternmost of Michigan's three producing regions, the Marquette, Menominee, and Gogebic Ranges.

At the Presque Isle ore dock of the Lake Superior & Ishpeming Railroad Company, one of two Marquette docks, I boarded the S.S. *John Stanton* of Indiana Harbor, Indiana. Mate Waldo Kirk walked me past her 30 loading hatches. Talk was out as hematite ore poured with a roar down steel spouts into the hold. The *Stanton* can take 10,000 tons in as little time as two-and-a-half hours.

To help meet the Nation's steel hunger, Michigan's ore-loading ports in 1951 neared all-time records for iron ore shipped: a year-end estimate showed 13,750,000 tons moved.

From offices of Cleveland-Cliffs Iron Company at Ishpeming, Jack Bowen of the company's welfare department drove me to the near-by site of the first iron mine in the whole Lake Superior district.

Meeting a "Cousin Jack"

At the Mather Mine, A shaft, we watched miners scramble off the lift cage at the end of their shift. Bowen stopped a man of rugged build and introduced him to me.

"This is Billy Richards," said Bowen, "one of our miners whose ancestors came from Cornwall, in the southwest of England."

Cornish miners are known locally as "Cousin Jacks." Topnotch men underground, their forebears came to Michigan when Cornwall's tin mines petered out.

At Ishpeming I looked up Walter F. Gries, superintendent of Cleveland-Cliff's welfare department.

"Ever hear of a Cornish pasty?" (Gries pronounced it "pass-tee.")

"Never have," I answered.

"Well, the pasty helped build this country. Come home with me and I'll have Mrs. Gries make you one."

Mrs. Gries let me kibitz as she rolled out four pieces of dough to dinner-plate size. On half of each dough disk she piled potatoes, turnips, onion, cubed beef, and pork. Liberally seasoned, each structure was topped with a walnut-size chunk of butter.

Then Mrs. Gries folded over the dough and crimped the edges of the half-moons. Slit at the top, the pasties went into a hot oven for an hour. The steaming pasties were the backbone of a feast rounded out with a green salad, chowchow, and strong tea.

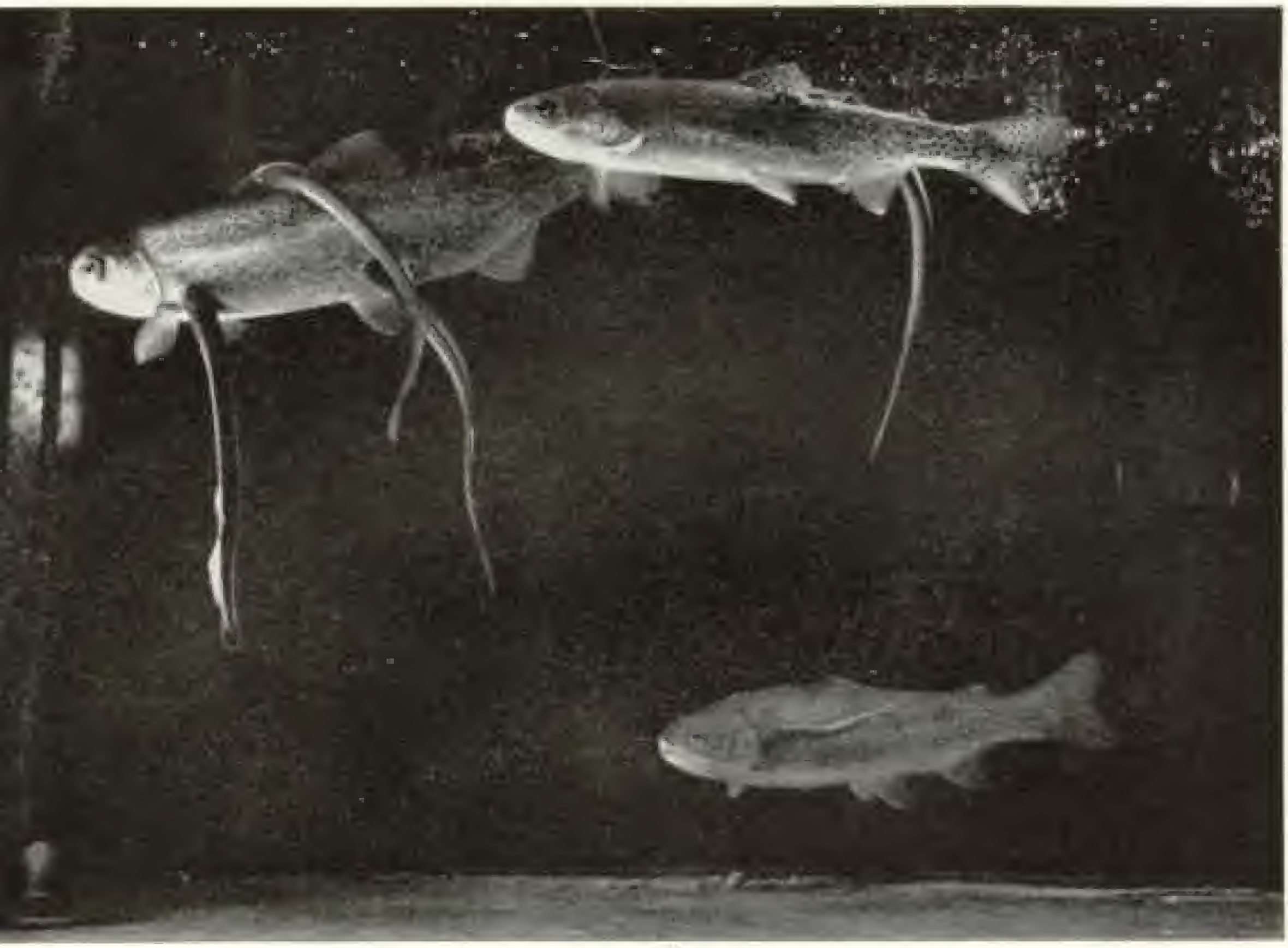
Upper Peninsula's iron and copper mines, and lumbering, attracted not only Cornishmen but also Finns, Swedes, Irishmen, Italians, and French Canadians. Their dialect stories are part of local folklore.

On Finnish farms and in small towns where Finns predominate, the home-country *sauna*, a bath in steam generated by pouring water over hot rocks, still is used.

West and north from Marquette, U. S. Route 41 led me to the hooked claw of Keweenaw Peninsula, Michigan's Copper Country. This district has produced, to date, nearly 10 billion pounds of the ruddy metal. About a seventh of all copper so far mined in the U. S. has come from Michigan.†

* See, in the National Geographic Magazine, by George Shiras, 3d: "Wild Life of Lake Superior, Past and Present," August, 1921; "Wild Animals That Took Their Own Pictures by Day and by Night," July, 1913; "One Season's Game-Bag with the Camera," June, 1908; "Photographing Wild Game with Flashlight and Camera," July, 1906.

† See "'Rockhounds' Uncover Mineral Beauty," by George S. Switzer, National Geographic Magazine, November, 1951.



Blood-sucking Lampreys, Hanging On Like Leeches, Kill Trout by the Million

Sea lampreys, using man's canals to get past Niagara Falls, have invaded the Great Lakes and adapted themselves to fresh water. Nothing now seems to stop them but weirs and electric fences built across spawning streams (page 293). Hammond Bay Fishery Laboratory pens these eellike killers with rainbow trout for scientific study. Clinging with suction-cup mouths, the hitchhikers pierce scales and skin with razor teeth.

Thousands of years before white men came, some unknown people worked Keweenaw's copper lodes. Speculation about their identity has ranged from aboriginal Indians to the Vikings and back even to the Aztecs and Phoenicians!

Copper output on the range reached its peak in 1916 and 1917. Later, unsettled conditions and richer discoveries elsewhere cut back operations.

To a Miner, a Strike Is a Strike

North on U. S. 41 from the twin cities of Hancock and Houghton, the road curved past mine-shaft headworks, suggesting grain elevators with bustles.

At Calumet, W. I. Sincock, director of industrial relations of Calumet and Hecla Consolidated Copper Company, told me that during boom days at the turn of the century Calumet and Hecla stock sold for $1,000 a share!

Mr. Sincock had a story for me about a Finnish miner's visit to Detroit in the days just after the crippling miners' strike of 1913.

This uncitified fellow went to his first baseball game. Confused by the goings-on, he heard "Strike one" and "Strike two" called against "tat fellow wit clubee."

The batter missed for the third time. Then, as the miner related it: "Tat fellow wit nuttress on pellee and bird cage over head holler, 'Strike tree! You're oudt!' Dat's funny ting. In de Copper Country where I gome from, one strike and everybody out!" *

The coast of Keweenaw Peninsula is north-country landscape at its best. Between Eagle River and Copper Harbor the road spanned a pleasure land of blue waters, capes of twisted rock, white sand crescents, and fragrant evergreen woods (pages 314 and 316).

East of Eagle Harbor, spectacular Brockway Mountain Drive climbed hill crests bright with wild flowers. From Brockway Mountain I counted 17 Lakes freighters laying smoke plumes as they plowed the immensity of Lake Superior.

Heading back toward lower Michigan, I drove southeast to Manistique.

* Richard M. Dorson has collected and published a number of these dialect stories in the Journal of American Folklore, April-June, 1948.

Paper and pulp mills abound in Michigan. At Escanaba and Manistique, for example, mills of the Mead Corporation turn out not only familiar magazine stock but also target paper for the armed forces, "hanging paper" (wallpaper, before printing), and smooth stock for children's books, coloring tablets, and paper dolls.

South Along Michigan's Riviera

The Straits of Mackinac recrossed, I turned my car south along Lower Peninsula's Lake Michigan coast.

The 300 miles of Lake Michigan shores from Petoskey to the Indiana border form Michigan's own "Riviera." In the north, bays flecked with sails indented hilly land. Long lakes of crystal translucency enhanced green farm lands.

Up from shores of Grand Traverse Bay marched ranks of cherry orchards; this region is an American "cherry bowl."

In Traverse City, during the mid-July National Cherry Festival, I was quick to enter a restaurant and order cherry pie, and to tie on the tag stating I'd eaten it. Cherry Cops patrolled the streets, ready to "arrest" any persons not displaying tags. Such unfortunates were haled before a kangaroo court. Loud-speakers broadcast the proceedings, which made examples of the "guilty."

Coronation of the Cherry Queen—1951's winning choice was beautiful Mary Lynn Trapp—climaxed three days of parades, fireworks, and carnival fun.

On Old Mission peninsula, at the farm of David Murray, I watched pickers nimbly relieving cherry trees of their bright burden and pouring the red fruit from pails into wooden crates. Ninety percent of the Grand Traverse Bay region's 2,000,000 cherry trees bear red tart (sour) cherries, canned and frozen for pie filling, toppings, jams, and jellies.

Entering Leelanau peninsula, I ranged the little finger of palm-shaped Lower Peninsula, which matches its more prominent eastern thumb. Bright hues of green and blue marbled the surface of Glen Lake, separated from Lake Michigan by Sleeping Bear Sand Dune.

Louis Warnes of Glen Haven shows off the dunes from open stock cars with oversize tires. In these Sleeping Bear Dunesmobiles, Warnes's drivers sell thrills aplenty as they speed over wind-rippled sands (next page).

I clutched hardware and upholstery of one of Warnes's wheeled jack rabbits, as a driver "wrung it out" on sand ridges, hairpin turns, and flats taken at full throttle. This "dune scooting" was real sport!

Cresting several hundred feet above Lake Michigan, the dunes command glorious views. Sparse grasses cling to the drifts. Pockets shelter ghost forests, their spectral trunks drowned by shifting sands.

Near Muskegon I returned to south Michigan's farm-and-city pattern. Muskegon, with a rugged past in the "roaring eighties," employs descendants of its old-time millhands and lumbermen in factories turning out motor castings, office equipment, textiles, leather products, and many other items. One hundred and sixty manufacturing plants make $350,000,000 of goods a year (page 320).

On I rolled to Grand Rapids, once just the name of a frothing stretch of Grand River. Today, synonymous with fine furniture, it's Michigan's second city, after Detroit.

During lumbering days, river drivers' calked boots ground the town's boardwalks into matchwood. One hotel proprietor required lumberjacks entering his hostelry to exchange boots for carpet slippers. He provided the slippers.

A Natural Furniture Town

Close to wood, water power, and water transport, Grand Rapids even before modern roads and railroads was a natural site for furniture manufacture. Surviving the ebb and flow of taste and technique, the city still is style leader in the American furniture trade.

Seventy-seven factories in Grand Rapids turn out, not more furniture than any other locality, but far more of top quality. The city has the country's largest colony of furniture designers (page 299).

At Johnson Furniture Company, Earl M. Johnson took me to the stock room. Choice veneers breathed the aroma of far places—of Africa's Gold Coast, European wild pear groves, and rain forests of Nicaragua and Honduras. Then we followed production from cutting to finishing. Between rough wood and finished piece, what a transformation and what dependence on skilled hands!

Many Johnson craftsmen (as in all Grand Rapids firms) were Hollanders: Grand Rapids, with America's largest Dutch colony, is 25 miles from Michigan's own Holland (pages 287, 288, 289).

Excitement reigns during Grand Rapids's semiannual furniture markets. Held yearly since 1878, they constitute the Nation's oldest merchandise mart.

Still southbound, I drove on to Battle Creek, the setting of a great success story. Battle Creek tells the tale of two names familiar at nearly every American breakfast table.

The imagination and daring of John Harvey Kellogg, W. K. Kellogg, and C. W. Post made Battle Creek and the names Post and Kellogg bywords for breakfast foods and physical well-being. The health-conscious city still is so keyed to promotion of human fitness that the

Kodachrome by Andrew H. Brown

Sleeping Bear Dune's Sandy Ramps Slope Down 600 Feet to Lake Michigan

These golden shores, a playground for sun bathers and hikers, form Michigan's own Riviera. Three women have just enjoyed a full-throttle roller-coaster dunes ride on the stock car's oversize, underinflated tires.

Soil Scientists Weigh Hay Grown on Test Plots near Chesaning

Michigan State College agronomists subject small plots on this farm to several different systems of crop rotation. Weighing hay to learn each experiment's yield, professor and students here seek the best crop sequence. Certified seed is a Michigan specialty.

Big Wheels Straddled and Lifted Logs for Summer Hauling

Michigan with its pine lumber largely built the Prairie States. In the 1870's it led the Nation in production; its 1,600 sawmills cut more than three billion board feet a year. This antique carrier rests in Hartwick Pines State Park near Grayling.

Kodachrome by Andrew H. Brown

Tireless Fisherman or Wary Trout: Which Loves the Swift Au Sable the More?

Night fishing becomes popular here in spring when hungry trout leap for dusk-loving May flies. For a de luxe trip, this wader and friend may canoe downstream, casting until after dark. A hired car will pick them up.

Speedboat and Aquaplane Flash Past Sun Bathers Beside Indian River

Recreation runs neck and neck with agriculture for second rank among Michigan industries; automobile making holds first place. Travel, outdoor sports, and allied activities are worth half a billion dollars a year to innkeepers, guides, and many others catering to vacationers. Michiganders themselves pay out 40 cents of every tourist dollar spent in the State.

Thousands of lakes and streams dot and furrow the State. Shores of the Great Lakes provide hundreds of miles of tideless beaches (page 303).

Michigan makes three-fourths of the Nation's inboard marine engines and half its motorboats. Its residents run some 160,000 outboard motors of their own. Canoe and rowboat liveries do a booming business.

Peaceful Indian River is considered too narrow for fast aquaplaning, but this venturesome crew did not hesitate to oblige the photographer. Forewarned of the powerful wake, boat owners held their moored craft away from retaining walls. The scene of the picture is Finehurst Inn, near the northern tip of the Lower Peninsula.

Kodachrome by Andrew H. Brown

◂ Water Entering Boat Amidships Keeps Penned Trout Alive

Each year Michigan plants more than a million legal-size trout. A few giant brood fish are liberated at the end of the hatchery season.

Watertight sections fore and aft give buoyancy to the rowboat. Fresh water, freely entering the live pen, can supply oxygen to hundreds of fish.

This Department of Conservation crew dips brown and rainbow trout into the Au Sable's South Branch. The fish were reared from eggs by the Grayling hatchery, one of 12 in Michigan. A tank truck transferred them to the planting boat at a bridge crossing.

▿ Jack Schweigert, a Roscommon tackle dealer, mounted this exaggerated fly as an advertisement outside his shop. He ties it to a line to suggest the monstrous trout his customers hope to catch.

Kodachromes by Andrew H. Brown

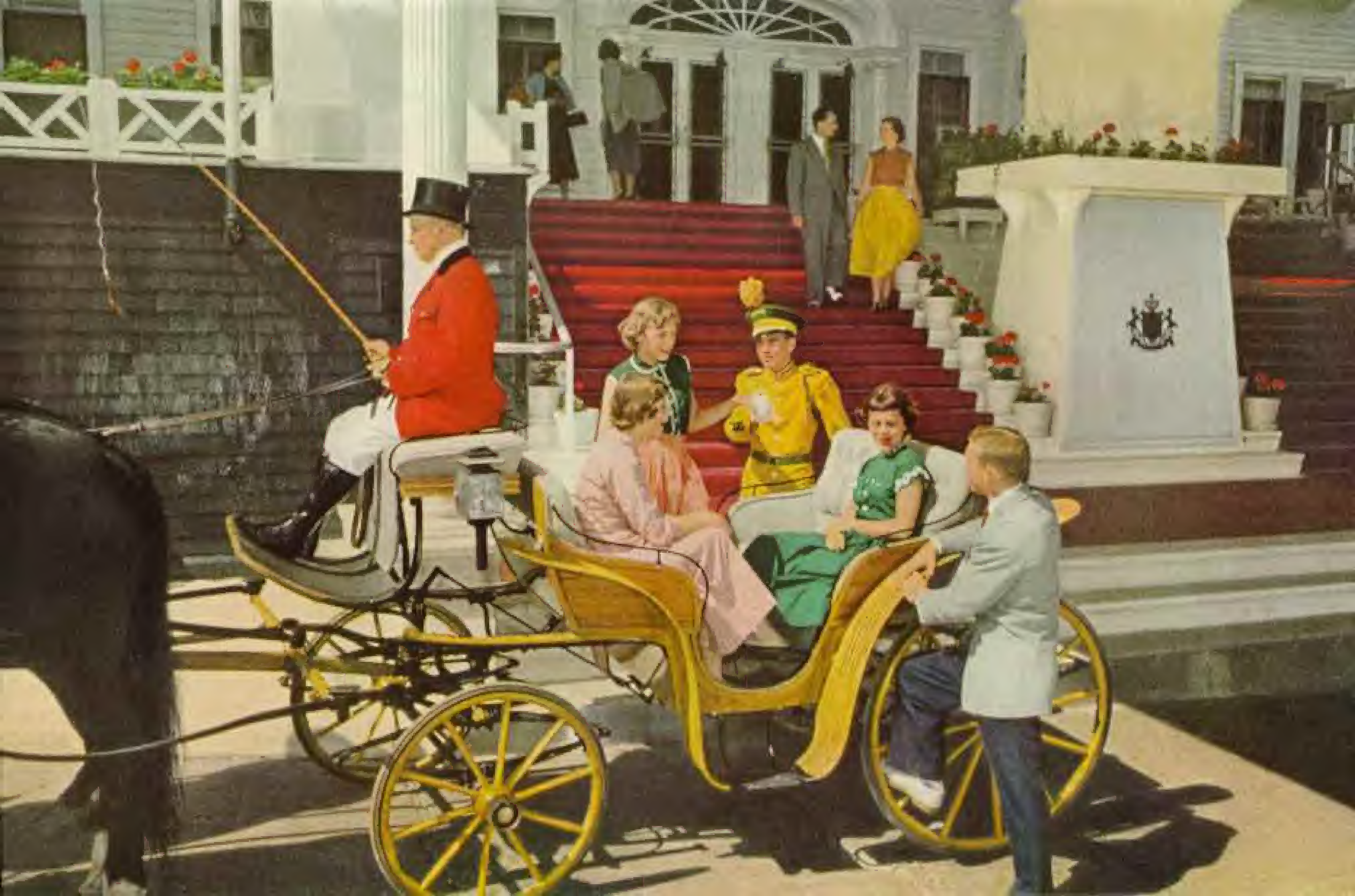
In Comes a Steamer to Mackinac Island

In the fur-trading years this dot of land saw fabulous sights. Sometimes 3,000 Indians camped along the beach. Ignorant backwoodsmen mingled with highborn adventurers from Europe. When the fur trade declined, Mackinac's population shrank almost to nothing. But summer colonists, finding the island free of mosquitoes and pollen, turned it into a resort.

→Visitors survey Mackinac Island City from Old Fort Mackinac, a onetime British outpost.

Opposite: A carriage picks up guests at red-carpeted Grand Hotel.

Kodachromes by Andrew H. Brown



Horses Do a Thriving Business; Mackinac Island Bans Their Automotive Competitors

This motorless oasis in the leading automobile State makes cars as unwelcome as horse carts are on Broadway. Carriages lined up for fares on Huron Street are a sure sign that a passenger ship is approaching.

School's Out for the Summer! Children Play in Higgins Lake

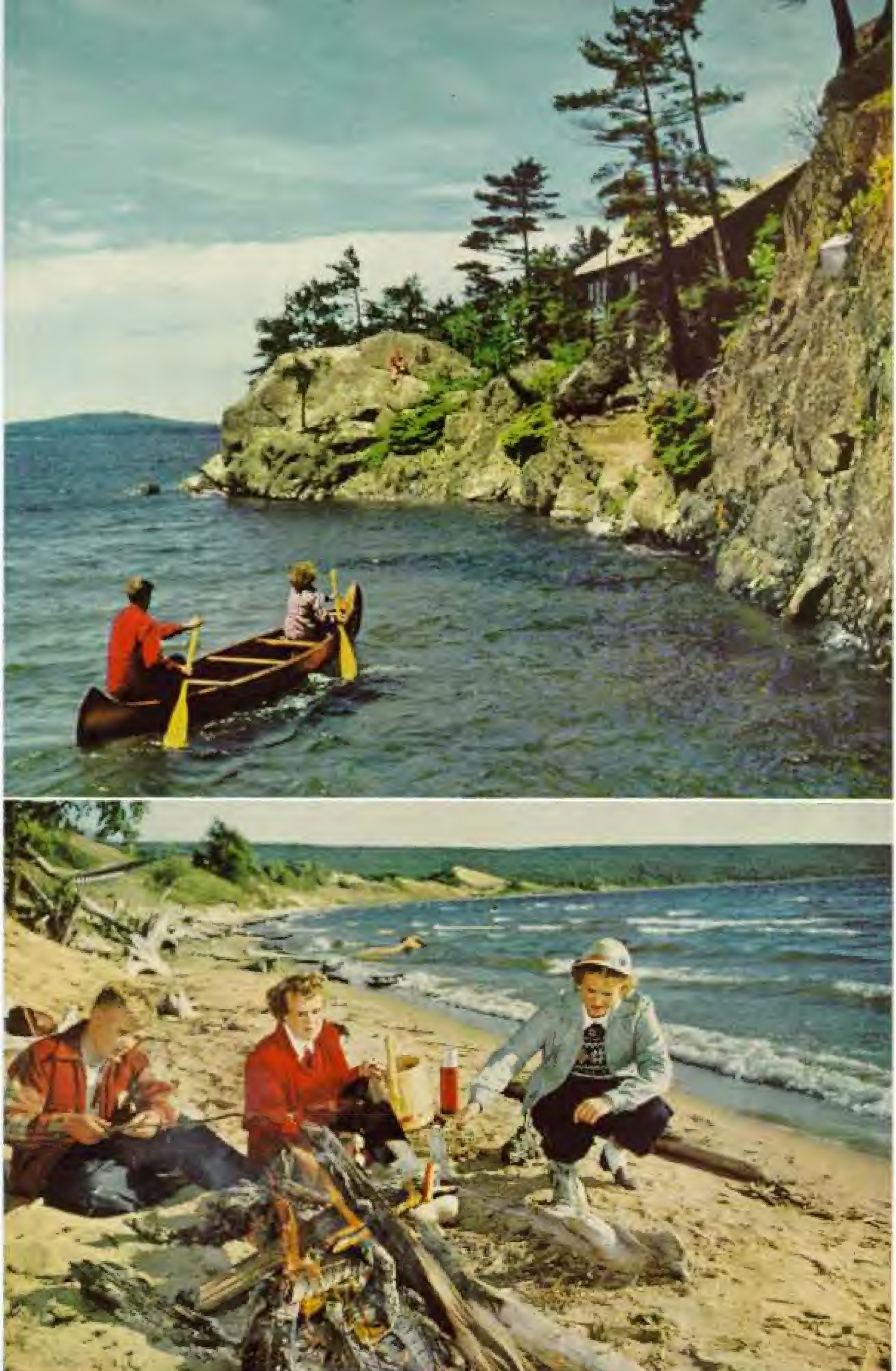
Each vacation time, campers flock to Michigan's State parks by the thousands. They pay a small charge for a trailer or tent site, which they may occupy not more than 15 days. Higgins Lake borders such a State park. Its water has a glasslike clarity.

