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New 10-Color Map of the West Indies

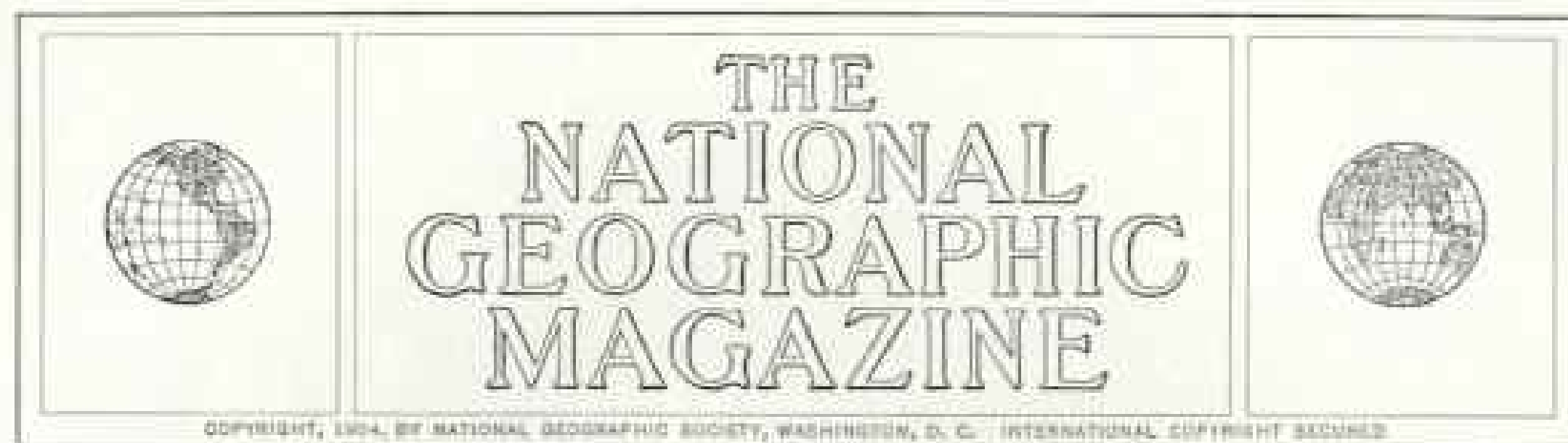
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The Greener Fields of Georgia

287

Dixie's Empire State Turns Cotton Land to Pasture, Makes News with Pine, and Multiplies Its Industries

BY HOWELL WALKER

National Geographic Magazine Staff

With Illustrations from Photographs by the Author and B. Anthony Stewart

GEORGIA, the Empire State of the South, does not and will not forget its past. As long as mockingbirds sing in the trees and the moon silhouettes magnolia leaves, nostalgia will linger with the legacies of a gentle folk. Yet an exuberance exciting as spring animates the State today.

When left poor by the War Between the States (as people down here prefer to call it), the Deep South faced a shallow future. Southerners went north to make a living. Transient Yankees, like migratory robins, visited Georgia in winter only.

But now Georgians turn to promising jobs at home. Moreover, northern families and northern enterprise are moving south for good. Even dyed-in-the-West cattlemen shift here to profit from pasture with plenty of water. For native and newcomer, the fields grow greener.

State on the March

Everywhere fresh industries burgeon like the Georgia-developed wonder grass for grazing. Purebred cattle and diverse crops flourish on abandoned cotton land. Expanding factories make synthetic fabrics that challenge time-worn textiles.

Hand in hand, agriculture and industry, southerner and northerner are happily marching through Georgia 90 years after Sherman. The State, inspired by its own gains, welcomes

the invasion as zealously as Atlanta tried to repel that Union general.

To watch the parade, I blew out of Washington, D. C., on the wings of a cold wind from the north in the crisp wake of a biting blizzard. From the Potomac to South Carolina, winter gripped the earth with brittle fingers.

When I crossed the Savannah River and entered Georgia, I stopped the car and peeled off my coat. The sun was hot. A heady essence of pine filled the soft air. I smelled the South and felt at home, for home I was—after an absence of 20-odd years.

It's a Different Georgia Now

Yet, how different! Some 10,000 miles of driving were to reveal a Georgia vastly changed from the one I knew as a boy.