Upper Peninsula's Huck and Tom Fish from a Homemade Raft

Some Michigan clubs set aside fishing ponds and streams exclusively for children. Especially in the water-laced north, the State gives youngsters wonderful opportunities to dangle a worm or flip a fly. These boys play on Plumbago Creek pond at Alberta.

A Great Lakes Carrier Hauls 14,000 Tons of Iron Ore Down St. Marys River to Speed the Nation's Remobilization

Back and forth along this life line of liberty steams approximately 100 ore ships moving 70-80 million tons a year. This 600-foot vessel can load in three-and-a-half hours and discharge in six. Below: Lake of the Clouds is a jewel of the Upper Peninsula's Porcupine Mountains.



Kodachrome by Andreas H. Bresse

Lake Superior Waves Carved the Helmeted Giant; Sunset Gilds the Pictured Rocks

◂ Frankfurters roast on the Keweenaw shore of Hiawatha's Big-Sea-Water (Superior). Above: Young canoeists head for a pine-studded cabin on Middle Island Point, a scenic setting for summer camps.

S. S. *Altadoc*, Running Ashore, Has Stayed on Land 25 Years

A Lake Superior blizzard wrecked this Canadian grain ship on the night of December 7, 1927. All hands escaped as the vessel split in two on rocky Keweenaw Point.

In 1928 salvagers took away *Altadoc's* machinery. At the same time they cut the superstructure free and carried it to Copper Harbor. There it became the headquarters of Pilot House Resort, a tourist court. Karl Christensen, the owner, here standing on the bridge, lives in the cabin.

Each year ice in harbors and the Sault Ste. Marie locks closes navigation on Lake Superior, usually from early December to mid-April. Early winter storms, raising seas worthy of oceans, used to take heavy toll of ships. Hazards are lessened now by improved navigation aids.

If a ship does get in trouble, she should find rescuers close at hand. The author, standing on a mountain, counted 17 vessels rounding Keweenaw Peninsula at one time. One of these carriers is another *Altadoc*, the wrecked ship's namesake.

Tahquamenon Falls Tumbles 40 Feet in Fleecy Foam

Tahquamenon River figures prominently in Longfellow's *The Song of Hiawatha*. Today visitors pass the bank where Hiawatha built his birch-bark canoe; they paddle over the watery grave of Kwasind, Hiawatha's friend, victim of the crafty Pok-Wudjies (envious Little People). The tea-colored water is tinted by decomposing vegetation.

Tahquamenon Falls has been called Michigan's Niagara. Six miles downstream the river drops 43 feet over a series of cascades called Tahquamenon Lower Falls.

Tahquamenon Falls State Park is one of 59 administered by the Department of Conservation. More than a third of Michigan's wild land lies within 22 State and three national forests. Both produce controlled yields of lumber and pulpwood.

In the old logging days the Tahquamenon River floated out millions of feet of pine; it still drains important lumbering areas. Most of today's logs, however, travel to sawmills by truck.

Detroit's Children's Zoo Encourages Youngsters to Make Friends of Animals

Children's Zoo sits on Belle Isle, 985-acre playground in the Detroit River. Pleasant Sundays lure Detroiters to the island by the thousands. Three times a day zoo attendants take small, friendly beasts to the sawdust ring for children to pet. Cries of delight and wails of frustration greet the animals, depending on their cooperation. Above: Samson and Delilah, the raccoons, patiently endure manhandling. Robert, a hooded rat, cuddles in a girl's arms, but Becky, a Barbados lamb, tugs to escape the boy's grip. Murgatroyd, an 18-year-old African leopard tortoise, offers no hazard, being a vegetarian. Below: Lambs enjoy the bottle hour.

local radio outlet is Station W-E-L-L, Battle Creek.

The story goes back to 1855, when the Seventh-day Adventist Church moved headquarters from Rochester, New York, to Battle Creek. (Later it shifted permanently to Washington, D. C.)

The Adventists, in their teachings, stressed temperance and health reforms; local roughnecks, sneering at them as fanatics, called them "Gizzardites."

Cereal Success Story

John Harvey Kellogg, a year out of medical school, took charge in 1876 of the Adventists' Western Health Reform Institute, promptly renamed Battle Creek Sanitarium. Kellogg not only made the sanitarium world-famous but found time to invent useful medical and surgical appliances, develop the electric-light treatment, and experiment with novel diets.

The machines and methods for food processing developed by the Kellogg brothers founded modern dry-cereal and nut-food manufacture.

A young salesman and farm machinery builder, C. W. Post, benefited from treatment at the Battle Creek Sanitarium. His La Vita Inn, opening in the city in 1891, catered to people in delicate health. Post's warm cereal drink, Postum, was phenomenally popular. A line of breakfast foods followed.

Post's mushrooming factories were models of cleanliness and sanitation; he subsidized homes for employees. Post was among the first to exploit advertising on the grand scale: his annual promotional budget reached a million dollars. Post cereals swept to success; C. W. Post became a multimillionaire.

W. K. Kellogg, John Harvey's brother, meanwhile built up the Kellogg Company dry cereal firm, starting with Kellogg's Corn Flakes, then and now the largest-selling of all ready-to-eat cereals. So the Kellogg Company achieved world leadership in the field.

In 1930 the W. K. Kellogg Foundation was established at Battle Creek to promote health, education, and welfare through programs undertaken in many countries. By late 1951 the Foundation's outlay for good works totaled $36,000,000.

Today in Battle Creek a nutty-sweet aroma tickles visitors' nostrils. It's the pleasant exhalation from factories of the Kellogg Company and the Post Products Division of General Foods Corporation. In output of prepared breakfast foods, Battle Creek leads the Nation.

West of Battle Creek my route led to Kalamazoo, whose Indian-derived name intrigues poets and songwriters.

"Kalamazoo is a city surrounded by celery, bulbs, and pansies where the people, lots of them Dutchmen, keep out of trouble making pills, paper, fruit pitters, guitars, and oil of peppermint," a Michigan friend briefed me.

His analysis, though far from complete, hit high spots of the truth. Mucklands ringing the city support vast plantings of celery. In spring these fields are banded with pansies in bloom, the flowers a rotation crop yielding extra income to the farmer.

Kalamazoo is a cornucopia of paper products. Eight paper mills rolled out more than 460,000 tons of paper in 1950 in a wide variety of finished forms, from boxes and cartons to printing papers, labels, wrappers, and food protective papers.

Sixty-seven years ago the Upjohn Company was founded in a Kalamazoo basement to make patented pills. Now a giant in the pharmaceutical field, Upjohn makes more than 700 different products in its new Portage plant six miles from downtown Kalamazoo. Vitamins, hormones, antibiotics, and a variety of powders and ointments are produced in incredible volume (page 298).

Berryin' in Berrien

Driving west and south from Kalamazoo, I plunged into fruit-growing country, striped and checkered with peach, apple, plum, pear, and cherry orchards. Berrien County is one that, in addition to these tree crops, grows highbush blueberries.

"So in the summer," as a local wag put it, "we go berryin' in Berrien!"

At the plant of Simplicity Pattern Company, Inc., in Niles, vice president Henry A. Herzig showed me through the world's largest ladies' dress-pattern firm, essentially a vast photoengraving and printing shop. Ten presses were making 2,000 impressions every hour on tissue fabricated in the same plant.

Pattern use is growing at weed-speed. American home sewers in a recent year bought an estimated 105 *million* patterns, which was more than twice the number they bought in 1939. Sixty million were Simplicity patterns.

In shady, restful Dowagiac, typical of Michigan's pleasant smaller cities, my cameras' flash equipment failed. My outfit was utterly strange to the electrician in a local radio repair shop. Yet—praise be to small-town artisans—in 15 minutes it was fixed!

Pride in workmanship likewise was a keynote at James Heddon's Sons fishing-tackle plant in Dowagiac. Heddon's makes beautifully finished bamboo and glass fishing rods and a kaleidoscopic array of fishing plugs and baits. Heddon's was the first tackle maker to market an artificial plug, in 1898.

Many years ago, founder James Heddon tossed a whittled piece of wood into Dowagiac

National Geographic Photographer B. Anthony Stewart

Guns or Butter? Pleasure Cars or Tanks? Michigan Makes Them All

Rearming, the free world turns to the motor State, as in World War II. Continental Motors assembles these air-cooled engines in Muskegon (page 302). They go into 41-ton Patton medium tanks, one answer to Russia's 57-ton Stalin III. Their 810 "horses" exceed earlier models by 300. One lever controls both steering and automatic transmission. So simple is the Patton that two minutes' briefing enabled an Army stenographer to drive one. The U. S. Army last December announced the T-43, a new heavy tank with a 120-mm. gun.

Creek. When a bass smashed at it, Jim rubbed his head in thought. Result was a popular surface lure, "Old 210," and the rapid growth of James Heddon's Sons. Heddon's "Dowagiac Minnow" made the town's name familiar to fishermen.

Across the State from Dowagiac I visited the old schooner, *J. T. Wing*, berthed in a filled channel on Belle Isle in the Detroit River.

Built in Nova Scotia for the coastal trade, the *Wing* later hauled lumber on the Great Lakes. Today, its sailing days past, the earthbound vessel is still at work as a Museum of Great Lakes History. Capt. Joseph E. Johnston, in charge of the ship, showed me its displays of photographs, ship models, and silhouettes that tell the story of Great Lakes shipping from Indian canoe to steel-plated cargo carrier.

Later, through the standing rigging of the *Wing's* tall masts, we watched the endless procession of ships on the Detroit River.

"One of them goes by every 17 minutes, on the average," said Captain Johnston. He nodded toward a passing ore boat. "They'll never match sail for looks or thrills, but for the heavy hauling that builds our world—well, what would we do without 'em?"

My travels only sketched in the varied resources of this great State. Inescapable, however, were its generous gifts to the Nation: industries of amazing diversity and yield, climate healthful and invigorating, scenic areas unexcelled for rest and recreation. Mighty and enticing is Michigan.

White Magic in the Belgian Congo

Tribesmen Mine Uranium, Run Machines, Study Modern Medicine as Booming Trade Opens Up the Vast Colony's Resources

By W. Robert Moore

With Illustrations from Photographs by the Author

THE BELGIAN Congo today affords vivid proof that "darkest" Africa is becoming very bright indeed.

In this equatorial colony, noisy compressed-air drills, chiseling holes in rich ore deposits or probing cliff walls on new hydroelectric dam projects, beat a more persistent tattoo than do native tom-toms.

Engineers, chemists, biologists, and physicians are making stranger magic here than ever did any tribal witch doctor. And certainly no tribal fetish of wood, bone, or fiber has affected the thought of so many persons as does the uranium ore—raw material of the atom bomb and atomic power—which laborers are digging from mines in the southeastern Province of Katanga.

On the day the Pan American Airways Constellation landed me in Léopoldville, capital of the Belgian Congo, I bumped immediately into one of the colony's big problems. My cable asking for reservations hadn't arrived, and not one of the half-dozen hotels had a single unbooked room! Fortunately, an acquaintance generously came to my rescue.

Mineral Wealth Brings Rapid Expansion

I was to find the crowding of Léopoldville's hotels typical of conditions throughout the colony. Building is going on at a rapid rate, but it cannot keep up with expanding needs.

"When I first came to Léopoldville 40 years ago," Governor General Eugène Jungers told me later, "there were only 40 Europeans and 20,000 natives here. Now the city has more than 10,000 Europeans and 200,000 natives. Its population has doubled just since the war."

World War II gave the colony tremendous impetus. Its strategic minerals and other raw materials were vitally needed by the Allied countries. Since the war, its momentum has kept on at an accelerated rate.

Ever-increasing quantities of copper, cobalt, tin, industrial diamonds, and other minerals are being torn from the Congo soil.

Only 75 years ago the whole Congo Basin was virtually unknown land to the Western World. Fired by Dr. David Livingstone's African explorations, Henry M. Stanley spent the years 1876 and 1877 tracing the course of the long, curving Congo River which, unique among the world's big rivers, twice crosses the Equator.* Later Stanley came back to help direct the setting up of the Congo Free State for Leopold II in 1885. The Free State has since become a Belgian colony.

This big colonial child of Belgium embraces most of the Congo Basin and reaches to the headwaters of the Nile—more than halfway across Equatorial Africa. It is 77 times the size of its parent, and larger than all our States east of the Mississippi combined.

To see what goes on here now, I traveled more than 8,000 miles by river boat, automobile, and plane (map, page 324).

I saw steamy, tropical bush, but I also traveled through wide regions of upland plateau, ranging from 3,500 feet to 7,000 feet altitude, where the equatorial sun is robbed of its sting and where colonists raise wheat, coffee, cinchona (source of quinine), and pyrethrum, whose blossoms are the base for a potent insecticide.

In the eastern part of the colony rear lofty volcanoes. Here, too, are the perpetual snow peaks of Ruwenzori, the "Mountains of the Moon," towering more than 16,500 feet.

Even in tropical areas, large sections of forests have been slashed away to make space for huge palm-oil plantations. Europeans supervise some 365,000 acres; the Congolese harvest 119,000 acres and also raise coffee and quantities of cotton.

Impressive, too, in the Congo are the efforts the Belgians are making toward the improvement of conditions for the Congolese. Old exploitation days are gone. At mining centers, railway workshops, and in towns, good housing, hospitals, child welfare, and recreational facilities are being provided for these natives.

Scarred Natives Now Skilled Workmen

How big a step forward this has been is best understood when one sees skilled workmen, some so near to their ancestral background that they wear tattoo markings and tribal scars, running bulldozers, operating precision metal lathes, and doing chemical and microscopic tests in medical laboratories.

One of my car drivers had a decorative scar extending vertically from his hairline to the tip of his nose, and two marks on each cheekbone.

* See "Keeping House on the Congo," by Ruth O. McBride, National Geographic Magazine, November, 1937.

"Read All About It!" A French-crying Newsboy Peddles *Le Courrier d'Afrique*

Léopoldville's only "skyscraper," the nine-story air-conditioned Forescom Building, looks down on this scene. *Le Courrier* is an afternoon daily. Magazines and European newspapers are flown in.

Tribal womenfolk, traditionally conservative, now queue up at clinics to receive care for themselves and their babies. In the big hospital in Léopoldville, one of the biggest in Africa, I saw many of them in maternity and surgical wards or waiting in outpatient lines for minor treatment.

In 1950 this hospital alone received nearly 20,000 new cases—three-fourths of them native—and treated more than 560,000 outpatients.

Today medicine is being carried into rural districts by young, intelligent Congolese. At the Ecole d'Assistants Médicaux Indigènes, in Léopoldville, I saw Belgian doctors training eager youths brought in from the Provinces. Students come for a six-year medical course, after which they return to their homes as medical practitioners. Others also are trained as infirmary attendants and maternity aides.

Léopoldville, or Léo, as the Belgians often call it in their passion for abbreviation, is young. It has been the capital only since 1923, when colonial Government offices were moved here from Boma.

New post office and telegraph buildings are under construction, as is a whole new unit for housing the Governor General's offices. Everywhere along its wide business streets and residential avenues new buildings are being erected (pages 328, 344).

Attractive homes are surrounded by lush gardens, and the entire city is half-hidden by luxuriant shade trees.

Private cars, trucks, and taxis, most of them of American make, crowd the thoroughfares. But drivers watch signals of ebony police directing traffic at intersections, keep an eye out for bicyclists, and maintain courtesy at the city's circles and triangles.

To avoid midday heat and to cater to their own comfort, many businessmen and Government officials go to work early and close up shop between 12 and 2 o'clock, as in many Spanish-speaking countries.

Hotels and restaurants lend a continental flavor to the town by spreading tables on the sidewalks at sunset apéritif time.

The pleasant evening oasis on the sidewalk in front of my hotel was made even more interesting by the rows of dusky Islamic traders, garbed in white gowns and fezzes, who spread out tempting displays of ivory statuettes, ebony heads, and snakeskin or crocodile-leather handbags.

Yes, I bought ivory after long bargaining!

Skilled with His Chisels, Lufwa André Carved "The Boy with the Calabash"

Missionaries train this young sculptor at a Catholic school in Léopoldville. He has produced several striking wood figures. The author found him molding a clay crocodile for casting in bronze as a fountain decoration.

Léopoldville, like other centers throughout the Congo, is really two separate towns—one European, one Congolese.

Thousands of the Congolese work in the European section during the day, but return to their own quarters at night.

Building in this native section, as in the European, has difficulty keeping pace with increasing population. Here new housing units are going up by hundreds, new markets are being opened, and other improvements being made. There is even a new stadium, to seat 75,000 persons, under construction within an extensive recreation center.

Cascades Block River Traffic at Léo

Industries in Léo are growing, but the city is essentially a distributing center, and much of its business is connected with transportation, both by river and by rail.

Although Léopoldville's water front is lined with docks and boatbuilding and repair yards, the town is no seaport. It lies some 320 miles from the ocean.

By an odd twist of geography, the more than 8,000 miles of navigable waters of the Congo and its tributaries end abruptly at Léopoldville.

Geological ages ago the Crystal Mountains were thrust up between the main portion of the river basin and the coast; the river has had to cut a tortuous path through these hills to the sea. In more than 200 twisting miles between Léopoldville and Matadi, main port for ocean-calling steamers, the river drops some 850 feet over a series of cascades and seething rapids.

All freight moving in and out of Léopoldville has to be transported around this "river block" by rail.

When the Crystal Mountains first reared their bulk to bar the river, they helped create a wide inland lake in the region where Léopoldville now stands. Wide, sandy flats and marshes attest to that fact, as does the widened spread of the river, called Stanley Pool.

In its broadest part, Stanley Pool is some 17 miles wide, but a big island lies in its center. Léopoldville sprawls on a low, sandy bluff at the lower (or western) end of the Pool, just above the first of the rapids.

Within sight on the opposite bank, and only a few minutes distant by launch, is Brazzaville, capital of French Equatorial Africa.

A few days before I left Léopoldville on my circuit around the Congo, I rode out to

Belgium and 76 Countries Like It Could Be Fitted into Its Congo Colony

Sprawling across the Equator, the territory embraces most of the Congo River Basin. Huge deposits of copper, cobalt, and uranium lie in Katanga Province. Industrial diamonds come from Kasai.

Zongo Falls, some 50 road miles southwest of the city, where the Vice-Governor General was dedicating a new hydroelectric project.

Zongo Falls to Generate Power

Because of the capital's rapid growth, its present electrical facilities already are inadequate. Zongo will furnish an additional 42,000 kilowatts (enough to serve an average American city of about 100,000 people) when the project is completed in 1954.

At Zongo the brown torrent of the Inkisi River makes a spectacular 197-foot plunge into a gorge just a few miles before joining the Congo.

Here engineers are to erect a 33-foot-high barrier across the river a short distance above the falls, drill an intake tunnel straight through more than 2,100 feet of rocky hill, and set their generators in a bend in the deep valley below.

"What do you do when you are not pondering the multitude of problems this task will involve?" I asked a Swiss engineer.

"Read the National Geographic Magazine," he replied with a grin.

Several friends emphasized that my trip through the Belgian Congo would not be complete unless I really saw the Congo River. So I bought a ticket on one of the river boats, the *Reine Astrid*, bound for Stanleyville, more than 1,000 miles upstream (page 353). Eleven

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Shoppers Prop Their Bicycles Against the Pillars of an Elisabethville Arcade

Cycles are almost as thick as they are in Europe; the ambition of many an African is to own one. Automobiles are equally popular; most come from the United States. Cophaco (right) identifies a drugstore chain.

days and 14 woodpiles later we were due to arrive.

Because the hungry wood burners are fast depleting accessible fuel supplies, the river transport company, Otraco, is turning to Diesels. Their newer Léo-Stanleyville passenger boat, the *Général Olsen*, has screw propellers and burns oil (page 332). The company also has purchased several surplus United States landing craft and is converting them to push freight barges up and down the rivers.

The *Reine Astrid* carried only three European officers, the captain, first officer, and steward, whose families also were aboard. The rest of the crew was Congolese.

This old triple-decked stern-wheeler had interesting travel habits. Primarily a day-light traveler, she seemed governed mainly by her "power hunger." She had to get to a woodpile at night, however late or dark it might be!

Fantastic Appetite for Firewood

Astrid's boilers burned seven *stères* (approximately two cords) of wood an hour. When she stopped at a woodpile, men filled the hold and piled the lower deck with seemingly fantastic quantities of firewood.

At full speed in still water, the *Astrid* could splash along at 10 miles an hour, but her actual upstream progress depended upon the

current—varying from one to five miles an hour—against which she was running.

Two crewmen with sounding poles sat on either side of the bow to warn of shallows.

"How can they tell deep water from shallow in such a muddy current?" I asked the first officer, after having watched the polemen take soundings only part of the time.

"By the sound of the 'mustache,'" was his answer.

"The mustache?"

"Yes, the cleavage of the water at the bow," he explained. "Its noise over deep water is different from the sound it makes when we cross shallows."

We bumped sand bars only twice.

Shortly after leaving Léopoldville we passed between bluffs, some of which Stanley once facetiously called the "Cliffs of Dover." Farther upstream the land levels out. For much of the journey until we neared Stanleyville we saw only water and the thick jungle along the river's edge.

In places the river spreads to a width of 10 to 15 miles, but the course is so strewn with jungle-covered islands that one seldom is aware of its full width. Indeed, even with a map it is difficult to tell where large tributaries enter the main stream.

Natives Aboard Eat at Woodpile Pauses

We stopped at small towns to discharge and take on passengers and packing cases. At these stops and at woodpile pauses the native passengers and crew made a wild dash to buy food. Afterward the lower deck of the *Reine Astrid* became a clutter of steaming cooking pots and took on the appearance of a native market.

At other villages we reduced speed to unload and pick up packages and mail. People in dugouts hovered in midstream awaiting our approach and then raced alongside to clutch the gunwales. Other boatmen also made flying tackles at the *Astrid* to sell smoked fish, chickens, and fruit. Some villagers brought out clay pots and charcoal braziers.

Two days upstream from Léopoldville we stopped for the night at Bolobo, where there are a mission station and a few business concerns. Ivory carvers here did a lively trade selling their output to European passengers. Prices for upstream travelers, I was told, are cheaper than for those going downstream to Léopoldville.

Until we reached the junction of the Ubangi River we rode the boundary between French Equatorial Africa and the Belgian Congo. Beyond there, the river forms a huge scimitar-like curve within the heart of Belgian territory.

At the trim town of Coquilhatville we crossed the Equator. A heavy thunderstorm, common to the Congo Basin, was brewing. Wind blew and lightning rent the black massed clouds; then it began to pour. Even though we were on the Equator, the weather quickly turned cool.

Sometimes the winds of these tropical storms reach tornado violence, forcing the top-heavy, shallow-draft boats to seek quick shelter in the lee of the forest-covered bank.

Both Lisala and Bumba, farther upriver, are small but important towns. Bumba, particularly, has a thriving trade, as it is an outlet to the river, railway, and road system that taps the wide region of the northeast Congo. From this district come cotton, ebony and other woods, palm oil and palm kernels, copal, and other products.

Science Improves the Congo

A little more than 100 miles short of Stanleyville is Yangambi, one of the most important spots in the Belgian Congo, for here is the headquarters of Ineac—the Institut National pour l'Étude Agronomique du Congo Belge.

Ineac's scientists coordinate practically all of the biological research carried on in the colony. Whether it be the development or selection of coffee, rubber, cinchona, or palm-oil trees for plantation crops, the improvement of cattle, control of pests, the betterment of native foods, learning the results of "soil burning" under the tropical sun, or introduction of such new industries as silk culture, the research workers of Ineac have a hand in trying to find the right answers.