The State—larger than Maine, Massachusetts, Connecticut, and Maryland combined—now has three and a half million people.

Rough old roads of sand or clay have widened into smooth paved highways. The weary plowman and his mule are passing from the scene. Areas once ravaged for cotton, now reforested, supply chemical plants, paper and lumber mills.

Cities and towns build up, spread out. Housing projects take over country where I used to hunt rabbits and quail.

All Georgia is divided into three parts: mountains in the north; wide plateau across



Moss-draped Live Oaks Lend Dignity to Georgia's Grove Point Plantation

The spirit of the Old South lingers in lovely white-columned homes like Grove Point on the Ogeechee River near Savannah. This house, reconstructed from the bricks of a dwelling burned by Gen. William T. Sherman's troops, surveys canal-threaded islands that once were rice fields as far as the eye could see. Mrs. George A. Marcus, Jr., the owner, traces the plantation's history back to land grants from England's King George III.

the center; and coastal plain extending inland over the south. A 100-mile-long chain of islands lies just off its Atlantic seaboard (map, page 290).

Climate differs in these vast belts, but it generally offers brief, brisk winters and long, warm summers with ample rainfall. It lets Georgia go to grass—in a progressive sense. Since 1940 total pasturage has more than doubled, to three and a half million acres, while cotton acreage has shrunk from five to about one and a half million and continues to dwindle. Income from beef cattle has increased 466 percent in the past 12 years.

Riding across the countryside, I saw what grass can do for an erstwhile one-crop commonwealth. Sharecropping and shabby tenant houses are on the way out. The enlightened farmer now uses electricity, paint, fences, fertilizer, mechanical equipment. He knows the value of soil conservation; he lives and works on his own land.

Farm Products Diversified

Farms cover nearly two-thirds of Georgia, and the State leads the Nation in production of broiler chickens, peanuts, watermelons, pecans, and pimientos—but not in peaches at present, though this is traditionally the Peach State.

Long second among the States in cotton output, Georgia now ranks only sixth, but cotton culture, like most long habits, dies hard (pages 304 and 305). Even if no longer king, cotton remains the chief cash crop. All except five of the 159 counties raise it for textile manufacture, Georgia's largest industry.

Fragrance of pine gave way to industrial aromas as I approached the outskirts of Savannah. From tall chimneys of the Union Bag & Paper Corporation, smoke drifted over mountainous piles of pulpwood. It took me several hours to walk through the plant,



Peanut Vendor Makes a Sale by Atlanta's Statehouse

Corridors of Georgia's million-dollar capitol, lined with native marble, display many historic flags, some torn by shot and shell.

one of the world's largest paper-bag makers.

Huge machines here chew up daily 200 carloads (3,000 cords) of pine, mostly from Georgia's 23 million acres of forest. Six of them, each longer than a city block, convert the pulp into enough paper and paperboard for 40 million strong bags for food, grain, fertilizer, building materials; 300 tons of corrugated shipping boxes; and additional masses of creped, waxed, and plastic-coated wrappers—all in one day.

For several years the State has topped the South in pulpwood production. Climate and soil favor rapid regrowth that keeps abreast of the harvest.

In the early 1930's Dr. Charles H. Herty, of Savannah, pioneered in the making of newsprint from southern pine. As a result of his experiments, seven big pulp and paper mills have gone to work in Georgia. More are going up, and the industry swells with similar plants throughout the South.

Savannah Cradled the Colony

In 1733 Gen. James Oglethorpe and about 120 pioneers arrived from England to settle the last of the 13 colonies, in the name of King George II. Their ship moored at a bluff 18 miles up the river called Savannah. Dealing peaceably with the Indians, they laid out a town. The plan they followed still distinguishes the city of Savannah, cradle of Georgia.

Into the growing port sailed vessels of every rig and size, bringing settlers and legal cargoes. Some smuggled contraband to a colony trying to outlaw slavery and rum. Schooners' ballast stone subsequently buttressed the bluff and cobbled the streets.

Rocky ramparts give the old haven the hoary look of a medieval fortress. Walking over the mellow paving, I imagined the scene in days gone by: wooden masts by the score, dusky longshoremen, lantern-lit taverns, rollicking chanties, and salty smells.