Ineac has a research station of thousands of acres centered at Yangambi, but much of its work is conducted elsewhere. Its field stations are scattered throughout the colony.

Stanleyville comes close to being in the center of Africa, but anyone who pictures it as a lonely colonial outpost is due for a surprise when he sees it.

Gleaming shops and pleasant, frequently luxurious, homes perch on gardenlike banks of the river just below the lower of the seven cataracts that block transportation on the upper Congo. More than 2,500 Europeans and 40,000 Congolese live here.

I saw bulldozers cutting new residential streets; carpenters, bricklayers, and stonemasons were building homes and offices.

Termite Hills Form Golf Hazards

Seat of government for the large Oriental Province, Stanleyville also is distributing center for much of the eastern portion of the colony.

Numerous trucks bring in produce and carry away supplies for distant towns. Across

Kodachrome by W. Robert Moore

A Mangbettu Chief Winks at His Sister and Starts the Dance in Paulis

He in striped loincloth, she in plumed headdress, these two led the night dance to the beat of tom-toms. Holding shield and spear, the girl made frenzied charges at an imaginary enemy.

Shoppers Throng Léopoldville's Native Market

The Congo capital's 200,000-odd Africans do not live in the European quarter; they have a section of their own, complete with hospitals, schools, sports arena, movies, and markets.

Natives may work in the European quarter by day, but by night they must go home unless duties detain them. Similarly, Europeans are forbidden to linger within the native section after dark.

The Belgian Congo Government is building extensive new housing units for natives and is laying out a second large market place.

This sanitary shopping center was erected in 1934 exclusively for native residents.

Vegetable and fruit dealers, displaying their wares on mats and dishes, congregate in the open area. Butchers, fish dealers, and other merchants occupy covered stalls.

Bicycle and Loud-speaker Adorn a Textile Pattern

→ Utexléo, short for Usines Textiles de Léopoldville, is central Africa's most important cotton mill, weaving native fibers and training native workers. Catering to the unsophisticated African market, it makes profitable use of bizarre designs, including automobiles, telephones, and lettered mottoes.

When six-cylinder cars were introduced into the Congo, cotton-print artists ornamented fabrics with spark plugs, and wearers became known as six-spark-plug women.

↓ This engraver tools human hands, flowers, and geometrical designs on a copper printing cylinder.

  Kodachromes by W. Robert Moore

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Who'd Ever Guess It? *Kigoma* Came from the Mississippi

One can vision the *Kigoma*, smokestacks erupting, whistles screaming, musicians playing, as her paddles churned American waters overhung with Spanish moss. Romantic she may have been, but swifter carriers stole away her passengers. Years ago she was taken apart and shipped to the Belgian Congo. Reassembled and renamed, she took a new lease on life, steaming the 1,075 miles between Léopoldville and Stanleyville.

Lately, progress caught up with *Kigoma* a second time. An oil-burning, screw-propeller passenger ship joined the Léopoldville-Stanleyville run (page 332), and the wood-eating stern-wheeled *Kigoma* retired from service.

Here she stands at the Léopoldville docks, her decks still stacked with cordwood because rookie crews use her as a training ship.

In recent years a few war-time landing craft have been converted to push freight barges, but mostly paddle-driven craft do duty on the more than 8,000 navigable miles of the Congo and its tributaries (page 333). No vessel, however, ventures below Léopoldville, where rapids block all shipping.

Imported materials on this pier came by flatcar from Matadi, 230 railroad miles away on the lower Congo. Railroad ties on the right are stacked for river shipment to the interior. They are steel, if wooden ties were laid, Africa's voracious termites would devour them quickly.

Crane and stevedores, busily shuttling cargo, suggest the tempo of the Congo's growth. Not the bush villages' posts, thatch, and lianas, but steel, copper, and concrete build Africa's modern cities.

Kodachrome by W. Robert Moore

Général Olsen and Mirrored Image Cleave the Broad and Placid Congo. Passengers Line the Rails

Oil-burning, propeller-driven *Olsen* makes the 1,075-mile Léopoldville-Stanleyville run in nine days, two less than the wood-burning, paddle-pushed *Reine Astrid* (opposite). In places the island-dotted Congo stretches 15 miles from shore to shore.

Kodachrome by W. Robert Moore

Reine Astrid Ties Up to Shore to Load Firewood

On her 11-day run from Léopoldville to Stanleyville, the old-fashioned stern-wheeler makes 14 stops at woodpiles. Her boilers, their appetites never satisfied, burn about two cords an hour, and in calm water they push her upstream at 10 miles an hour. Each evening, and sometimes by day, the wood crew scrambles ashore on gangplanks. With whoops, chants, and prodigious heaves, they load the foredeck high.

Astrid stays at her mooring overnight; by dawn she breasts the current again. She carries three European officers.

Though airplanes woo many passengers, river boats still haul the heavy freight. This tow craft drags two laden barges.

No Auto Taxes, No Traffic Jams. A River Man Can Scoop His Dugout from a Tree and Park It Anywhere

Back of this clearing stands the primeval African forest. *Chop! chop! chop!* go the axes all day, not for furniture's hardwoods but for Congo steamers' boilers. A wider view would show a huge pile of firewood.

Congo's Palm Nuts Yield Food-rich Oil for Cooking and Export

Margarines, soaps, and cooking fats come from the *Elaeis* palm, whose fruit is harvested both in jungles and on plantations. Its nuts ripen in huge clusters (left), some weighing 50 pounds. Pulpy portions give up the orange-red oil sold in local markets, to which buyers bring their own bottles (below). Dried inner kernels generally go abroad for refining.

Wagenia Wives Wash Clothes, Pots, and Bodies in the Congo Rapids; Boys Anchor Basketlike Fish Traps

Virtually living in the water, the Wagenias are a healthy, carefree people. Neither women nor men wear more clothing than they have to. Since time immemorial the tribe has caught fish in Stanleyville's seventh cataract. Daring crews of canoemen drive forests of scaffolding into the rocks and, using lianas, lash wide-mouthed traps to the poles. Paddlers daily visit the cataract to see what luck the current has brought.

Kodachrome by W. Robert Moore

Giant Gorillas Make These Dead Volcanoes Their Lofty Homes

From Lake Kivu to Uganda stretch the Virunga peaks, a chain of volcanoes, some extinct, others alive. Tallest are the sister cones, 14,556-foot Mikeno (left) and 14,787-foot Karisimbi. There in dense bamboo groves gorillas roam.

Prey of hunters, the giant apes were threatened with extinction until Carl Akeley, American sculptor-naturalist-explorer, persuaded the Belgian Government to set aside a reserve for them. Albert National Park, an extensive sanctuary for many wild types, is in a sense Akeley's memorial. Actually he lies beneath a simple slab on Mikeno, where he died of a fever in 1926.

Ankole Cattle Spread Lyre-shaped Horns

The Ankole cow, or Hima ox, is found in various parts of Africa, sometimes mixed with India's humped zebus, or Brahmans. Is it the survivor of an ancient Egyptian breed? Proof does not exist; but Egyptian monuments depict long-horned cattle strangely like these.

A cow is a rarity in parts of the Congo, but Ruanda-Urundi, the adjacent trusteeship, has a million or more, many owned by the Watusi (page 353).

Ruanda's Watusi king owns a pureblood herd of such beasts. On ceremonial occasions their enormous horns are sand-polished; pearls are strung across their heads, and tails are tufted with colors.

Kodachrome by W. Robert Moore

Africa's "Untamable" Elephants Parade Like Gentled Mustangs. They Love Their Afternoon Splash in the River

Here at Gangala na Bodio the big-eared Congo elephant learns to work like its Indian cousin. Taken young, each is bound to an older elephant, which, irritated by its squirmings, punishes the little one for each tug toward freedom. Only one in this crew requires fetters. Natives did not ride elephants until Europeans taught them.

A Brick-red Slash in Ruanda's Green Mountains Yields Black Cassiterite, 76 Percent Pure Tin

Here at Rutongo thousands of Bahutu tribesmen labor under Belgian engineers and native foremen. Underground workings swell the output of this open pit. Some shipments go to the United States for smelting with lower-grade Bolivian ore.

Kodachrome by W. Robert Moore

Reduction by W. Robert Moore

Powerful Sprays Wash Away Light Gravels; Heavier Gold Settles in Sluice Boxes

In 1950 the Belgian Congo recovered some $12,000,000 in gold, part of it from an underground digging. This placer gang washes grit hauled in by trucks. Shovel men keep the channel open.

the river, dock facilities are being expanded to handle the volume of trade that goes by railway around the 80-mile river barrier caused by the rapids.

Airlines tie the city to East and South Africa and to Belgium, as well as to towns throughout the colony.

When businessmen tire of office routine, they can always go out and play golf on a nine-hole course. Its hazards are huge grassed-over termite hills. And anyone who slices into the rough really has it rough, for the course is hemmed by lush jungle. But fairways and greens are perpetually fresh with springy grass.

Just outside town is delightful Tshopo Falls, where the Tshopo River leaps madly over a rocky cliff shortly before its waters pour into the Congo.

While the cataract on the main river is less spectacular than Tshopo, it is here that the tribal Wagenia fishermen daringly string their fish traps in the rapids and as daringly paddle their canoes into the rushing water to collect their catch. Across much of the width of the river they have set up a spindle-legged network of poles to which they fasten long funnel-shaped woven traps by means of flexible lianas (pages 336, 337).

Besides these Wagenia, who keep much to themselves and to their dangerous occupation, Stanleyville has an "Arab" settlement, a Negro Moslem remnant of the days when Arab traders and slave raiders roamed central Africa.

From Stanleyville I took off by car to see the northeastern and eastern parts of the country. Our trip started in a tropical rainstorm, but on this first day's drive we covered nearly 300 miles, arriving late at Wamba in another blinding downpour. This route threads heavy bush much of the way, but passes a few plantations of rubber and coffee.

Traffic Jams at River Ferries

At the Lindi River near Bafwasende I experienced the first of the *bacs*, or ferries, in the Congo. When we reached it, I visualized waiting hours. Ahead of us were a dozen or more trucks. Another truck, half off the ferry, was stuck against the incline of the road.

When it finally was freed, my driver immediately drove to the head of the line and went aboard. Passenger cars, I learned, go first, for heavily loaded trucks have a habit of getting into difficulty negotiating the light pontoon ferries (page 356).

Until recently, virtually all rivers in the Congo had to be crossed by these ferries. Since the war, the Government has bought a large number of Bailey bridges to span many of the streams.

From Wamba we drove north to Paulis, in the region of the Mangbettu tribes. The Mangbettu are the people who have long, tapering skulls from head binding in infancy. The custom now is discouraged and is dying out; in only a few outlying villages did I see infants whose heads were bound (p. 346).

The day I called upon the chieftain, I saw his palanquin and eight personal bearers resting outside the local court building, where scores of people were gathered to pay taxes.

The young chief courteously invited us to a dance later that day, then apologized for having to leave immediately for an appointment. I readied my camera to picture him leaving by palanquin, but he dashed away on a bicycle!

That evening, when men started beating hollow log drums and tom-toms, and half-nude villagers began jigging in strange dance steps or excitedly brandishing spears and shields, I soon discovered that old customs of Africa had not entirely vanished (page 327).*

Leaving Paulis, we rode through several coffee and palm-oil plantations, then continued northeast into more open country.

Passing through open bushland, I saw numerous gray earth formations, two or three feet high, shaped like giant mushrooms. Some of these "mushrooms" were multiple-storied and had wide overhanging roofs. They were an unusual type of termite nest.

African Elephants Trained to Work

At Gangala na Bodio we came to a remarkable school—a school for elephants. Here the Government maintains a station for domesticating the big African beasts (page 340).†

When I arrived, the station's annual hunt had just ended. Fourteen young elephants had been added to the herd. In some annual dry-season hunts, as many as 30 or 40 are captured.

The work at Gangala na Bodio belies the old belief that African elephants cannot be trained. Their domestication has been successfully carried on since 1902 after King Leopold II had ordered Commandant Laplume to try to train some for transport service. Traditional example of the use of African elephants was Hannibal's famous march over the Alps.

To capture the elephants, native *chasseurs* on foot, armed with lassos, creep up to a herd.

* See "Curious and Characteristic Customs of Central African Tribes," by E. Torday, National Geographic Magazine, October, 1919.

† See, in the National Geographic Magazine: "Trans-African Safari," by Lawrence Copley Thaw and Margaret Stout Thaw, September, 1938; and "Nature's Most Amazing Mammal," by Edmund Heller, June, 1934.

Booming Léopoldville at Midday Shuts Up Shop and Gets Off the Streets; Nearly Everyone Takes a Siesta

At the colony's tree-shaded capital, the Congo River, backed up by the Crystal Mountains, forms Stanley Pool, the 17-mile-wide lake at upper left (page 323).

An Electric Shovel Gashes the Earth for a Trainload of Copper Ore

To a metals-hungry world, the Congo has contributed nearly 194,000 tons of copper and 6,105 tons of cobalt in a peak year. A large share of the uranium so vital to the free nations comes from the carefully guarded Shinkolobwe mine at Katanga.

The author hoped to bring back a single picture illustrative of the mining boom, perhaps a mountain of ore crawling with thousands of miners. He was surprised to find vast open pits attended only by a few skilled hands. Powerful American machines did the work of men.

Electricity runs this digging, the Ruwe pit near Kolwezi, Katanga Province. Shovels, locomotives, and ore-washing plant all depend on power tapped from cascading rivers.

Ruwe, strangely, began as a gold mine. After 30 years a huge and unsuspected deposit of copper oxide came to light. To bring the ore within reach, shovel operators removed 12 million cubic yards of overburden, some of it 165 feet thick. That task required nine years.

Other mines near by yield cobalt as well as copper. Ores go to Jadotville for electrolytic refining.

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Mangbettu Fashion Decrees Long Heads, Twisty Hair-dos, and Facial Scars

Belgian administrators frown on binding baby's head to elongate the skull. The ancient custom is dying out.

single out a young beast, and dash after it to rope its legs. Once it is lassoed, the men snub the ropes around trees to prevent its escape. In the melee of the stampede, the mother or other adults sometimes attack and have to be shot.

Captured animals are tied to tame monitor elephants to keep them in control. Kept with these monitors, they are systematically trained for 10 to 12 months. They become as obedient and intelligent as are Indian elephants. I saw young elephants, captured only a month before, already responding to their schooling; they were begging sugar cane and manioc root from their *cornacs*, or mahouts.

Best time for visitors, and for the elephants themselves, is morning and evening when the herd shuffles down to the river to bathe.

White Rhinos Roam Northeast Congo

From near Gangala na Bodio and extending northeastward to the Sudanese border, the Government has created a reserve, the Garamba National Park, embracing more than 1,235,000 acres.

In this bush and open grassland wander herds of elephants, giraffes, numerous kinds of antelopes, including the giant eland, and both black and white rhinoceroses. Here is one of the few places in Africa where white rhinos can be found.

While visiting Garamba, I called at the camp of a group of Belgian scientists who were making a survey of its insect and animal life. In traps and in specimen containers I saw thousands of different kinds of insects, large and small. The men also had collected snakes, fish, crocodile eggs, spiders, beetles, and a multitude of other specimens.

One beetle the scientists showed me has a remarkable means of self-preservation. It makes for itself a mud ball, larger than a baseball, within which it imbeds itself and remains protected even against the fires set by tribesmen in clearing lands of tall grass.

From Garamba I turned south to Watsa, and for more than a week roamed around Watsa and Monghwalu, farther south, visiting numerous gold workings of the Mines d'Or de Kilo-Moto.

Having an extensive concession, this company includes in its operations the simple washing of alluvial gravels along valleys, the use of big power shovels and dredges, and chiseling and blasting gold-bearing quartz from the rocky hills, in both open-cut and underground diggings (pages 342 and 348). Ores are processed in huge ore-crushing plants.

Besides the gleaming bricks of gold from the refinery, I also saw several rare specimens of crystal-shaped formations that have been found as tiny nuggets during nearly 50 years of operation.

Gold production in the Congo has ranged from 300,000 to some 500,000 fine ounces annually during the last 10 years. In 1950 the amount was more than 339,400 fine ounces, representing a value of about $12,000,000. The output of Kilo-Moto's mines accounts for a sizable portion of that amount.

Africa Split by Huge Land Crack

Eastward and southward from this mining district lie scenic rolling uplands, rising to 7,000 feet elevation, where cattle herds pasture and where there is considerable colonial agriculture.

Along the eastern frontier of the Congo, however, the land seems almost to drop from under one's feet. Here one comes to the precipitous edge of the western branch of the Great Rift Valley, one of Africa's outstanding geographical features. The valley floor lies hundreds of feet below sharp escarpment walls.

Actually, this vast land crack begins in Syria and extends through the Jordan Valley, the Red Sea, and much of the length of Africa. Within the portion edging the Belgian Congo lie Lakes Albert, Edward, Kivu, and long, deep Lake Tanganyika.

As we twisted down the escarpment to the port of Kasenye on Lake Albert, it grew hot. This Nile lake lies at an elevation of little more than 2,000 feet.

The lake steamer that calls here, and at Mahagi Port farther north, is operated by the East African Railways and Harbours Administration, which maintains a water-rail link across Uganda and Kenya to Mombasa, on the east coast.*

Lake Albert's waters are well stocked with fish, among them the famous Nile perch (*Lates niloticus*), known to reach the weight of 266¾ pounds. There is also a reported catch of 280 pounds. The reedy south end of Albert, where the Semliki empties from shallow Lake Edward, seethes with crocodiles.

Fabled Land of Pygmies

On our motor trip toward Beni we entered the tropical Ituri Forest. At one spot we temporarily abandoned our car and hiked a narrow jungle trail to visit a group of Pygmy people. In a clearing beneath big trees we found their four-foot-high huts of twigs and leaves.

One by one the tiny, kinky-haired men, women, and children shyly came from the bush. Among them I felt almost like a Gulliver in a jungle Lilliput (page 361).

* See "Britain Tackles the East African Bush," by W. Robert Moore, National Geographic Magazine, March, 1950.

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Driller and Helper Prepare Gold-bearing Quartz Ores for Blasting

The Mines d'Or de Kilo-Moto operates numerous surface holdings. This tunnel near Mongbwalu is its only underground digging. It follows these tilted white veins of quartz, in which Nature has locked up free gold.

Most of these primitive folk, among them several aged adults, were only about four and a half feet tall. A few were taller, indicating some mixture of Bantu blood. Small though they are, the men are bold and skilled hunters, and even will attack elephants. The arrows and spears they use, I was told, often are tipped with poison.

East of Beni, across the Rift Valley, rear the Mountains of the Moon.* For several days I watched Ruwenzori's snow peaks play hide-and-seek in dense clouds and equatorial rainstorms. Finally I succeeded in gaining a view of the snows early one morning, and again one evening when sunset had tinted the glaciers a pale alpine pink. During the storm several lower peaks had been dusted with fresh snow.

In the Rift Valley at the base of Ruwenzori and extending southward across Lake Edward to Lake (Lac) Kivu, is one of the spectacular wild game regions of Africa. Here the Belgian Government has set apart an extensive natural reserve, the Albert National Park.†

Elephants, buffaloes, lions, and numerous kinds of antelopes wander over the countryside. Thousands of hippos congregate in Lake Edward; more thousands bask on the mud banks or blow bubbles in the Rutshuru River.

Some 186 miles long and 12 to 30 miles wide, Albert Park embraces a remarkable variety of physical and climatic conditions. Here are lakes, hot, flat plains, dense jungle, and steep mountain slopes that tilt up to perpetual snows. Near its southern end, too, the earth still is in the making from volcanic lava flows.

* See, in the National Geographic Magazine: "World's Highest Altitudes and First Ascents," by Charles E. Fay, June, 1909; and "Amid the Snow Peaks of the Equator," by A. F. R. Wollaston, March, 1909.

† See "Roaming Africa's Unfenced Zoos," by W. Robert Moore, National Geographic Magazine, March, 1950.

Diamonds! Fashion's Brightest Star and Industry's Hardest Tool

Only diamond will cut diamond, the hardest object known. Tool and drill makers use the stone to work the toughest alloys and rocks. This woman weighs some 500,000 carats a year at Tshikapa (page 360).

Because the park is hemmed between Rift walls and mountains, intrusions and migrations of plants and animals are few. The region thus affords a unique laboratory for the study of plant and animal life. I found it fun simply to watch the animals.

The only commercial activity allowed in the region is fishing in Lake Edward to supply natives with food. Lazy marabou storks have found that they can gain free and easy feeding by hanging about while catches are cleaned; it saves them the trouble of fishing for themselves.

Volcanoes Fume in Lake Kivu District

To me, the Lake Kivu region is one of the most striking spots in all Africa. The vivid blue lake, highest on the Continent of Africa (4,790 feet), lies cupped in green hills and high rolling plateau. Just to the north and east rears a row of eight volcanic peaks.

Two of the volcanoes, Nyamlagira and Nyiragongo (or Tshaninagongo), still breathe fire.* From flower-embroidered, lakeside Kisenyi, where I stayed, Nyiragongo seemed like the Biblical pillar of cloud by day and pillar of fire by night. A large smoke plume rises from its fiery throat, which at night glows red against the sky (page 353).

Several successive lava flows cover the plain at the north end of Kivu. One occurred in 1938 when Nyamlagira erupted, and the other in March, 1948, when three streams of lava burst from vents at the foot of Nyiragongo. These flows still lie in black contorted folds over a broad path that ends in the lake. One section of the lake has been almost completely severed from the main body of water by an older lava flow (page 354).

Giant gorillas live in high bamboo forests on some of the volcanoes. Elephants, buffaloes, leopards, and even lions haunt their slopes to the height of 13,000 feet.

* See "We Keep House on an Active Volcano," by Dr. Jean Verhoogen, National Geographic Magazine, October, 1939.

Highest of these volcanoes, Karisimbi (14,787 feet) and Mikeno (14,556 feet), had their heads whitened with snow when I saw them (page 338).

Motoring eastward along the base of this volcanic chain, we traveled into Ruanda and Urundi. This region was a portion of former German East Africa, which Belgium acquired by mandate after World War I.

Having felt like a giant among the forest Pygmies, I suddenly was to feel small when I met the Watusi tribesmen of Ruanda. Some of the men are seven feet tall.*

These long-legged men are famed for their high jumping. From a running start, they take off in soaring leaps from a low termite nest. They remind one of pole vaulters minus the pole (page 362).

Many of the old customs of this unusual people are now vanishing; yet I did have the opportunity of witnessing one of their wild, colorful dances. Performers leaped and stamped to the jangle of ankle bells and swished their monkey fur and fiber headdresses (pages 352, 353).

Educated by European tutors, the Mwami, or king, of Ruanda, lives in a modern palace at Nyanza and drives about in a shiny new Lincoln automobile. I met him at Usumbura, and also the Mwami of Urundi, who likewise is well-educated and progressive. The latter had an equally new and shiny Cadillac.

High-piled lands of Ruanda and Urundi are green and rich. Driving through the country, we passed terraced farms and saw large herds of colossal-horned cattle grazing on fresh hillside pastures (page 339). Tin and gold mines scar some of the slopes.

To get to Usumbura on the shores of Lake Tanganyika, we again spiraled down the Rift escarpment. From this trim, fast-growing town, it is another steep climb up the Kamanyola escarpment to reach Costermansville, 110 kinking road miles to the northwest.

Tom-toms Control Traffic

Almost as interesting to me as the spectacular views one gains of the Ruzizi River gorge, through which Lake Kivu empties into Lake Tanganyika, is the novel system used to control traffic on the narrow mountain highway. Watchers, stationed at strategic lookouts on the hills, hoist and drop crude semaphore signals and tom-tom on empty oil drums to direct traffic one way at a time.

Few towns can boast a more delightful setting than Costermansville. Much of it sprawls on several fingerlike peninsulas that jut into the southern end of Lake Kivu; the rest perches on surrounding hills.

The climate of Costermansville is as delightful as its setting: its altitude gives it the mildness of a European summer. I met a number of Belgian residents who had not been away from the place for years and saw no reason for vacationing in Europe.

During the war, when military occupation of Belgium left the colony to its own resources, schools for European youngsters were established here to afford full education up to continental university entrance requirements.

The countryside about Costermansville is given over to prosperous agriculture and stock raising. Here are numerous plantations of dark-green cinchona trees, from whose bark, stripped after the trees are cut, quinine is extracted. On these rolling hill lands are large fields of pyrethrum, whose daisylike blossoms are plucked for the insecticide they contain. Native farmers also hoe garden patches on the slopes.

World's Second Deepest Lake

From Costermansville I headed southward by plane for Elisabethville, center of the colony's biggest mining enterprise.

On the way we touched again at Usumbura and flew nearly half the length of Lake Tanganyika to Albertville. Not only is the lake long (400 miles), but it is second only to Lake Baikal in Siberia as the deepest lake on earth. The bottom of the western branch of the Great Rift Valley trench lies more than 4,700 feet beneath Tanganyika's blue surface.

After circling Albertville's modern hilltop church and town and skimming low over its protruding mole, which serves as pier and as a dry dock for lake steamers and barges, our plane came to rest on the lakeside airstrip.

The town is headquarters for the railway and water communications that tie the Tanganyika region with Stanleyville and Lualaba River (or upper Congo) towns. Only a few miles away is one of the two workable coal deposits in the Belgian Congo.

From Albertville we hopped to Manono. A few years ago this was an almost empty spot in an empty semidesert wasteland. Now Manono is a thriving town of fresh gay homes for both Europeans and natives. Its magic has been cassiterite, a tin ore. In it also are small quantities of the rare tantalite ore.

Piles of earth tower like pyramids beside the town, and wide-open cuts yawn where miners are digging out ores. The whole operation, from digging to turning the tin into ingots, is done by efficient mechanization with electrical power. A river has been turned to bring water to the once-thirsty site.

Flying southward from Manono, we saw waterfalls breaking from high cliff walls near

*See "Land of Giants and Pygmies," by Duke Adolphus Frederick of Mecklenburg, National Geographic Magazine, April, 1913.

Elisabethville, a Copper-boom Town, Has Sprung Up from Bare Bushland in 40 Years

Here Africans used to smelt green ore in adobe furnaces to make a crude sort of copper money. Today the site has become the Belgian Congo's second largest city. Elisabethville did not grow helter-skelter like an American gold-rush camp, but followed a planned development, laying out flower beds, shady streets, neat houses, and inviting shops. It boasts theaters, swimming pools, fashionable clubs, daily newspapers, dial telephones, college, and zoo. Copper, the source of all this prosperity, advertises its presence with a smelter's huge pile of slag and giant smokestack. Above, the Grand Hotel; below, the Post and Telegraph Building (left).

Ankle Bells Tinkle, Fiber Plumes Fly as Leaping, Stamping Ruanda Dancers Make a Pretended Charge

In fun rather than anger, the warriors charge with sticks instead of spears. They perform for a Watusi chieftain north of Lake Kivu. No one who saw *King Solomon's Mines* at the movies can ever forget the tall Watusi, Africa's high jumpers (opposite).

A Seven-foot Watusi Aristocrat Directs the Labor of Humbler Bantus

The Watusi, one of the Bahima tribes, represent an original Caucasian stock now mixed with dark-skinned peoples. Some of them bear such a striking resemblance to figures on Egyptian monuments that travelers wonder if they did not come out of ancient Egypt, together with their cattle (page 339). Becoming kings wherever they settle, the Watusi delegate hard work to their servants. They subjugated Ruanda's Bantus several centuries ago. Below: The slender, white-gowned Watusi supervises a construction near Nyiragongo, an active volcano (background). Seen in close-up (right), he smokes a pipe, wears sneakers, but dresses his hair in the old-fashioned way.

Kodachromes by W. Robert Moore

A River of Lava Lies Frozen in Its Tracks Close to Lake Kivu

Earth's primeval volcanic processes stand out in raw simplicity in the Kivu region. Small craters pock the countryside; lava covers an entire plain. Six volcanoes stand as towering monuments to their own dead fires (page 338), but two remain alive and smoking.

Nyiragongo spreads plumes of vapor across the Kivu plain (page 353). As recently as 1948 it sent lava hissing into Lake Kivu (upper right). Nyamlagira broke loose in January, 1938. Spreading across the plain on a broad front, its lava tumbled into the lake 11 months later and sent up huge clouds of steam. In its wake the molten river left a weird, contorted landscape. Another eruption was reported in 1951.

This scene is surveyed from a road which crosses the field like a causeway. So mineral-rich is the unleached stone that a few flowering plants already have gained foothold.

An earlier flow, extending a long fiery arm, almost succeeded in damming a bay and cutting the lake in two.

Sixty-mile-long Kivu, standing at 4,790 feet, is the loftiest of Africa's major lakes.

Kodachrome by W. Robert Moore

In Plumed Cap and Brass Anklets Stands the Mighty King of the Bakuba

Massive Bope Mahinshe rules a Kasai Province tribe like an autocrat. Popular report says he has 350 wives, some of whom he may never have seen. Here in his high-fenced compound at Mushenge he stands among his courtiers, two of them guarding the royal stool (left). Cowrie shells adorn the regal chest and waist. On ceremonial occasions Bope puts on so many that he requires two hours to dress. Right: Leopard-skin apron and native ax are dance accessories near Tshikapa (page 338).

Kodachromes by W. Robert Moore

Katherine Jr. W. Robert Moore

↑ Crossing by Ferry Is an Adventure

The Congo Government has spanned many streams with war's surplus Bailey bridges, but this Lulua River crossing still depends on its ferry. Though the craft has a motor, it needs a cable's support to prevent drifting. Even as the ferry approaches, women on shore go on using the landing as a laundry.

← Buckets on Heads, Babies on Backs

A few decades ago dry, infertile Katanga Province had few people of its own. Exploitation of rich mineral strikes has made necessary the importation of native labor.

To the African newcomers, the Katanga seems as strange as it does to Europeans. They mix with alien peoples, hear unaccustomed tongues, work regular hours. Many get homesick.

But the Katanga offers one big compensation—the knowledge of where the next meal is coming from. As these women realize, food flows from the commissary's never-failing stocks. Wives of copper miners, they queue up for rations at a company store in Kipushi.

Knife Wielder Stalks Dancer; the Gourd Orchestra Goes Oomph

On weekdays the men are kept busy in the mines; their wives are occupied with cooking and baby tending. Sunday holiday lets loose a carnival of merry-making. Civilization's hard demands retreat; primitive ways return. Drums beat, voices ring, and bodies sway.

Here in the Tshikapa district (page 555) the author saw girls as young as 10 years dancing in a circle. Older women, like some of the gourd blowers below, wore their tribe's blue tattoos on foreheads and cheeks.

Tshikapa is a center of the Congo's diamond-digging industry. Native crews dig away gravel beds and wash them for diamondiferous concentrates. These are sifted later on greased tables, which, discarding trash, enmesh diamonds as flypaper traps insects. To get one carat of diamonds, workers comb almost three tons of earth.

No one has ever found the Congo diamonds' primary deposit, probably a pipe, or vent, left by an ancient volcano in the form of a deep, vertical plug in the ground, as in the Kimberley region. Erosion has washed the original matrix into river beds.

the eastern frontier. To the west spread marshlands and streams that culminate in a chain of lakes, of which Upemba is largest.

There is little about gleaming Elisabethville, or E'ville, to indicate that it ever was a mining camp. In fact, from its inception some 40 years ago the town was carefully planned with wide streets, good shops, and good housing. Today E'ville is the second largest city in the Belgian Congo (page 331).

Elisabethville Capital of Mining Empire

To understand Elisabethville, and indeed to understand the industrial and mining empire that has grown up on this once-isolated plateau of the Katanga, one has to look to the Union Minière du Haut-Katanga.

A branch of the colossal Société Générale de Belgique, the Union Minière holds a huge mining concession covering more than 13,000 square miles.

During the years of its operation, the Union has been responsible for a network of railroads into the region. One line ties with Northern Rhodesia to bring in coal. Two other routes afford access to the Atlantic coast. One line forks westward to Angola; the other twists northwestward for nearly 1,000 miles to reach Port Francqui, on the Kasai River, one of the branches of the Congo.

The Union Minière also has spawned a number of subsidiary companies to furnish electricity, make explosives, mill flour, provide housing, and produce chemicals from the by-products of the mines.

In truth, virtually everything one finds in the Katanga except the bushland, minerals, and the excellent climate has been brought in by the Union. A large majority of the 17,000 white persons and 1,281,000 Congolese in the Province are connected in one way or another with the Union.

Many of the natives were brought here because the countryside formerly was sparsely populated. They have been comfortably housed, given expert medical attention and schools, and the workers trained for their jobs (page 357).

The region contains a fabulous wealth of minerals. Here, besides the vast copper belt, are cobalt, uranium, zinc, manganese, and lesser amounts of other minerals.

The one vivid evidence that E'ville is a copper town is the huge smelter which stands at the edge of the city, a short distance beyond the gay Lido swimming pool. Its colossal chimney and a towering heap of black slag are conspicuous landmarks.

Northeast of the city is the gaping hole of the old Etoile mine, now exhausted.

Biggest mine in the vicinity now is the one at Kipushi, about 18 miles to the southwest. This mine, the Prince Léopold, is notable for two reasons. It is the only one in Katanga in which there is deep underground digging, the others being open cuts. It is also known as the "patriotic" mine.

The ore first was discovered as an outcrop only about 900 yards from the Rhodesian border. For a short distance it sloped down at an angle of 45°; then abruptly, only 200 or 300 yards short of the frontier, it tilted vertically downward to remain entirely within the Belgian Congo—hence the "patriotic" label.

Around Jadotville and Kolwezi the earth gapes with several open cuts where other rich deposits of copper and cobalt are being mined. Here, too, are concentrators, a huge electrolytic separation plant, and flaming furnaces to turn the ores into gleaming metal.

In a peak production year the Union Minière has produced nearly 194,000 tons of copper, together with some 8,600 tons of cobaltiferous alloy and 2,390 tons of granulated cobalt.

Source of Uranium for Atom Bombs

In this same rolling bushland, at Shinkolobwe, is the famous deposit of radioactive pitchblende. Before World War II it was known as a radium mine; now it is one of the major sources from which the United States gets uranium for atom bombs. The Union Minière talks little about the present work at this mine, and the route to it is carefully guarded. Even its name is missing from most Belgian-made maps.

"Only two persons know how the ore is shipped from the Congo," the security administrator told me.

"You and who else?" I asked, jokingly.

"We will skip that one, if you don't mind," he answered.

A few miles from Kolwezi I visited the Zilo Rapids, site on the Lualaba River where a new hydroelectric dam is being installed.

At the time of my visit, workmen had begun pouring cement for the dam, which when completed will form a 216-foot-high block in the gorge. From this dam water will be conveyed to generators by a tunnel which is hewn through more than a mile of solid rock.

I went underground to watch the tunnel being bored. The "Big Jumbo" driller—a framework the size of the tunnel, upon which are mounted 14 air drills—happened to be quiet when I entered. Suddenly the roar of one drill began assaulting my eardrums; then another joined in; then another. When all 14 were working, I no longer recognized the din within the confined tunnel as sound at all, but as a terrific pressure on my ears. It became sound again only when some of the

360 African Film Project

Young Lemba Sees Others as the Photographer Sees Him

Familiar village life looks like high adventure when glimpsed through the view finder. Clothes do not burden youngsters in this equatorial country.

drills stopped and I became aware of individual vibrations.

I was nearly deaf for hours afterward. Only with difficulty did I hear the superintendent explain that the first of the generators will be in operation in 1953 and that the completed installation will yield an output of 90,000 kilowatts.

The genial Belgian engineer who has charge of the tunnel drilling told me he had gained his idea for the Jumbo on a visit to the United States.

Not only here but throughout the mining districts I saw quantities of equipment marked "U. S. A."—huge shovels, generators, mining machinery, and even X-ray equipment in medical laboratories.

From the Katanga I flew to Lulualbourg, capital of Kasai Province, in the south-central Congo. Here again I was due for a surprise. Probably no other town in the colony has mushroomed so fast as Lulualbourg. Virtually all of it has been built up in the last five or ten years. Much of the town is so new it still is unfinished.

The reason for this rapid expansion is the transfer of the provincial capital from Lusambo to here. Banking facilities also have been brought here from Port Francqui.

The Kasai's outstanding resources are diamonds, palm oil, foodstuffs, and people.

Not the least of these is its people, for the majority of the workmen and their families who migrate to the mining districts of Katanga come from the Kasai. The Province supplies cattle, corn, and other food needed in Katanga.

A Million Carats of Diamonds a Month!

The Kasai's own mining interests are notable. There are two diamond-bearing districts, one centered at Tshikapa to the southwest of Luluabourg, and the other at Bakwanga to the east.

For years miners have been combing the valley gravels along the Kasai and feeder streams around Tshikapa for diamonds. Operations here yield some 500,000 to 600,000 carats a year, about half of them gem stones.

Diggings at newer Bakwanga produce about 10,000,000 carats a year! These are mainly industrial diamonds, or bort. Bakwanga's output is expected soon to be boosted to a million carats a month. Large quantities of these industrial diamonds are sent to the United States for use in machine tools, drills, and other cutting equipment (page 549).

The stones at Tshikapa are found in alluvial gravels, but are little worn by stream washing. Apparently they have not moved far from where they originally were deposited.

"Are there no volcanic pipes such as South Africa's Kimberley from which they have come?" I asked a mining official.*

* See "Cities That Gold and Diamonds Built," by W. Robert Moore, National Geographic Magazine, December, 1947.

"There must be," he said, "but that is what you Americans would call your $64 question. Our geologists are searching, but thus far they have found none."

Turning from diamond mining, I motored to Port Francqui and Brabanta to see a huge palm-oil plantation.

On the way I detoured through Mushenge to visit the tribal king of the Bakuba people. Reaching his court, a bamboo and thatch village, we were escorted through several reed fences and outer buildings to a pavilion where we met the king.

A huge, elderly man, he apologized for not having dressed in full ceremonial costume for his photograph (page 355). I could hardly blame him, for his ceremonial outfit is a heavy mass of cowrie shells and beads which requires nearly two hours to put on. When fully dressed, and further burdened with heavy coils of copper around his legs, the king has to be assisted by two attendants to move or sit down.

Pygmies Stand Not Even Shoulder High to the Author's Driver

These Ituri Forest hunters, out for small game, carry poisoned arrows. Using spears, they have attacked elephants (page 347). One wears a castoff coat.

In another courtyard a few of the king's 350 wives were blowing on gourd "musical instruments," while others, carrying animal-tail fly whisks, shuffled in old dance steps.

After having seen some of the Bakuba men running power tools and doing other skilled tasks at the mines in Katanga, it seemed strange to come here and observe the ancient ways of the court.

Palm Plantations Yield Oil for Export

The palm growing and oil extraction that I saw later in Brabanta and elsewhere is one of the important industries in the Congo. The African oil palm tree (genus *Elaeis*) grows in wild abundance throughout the country, but oil production comes mainly from cultivated plantations (page 335).

The oil-bearing fruits of this palm grow in huge clusters, sometimes weighing as much as 50 or more pounds. Individual fruits are about the size of a small plum and have a tough skin, oily fibrous flesh, and a rather hard-shelled nut containing the kernel.

The pulpy portion contains one type of oil (palm oil) which, when freshly extracted, is bright orange-yellow or reddish in color. It is used extensively as cooking oil by the Congolese. One of the excellent native dishes I ate in the Congo was *moamba*, chicken cooked in the oil and served (with a fiery sauce) on rice.

The kernels contain another kind of oil, similar to coconut kernel oil. Most of them are shipped abroad to vegetable-oil companies instead of being processed locally.

Two large corporations and a number of smaller companies grow and process palm oil, producing more than 170,000 tons of palm oil and nearly 113,000 tons of palm kernels a year. Much of it is for export, but some is converted locally into soap and margarine.

Several tanker barges ply the Congo and its

Marion Collins—Rapho-Guillumette

A Tall Watusi Jumper Clears the Bar at Seven Feet Six Inches

Watusi high-jumping originated as an exercise to train warriors. Leapers now perform only at festivals. As they take off from foot-high termite mounds, their jumps cannot be compared against Western records (p. 350).

tributaries, carrying oil in bulk; others have holds and decks piled with 50-gallon drums.

From the Kasai I flew back to Léopoldville, completing my 8,000-mile circuit around the Congo.

Having thus seen much of what the Congo is already doing, I called upon Dr. H. A. A. Cornelis to ask what the colony plans for the future. In addition to being Director General of Economic Affairs, Dr. Cornelis is Director of the Secretariat of a 10-Year Plan for the Economic and Social Development of the Congo.

Dr. Cornelis told me that work is already under way on an extensive program to reduce the cost of transport and to develop electrical power for industrial use, since the colony lacks coal.

Although the Congo has some 69,575 miles of highways, most of them are only dirt roads that cannot stand heavy truck traffic. The plan calls for several arterial routes which will thread the colony from north to south and east to west.

"One of the first tasks being tackled is the road between Matadi and Léopoldville," the Director General said. "Some of the road-building machinery, secured under ECA loan from the United States, has already been unloaded at Matadi; more is on the way."

He explained the concentrated effort being devoted to the study of foods for the natives, to their housing, clothing, hygiene, and education.

"I have been much interested in reading your April, 1951, NATIONAL GEOGRAPHIC article on 'Growing Pains Beset Puerto Rico,'" Dr. Cornelis continued, "for we have many growing pains ourselves, but of a different nature, many of which are being felt in this office."

The great aim of this policy is to develop a systematic combination of mechanization and manpower which will reflect itself in higher wages, increased purchasing power, and better conditions for the Congolese peoples. This in turn will create even greater potentialities for the rapidly growing Congo.

Barbados, Outrider of the Antilles

For 300 Years Fields of Sugar Cane, Rippling in the Trade Winds, Have Been This Caribbean Island's Life

By Charles Allmon

With Illustrations from Photographs by the Author

MORE than 325 years ago the captain of the English supply ship *Olive Blossom* found a small island, shaped somewhat like a pork chop, lying east of the curving archipelago that guards the Caribbean. He erected a cross and claimed the land for his king by scratching on a near-by tree "James K. of E. and This Island." There was none to protest, for nobody at all lived on the verdant isle.

In 1952 this same island—Barbados—is the second most densely populated territory or country in the Americas. Some 210,000 people crowd its 166 square miles—about 1,250 inhabitants to the square mile, as compared with Bermuda's 1,670, Puerto Rico's 645, or 51 for the United States.

Crowded Island a Sugar Bowl

Even this astonishing figure only hints at how crowded Barbados really is. Most of its heavy human load lives crammed together on only about one-fifth of its territory. Much of the remaining four-fifths is devoted to a single business: raising sugar. In Barbados, sugar is king.

Getting acquainted with this 21-mile-long sugar bowl took time. I drove many miles through the countryside to admire the short-lived spectacle of ripening sugar cane. Everywhere vast multitudes of rustling cane arrows quivered in the January trade winds.

At Locust Hall Estate, first of many big plantations I visited, I watched sweating cane cutters, armed with formidable razor-sharp "cane bills," sever stalks from the ground with swift, sure strokes. A second slash decapitates the green top leaves, used to feed animals. A rake of the cane bill down the length of the stalk cleans it off.

Cane cutters prefer to cut with the wind, for the fields are oven-hot and tall cane blocks the breeze. Women follow the reapers and carry the cane to waiting red trucks or, on smaller estates, to mule-drawn carts. Harvesting continues in full swing until about June.

The history of Barbados is the history of sugar growing. "James K. of E. and This Island" apparently was preoccupied with other matters of state, and it was during the reign of his successor that a wealthy London merchant, Sir William Courteen, equipped a colonizing expedition to Barbados. His ship landed in 1627 near the inscribed tree, and there the colonizers founded Jamestown, now called Holetown (map, page 366).

"Little England" Is Proudly British

Under Britain the trim little island has progressed peacefully, for the most part. Unlike most of its neighbors, it has never changed hands. Intensely British, Barbados is proud of its ancestry. Names like Hastings, Yorkshire, St. George, and Bridgetown's Trafalgar Square impart to this "Little England" some of the atmosphere of old England.

Only the name of the island itself implies mixed parentage. It was probably coined by early Portuguese sailors so impressed by the bearded fig trees they found that they called the land "Barbudos"—"beards."

Sugar cultivation began in earnest in 1640. News of the first small yields from a few scattered plantations quickly reached England. Then one of the world's most precious commodities, sugar promised fabulous wealth. Planters envisioned every inch of the island's arable land under cane.

It was the age of slave labor. Shiploads of Negroes were brought to Barbados. Today the island has some 200,000 Negroes; only about 10,000 residents are white, and 150 East Indian.

Windmills Grind No More

In the early days of sugar manufacture, cattle and horses turned the mills. Then came windmills. One planter recently reminisced: "In those days we worked only when there was a breeze. Frequently we had to rouse our labor at midnight, praying the wind would hold. Sometimes the mill sailed for several days while we worked around the clock."

The last windmill ceased grinding in 1946. A few mills still retain their arms, but sails have disappeared. Most of the picturesque mill towers are used for storage.

As I drove through St. George Parish, I passed heavy-laden trucks and mule carts lumbering toward Bulkeley factory, largest of Barbados's 36 sugar factories. At its big receiving platform about 20 vehicles queued up to discharge bulky loads.

I watched a wide-jawed crane swoop up several tons of cane, a full truckload, in a single bite and drop it on a briskly moving

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For State Occasions, "Little England's" Governor Wears Full Dress and Cocked Hat

Sir Alfred Savage, a veteran of 32 years in the Colonial Service, is the 67th Governor of Barbados. Here attended by his aide-de-camp, he leaves Government House, Bridgetown. Swan plumes top his hat (page 377).

conveyor belt. Revolving knives and heavy rollers crushed the stalks, extracting some 95 percent of their juice.

The crushed cane residue, bagasse (or megasse, as the British here term it), was conveyed directly to the furnace as fuel to produce the steam that turns the factory's machinery. It can also be used as fertilizer.

20,000 Tons of Sweetness

Superintendent W. B. Carrington conducted me through the busy establishment. "We hope to turn out about 20,000 long tons of sugar this year," he told me.

Milk of lime and high heat purify the sugar juice. When clarified, it is poured into evaporators and boiled under vacuum until it reaches the syrup stage. Boiled again in vacuum pans, it "grains"—forms sugar crystals.

Centrifuges separate sugar grains from syrup, now "blackstrap molasses," used as cattle feed or for the manufacture of rum.

"Fancy molasses," an important Barbados export, is the best type of table molasses. To make it, syrup goes to inverting tanks instead of vacuum pans. Molasses is shipped in wooden casks, called puncheons, made locally from Canadian wood (page 374).

In 1951 Barbados produced more than 164,000 long tons of raw sugar and over 23,000 long tons of fancy molasses. The British Government, through its Ministry of Food, purchased the entire exportable output of sugar. More than 900,000 gallons of rum were shipped out in 1950 and even more in 1951.

At the British West Indies Central Sugar Cane Breeding Station I tramped through field plots where important laboratory tests are currently being conducted under the direction of G. C. Stevenson, an expert on sugar-cane breeding. "Lanterns," or "towers," enclosed the cane arrows, protecting them from wind-blown pollen. By this method it is possible to produce seedlings from the parentage intended (pages 372, 373).

Experimental work here dates back to 1884. The station began to function in 1932, supported by grants from member colonies. Present results of the long-range program are reflected in greatly increased sugar yields throughout the Caribbean area from varieties of cane bred in Barbados.

George Washington Lived Here

In sugar culture the planters are willing to adopt new methods, but they cling to social patterns of the past. In the suburbs of Bridgetown I saw stately old residences, built in colonial style with large open rooms and wide verandas, that reflected this spirit.

When Winter Grips the North, Barbados Sands Invite Bare Feet and Summer Dress

Bathsheba coast's huge boulders, which tumbled from cliffs long ago, are called "Music Rocks" from the melodious sound made by breakers coursing among them. Swimming is excellent the year round.

At the corner of Chelsea Road and Bay Street stands George Washington House. The famous soldier-statesman lived there for nearly two months with his half-brother Lawrence, who was seeking to regain his health. George was only 19 at the time. He was charmed by the planters' hospitality, but surprised at their luxurious living.