Georgia Owes Its Name and Charter to England's George II

The State's Creek and Cherokee Indians first saw white men when Hernando de Soto's Spaniards came seeking gold in 1540. Almost two centuries later James Edward Oglethorpe founded Savannah and established the 13th English colony in America.

The South's Empire State is famed for Uncle Remus and *Gone with the Wind*; for EB Whitney's cotton gin, Coca-Cola, and peaches; and for the song of the Chattahoochee, as it skips through the hills of Habersham and the valleys of Hall.

Formerly at the mercy of cotton prices, Georgia now draws her wealth from diversified farming, cattle raising, and a host of booming new industries.





NORTH CAROLINA

TENNESSEE NORTH CAROLINA

SOUTH CAROLINA

Atlanta Savannah

ALABAMA

Atlantic Ocean

Gulf of Mexico

0 100 STATUTE MILES

ROSLINA

ORGIA

Atlantic Ocean

0 10 20 30 40 50 STATUTE MILES

© National Geographic Map
Drawn by Ivan E. Allen

ORIDA

Jacksonville



Heroes of the Confederacy March Ghostlike Across the Face of Stone Mountain

Gutzon Borglum began this gigantic memorial near Decatur on the scarp of a 650-foot granite dome, largest of its kind in North America. When plans went awry, the sculptor's work was blasted away. Augustus Lukeman began a second attempt to carve a cavalcade of Confederate leaders and troops, but left the project incomplete for lack of funds. Here Gen. Robert E. Lee and his horse Traveller form a shadowy outline as high as a 10-story building (page 306). Jefferson Davis's face looms from the rock ahead of Lee. Gen. Stonewall Jackson is roughed in at right. This deceptive telephoto shot was taken a quarter of a mile from the cliff.



Twin-barreled Cannon, a Fiasco in the Civil War, Fired Only One Charge

Two chained balls shot simultaneously were supposed to mow down Union troops like a scythe. When tested, the balls broke the chain and sliced wide of the mark. Athens keeps the relic on its city hall lawn.

From the harbor in 1819 departed the *Savannah*, first steamship to cross the Atlantic. Though she used sail during most of the crossing from New York, she heralded the new era of steam.

Like a central keep overlooking the river, the old Cotton and Naval Stores Exchange is a quiet reminder of busier times (page 308). Savannah once annually handled one and a half million cotton bales and still exports more barrels of turpentine and rosin than any other harbor in the world.

Georgians Invest in Port Expansion

Upstream the picture changes. The harbor is expanding its facilities. Now in operation is a State-financed \$20,000,000 dock and warehouse system, served by 26 truck lines and five major railroads. The newly completed project aims at a larger share of the Nation's export and import trade.

I remember when pine groves and moss-draped live oaks, scattered plantations and empty marsh surrounded drowsy Savannah. Then I could hear mockingbirds singing all day, smell magnolia blossoms and old-fashioned roses, and walk in the calm of ancestral homes, walled gardens, and little lanes (page 288).

Now the impact of a new South crashes at the gates of the gracious city. Factories, warehouses, and power plants; silos, oil tanks, ship and rail yards; mills and airfields are creating a commercial boom.*

Still unchanged at heart, however, the quiet community of easygoing charm seems to ignore the clatter of industrial progress. Savannah listens instead to the insistent undertones of the past. Its residents politely dis-

* See "Dixie Spins the Wheel of Industry," by William H. Nicholas, NATIONAL GEOGRAPHIC MAGAZINE, March, 1949.

credit any tendency to alter the city's way of life. They see no need of speed on the streets; so they keep traffic-slowing squares as Oglethorpe laid them out almost two and a quarter centuries ago.

Shrimp by the Millions

Fishing trawlers ply Savannah's marshy waterways, which in the long ago were infested by rumrunners and slave traders. Shrimp fleets dock beside canning plants in the suburbs.

In 1948 the president of one firm gave up his city grocery for fantail shrimp!

"People wanted shrimp," said William Mullis, "but not the bother of preparing it. So, in our kitchen, my wife and I started putting up 12-ounce packages—cleaned, dipped in egg batter, and frozen. All the customers had to do was drop them in a frying pan."

Now 500 workers in Mullis's Trade Winds Company process 12,000,000 to 15,000,000 pounds of shrimp a year. Partner Henry Ambos runs the boats that net the haul.