Virginia's future "first farmer" was favorably impressed with the island's careful agriculture. "The very grass that grows amongst their corn," he wrote, "is not Lost but carefully gathered for provender for their Stock."

So intensively is land cultivated in Barbados that it has been called the "island without weeds." Almost literally every square foot of arable land is used, to support the large population.

Weeding has been done so carefully and for so many years that weed seeds are virtually nonexistent except as they arrive from lands outside.

Crops are rotated regularly, and when a field is not sown to sugar, it is quickly turned to producing yams, sweet potatoes, maize, and other staples. By law, each plantation must devote part of its acreage to such food crops.

The fact that the island's thin soil has not been depleted by three centuries of such heavy farming has astonished agriculturists. Non-depletion is due mainly to two factors.

First is the careful use of fertilizer, chemical, animal, and vegetable. Unused portions of the sugar cane, together with fibrous material from food crops, are mulched back into the soil.

Second factor is the island's geological formation, which works to prevent erosion. Most of Barbados, under the thin soil, is covered with coral limestone, nearly 300 feet thick in a few sections and petering to nothing around the edges.

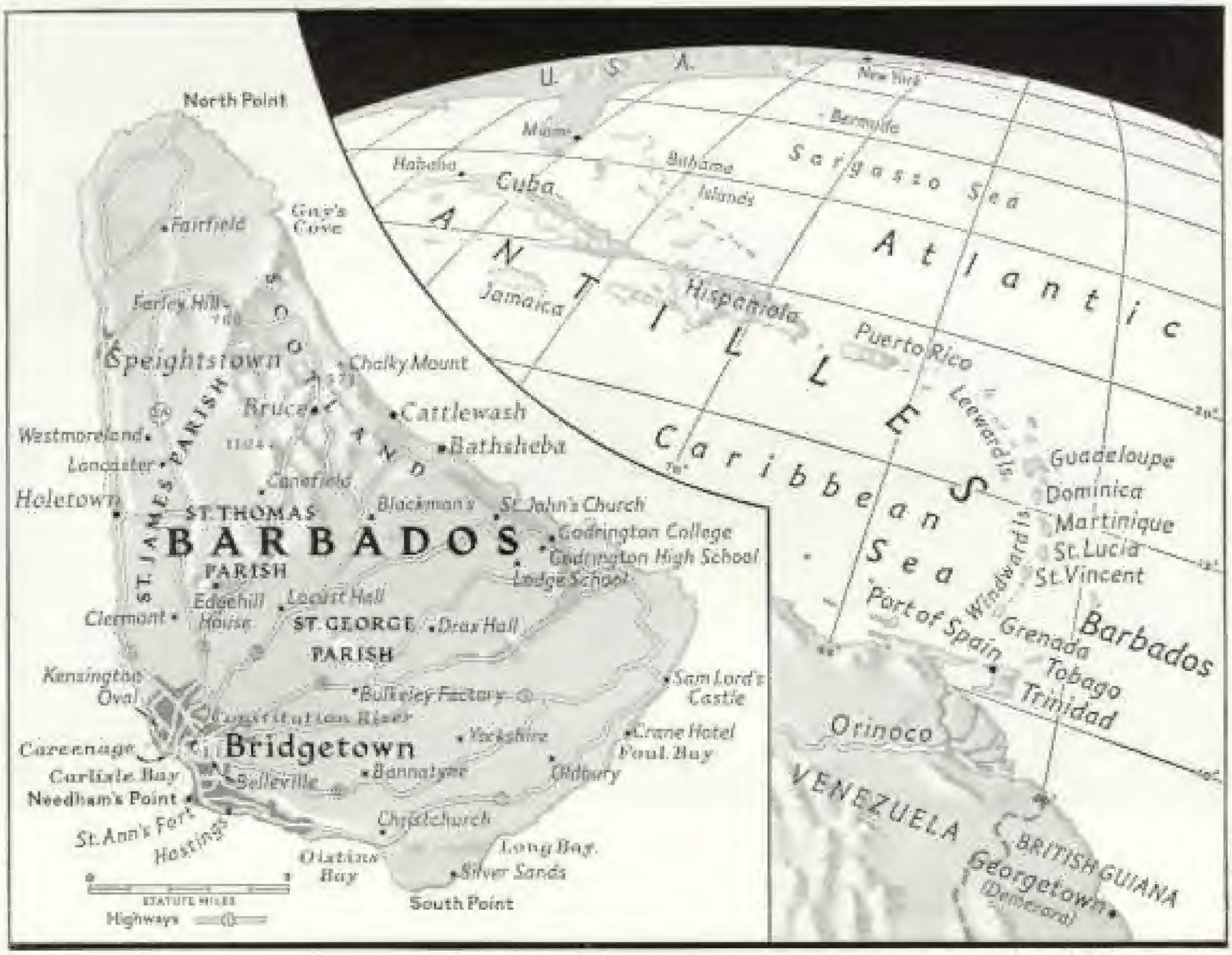
No Erosion Problem

Rain, an average of 60 inches a year, falls chiefly during the rainy season from June to November. Instead of pouring off the surface of the land, however, carrying irreplaceable soil with it, the excess water sinks into the porous coral.

Here it percolates slowly downhill toward the edges of the coral cap, emerging in the coastal regions as bubbling fresh-water springs. Since this takes about six months, the springs are at their most productive during the dry season—just when they are needed most.

Layers of volcanic ash deposited from eruptions on neighboring St. Vincent and Martinique have helped to build up the soil. Two to three inches of volcanic dust fell over the island during the eruptions of 1902-3.

In St. George Parish I turned off the main



Barbados, a Sugar Isle, Lies on the Rim of the Caribbean

A space platform hung 800 miles above South America would give this view of the West Indies stretching between Trinidad and the Bahamas. Volcanoes raised the Windward chain; sea creatures built Barbados with their limestone skeletons. Trade winds fan the island; hurricanes on rare occasions lash it.

road to visit Drax Hall, built by one of the men responsible for turning Barbados into a sugar island. There is no record of when this fine old Jacobean mansion was built, but tradition fixes it at about 1650.

Other estates named Canefield, Clermont, Westmoreland, Lancaster, and Yorkshire suggest their English tradition.

Most famous historically of Barbadian mansions is Sam Lord's Castle (page 390). Built in 1820 with slave labor, it is now a cozy hostelry for honeymooning couples. As I climbed its black and white marble steps, I gazed upward at towering battlements surmounting the castle's thick walls. Inside, handsome plaster ceilings, mahogany columns, and 18th-century furniture brought visions of an era of gracious living—of sumptuous banquets with plentiful wine and an ox roasted whole in the huge hearth below the stairs.

Mystery surrounded Sam Lord in his lifetime and still shrouds his memory. Legend describes him as a fabulous character who gained vast wealth from cargo washed up on reef and shore from wrecked ships. After he became powerful in Barbados affairs, he crowned his success by erecting the castle high on the bluff.

In striking contrast to Sam Lord's Castle and other fine residences on Barbados are the tiny huts where the Negro population lives. Government-sponsored, low-rent housing developments have not yet replaced these cabins, which can be seen all over the island in rows, in clumps, in halting lines. They are as simple as the houses a child draws on a slate—made of wood weathered pewter gray, raised above the ground on a few rough stones, and roofed with dark shingles.

Shutters Keep Out "Jumbies"

Such houses have shutters instead of glass in the windows. The Badian Negro sleeps with firmly closed doors and shutters to keep out "jumbies" (evil spirits), ghosts, and other horrors of the night.

Occasionally the original house is expanded by the addition of a second identical structure attached to the rear. I saw some with three sections and several with four. Some houses

Bridgetown Tea Vendor Wears a Spouting Hat. From Tap to Glass She Never Loses a Drop

Selling a beverage brewed from bark of the mauby tree, she chants, "Mawbeee! Git yo' mawbee! Who callin' me?" Though weighted with superfluous coconuts, her neck never tires. Her pail holds extra glasses.

Small Schooners Crowd Bridgetown's Shallow Harbor. Big Ships Must Anchor Outside and Transfer Cargoes to Lighters

Harbor Police Pay No Heed to Changing Styles. They Wear the Garb of Nelson's Sailors

Barbados, which has flown an English flag for more than 300 years, remains so staunchly British that some people call it "Little England." Admiral Horatio Nelson visited the island in 1784 and 1805. Honoring him, Bridgetown raised a Nelson monument before London did (page 370).

Bridgetown: Capital, Chief Port, and Largest City of Barbados

Founded 324 years ago, the city now counts 13,345 residents. Trafalgar Square, with its shaft to Nelson, sits beside the inner harbor. Sailboats (left) head home with hauls of edible flying fish.

121 Kodachrome by Charles Allmon

Its Snug Inner Harbor Occupies the Mouth of Constitution River

Bridgetown was named for a span that crossed the stream long ago. Timber being scarce, the city builds with coral limestone, which covers the island almost everywhere. A schooner in Carlisle Bay sails for Trinidad.

Reclamation by Charles Allmon

Sugar Is King on Barbados. Verdant Stands of Cane Cover More Than a Third of the Island

Sugar and its by-products support the island, second only to Bermuda as the Americas' most densely populated country or territory (some 1,250 to the square mile). Last year Barbados produced more than 164,000 long tons of sugar; Great Britain bought the entire export crop. A plantation's buildings stand in the lower right.

Purebred Strains of Sugar Cane Grow Inside Glass "Lanterns" Which Wind-blown Pollen Cannot Penetrate

Using selective breeding, this experimental station produces varieties that are sweeter and more resistant to pests, diseases, and drought. Scientist G. C. Stevenson checks this lantern. Right: Harvesters load a truck. Oxcarts quit the sugar fields only a few years ago.

Kodachromes by Charles Allmon

Chains and "Spiders" Swing Puncheons of Molasses

Sugar, molasses, and rum are the chief exports of Barbados. In 1950 the island shipped some 5,800,000 gallons of fancy molasses, mostly to Canada, Britain, and the United States. In the same year more than 900,000 gallons of rum went overseas.

Molasses casks are built in Bridgetown of Canadian wood. Known as puncheons, they hold about 114 U. S. gallons and average 1,400 pounds gross.

Two puncheons (above), hanging from a crane, are hoisted for shipment to London. A lighter (right) reveals two of the 10-foot oars used by crews rowing out to freighters in Carlisle Bay.

A man-drawn rig known as a spider handles a Quebec-bound cask to the water's edge.

Kodachrome by Charles Allmon

are brightly painted: many have neat flower gardens enclosed by picket fences.

More than once I met a house on the highway in the process of being "removed." Its walls were piled on a cart, one above the other, like pieces of a stage set. Roof shingles jostled about on the floor of the cart. The owner led the way, toting the front door on his head; behind followed a procession of friends and relatives bearing window shutters, doorstep, and chicken coop.

"Divorce House"—Cut in Two

A "divorce house" startled me even more. The dwelling, neatly sawed in two, told the sad tale of a broken home. The irate husband had carted away his half of the common property.

Generally flat, the island in the northeast presents rugged contours in the Scotland district. As I scanned this area from the crest of Farley Hill, a range of miniature mountains and diminutive peaks rearing skyward reminded me of a large-scale relief map.

Barbados is too small to boast lakes or rivers. Sumps in cultivated fields help drain the porous soil, and a plentiful supply of fresh water is pumped from a honeycomb of underground springs.

Geologists are optimistic about finding valuable deposits of oil in subterranean pockets. During the latter part of the 19th century so-called "Barbados tar" was exported. It is reported that in 1870 high-quality lubricating oil, obtained from crude oil from hand-drilled wells less than 100 feet deep, was exported to Russia, where it was valued for its low freezing point.

Drillers Probing Deep for Oil

Today, Barbados Gulf Oil Company is making a thorough survey under a license covering approximately half the island. Exploratory wells to be drilled in 1952 may reach a depth of some 12,000 feet.

Tall-masted, bright-hulled schooners from Demerara (now Georgetown, British Guiana), Martinique, Trinidad, Grenada, and "down the islands" tie up at Bridgetown's careenage, or small inner harbor (pages 378, 383). The odors of molasses, oakum, sugar—the seaport smells of centuries—still linger over the busy water front.

Workmen trundle puncheons of molasses about in curiously designed rigs known as "spiders." Others plaster final seals on the wooden barrels before they are hoisted into lighters for transport to waiting ships (opposite page).

The doorsteps of old stone warehouses are receiving platforms for miscellaneous cargoes that include lumber, rice, coconuts, fruit. Firewood from near-by islands is a chief import. Often I paused to listen to dusky women dressed like Aunt Jemima haggle over the price of a bundle of sticks.

On the quayside vendors of peanuts, known locally as "courting nuts," carry on a brisk trade. Sweet drink and cane juice sellers are ever at hand to quench the thirst of the perspiring population.

"Mawbeeeeeee! Get yu mawbeeeeeeeee!" a vendor shouts.

"Mawbeeeeee cooooooooooool! Who calling me?" her competitor shrills.

This sweet drink is brewed from the bark of the mauby tree. With deft hands sellers turn the taps of heavy urns atop their heads, and a stream of cold juice splashes into a glass. I never saw a mauby tea vendor spill a single drop (page 367).

Thirsty wharf workers also patronize producers of "raw liquor," fresh juice squeezed from sticks of sugar cane crushed in a small handmill.

Oarsmen Wield 30-foot Sweeps

I watched sugar and molasses being loaded onto fleets of lighters which ply constantly between wharves and big ships anchored in Carlisle Bay. Husky oarsmen "bent to" on the 30-foot sweeps which propel the heavily laden craft. Best paid of all water-front workers, stevedores earn as much as $4.30 per day.

Natty harbor police in Bridgetown wear a uniform dating back to Admiral Nelson's day (page 369). Bridgetown, incidentally, honored Nelson with a statue in its Trafalgar Square, center of the island capital's public buildings, before London similarly recognized the great seaman (pages 370-371).

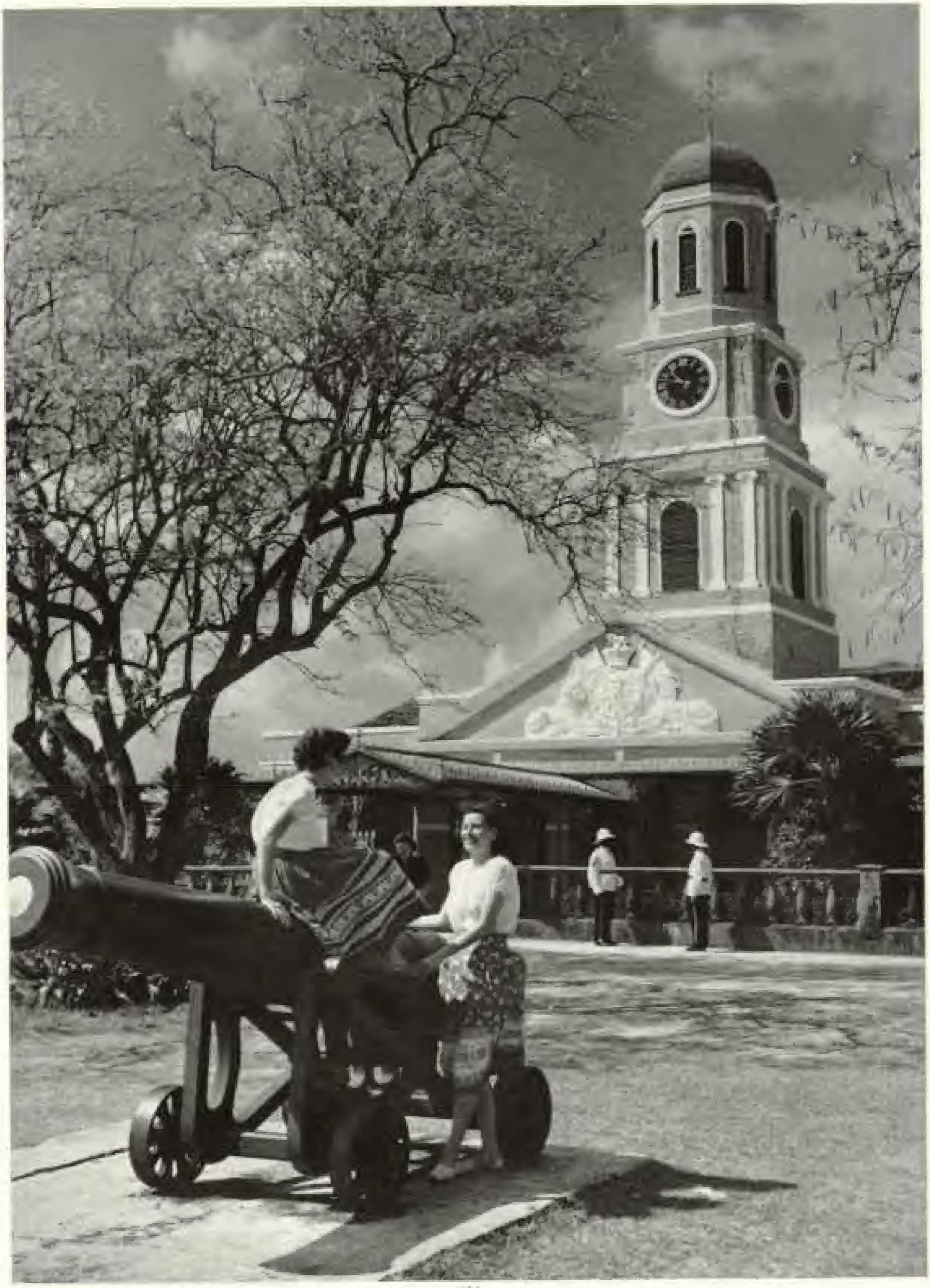
Bridgetown's founding was unique in the bloodless occupation of Barbados. In an island-scattering mood, Charles I, in 1627, gave all the Caribbean islands to the Earl of Carlisle, whose friend, Lord Marlborough, was also interested in the scheme, though he shortly surrendered his claim to Carlisle.

Then the monarch evidently forgot or regretted the act. He gave Barbados to the Earl of Pembroke in 1628, and the Earl supported the claim of his protégé, colonizer Sir William Courteen (page 363).

Carlisle was incensed; he sent out an expedition and founded St. Michaels, now Bridgetown. Barbados became a center of contention between the two noblemen. Eventually the King decided in favor of Carlisle.

In 1662 the Carlisle patent was surrendered to the Crown.

The Barbados House of Assembly is the fourth oldest legislative body in the British Commonwealth. The trappings of tradition



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Savannah Club, Shrine of Polo and Horse Racing, Once Garrisoned Troops

A Bridgetown landmark, the club was long the guardroom of the Barbados Regiment (opposite page). Now a sports center, it overlooks extensive athletic fields that were parade grounds. Bricks of the steepled 18th-century building arrived as ballast in ships that called for sugar. The cannon once roared from a sail-topped man-of-war.

clothe the beamed chamber of the House. A bearded mace-bearer in an old tail coat, the gowned Speaker perched upon his dais, call forth an atmosphere of faded but still rigid protocol. The "prime minister" of the House is Grantley Adams, an Oxford graduate and a barrister.

The executive branch of the island's government is headed by Sir Alfred W. L. Savage, a veteran of the British Colonial Service in Africa, the Middle East, and South Pacific. He is the sixty-seventh governor of Barbados (page 364). His residence, Government House, was rebuilt in the 18th century and renovated about a hundred years ago. Admiral Nelson was a guest there in 1784. The estate, near Belleville, was known as "Pilgrim."

When I attended a lawn party at Government House, the colorful Zouave uniform worn by attendants caught my eye. I was told that a similar uniform had been worn by a French colonial regimental band at the great International Exhibition in London in 1851. Queen Victoria liked it so much that she requested the uniform be adopted by a regiment in the British Army. Members of the drum and fife band of the Barbados Regiment wear the gaily colored garb at official functions (page 387).

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Coral Limestone, Fresh from the Quarry, Saws Like Wood

Barbados grows no timber; it builds most homes from native rock. Moist when it comes from the quarry, the coral is cut into blocks, which harden as they dry. Having little competition, stone does a big business (pages 391 and 392).

Regiment Mans 248-year-old Fort

Maj. M. L. D. Skewes-Cox showed me 248-year-old St. Ann's Fort, the island's stronghold commanding the anchorage of Carlisle Bay. It is the only fort on the island still occupied by soldiers of the Barbados Regiment. The local regiment at present numbers only 300, but it is being built up.

On an old map of Barbados, dated 1782, Major Skewes-Cox pointed out 26 forts which once lined the west and south coasts. North and east coasts had no fortifications, since landing there was considered impossible because of coral reefs and heavy surf.

The former guardroom of St. Ann's is now the Savannah Club. Near by is the Savannah, an oblong of grass used as a parade ground and race track. Crowds cheer the colors of families that have raced in Barbados for generations.

Some of the world's finest cricket players have come from Barbados (page 389). The island contributed six players to the West Indies team which lost only three out of 33

Thirty-foot Sweeps Push a Lighter Out of Bridgetown Harbor

Only vessels drawing 14½ feet of water or less can enter the city's narrow inner harbor, or careenage (pages 370-371 and 384). Freighters and passenger ships anchor outside in the deep sheltered waters of Carlisle Bay.

Bulky lighters and other small craft shuttle between ships and shore, carrying passengers and freight. Husky boatmen, straining on the big sweeps, transfer many cargoes.

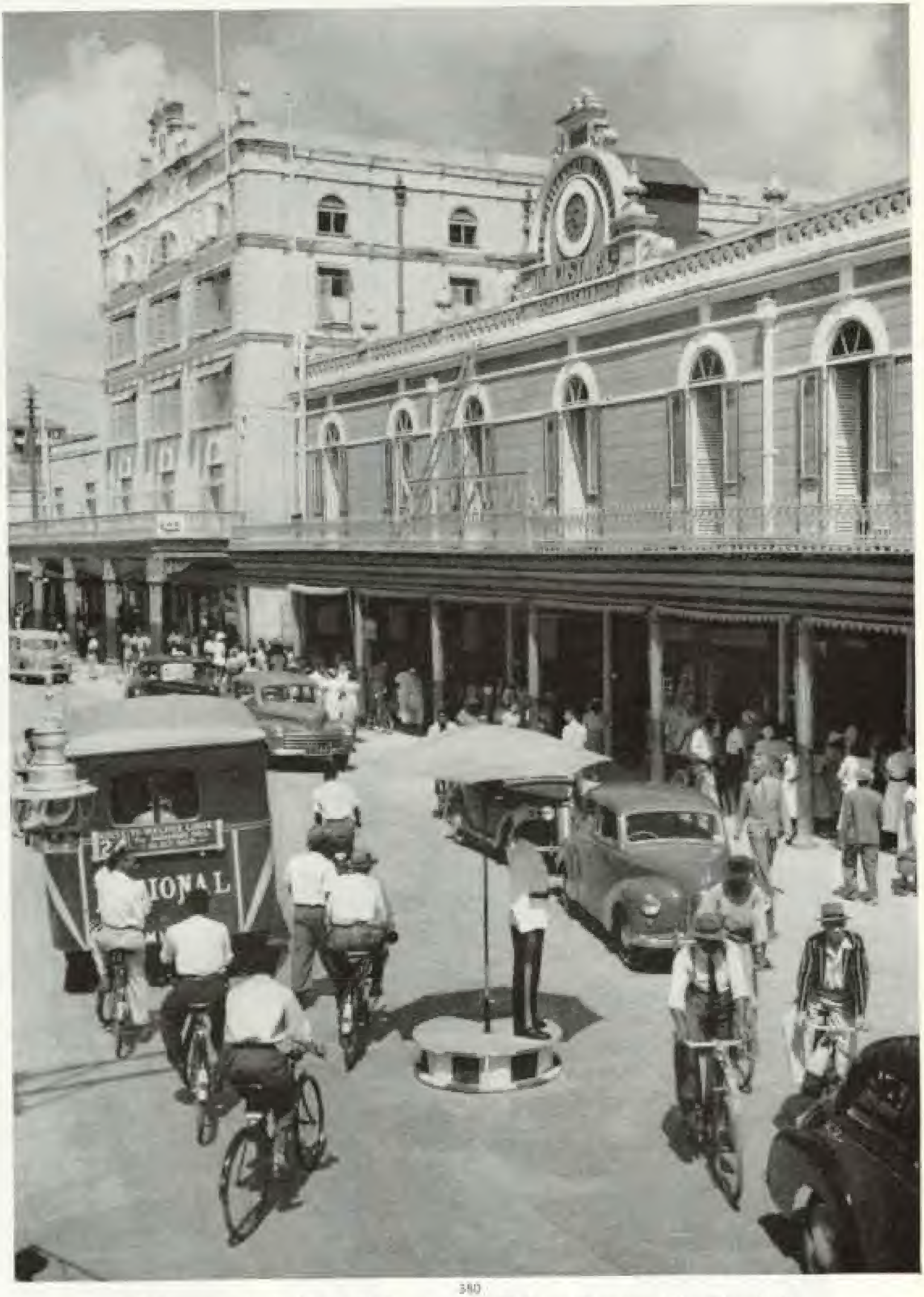
In the roadstead, freighters load sugar, rum, molasses, lime, and cotton. They disgorge from their holds rice, flour, fodder, meat, lumber, textiles, electrical apparatus, and machinery.

In earlier days the arrival of a cruise ship in Carlisle Bay created bedlam. Barbados boatmen, pushing their water taxis, swarmed around her, clamoring for fares. Competition was fierce. Forewarned passengers seldom ventured ashore until a bargain had been struck in advance. The fares were set by law, but boatmen were not above asking unsuspecting newcomers all the traffic would bear.

Now order has come to the busy roadstead. Steamship companies make contracts with a local firm to take passengers ashore and back.

Sails Reefed, Deep-sea Fishermen Net a Barbadian Delicacy Out Where the Flying Fishes Play

As a lure, one man dangles a basket of scraps while his mates scoop up the catch. A good day's haul brings in 8,000 to 10,000 flying fish. Barbados serves them in several guises; a specialty is flying-fish pie (page 582). Keelless fishing boats make fast runs but capsize easily.



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Bridgetown Traffic Goes Left; Arcades Shelter Shoppers from Tropic Sun

Once considered very wide, Broad Street has seemed to shrink as buildings grew higher and automobiles and bicycles multiplied. Traffic occasionally defers to a barefoot Negro leading a pig on a rope. Two leading department stores stand across the street. Barbados gets its gasoline from near-by Trinidad.

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Sunken Roads Elevate Cane Fields to a Convenient Truck-top Level

This lane, like many others, has been scraped to bedrock limestone; its natural surface is smooth but dusty. When near-by cane has been gathered, the truck will move into the fields. Barbados's bumper sugar crop in 1951 yielded enough to supply every person in the United Kingdom with about seven pounds.

matches in England in 1950. In 1951, at Kensington Oval, I watched test matches between Trinidad and Barbados.

That day business firms in Bridgetown locked their doors at 11 a.m. Tension was like that prevailing in the United States during a World Series. This test would determine some of the cricket stars who would invade Australia in the autumn as members of the British West Indies team.

Advice from the Bleachers

Evenly matched elevens battled several days. When a batsman tipped the score for Barbados, an Englishman behind me quietly commended, "Well done."

Negro spectators were less restrained. When a star "Bajan" bowler was having difficulty getting the ball near the wicket, a spectator shouted from the bleachers, "Bowl de ball 'pun de wicket, mahn, or you ain't never goin' to see dem kangaroos!"

Pedestrians, automobiles, and donkey carts congest narrow Broad Street, main thoroughfare of Bridgetown. Bakers peddle bread and cakes from door to door, summoning regular customers with loud bugle blasts. Kerchief-turbaned women in short skirts, balancing baskets and trays of vegetables on their heads, exchange quips. Such scenes take place against a staid background of shops, offices, and banks (opposite page).

On Saturday nights the yellow flare of kerosene torches illuminates the shiny faces of hucksters squatting in closed doorways behind trays of confections and vegetables.

One day as I carefully picked my way through Broad Street, I paused to ask directions to a business house.

"No, please, dis de wrong street. 'Turn left next gap,'" came the Bajan reply. Streets crossing a more important thoroughfare are called "gaps" in Badian language.

In a balcony-shaded lane in Bridgetown I met a pig on a leash. The prospective bacon slithered toward the intersection as a lanky shuffling Negro tipped his stiff straw bowler in friendly acknowledgment of my curious

stare. A poker-faced Negro bobby gave them right of way.

Such a quiet and unorthodox encounter reflected the casual attitude of the West Indies, the genial humor of the Negro, and the easy economy of walking a home-grown pig to market.

Later I boarded the schooner *Margaret*, one of the few remaining "droghers" which were once the chief means of transport between Bridgetown and Speightstown, a once thriving commercial center but now a quiet fishing village. Trucks have now largely replaced them.

The vessel's rig was one I had never seen elsewhere. An exaggerated bowsprit stretched more than half the length of the 55-foot schooner, supporting a mass of sail well adapted to conditions on the leeward coast but ill suited to deep-sea sailing.

Despite their clumsy appearance, the vessels are unusually fast. We made the 13-mile trip in just over 90 minutes—only moderate time, the skipper told me.

As we neared the Speightstown dock, a wharf hand was slow to toss in a forward line. Our skipper, one foot on the dock and the other on the schooner's rail, quickly found himself "spread-eagle." A second later he hit the water with a gigantic splash, while laughter convulsed villagers and crew.

Old School Tie in Barbados

The island's schools have long been among the best in the West Indies. Boarding schools —Lodge School for boys and Codrington High School for girls—attract students from Venezuela, Trinidad, Grenada, and most of the Caribbean's Windward and Leeward Islands.

Codrington College, founded in 1710, is the oldest college in the West Indies and takes pride in its tradition. Affiliated with Durham University, it grants an English degree. Codrington alumni include many prominent citizens of the Caribbean colonies.

Barbados provides excellent medical facilities. Experienced surgeons and physicians staff its hospitals. Last year four Negro girls, studying to be nurses, journeyed as far as Maidenhead, England, to take training. Malaria is almost unknown on the island.

One day I turned off highway No. 2 in St. Thomas Parish to Edgehill House, residence of genial Sir John Saint, director of Barbados's recently established Sugar Technology Research Unit.

As Director of Agriculture during World War II, Sir John was largely responsible for putting into effect agricultural practices which staved off starvation for the densely populated isle. Before the war, only about five percent of the arable acreage was planted in food crops.

Sir John required all landowners to devote 33 percent of their land to vegetables. To take care of seasonal surpluses, a dehydrating plant was built for drying food crops.

As the war proceeded, the importation of meat dwindled, and early steps were taken to control local supplies. An order forbade the slaughter of breeding and young stock. In addition, plantation owners were required to keep numbers of livestock of specified kinds.

In 1950 John Saint was knighted for this great service to the island of Barbados.

Try a Flying-fish Pie

Because of wartime protein shortages, the island's fishing industry made a big comeback. On my first day in Barbados curiosity prompted me to order flying-fish pie. The novelty soon abated, however, for flying fish were listed almost daily on hotel menus.

From the open-air dining room of my seaside hotel I watched sailing craft of Bridgetown's flying-fish fleet make for the fishing grounds, 5 to 25 miles offshore. Later Dudley W. Wiles, Barbados fishery officer, invited me to join him on the Department's experimental boat, *Investigator*, a 43-foot Diesel-powered craft.

On our way out we passed occasional fishing boats. Carrying a crew of three, the 22-foot vessels leaped over the sea in a shower of spray, making excellent time.

These small craft sometimes venture as far as 27 miles offshore; sometimes they spend the night at sea. Fairly well suited to their purpose, they are light, fast, and keelless. They are also dangerous. Ballast, usually chunks of scrap iron, is kept inside the boat and shifted according to the wind.

"Quite often," Wiles told me, "ballast is piled up on one side, and a back wind comes and capsizes the boat, which quickly sinks. A better type of boat has been designed, but it's too expensive for the average fisherman."

When we had been out about 20 minutes, Wiles dropped a collector overboard to gather plankton. These minute sea organisms are the staple food of flying fish.

Hauling the collector aboard, Wiles showed me an exhibition of plankton. On the gauze I saw small pink blobs tinier than grains of sand, some even more minute specks, and other relatively large and colorless splotches. Under the microscope the pink dots looked like tiny lobsters; the green ones like gems.

"Clumps of moss guide fishermen to schools of flying fish," Wiles said, "but plankton is more reliable. I hope to get permission soon to make radio announcements telling fishermen where the fish can be found."

Tipsily Atilt, a Schooner Gets Repairs in the Careenage, Bridgetown's Inner Harbor

Small craft have long been careened here to be scraped, caulked, and painted. A stout line attached to the mast dragged this vessel on her side. A laundress uses the pier for work, her brood for play.

Kodachrome by Charles Allmon

Caribbean and Atlantic Combers in Timeless Surges Beat Against the Island's Coral Cliffs

Crane Hotel overlooks a sea that changes from lettuce green to forget-me-not blue. The resort takes its name from a shippers' hoisting crane which once hung over the bluff. Opposite: So hostile is the north shore that forts were never considered necessary. In stormy weather, spray leaps 50 feet.

Kodachrome by Charles Allmon

Barbados Mounties, Astride Canadian Horses, Line Up for Spit-and-Polish Inspection

Pride of the island's police force are its precision-drilled mounted officers. They have been invited to perform in the United States and Canada. Barbados has a British Governor, an appointed Legislative Council, and an elected House of Assembly.

Police and Army Compete in Dazzling Dress

Unlike many of its West Indies neighbors, Barbados has never changed hands. Once a score of forts guarded the island against challenging Frenchmen, Spaniards, and pirates. Long outmoded, all have been abandoned except 248-year-old St. Ann's Fort, which commands Carlisle Bay, the outer harbor. There the island maintains a regiment of some 500 soldiers.

→ One of those 500, the bugler plays in the Barbados Regiment's Fife and Drum band. His colorful dress reflects a royal whim. Zouave uniforms like his caught Queen Victoria's eye at London's International Exhibition of 1851. She requested that a British regiment adopt the style, and Barbados gallantly obliged.

← A drummer in the Police Force band covers his white tunic with leopard-skin protector. He and his friends play at state functions and public concerts. Barbados calls them "Jingling Johnnies."

Redeliveries by Charles Allmon

↑ Neither Tide, Slope, nor Boulders Can Stop Determined Cricket Players

Cricket is the island's favorite sport. Native field hands play the game no less enthusiastically than Etonians. Some of them become international stars.

Playing space is scarce; but give Barbados men ball, bat, and wickets and they'll find the field.

Here the Bathsheba coast offers a hazard-strewn terrain. By the ground rules, any ball hit into the sea counts four runs.

Since 1928 an all-star eleven has represented the British West Indies in top-flight cricket competition. Composed of players from Barbados, Trinidad, Jamaica, and British Guiana, the team has toured India, the United Kingdom, and Australia since the war. Last season it won all but three of 34 matches played in Britain. Six men of the squad of 16 came from Barbados.

The author, watching Barbados and Trinidad men playing to determine who should meet Australia, heard a fan shout to a faltering player, "Bowl de ball 'pun de wicket, mahn, or you ain't never goin' to see dem kangaroos!"

← A streetside vendor in Bridgetown offers home-grown corn and tomatoes.

↓ Who wants candy when sugar cane is handy? Any sweets-hungry child has only to reach out as a mill-bound truck passes by.

Sam Lord in 1820 Built His Castle with Slave Labor; Now the Public Uses It as a Hotel

Legend says Lord crammed the vaults of his mansion with cargoes salvaged from wrecked ships. Windmills used to grind the island's sugar crop; this one pumps water.

We were offshore some eight miles when *Investigator* hove to. I counted 10 boats with masts and sails down, drifting on the fishing grounds netting fish.

Flying fish bait must be smelled to be believed. Fish entrails and land crabs several days dead are put in a small, loosely woven basket. A crewman continually dips, or churns with, his bait basket, attracting scores of the mother-of-pearl-colored fish to the surface. Other crewmen dip them from the sea in hoop nets (page 379).

"On a good day," Wiles said, "a boat may bring in 8,000 to 10,000 fish."

Fishermen Sometimes Swim Home

Next day at Speightstown, Silver Sands, and Bathsheba, I watched returning boats. At Bathsheba a number of the vessels capsized while negotiating the narrow channel. Then fishermen had to swim home.

Crowds of housewives, summoned by the fishermen's conch shells, thronged the white sandy beaches to haggle for fish.

White sea eggs—known in northern climes as sea urchins—are in season in Barbados in months that have an R. They cluster on rocks and reefs in shallow water, curious balls of spikes, about the size of a baseball.

To prepare sea eggs for market, fishermen crack them open on the beach and wash out the muck. The "roe" sticks to the sides of the shell in strips about half an inch wide, each containing thousands of tiny yellow eggs. After being washed, these are taken out and the contents of several shells are used to fill one to overflowing. The leaf of the sea grape serves as a neat little cap. Filled shells are packed in wooden trays.

I learned to like sea eggs for breakfast, steamed or fried with onion and butter.

Incidentally, "breakfast" on Barbados is really lunch, served from 11 a.m. until noon. The first meal of the day is more like a tea, which can be ordered almost any time.

Many Barbadians choose the Bathsheba coast for week-end holidays (page 365). With Aubrey Boyce, a retired Trinidad businessman who lives in Barbados, I headed for this area one Friday morning. We drove on the left-hand side of a major road, sometimes overtaking rickety pony and donkey carts.

At intervals buxom women waited for the brightly colored buses which bowl along the sunken coral road toward Bridgetown. About 160 of these vehicles carry the burden of island transportation.

Occasionally we looked up at fields on either side of us. Boyce explained: "In old times roads were mended by scraping them to level out potholes. As a result, the whole surface sank lower and lower. The seemingly aimless winding follows tracks made by animals and pedestrians perhaps three centuries ago."

We passed a quarry where workmen hewed blocks of coral limestone from a cliff. The coral polyp has built much of the stone used in the island's houses. Later I saw builders cutting similar blocks with handsaws in erecting a modern coral limestone house (p. 377).

A mile or two from the Atlantic coast the road began a tortuous ascent. Tiny cottages of the natives hung on the hillsides. Breadfruit trees and banana plants suggested the Tropics, although the whole sea front in this part of the island has aptly been termed a miniature Cornish coast.

Before teatime we paused to watch a cricket match on a narrow strip of grass. A ball hit into the sea meant four runs, the equivalent of a home run in baseball (page 388).

Along the Bathsheba coast live descendants of the "Red Legs," staunch Irish, Scottish, and English Royalists deported to Barbados by Cromwell in unsavory convict ships in the second half of the 17th century. Theirs was a heritage of woe. Many were sold as white slaves for 1,500 pounds of sugar per head.

Unused to long hours in the sun and grueling field labor, the majority died. Their nickname came from their sun-reddened legs, for many wore kilts. Small wonder that with their bitter tradition they scorned their neighbors, marrying only among themselves.

The Church of England is dominant in Barbados. In the church at Holetown, on the St. James coast, I saw one of the oldest church bells in the Western Hemisphere, inscribed "God Bless King William 1696."

Another old church on the Bathsheba coast is St. John's. In its cemetery I found the obscure grave of Ferdinando Paleologus, "descended from ye imperial lyne of ye last Christian Emperors of Greece." He died in Barbados in 1678.

Sunday, Not Saturday, Is Bath Day

Sunday is bath day for Barbados animals. At Silver Sands I saw balky donkeys prodded to the water's edge for their weekly scrubbing. Goats, too, are sudsed. Cattlewash, a village on the Bathsheba coast, owes its name to the act the word implies.

A pair of monkeys skipped across our path near Farley Hill, possibly out to raid a yam patch. Sweet potatoes, eddoes (a member of the taro group), maize, pulses, and cassava form staple food crops on the island.

Practically all the families living on the barren hilltops of Chalky Mount make pottery from the plentiful supply of good clay at hand. One amiable potter invited me to see his workshop. A small boy squatted on

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Coral Limestone Builds Fine Houses; Thick Walls Keep Them Cool

Mrs. Frank Morgan (standing), an American, came to Barbados with her husband 15 years ago. They completed their new home in 1950.

the floor working a stick that drove the wheel. I was allowed to fashion a bowl, but my product was a poor match indeed for the bowls baking in wood-fired kilns in the hillside.

My last impression of Barbados was one of fanfare and pageantry. Not long before I left, the Police Force, part of which is mounted, put on its famous musical ride (page 386). My ears were already attuned to the fortissimo potpourri of the Police Force band, which gave frequent evening concerts.

But the concerts never imparted the stirring effect of the band on parade. Colorful "Jingling Johnnies" in leopard-skin dress twirled drumsticks in the best English manner (page 387), while snare drummers, eyes front, sounded staccato rhythms and beautiful Canadian horses pranced. Brass horns glittered in the sun.

No less stately than the Horse Guards of Whitehall, the Barbados mounted police passed in review. Standing in the crowd, a visitor cannot fail to realize the pride of the Barbadians in their orderly island or to sense their loyalty to British tradition."

*See "British West Indian Interlude," by Anne Rainey Langley, National Geographic Magazine, January, 1941.

Finding an "Extinct" New Zealand Bird

Rediscovered by a Persevering Doctor, the Flightless, Colorful Takahe, or "Wanderer," Struggles to Survive

By R. V. Francis Smith

IN New Zealand's rugged Fiordland a bird thought extinct for fifty years is struggling for survival. Behind the rare species in its fight for life is all the protective power of the Dominion Government.

Rediscovery of this flightless bird, the large, brilliant-hued native rail which the Maoris called *takahea*, meaning "wandering at large," excited almost as much interest in New Zealand as discovery of a living passenger pigeon would arouse in America.

To zoologists and bird lovers throughout the world, reappearance of takahea, now called the takahe, was a notable event. They had a scientific name for the creature—*Notornis hochstetteri*, the first half of which means "bird of the south"—but they knew tantalizingly little about it and had considered it lost in the limbo of vanished species.

To the rediscoverer, Dr. G. B. Orbell, a physician of Invercargill, New Zealand, the dramatic sight of a takahe alive came as the reward of years of patient and systematic search. Only four of the birds were known to science when he made his discovery on the shore of a lake in what is now called Notornis Valley (map, page 394). Since August, 1898, there had been no authentic report of one being caught, or even seen.

Futile Wings Have Three-foot Span

A primitive type of large moor hen found only in New Zealand, the takahe is unlike any other member of the world-wide rail family to which it belongs. For example, despite its membership in an aquatic family, it avoids swamps and rivers. It does, however, share some of the clan's characteristics, such as a large frontal shield (page 396).

The full-grown takahe stands some twenty inches high and weighs about six pounds. The wings, though incapable of flight, may have a three-foot span.

The adult bird is vividly colored. Head, neck, breast, and flanks are an iridescent indigo blue, becoming brighter on the shoulders and changing to a malachite green on the mantle. The dark rump and upper tail coverts are olive green, the abdomen and thighs purplish black, and the under tail coverts white. The powerful beak is scarlet at the base, fading outwards to a wax pink. Legs and feet are red, eyes reddish brown.

This brilliant color scheme is seen to full advantage only when the bird is approaching the observer or passing at right angles to him.

In contrast to its showy parents, the young takahe wears only a uniform, soft black down (page 395). The black beak is white-tipped, and the disproportionately large legs are a pale purple.

In New Zealand's ornithological history, extinction, or near extinction, has been the lot of many species as a result of settlement.

Originally, native birds had no enemies, and the vegetation which affords them cover was not subject to browsing by animals. Under these favorable conditions many unusual forms of life, including birds of little or no power of flight, were able to survive and thrive.

Vanished Birds Include 12-foot Moa

Before the arrival of Capt. James Cook in 1769, birds were the dominant land vertebrates. The only land mammals were the dog, a Polynesian rat, and two species of bats. The dog and rat had been introduced by the Maoris on their second migration, about A. D. 1150.*

After the Maoris had caused the extinction of the huge flightless moa, one species of which was twelve feet high, European settlement brought about more extensive changes. Ferrets, stoats, and weasels were introduced to control a plague of rabbits, and these, with cats, dogs, and other predators, virtually sealed the fate of numerous native species, among them the takahe.

The first living takahe known to Europeans was purposely killed and eaten. It was caught by a sealing gang on Resolution Island, near the southwest end of South Island, in 1849. Two years later a party of Maoris caught a second bird in Thompson Sound, about forty miles farther north.

Luckily, the skins of both birds were obtained by Mr. W. D. B. Mantell, who in 1847 had discovered the semifossil remains of the North Island variety (duly named *Notornis mantelli* by Sir Richard Owen, of London). The skins were sent to the British Museum.

Twenty-eight years passed before another specimen appeared. A rabbiter's dog caught it near the south end of Lake Te Anau. The bird was destined for the cooking pot when

* See, in the National Geographic Magazine: "The Columbus of the Pacific: Captain James Cook," by J. R. Hildebrand, January, 1927; and "Tuatara: 'Living Fossils' Walk on Well-Nigh Inaccessible Rocky Islands off the Coast of New Zealand," by Frieda Cobb Blanchard, May, 1935.

Drawn by Herbert E. Eastwood and Victor J. Kelley

New Zealand Fiordland Shelters the Takahe, or Notornis, a Bird Long Thought Extinct

Notornis Valley, in South Island's Murchison Mountains, lies only six miles from a main road; yet it hid the takahe from human sight for decades. From boyhood Dr. G. B. Orbell, an Invercargill physician, refused to believe the creature lost. After thirty years his quest succeeded; Dr. Orbell tracked the takahe to the scene of its last stand in one of the wildest parts of the Dominion (pages 393, 397, 401).

it was rescued by a farm manager and eventually sold to a museum in Dresden, Germany, for £105.

After close examination, Dr. Adolph B. Meyer of the Dresden museum found that this bird was sufficiently different from the North Island semifossil form found by Mantell to warrant a distinct name. Accordingly, the name *Notornis hochstetteri* was given the present species.

The fourth specimen was caught by a dog on the shore of Middle Fiord of Lake Te Anau in 1898. The bird was bought by the Government for £250 to ensure that it remained in New Zealand. Preserved in the Otago Museum at Dunedin, it still is the only mounted specimen in the country, for no more takahe were known until Dr. Orbell's discovery.

A Thirty-year Quest Begins

Dr. Orbell's interest in the creature began more than thirty years ago when, as a boy, he found an old photograph showing the museum bird in a case. His mother told its story and explained that the bird was supposed to be extinct.

That word "supposed" stimulated Dr. Orbell's adventurous spirit, and he learned all he could about the species. From game rangers and from men who had probed the fastnesses of Fiordland, from hearsay and from stories told around campfires on numerous hunting trips, Dr. Orbell picked up fragments of information about possible takahe hiding places.

In 1945 Dr. Orbell built a summer home at Lake Te Anau, where two of the birds had been caught. The question of the takahe's existence and whereabouts was always with him, but he seldom mentioned the matter except jokingly or as a bait to catch information. In this way he learned that a man who knew the country round about always carried his rifle loaded when in a certain area.

"It might be worth £400 to £500," the man said with a knowing air.

By plotting any references to the bird on a map tacked up in his summer home, Dr. Orbell found that the area surrounded by reported sightings of the takahe was one of the least explored in the country. In each case the bird was claimed to have been seen on

705 J. H. Bowman

A Young Takahe Is All Legs, Beak, and Fight

This three-day-old chick is the first youngster of its kind known to have been seen by white men. The camera caught it in a quiet moment. Most of the time the captive struggled violently, inflicting painful pecks. White flecks are wing tip and spur. Age will replace black down with brilliant plumage (pages 393, 396).

beaches below the bushline in winters with heavy snowfalls.

Dr. Orbell also heard of a lake, seen from the air, that was unmarked on his maps. Maori history suggested its existence and whereabouts. *Kohaka-takahea*, "nesting place of the wanderer," the Maoris called the lake.

Maori tradition also held that the bird once was plentiful in certain areas, particularly along the shores of Lakes Manapouri and Te Anau, both large glacial lakes on the eastern fringe of the heavily forested and mountainous Fiordland.* The natives, so the story went, had made annual drives to capture the birds for food when the snows of winter drove the takahe from the mountains.

It was in April, 1948, that Dr. Orbell and two friends first made their way into the promising area. Reaching a ridgetop, they found themselves on the edge of a lofty precipice. Far below a lake glistened in the sunlight. Beyond the lake a valley extended for several miles, deep among the peaks.

Notes Heard, Footprints Found

There was little time to spend in the valley before turning back to camp, but it was long enough for Dr. Orbell to hear an unknown birdcall—two long, deep notes repeated twice—and to see large prints at the lower end of

* See, in the National Geographic Magazine: "New Zealand 'Down Under,'" by W. Robert Moore, February, 1936; and "The Making of an Anzac," by Howell Walker, April, 1943.

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Courtesy New Zealand Government

Flightless, the Rooster-size Bird Moves Fast on Big Feet

After a dog killed the last known specimen in 1898, the world of ornithology gave up the takahe for lost. Then came its dramatic rediscovery, after a lapse of half a century.

The takahe attains twenty inches in height and six pounds in weight. Twice as fleet as a chicken, it flaps three-foot wings in running. Head, neck, breast, and flanks are indigo blue; the back is malachite green; legs, feet, beak, and brow shield are red. The white tail bobs with each goonelike step.

A Hen on Her Nest Keeps Wary Eye on an Intruder

Mrs. Takahe bends down grass clumps as rainproof thatch over her home. She constructs several nests, each with two or more entrances. Apparently the eggs are laid in the one built last, though the bird moves from nest to nest as the one chick (or two) develops (page 400).

Only three eggs in five appear to be fertile. For a few days after hatching, the young take insects; then they become vegetarians. The takahe is a member of the rail family.

117 [caption] New Zealand Government

Only Accredited Observers May Enter the Bird's Grassy Haunts in Notornis Valley

Once the takahe roamed New Zealand without fear of enemies. Then Maoris hunted the bird in big drives. Those Polynesian colonists introduced dogs and egg-eating rats; white settlers later brought in ferrets, cats, and other predators (page 1931). Now the entire clan numbers only 20 to 100. This egg, about one and a half times the size of a hen's, is measured by Dr. R. A. Falla, director of Wellington's Dominion Museum.

the lake where he stopped to quench his thirst.

With careful measurements of the prints (scratched on the stem of Dr. Orbell's pipe!) the party returned home. They referred the evidence to noted New Zealand ornithologists, but the experts could not agree. Dr. R. A. Falla, Director of the Dominion Museum, who later led a number of expeditions to study the bird, thought it might be that of a takahe; another expert considered it the print of a white heron.

On November 20 of the same year the party again entered the valley, armed with cameras and 50 yards of fishing net.

Takahe Caught at Last

The difficult route led up terraced limestone slopes and through dense beech forests twined with brambles. Ferns, roots, and moss-covered rotting tree trunks gave uncertain footing.

Not 20 yards from where the tracks were seen the April before, the doctor again saw prints, so fresh that the sand still moved at their rims—and then the first takahe!

Seconds later, as Orbell's movie camera whirred, another bird, no more disturbed than a farmyard hen, moved into focus 20 yards away.

Quickly the net was drawn about the birds. The elusive takahe had been caught at last.

The party carefully carried the birds, a male and a female, to the lake shore and tethered them to stakes thrust in the sand. After study and more picture taking, the takahe were released to allow them to return to their nest in the tall grass. A third bird ran off toward the bush, but remained in full view, feeding and squawking, for an hour.

Since 1948 six expeditions have bushwhacked into the 685-square-mile zone prohibited to all but accredited scientists and other investigators working under the aegis of the Department of Internal Affairs. New colonies have been discovered in adjacent areas; the next valley south of Notornis Valley shelters a small population of the birds. Much has been learned about the takahe, and conservation methods have been studied.

So far as is known, the takahe is restricted to the rugged Murchison Mountains west of Lake Te Anau (page 398). The main colony survives in a hanging valley with an altitude of 3,000 feet, rising at the head to 4,000 feet.

From fossil and semifossil remains, it is known that the South Island notornis once ranged throughout the northeast, south, and southeast of the island, and it is interesting to note that in each case the remains were found in low country. As the bird knew no

Takahe Fights for Life in This Wild Setting

Fossil remains show that the bird once ranged widely across South Island's lowlands. Man's arrival is believed to have forced it to retreat to these high valleys in the snow-flecked Murchison Mountains, where a few nesting pairs survive.

All of New Zealand's flightless birds have suffered a like reduction in numbers. The moa is extinct; weka, kiwi, and owl parrot hang on. The giant moa, depending on stilt-high legs to outrun danger, was not only flightless but had lost all trace of wings.

Takahe's main colony dwells in Notornis Valley, which, with its lake, lies squarely in the center of the picture. At a glance, the dark lake appears to be another patch of woods, and the grassy flats surrounding it resemble snow. A few birds live in the valley on the left.

To reach the bird's haunts, ornithologists had to climb more than 2,000 feet from Lake Te Anau (foreground) along the spur to the right of the wooded gorge (center). Southern Hemisphere evergreen beeches cover the slopes.

***Kohaka-takahea*, "Nesting Place of the Wanderer," Maoris Called the Lake in Lonely Notornis Valley**

Most of the small notornis colony lives here, feeding on seeds and snow grass. When snows drift too deep, the birds move to hillside forests and forage on mosses and ferns. Takahea, now usually spelled takahe, is the Maoris' name for the bird.

enemy before the arrival of the Maoris and Europeans, settlement probably caused its retreat to mountain heights.

The Notornis (or Takahe) Valley, as the main valley is called, is only three miles long and at most a quarter of a mile wide. At the lower end lies the moraine lake, girt on three sides by tussocks of snow grass (page 399).

Although the adult takahe appears to be mainly herbivorous, the bird's diet varies somewhat with the seasons. When obtainable, the succulent bases of snow grass and sedges seem to be favored.

At times during the four months of winter, when deep snow covers the ground, the birds are forced to move to the forest. There they eke out the available supply of snow grass with the tender parts of shrubs, mosses, and possibly insects.

For eight to ten days after hatching, the diet of the chicks includes insects, but by the time they are a month old they appear to be vegetarians. At this age they still have not fully learned the adult method of feeding, but merely pick at tender shoots and leaf bases protruding from the beak of the parent.

An Acrobatic Eater

The feeding habits of the adult birds are fascinating to watch. By one method, the bird climbs into a clump of snow grass and runs its beak along the stems, stripping the seed heads. It may slide off taller tufts, garnering seeds as it drops.

To pluck shoots both of *Carex* (a sedge) and snow grass, notornis takes firm hold of the plants near the ground with its beak. A quick pull usually suffices to pluck a sedge shoot. When feeding on snow grass, however, the bird makes a strong upward swing, using the heft of its body as a weight lifter would.

Such a fibrous diet causes the bird's droppings to be easily distinguishable from those of all other birds. This peculiarity, together with the mass of discarded snow grass stems, offers unmistakable evidence of the takahe's presence, even to the most casual observer.

An interesting characteristic of the bird is its sense of property. Each mated pair ranges freely within what appears to be a fairly well-defined feeding territory.

The quiet chirps of a contented feeding pair are quickly broken off at the suspected presence of a third. Chirping changes to a series of rhythmical booming cries—"ker-lonk, ker-lonk"—which seem to be a combination of alarm and warning to any trespassers. The calls, coming from each bird in turn, rise in tempo for about 30 seconds and stop as suddenly as they begin.

Adults summon their chicks with a single repeated note, "cowp-cowp-cowp." When a pair is separated, one screams "kee-ew," the other answering with a single "kau."

The takahe flicks its tail up and down with almost every step. It runs swiftly, with a free-and-easy gait like a good trotting horse.

The three- to four-month nesting season begins in October (spring in the Southern Hemisphere), when every pair prepares a number of nests, each consisting of a grass bowl with at least two entrances, set between thick snow grass tussocks (page 396). The last to be made is apparently chosen for actual egg laying, and either one or two cream eggs flecked with light purple and brown spots are laid (page 397).

Within three or four days the hen begins sitting, and during incubation seldom moves more than 60 or 70 feet from the nest. Although well camouflaged itself, a nest can easily be located by the heavy feeding signs and the mass of droppings near by.

Beset by Many Dangers

To give the takahe every chance of survival, agents of the Department of Internal Affairs are trapping, shooting, and snaring stoats, weasels, bush hawks, and other predators. Some control of wandering deer that imperil nests and eggs may be necessary.

But other factors—the infertility of the species, the severity of winters, and the availability of snow grass for feeding and nesting—seem beyond human control. Bush fires may easily run wild and destroy the birds, which cannot fly to safety.

The history of the American heath hen is a graphic example of the decline and extinction of a species, with a parallel, perhaps, in the takahe. Once abundant in Massachusetts and probably much more of New England, the heath hen was driven eastward by hunting and after 1870 appears to have been restricted to Martha's Vineyard.

From 1890, when the heath hen population was estimated at 200, there was a slight decline until 1907. With sound conservation measures the number increased to about 2,000 by 1916, but in that year a combination of factors reduced the population to fewer than 150 birds, most of which were males.

Again the numbers rose slightly until 1920, when a steady and inexorable decline set in. By 1928 only one bird could be found; it was seen for the last time in 1932.

As the case of the heath hen demonstrated, when a species is reduced to a very low number, fertility may fall off sharply. Biologists recognize this fact, although they do not yet fully understand the reasons.

At present, estimates of the total number of takahe vary from 30 to 100, compared to

Dr. Orbell (Right) Brought the Takahe Back to Human Ken

The rediscoverer stands in the snow grass of the remote valley where he found the species after years of search. Dr. Falla holds a squirming chick only a few days old. Reproductive power appears to decline: few young are hatched, and of these perhaps only a third survive.

about 150 birds in one colony of the American heath hen when the final contraction of that ill-fated species set in.

The known remaining takahe form several colonies, the largest of which has only about ten breeding pairs. The infertility danger is obvious.

Severe Winters Limit Food

From observations over three nesting seasons, it seems that most, if not all, of the birds in the main Notornis Valley breed yearly, but very few chicks are hatched and raised. In the 1949-50 season, 40 percent of the observed eggs were totally infertile, only three chicks were hatched, and by February, 1950, only one remained alive. It is now known, however, that several birds besides those under observation were nesting.

The availability of snow grass and other food during severe winters, when the area is deeply covered with snow, is an important factor in the survival of the species. A dead adult bird, untouched by predators, was found in the main valley in the spring of 1949. This and other complete skeletons have suggested that starvation is a not uncommon cause of death.

Every endeavor is being made to preserve these contemporaries of New Zealand's extinct giant moa, swan, and eagle, interesting creatures sorely missed. But if measures to combat predators prove ineffective, if nesting shelter and food suffer serious depletion, if a severe winter strikes, or if infertility increases—if any one or a combination of these mishaps overtakes back-to-the-wall notornis—then the species must inevitably join the heath hen, the dodo, the great auk, and others that are lost to the world forever.

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Earth Shocks Dumped Torrents of Rock and Rubble Down This Assam Hillside

In Tibet the author and his wife escaped harm when the Himalayas shuddered and avalanched. They spent weeks hiking out on treacherous trails. These border patrolmen joined them in India's devastated Assam Province.

Caught in the Assam-Tibet Earthquake

Record Shocks Dammed Rivers, Split Mountains, and Trapped Botanists in Rock-strewn Devastation for Three Months

By F. Kingdon-Ward*

With Illustrations from Photographs by the Author

DARKNESS had fallen over the upper Luhit Valley in rugged far-eastern Tibet. Our simple evening meal was finished; my wife was already in bed.

Near by our two servants were sleeping peacefully in their tent. I was seated near the entrance to ours writing in my diary by the light of a hurricane lamp. I glanced at my watch; it was 8 o'clock.

Suddenly a most extraordinary rumbling noise broke out, and the earth began to shudder violently. Shattering the dead silence of the night in that remote mountain retreat, the ominous rumble swelled to a deafening roar. It was as though the keystone had fallen out of the universe and the arch of the sky were collapsing.

Alarmed, bewildered, but also curious, I sprang up and thrust my head between the tent flaps. The night was black, for there was no moon, but I remember seeing a dark ridge silhouetted against a planet-powdered ribbon of sky become fuzzy for a moment. The whole bristling edge of forest was shaking violently.

My wife leaped out of bed shouting "Earthquake!" I seized the lantern, and together we rushed outside, only to be thrown immediately to the ground. The lantern went out.

A dozen yards away our boys were crawling out of their tent. We yelled to them to join us; and, although they had not heard our shouts, a minute later they crawled across to where we lay.

All four of us held hands and lay flat, waiting for the end.

Earthquake Roars to a Climax

My first feeling of bewilderment had given place to stark terror. These solid mountains were in the grip of a force that was shaking them as a terrier shakes a rat. Yet, frightened as we were by the din and violent earth tremors, we spoke quite calmly to each other.

The earthquake roared on. Something was pounding the ground beneath us with the force of a giant sledge hammer. Our once-solid ground felt like no more than a thin covering stretched across the valley floor and attached by its edges to the mountains. It seemed that the very foundations of the world were breaking up under the violent blows, that the crust on which we lay would crumple like an ice floe in a rough sea and hurl us into a bottomless pit.

Besides the roaring of the earthquake itself there was another more familiar sound—the crash of rock avalanches pouring into the valley on every side. The mountains themselves seemed to be falling into the gorge as cliffs broke in half and boulders poured down a hundred scuppers with a clatter and a rumble.

Not far from our camp the mountain rose steeply for hundreds of feet to a higher terrace. Surely the slope would give way and we should be crushed to death or buried alive.

But presently the battering ceased, and the noise died away except for an occasional avalanche. Then without warning came four or five sharp explosions in quick succession, seemingly high up in the dark sky. They sounded like ack-ack shells bursting. It was the cease-fire; everything became quiet, and the madness was over for a while.

The initial shock had lasted only four or five minutes. It had seemed an eternity.

Floods and Landslides Bury Villages

Returning to our tent, I noticed that my traveling clock was on the table and ticking, the altimeter still registered exactly 5,000 feet, and the thermometer showed 73° F. Nothing inside the tent was disturbed except a glass of water that had been upset.

Luckily the steep slope near our camp had not slipped badly; at any rate, no boulders or slides reached us. Apparently we could not have selected a safer site.

Not until weeks later did we learn the magnitude of the earthquake. Over thousands of square miles it created utter havoc. All communications were disrupted. Avalanches buried whole villages and flung rock dams across rivers. When the dams burst, devastating floods raced down valleys, sweeping everything in their path.

Fortunately, in this sparsely settled region the loss of human life, though in the hundreds, was surprisingly small for such an upheaval. Stock died by the thousands.

Seismologists whose instruments all over the

* The author, a British scientist and explorer, has published numerous books and articles on plant hunting in southeastern Asia, including China, Burma, Tibet, Assam, and the Himalayas.

Deep Scars Gully a Mountainside Where Village and Forest Stood

Only one tiny hut perched on the brink remains of an Assam village destroyed in a twinkling during the 1950 earthquake.

Landslide and rain furrowed this mountain. Forest giants were carried away like jackstraws in a millrace.

Towering mountains shook like leaves in a hurricane. Avalanches roared into the valleys, burying villages and damming rivers. When the dams burst, raging waters engulfed valleys (page 403).

James Burke © LIFE

Frequent Tremors Rock the Himalayas

Southern Asia is noted for seismic activity. The Himalayas, still rising, strain the earth's crust. Subterranean rocks give way, causing the crust to rebound and vibrate. The author, a botanical explorer, was camping near Rima when the earthquake struck the sparsely settled Assam-Burma-Tibet border country. Drainage flows into the Brahmaputra.

Drawn by H. T. Eastment and F. E. Allcock

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A Rima Mother Washes Her Child in a Mountain Stream

Fatalistic Rima people, losing homes and stock but not their lives, resumed work in the fields immediately after the earthquake. This youngster got the usual morning bath. A ragged hemp coat is the woman's only garment.

world had been jarred, calculated that the epicenter of this frightful cataclysm in August, 1950, had been along the border between Assam and Tibet, very close to our campsite on the outskirts of the Tibetan village of Rima (map, page 405).

Earthquakes are frequent in this region. It lies in one of the earth's two great belts of seismic activity, which extends from the Mediterranean across southern Asia. The other encircles the Pacific Ocean.*

Although little is known about possible faults or rifts in the earth's crust in this area, it is probable that the shocks which we experienced were associated with one or more faults, as are most earthquakes. Faults are found where mountain chains are rising, in this case the Himalayas. Indian geologists refer to one as the Great Boundary Fault—at the eastern end of the Himalayas, near where Tibet, Assam, and Burma meet.

As the mountains rise, rocks in the earth's crust are put under great strain. Finally the rock gives way, and, as the strain is released, there is an elastic rebound of the crust, with a rock mass on one side of a fault slipping past that on the other. The rebound sets up the vibrations felt in an earthquake.

Even a small amount of ground movement can cause severe damage, especially in a region of steep mountains where masses of rock and earth can easily be dislodged.

The magnitude of this earthquake was 8.6 on the Gutenberg-Richter scale used by seismologists. It is believed to have been at normal depth, about nine miles below the earth's surface. No stronger earth shock has been recorded since the use of seismographs for measuring them became general about the turn of the century. Only one other in the past 50 years was of equal magnitude, that in Colombia in 1906.

Rendezvous with an Earthquake

My wife and I had traveled far to keep our unwitting rendezvous with one of the world's severest earthquakes. Our purpose was to gather botanical specimens high in the Himalayas for the Natural History Museum in London.

During the past 30 years I have been engaged in studying plant life in the remote mountain core of southeast Asia. Botanically, the region we visited in 1950 is little explored, yet it is of particular interest, since the wild ancestors of many of our present food crops came originally from this part of the world.

Our object was twofold: First, we wanted to make, or at least begin, a survey of the flora in this region to link it into the plant geography of Asia and the world as a whole. Second, we hoped to collect seeds of alpine plants which might prove practicable for cultivation in western gardens.†

* "Our Home-town Planet, Earth," by F. Barrows Colton, National Geographic Magazine, January, 1953, contains a map of these areas and discusses the causes of earthquakes.

† For accounts of plant exploration and how it has enriched our gardens and orchards, see, in the National Geographic Magazine: "How Fruit Came to America," by J. R. Magness, September, 1951; "Our Vegetable Travelers," by Victor R. Boswell, August, 1949; and "The World in Your Garden (Flowers)," by W. H. Camp, July, 1947.

Months before the catastrophe, we had arrived in Sadiya, our expedition's jumping-off place in India's northeast Province of Assam. Following the Luhit, a wild, impressive mountain river, we hiked across the formidable Mishmi Hills—noted for their grim steepness, unfathomable gorges, rain-drenched forests, and narrow passages—to the Tibetan frontier. We arrived at remote Rima, a cluster of small villages a day's march inside the border, in time to help celebrate the Tibetan New Year with wassail, feasts, and pony races.

After Chaos, Business as Usual

Early in April, when mountain snows began to retreat before the sun's waxing strength, we undertook the first of a long series of field trips to high alpine pastures. Fortunately, when the big earthquake happened on August 15 we were back at our headquarters near Rima.

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Avalanches Fired Stone Projectiles into Trees

Landslips continued for weeks after the earthquake. In the Mishmi Hills the author crouched against a boulder while stones sang overhead. Flying rocks embedded themselves in this pine (page 414). Other trees were toppled.

There was not much sleep for anyone that night. I dozed fitfully for a few hours, my wife not at all. Violent tremors succeeded one another at intervals; stars dimmed and went out as a vast curtain of dust veiled the sky.

A song like that of a blackbird roused me at dawn. Then came the raucous cry of a small boy scaring birds away from the crops in a near-by field. When presently a procession of women and girls filed out of the village on their way to work in the fields, it was apparent that the world was not yet completely topsy-turvy.

I dressed and went out. This very morning we had planned to be on our way up the Lat Te River, a swift torrent tumbling down from the Burma frontier into the Luhit. But overnight the Lat Te had changed from a blue-green crystal stream to a raging flood of liquid mud.

Rising some four feet, the rock-filled river had smashed several small water mills along its bank. Invisible boulders rumbled as they ground against one another on the bottom.

The Luhit had also risen, carrying a forest of pine logs which had already begun to jam. The previous night we had watched the water in Rima's main irrigation channel, whence we drew our own supply, dwindle until it ceased to flow. For the next three weeks, until we found a spring, drinking water was a serious problem.

In Rima itself every house had lost its roof, every outhouse had collapsed. Its little monastery, with prayer flags bravely fluttering, lay on its side. Cattle and pigs had been killed by falling beams, but there was no loss of human life.

Cracks had opened in the fields, terrace banks had slipped, and here and there whole blocks of land had sunk several feet. Worse, the rope bridge across the Luhit River, connecting Rima with the only trail to Sadiya, had been swept downstream after breaking.

Mountain Giants Ripped to Pieces

The most startling changes were, of course, in the mountain landscape. Steep and craggy, with only thin pine forest for cover on the exposed face, almost every hillside had been torn open (pages 404-5). Strips of green pasture half a mile long had peeled off, leaving dead-white scars.

Nor was this damage confined to the outer

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An Earringed Mishmi Spearman Wears His Hair Long

Tibetans call the Mishmis "topknots" because of their upsweep coiffures. This village headman carries his knife in a split scabbard bound with cane strands. The spear doubles as a walking stick.

ranges. A later view revealed that the mountains up to 15,000 feet, and right back to the main divide, had been ripped to pieces and scraped clean, and that millions of tons of rock had been hurled into the narrow valleys.

The indifference, or fatalism, of the local population in the face of the catastrophe was amazing. Mending their dwellings in the evenings, they made Rima look normal again in a fortnight. Yet many of them expected a repetition of the major shock and thought they might all be killed.

The day was sultry. The wind rose about midday, lifting a curtain of dust which rose until the ragged outlines of the mountains became like shadows, and the red sun looked like a copper gong. I could almost believe it clanged as its rim struck the western range.

The raging river swept by in a coffee-colored flood, hundreds of tree trunks bouncing on the waves.

Night came again, an uneasy night marked by more severe tremors, each preceded by a noise like distant gunfire, or perhaps thunder, since it seemed to come from the sky. So it continued night after night and day after day, the earth trembling as if frightened at the havoc it had wrought.

As the ground shook, avalanches of rocks rolled and rumbled down the mountainsides, and the dust cloud thickened and swelled till every leaf of every plant was caked with the finest gray powder. We tasted and breathed dust; it filled eyes, nose, and ears. When rain fell it was a shower of mud.

To our other worries was added the uneasy feeling of being trapped. Early efforts to get a rope bridge across the river failed, and after three days the attempt was abandoned. We should have to wait till the river fell.

I turned over in my mind other routes out of the Luhit Valley, but could not hide from myself the fact that every alternative to the way we had come was long, difficult, and certainly dangerous. We could not cross the high passes, or even reach them, nor could we go down the Luhit to Sadiya on the Rima side of the river.

To attempt to go farther up the valley, were that possible, was to get uncomfortably close to the Communists, who were taking over Tibet. In fact, any escape from our predicament was out of the question until we could cross the river.

We took careful stock of our position and prospects. It was impossible to reach the alpine meadows from Rima now. On short rations we had food for only about two months, nor could we buy more locally. We heard a rumor that a political officer, who, because of the Communist menace, had lately come up to the frontier with an armed escort, had been killed by the earthquake.

An Assam Rifles patrol working on our side of the river up toward the Burma frontier was, however, reported safe by hunters who reached Rima exhausted. When at last we made contact with the patrol leader by mes-

senger, we were able to send them some food.

So the sticky, hot days passed in slow procession. On the last day of August, more than a fortnight after the earthquake, the indomitable lost patrol marched into our camp, having overcome almost incredible difficulties. Their clothes were torn, their boots worn out. They had no food, and we handed over more than half of our rations to them.

We ourselves were now reduced to a mere 10 or 12 days' supply of flour and rice; for weeks we had lived on little else. Something had to be done quickly.

River Crossed on Bamboo Rope

At our urging the local people tried again to establish the rope bridge across the Lohit, and by September 2 they at last got a line across (page 415). By the 5th a newly plaited bamboo rope was in position, and we decided to leave on the 7th. But first we sent off an urgent message south to Walong, an Indian outpost in Assam near the border of Tibet, asking for rations for the patrol and ourselves.

Porters for our journey arrived early on the morning of the 7th, as promised by Rima's headman, and the whole party set out for Walong. We crossed the river by the rope bridge safely. Each passenger was suspended by leather thongs from a half cylinder of hard wood which slid easily over the bamboo (page 413).

Earthquake damage beyond the river, though conspicuous, did not seriously impede us; in places cultivated ground was so badly fissured as to be virtually plowed up.

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A Tibetan's Fur Bag Suggests the Scotsman's Sporran

This man, chief of a village near Rima, wears a long cloak gathered in folds around the waist. In foul weather the garment covers him like a tent. Prayer beads dangle from his neck.

By evening we had reached a large village, and here we met a party of Assam Rifles who had been sent up from Walong to help us back to comparative safety. They brought a few days' food for all, much to our relief, for we had enough left for only two days, even on reduced rations. On the way the party had bridged torrents which, since the earthquake, had become ungovernable.

From this relief party we heard news of the outside, for the Walong outpost was still in touch with Sadiya by wireless telegraph.

First, the political officer and most of his party were safe, having had a miraculous escape from death. Three of their porters had been killed, several officers injured by falling rocks, and their camp buried with all equipment and food (page 411).

Second, we learned for the first time of the terrific intensity and wide extent of the earthquake.

Third, we found that there was no prospect of planes dropping food for us at present, but there was enough rice stored at Walong to last the entire party, including extra mouths, until November. This, however, allowed none for porters across the Mishmi Hills, who certainly could not carry loads unless they received rice.

Though we were strongly advised not to

↑ Assam Pavement Sags: Water Gushed Up Through the Earth

Huge cracks opened in farmers' fields. Entire blocks of land sank several feet. Strips of pasture half a mile in length pealed away.

Mountains as far back as the main Himalayan divide were ripped asunder and scraped clean, loosing floods of logs and other debris on the rivers.

Their streams fouled by silt, many people suffered for lack of fresh water. Broken communications confronted travelers with the threat of starvation.

Shattered slabs mark the course this road once took across the plains some 200 miles from the earthquake's epicenter at the Assam-Tibet border. It ran through the Assam valley from Gauhati to the Lohit River across from Sadiya.

← This Rock Slide Buried Campers Alive

India supervises vast Assam through a provincial governor assisted by district political officers. One of these officers, accompanied by troops, was en route to a Tibetan frontier outpost when the earthquake struck.

Moments later an avalanche engulfed the party's overnight camp north of Walong. Men found themselves rolling atop the rock flood like corks in a tide. Three porters were killed. Eighty-two other men miraculously escaped but lost all their food and equipment (page 409).

Here the author's bearers, led by Assam riflemen, pass the site.

attempt the difficult and hazardous journey to Walong, we determined to go through with it now that we were on our way.

On the following day we crossed a tributary of the Lohit at a place where we had camped for a month on the way up, half a year previously. We hardly recognized the place. For two days after the earthquake the river, dammed by an avalanche, had ceased to flow. When the dam broke, a flood swept down the narrow valley, ripped out its thick lining of forest, and plastered boulders to a depth of several feet with gray mud whose fetid smell fouled the air.

Now the water had fallen and the mud hardened: thus we had no great difficulty in crossing.

Hair-raising Traverses on Goat Trail

From this point on the going grew steadily worse. Drinking water was scarce, and we had to make long stages to reach it. The goat track we were following climbed to dizzy heights above the river and crossed hair-raising traverses where the whole mountain-side had slipped.

To the peril of falling over the edge of the precipice on one side was added the danger from falling stones on the other. Our fear of this danger was heightened by the rock falls we watched across the river. At one spot opposite our camp, where the cliffs rose almost sheer from the river for 2,000 feet, a fall occurred regularly every half-hour.

I have never watched a more terrifying sight. Immediately after the sharp crack of the rocks breaking loose came a crashing, grinding roar as they poured into the narrow chute, gaining speed. Then, toward the bottom, huge boulders leaped out to meet the river, spinning in the air as if fired from a gun, while the dust hung in clouds like smoke.

On the night of September 10 we camped near a hot spring after an exhausting day's march of eight and a half hours. Each morning we had started at daylight in order to get over some of the most dangerous places before sun and wind combined to start the boulders slipping and sliding. We were now only about a mile from Walong, but it was a mile of dangerous screes. More than ever was it necessary to start early. We got up at 4 o'clock, packed hurriedly, and before 5 o'clock were on our way.

Thus, on September 11 the whole party, now numbering (with riflemen, porters, and our own group) about 60 people, marched into Walong amidst the congratulations and handshakes of the garrison.

We settled down in camp at Walong with the knowledge that the path on to Sadiya had been overwhelmed in a score of places. Until some of the gaps had been patched up and some of the rivers bridged, there was no hope of getting straight through, and therefore no point in starting. We could expect at least another month of inactivity.

Thundering Avalanches Continue

It was difficult to proceed more than a mile or two either up or down the valley under present conditions; tremors continued, and on both sides of the river rocks came thundering down. Sometimes in the dead of night we were awakened by the terrifying noise of a big rock avalanche at close quarters.

It was possible, however, to climb shattered spurs and gullies immediately above the outpost, though extreme caution was necessary. I went out on botanical reconnaissance nearly every day, on one occasion reaching 8,000 feet altitude. Several times, by rough tracks, I climbed to more than 6,000 feet, 2,000 feet above Walong at the bottom of the gorge.

Each evening we gathered in the political officer's hut, read the wireless telegraph messages which had come in, and discussed our prospects of escape. One fact emerged clearly: Because of the shortage of porters we should have to withdraw by detachments.

On October 2 the political officer's party started for Sadiya. We were sorry to lose them, especially the P. O., a Lushai and a gallant fellow as well as a most cheerful companion. But I was thankful that we ourselves were not leaving just yet; I still had a few days' grace in which to reach the alpine region and collect seeds.

After our companions left, I persuaded two of the local inhabitants to reconnoiter the one remaining possible route to the heights. They returned three days later with the news that it would "go." An injured shin prevented my wife from making the climb; so I went off with four porters carrying light loads.

After crossing cliffs of heartbreaking difficulty, we made a long, straightforward climb up a steep grass slope and finally camped on the edge of a forest at 7,000 feet. Higher we could not camp for lack of water.

Here we spent three nights. Twice I climbed to nearly 11,000 feet, collecting seeds of temperate-forest trees and shrubs. Then the clear autumn weather broke, thick mist shrouded the mountains, and we returned to the valley.

Though the earthquake frustrated the major part of our alpine seed collecting, this brief expedition yielded valuable results to supplement our earlier work. We collected seed from about 50 species of plants. Of these, about half a dozen species turned out to be

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A Pack Load Slides Across the Raging Luhit on a Rope of Plaited Bamboo

The author found his escape route blocked in a number of places where floods had destroyed primitive suspension bridges. He spent days waiting for water to drop so temporary spans could be built. He and his wife made this hazardous crossing at Rima in a leather sling attached to a wooden slider (page 409).

among the more important botanical discoveries of the year. Nevertheless, we only scratched the surface. Most of the great gap in our knowledge of the flora of southeast Asia still remains to be filled.

River Bursts Earthquake-made Dam

We got back to Walong just in time. Our porters had arrived, and soon we were due to set out for Sadiya. Much of our equipment had to be left behind, for loads had to be cut to the minimum. However, we did not abandon a single specimen of our hard-won collection.

On the evening of October 14 we were strolling down the valley taking the air when suddenly we became conscious of yet another distant roar. It grew louder and louder, until it filled the gorge with reverberating thunder. We stood on the edge of a high terrace above the Luhit River and searched the valley with field glasses, but there was nothing unusual in sight.

Slowly the noise died down. Next morn-

ing we learned that the Yepak River, a tributary of the Luhit hidden in its near-by valley, had been blocked for 12 hours by an avalanche. The rock dam gave way in the evening, letting out the pent-up water, and it was this which had caused the thunderous roar. Once again we were delayed while another temporary bridge was thrown across the Yepak.

On October 16 we set out for Sadiya, hoping to reach the plains in 12 days. Little did we realize what was in store for us. The 10 days' journey across the Mishmi Hills is divided into three rugged sections of one four-day and two three-day marches. At the end of each section there is a small military outpost where we changed porters and could, if necessary, halt for a day's rest.

The first day's march, which included crossing the unleashed Yepak, was not as difficult as we expected, though when we halted that evening at the foot of a tremendous precipice I guessed we were in for trouble on the morrow.

Route Climbs a Dizzy Cliff

On our journey into Tibet we had walked around this cliff, but now eight feet of swift, ragged water battered at its foot. Up the face of the cliff now climbed a narrow timber gallery suspended by loops of wire from iron pitons driven into the cracks. It sloped upward at an angle of some 30°, curling around the smooth buttress and disappearing from sight around a corner.

There was just room enough to inch along between the rock wall and a loose handrail, which was meant to give moral but no other form of support.

After we had turned the corner, the gallery ended abruptly, and we found ourselves on the brink of the cliff hundreds of feet above the white-capped river, with a dangerous traverse of several hundred yards across a smooth, steep slope.

This was bad enough, but what made it infinitely worse was the ever-present threat of a rock bombardment from above, or even of the whole track sliding into the river as a fresh stratum peeled off.

The slope began a thousand feet or more above our heads. All such slopes were dangerously unstable and still very active, though it was nine weeks since the earthquake. We had the uncomfortable feeling that the next avalanche might start at any moment.

It was impossible to run across crumbling faces of this sort; there was no path, nothing but a series of toe steps slanting upward or downward, often nearly obliterated, with nothing to hold on to. We leaned our weight against bamboo staffs, as on a snow traverse, keeping as upright as possible to press nearly vertically on the loose material. It was a matter of balance, and balance alone. Luckily my wife's nerves are not affected by height. The porters, carrying nearly their full 60-pound loads, crossed the most frightful slopes as steady as guardsmen.

Rocks Hurled with Cannon Force

Late that afternoon we had to negotiate another hazardous traverse even worse than the first one. At one point stones were whizzing down, and we crouched against the rock as they sang over our heads. Their velocity may be gauged by the fact that we passed a pine tree in whose trunk several sharp-edged rocks hurled from the cliff above were deeply buried (page 407). So began our baptism of fire on this leg of the trip.

On the third evening we reached the corner where the Luhit makes a spectacular bend from almost due south to northwest. There a change of climate, and with it a corresponding change of forest, takes place. With greatly increased rainfall and a warmer winter, a type of broad-leafed Malayan jungle replaces the Tibetan pine forest.

I innocently supposed that once we exchanged the bare granite cliffs of the upper gorge for the deeply eroded slopes of the middle valley, with their protecting cloak of broad-leafed forest, there would be no more serious slides. I was quickly disillusioned. No sooner were we round the bend than we found ourselves on a particularly bad traverse, the smooth face sloping steeply for one or two hundred feet before dropping sheer to the river 1,000 feet below.

I consoled myself with the thought that we were scarcely into the real forest; probably the thick jungle of the lower valley would hold up the slopes. But in vain; landslides were perhaps fewer here, but they were even more sudden and violent.

That evening we completed the first section of four marches without accident and arrived at a satellite outpost of the Assam Rifles. It was the *Durga puja* festival, celebrating the end of the monsoon season, and in the evening we were invited by the *havildar* (sergeant) in command to drink rum with him and listen to the gramophone. We got no news here, for the post had no wireless set.

During the march from Walong we had passed numbers of Mishmi porters carrying up rations, parcels, and kegs of rum. It was a relief to know that transport was starting to move along this tortured track once more.

We had to rest a day at the outpost while fresh Mishmi porters were engaged (page 416). Our Tibetan porters started back for Walong.

It began to rain, and when we set out again on the 21st it was still raining. The most formidable obstacles we had to cross on this leg of our journey were the steep slips of the many slitlike ravines that are characteristic of regions with high rainfall and soft schistose rock.

Flooded River Blocks Escape Route

Nevertheless, we safely covered the three long stages to the next outpost, only to learn that the Tiding River ahead of us was in flood. We should not, we were told, be able to cross it for a week until another temporary bridge (the third) had been put up. A resthouse had been swept away by the flood, and since there was no hut by the river we decided to stay where we were, especially as it continued to rain.

This outpost possessed a wireless set, but it had been out of order for some weeks. We did get a little stale news from an Assam paper that had come up by post a month before. It gave us our first lurid account of the earthquake and flood in the Assam valley. We heard, too, that the political officer's party had reached the plains safely after a most trying journey.

Here we learned that the Luhit River itself had been blocked, an immense lake had formed, and there was talk of bombing the dam from the air—an all but impossible assignment. However, after 36 hours the dam burst. The flood that followed was catastrophic.

As though that were not enough, the almost equally big Dibang River also had been blocked, and when that carefree river simply changed its course, Sadiya was almost swept away. Finally, the Tiding, still the most formidable obstacle between us and the plains, had been blocking and unblocking itself every fortnight in an abandoned manner.

It was still raining relentlessly. With only five more marches to the motor road that leads into Sadiya, the week's holdup here was irksome.

The slow hours passed, and on October 30 we resumed our journey in clearing weather.

On November 1 we reached the ill-famed Tiding and found a party of men busily completing the temporary cane suspension bridge. That night we slept at a rationing post. From it food supplies were being sent up the valley for distribution to the starving hillmen.

Next morning we found ourselves in what appeared to be a vast, stony desert. We were in the almost-dry bed of the great lake which the blocked river had formed.

To say that not one stone remained upon another of the godowns and the bungalow we had stayed in on the way up would give a totally false impression. There were millions of stones; but no one would have suspected

415

Sturdy Tibetans Carry a Bridge on Their Shoulders

Patient fingers braided this 300-foot rope from bamboo fibers to bridge the Luhit (pages 409, 415). It weighs nearly 200 pounds.

414

The Author's Injured Wife Crosses a Mountain Flood on a Porter's Back

Mrs. Kingdon-Ward walked unaided over difficult trails, but here she accepted a ride to protect a bandaged leg. Mishmi tribesmen pack 60-pound loads.

that any work of man had ever stood there. It was not destruction; it was complete annihilation.

Even so, when we reached a vantage point near the place where the Luhit emerges from the hills, below its confluence with the Tiding, devastation surpassed anything we had seen yet. Whole ranges of hills had split open, and three major floods had swept over the debris.

A tedious ascent of 4,000 feet in 10 miles by a long zigzag path brought us to a saddle overlooking the valley of Assam, and there burst upon us the finest view in all the Province. It made up for all we had suffered.

It was late afternoon and the western sun gilded the wide-sweeping plain which stretched away westward into the evening mist. A score of converging watery threads, great and small, wriggled toward Sadiya 50 miles away, flashing like quicksilver 5,000 feet below.

As the sun sank behind the purple ranges, its gold slowly changed to crimson, and the crimson to violet. We could hardly drag ourselves away from the glowing view.

In the gathering darkness we hurried down to Dreyi, and slept our last night in the hills in a battered bungalow which stands on a windy spur. All around was the green forest.

The next day, November 4, an ever memorable day, after a sticky descent of 3,000 feet, we reached the plains. Our struggle through the awesome debris of one of Nature's greatest cataclysms was at an end.

New National Geographic Map Shows North America's Altered Face

TEN busy and eventful years of heavy production for war and peace, of growth and aerial exploration, have etched their effects upon the familiar face of North America.

Reflecting this decade of development, the National Geographic Society's new map of North America, sent to members as a supplement to this issue, gives an up-to-date full-color, full-length portrait of our ocean-moated continent.

Thousands of additions and changes have been made since The Society last mapped this area early in 1942, just a few months after the attack on Pearl Harbor plunged the United States into all-out war.

How Current Events Change a Map

Events which remake maps need not be so earth-shattering as a war, the sudden birth of a volcano, or even a new United States census, though all of these things have made their marks on the surface of North America in the last ten years. Changes may come from such varied causes as these:

A little-known officer in the United States Army rises to world fame as commander of the Allied invasion of Europe—and a peak in Alberta becomes Mt. Eisenhower.

In honor of a popular radio program, a town in New Mexico changes its name from Hot Springs to Truth or Consequences.

A Canadian prospector, looking for new claims to stake, pores late over some new aerial photographs of northern Canada—and the world's largest meteoritic scar, Chubb Crater, goes on the map.*

Thanks to oceans and to efforts of America's millions, no earth-scorching invasion armies marched across this favored continent. No war-born treaties, no land grabs, no revolutions or intrigues twisted its international boundary lines. But atomic development spawned new cities as far apart as Tennessee and New Mexico, Nevada and the State of Washington.

All Inhabited Continents Newly Mapped

With this map The Society's world-wide membership now has a complete postwar atlas of the world's inhabited continents. Similar large ten-color maps of Australia, Europe, Africa, South America, and Asia have been painstakingly prepared by The Society's cartographers and issued as supplements to The Magazine in the last four years.†

More than two million copies of the new North America map have slid from big lithographic color presses to meet the needs of The Society's ever-growing family of members.

On a scale of 173.6 miles to the inch, the 28-by-33-inch sheet shows not only the whole of North America but also the northern part of South America, including major portions of Colombia and Venezuela, rich in oil and iron. It contains a total of 5,204 place names.

The use of a larger scale (1 to 11,000,000 in the new map compared to 1 to 12,000,000 in the old) gives a 19-percent increase in area and permits the inclusion of 1,286 more place names than its predecessor had.

Like red arteries and dark veins, main railroads and highways crisscross the map. Important airports spangle much of its surface with red stars.

Changes in the appearance of the new map reflect, in part, improved techniques in map making. A new method of depicting a curved portion of the earth's surface on a flat sheet of paper, the Chamberlin Trimetric projection, invented by Wellman Chamberlin of The Society's Cartographic Staff, is here used for the first time on a North America map. It is particularly well suited for portraying a generally triangular continent like North America with a minimum of distortion.

Inset Shows How Close Is U. S. S. R.

How far is Russia from United States soil? A large inset of the Aleutian Islands and the Bering Sea emphasizes the answer: a mere three miles. Eskimos living on the two Diomede Islands used to visit relatives and friends, sledging over the ice from one hemisphere to another and from one date to another without a thought of world time or world tensions. Now the Kremlin has clamped down on this international visiting.

Dotting the frozen fringes of the Arctic Ocean in Alaska, Canada, and Greenland are a number of new communities which *cannot* be shown, because of military security.

These are the new United States and Canadian military and airforce bases, set up to listen for and repel any sudden air attack on this continent across the Arctic route. The number, size, names, and locations of these year-round "villages" are all secret.

Out of this Canadian-U. S. teamwork has

* See "Solving the Riddle of Chubb Crater," by V. Ben Meen, NATIONAL GEOGRAPHIC MAGAZINE, January, 1952.

† Members may obtain additional copies of the new North America map (and of all standard maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices in United States and Possessions, 50¢ each on paper; $1 on fabric; Index, 25¢. Elsewhere, 75¢ on paper; $1.75 on fabric; Index, 50¢. All remittances payable in U. S. funds. Postpaid.

come a virtual remapping of the American Arctic coastline. Foxe Basin, for example, formerly a blank expanse of icy water, boasts a handful of air-discovered islands. One, more than twice as large as Long Island, New York, honors the baby Prince Charles who may someday mount Britain's throne.

Northeast of Hudson Bay, like a round pockmark on the nose of Quebec, a newly drawn circle marks meteoritic Chubb Crater, so called for the prospector who hoped to find diamonds there. More recently, the Canadian Board on Geographic Names has formally retitled it Ungava Crater (Ungava is an Eskimo word meaning "far away"). The shorter name is now so well known that The Society's map lists both names.

Rails Push Toward Labrador's Iron

Stimulated in part by the needs of defense, North American steel mills last year poured approximately 109,000,000 tons of steel, about half of the world's total production. More than 105,000,000 tons of this were produced by the United States. At the same time, the main U. S. source of iron ore, Minnesota's great Mesabi Range around Hibbing, has grown dangerously close to exhaustion.

Wherever important new iron deposits have been found, new communities are springing up and old ones booming. One of them is Burnt Creek, Quebec, which will be the mining and shipping center for vast new-found deposits of iron extending into Labrador. A thin dashed line connects it with Sept Iles (Seven Islands), on the St. Lawrence River.

Where this line runs, crews of men and heavy machinery are now working to carve a new railroad out of the wilderness—a railroad which will eventually make Ungava considerably less "far away."

Another booming beneficiary of the world's eternal need for more steel is Iron Mountain, Utah, where new exploration has recently doubled estimates of iron reserves. Far south in Venezuela, the names of Cerro Bolivar and El Pao have appeared on the map, marking huge new-found deposits of high-grade ore.

The A-Bomb Jars Geography

Because of atomic research or atomic energy's raw material, uranium, new communities have sprung up and old ones have become newly famous. Names like Los Alamos, New Mexico; Oak Ridge, Tennessee; and Frenchman Flat, Nevada, win inclusion in this map of North America.

Before World War II, total world demand for uranium ore amounted to only about 200 tons a year; its chief use was as a coloring agent in glassware and ceramics. Now, with the Atomic Energy Commission buying every pound available, uranium finds itself in a class with the precious metals.

Almost all U. S. uranium production comes from the Colorado Plateau area where Arizona, Colorado, New Mexico, and Utah meet. Here newly important communities—and new names on the map—are cropping up fast. Naturita, Durango, and Rifle, all in Colorado; Monticello, Hite, and Marysvale, in Utah; and Grants, New Mexico, are on the new map chiefly because they are centers of uranium production or processing.

The Canadian Government has bought the El Dorado mine on Great Bear Lake in the Northwest Territories, and also has found uranium as far south as Lake Athabasca and Beaverlodge Lake, both in northern Saskatchewan. Canada yields much of our uranium.

During the winter of 1947–48 an alert young Canadian mining engineer, Robert Campbell, found a geological report which had been gathering dust in a Toronto library for a century. Written in 1847 by the American scientist John L. LeConte, it described a mineral found on the eastern shore of Lake Superior. LeConte called it "coracite."

Further research convinced Campbell that "coracite" actually was pitchblende, the primary ore of uranium. Armed with a Geiger counter, he set out to rediscover it. His strike marked the first pitchblende discoveries in the southern part of the Great Canadian Shield and spurred another uranium hunt in Ontario and northern Michigan.

Map Reflects Alberta Oil Boom

In Alberta, Canada, vast petroleum discoveries made since 1947 promise to change the whole picture of North America's oil production. In one small area being worked at Edmonton, reserves are placed at a billion barrels of oil and more than five trillion feet of natural gas. The new field has added the name of Redwater, Alberta, to the map, and the future is sure to add more in this area.

The sedimentary basin on which this field draws extends over 800,000 square miles through western and northwestern Canada. A new 1,127-mile Inter-provincial Pipe Line can carry 95,000 barrels of oil a day from Edmonton eastward to Saskatchewan, Manitoba, and Great Lakes ports.

Of scientific rather than economic interest is a new place name in west-central Alaska—Curlew Lake. Dr. Arthur A. Allen bestowed it to signalize the end of ornithology's 163-year search for the breeding ground of the bristle-thighed curlew, the last of 815 North American birds to yield the secret of its nesting place and summer home.*

* See "The Curlew's Secret," by Arthur A. Allen, National Geographic Magazine, December, 1948.

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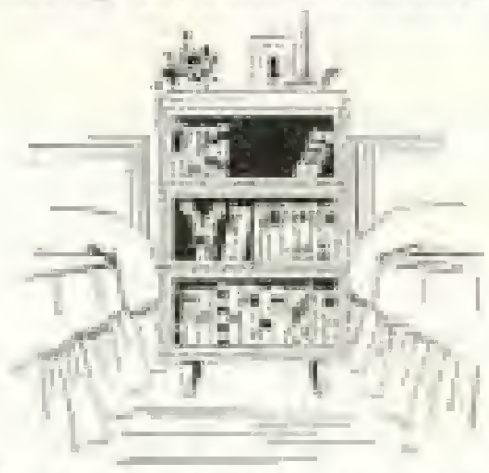

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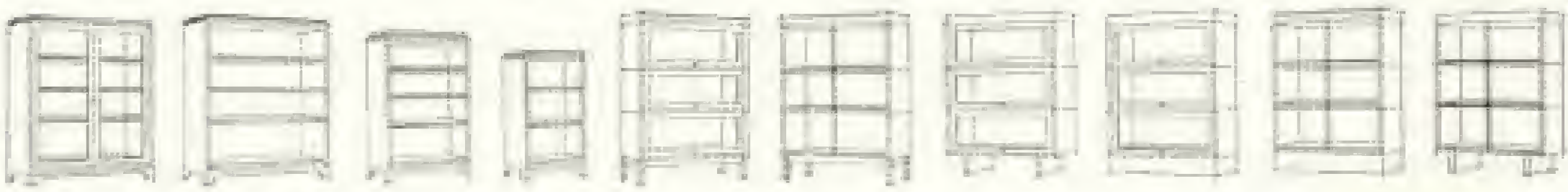

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