On an island near the Savannah River's mouth stands Fort Pulaski, erected early in the 19th century. Firing at this moated, thick-walled fortress, Union artillery in 1862 forced its surrender and showed for the first time that not even heavy brick-and-stone defenses could withstand shelling by rifled cannon.

Southerners, however, hated to think that anything Robert E. Lee helped engineer could crumble under Yankee fire. A Savannahian told me that when he was a child, his bicycle had accidentally knocked down a local pedestrian. The boy greatly feared the consequences. But father simply said, "Forget it, son; that man surrendered Fort Pulaski to the Yankees!"

On the Golden Isles of Guale

Eighty years before the Pilgrims landed at Plymouth Rock, the roving Spaniard Hernando de Soto explored what is now Georgia. In 1566 Menéndez de Avilés landed on off-lying St. Catherines Island and claimed the land for Spain, thus establishing Georgia's first white settlement. Here, two years later, Spanish missionaries compiled the first book in what was to become the United States.

In 1736 General Oglethorpe built Fort Frederica on St. Simons, another island off Georgia's coast. The Spanish had long since withdrawn to Florida, but were threatening

to push north again; and pirates lurked in this corner of the Spanish Main.

From their base at St. Simons the English waged a seesaw campaign against their Spanish rivals. Finally, in 1742, the Battle of Bloody Marsh, fought near Frederica, shattered forever Spain's challenge to British colonization of the Atlantic Coast.

"The Golden Isles of Guale," these off-shore islands have been called. Almost four centuries of priests, pirates, soldiers, settlers, sportsmen, and tourists have crowded them with history and romance.*

North to south, the chain includes Ossabaw, St. Catherines, Sapelo, St. Simons, Sea Island, Jekyll, and Cumberland. All but two are privately owned: Jekyll, a State park; and St. Simons (with Sea Island), a year-round resort (page 325).

Old-time Planters Prospered Here

Until the war between North and South, slave-owning planters prospered on the Golden Isles. They raised indigo, rice, sugar cane, and the country's first long-staple sea-island cotton. Magnificent oak forests provided timber for our Navy's earliest ships, like the *Constitution*. Thick pine stands fed lumber mills. But cotton, above all, kept the communities happily independent.

On visits to four private islands I found grass and cattle taking over abandoned cotton fields. Pasture improvement and beef production are the current interests of the isles.

St. Catherines' hospitable owner, Edward J. Noble, Chairman of the Board, American Broadcasting Company, showed me bulldozers clearing woods for grazing. Already, some 700 Black Angus cattle roam the island.

"Eventually," said Mr. Noble, "we hope to have between 4,000 and 5,000 acres of improved pasture. We're making soil tests to learn the most efficient grasses to seed."

Mr. Noble invited me to stay at his island home, a gem of colonial architecture. The house is believed to date from the time of Button Gwinnett, who moved here 10 years before he became one of Georgia's three signers of the Declaration of Independence.

Time has not effaced the natural beauty of the ageless Golden Isles. Lordly live oaks still whisper through long, mossy beards.

(Continued on page 303)

* See "The Golden Isles of Guale," by W. Robert Moore, NATIONAL GEOGRAPHIC MAGAZINE, February, 1934.



Classic Columns, Lofty Trees, and Southern Girls Grace Georgia State College for Women

Opened at Milledgeville in 1891, GSCW now has an enrollment of some 700 (page 300). A prison on this site was burned by Gen. William T. Sherman when he marched through Georgia in 1864.



Atlanta, Born at the End of a Railway Line, Has Become Georgia's Capital and the Hub of the Southeast

Since the 1840's Atlanta has grown into one of the country's leading commercial centers and the home of more than 430,000 people. Georgia's domed capitol is styled after the Nation's (page 189). The 14-story City Hall (left) occupies the site of General Sherman's Civil War headquarters.

World's Major Players Compete in the Annual Masters Tournament at Augusta National Golf Club

Bobby Jones and the late Dr. Alister MacKenzie laid out the course among pines, ponds, and flowering shrubs. First tournament took place in 1934. Member Dwight D. Eisenhower during brief vacations from the White House plays on the course and lives in a cottage on the grounds (page 350).

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Advertising Men of Coca-Cola Refresh Themselves in Atlanta with the Product They Publicize

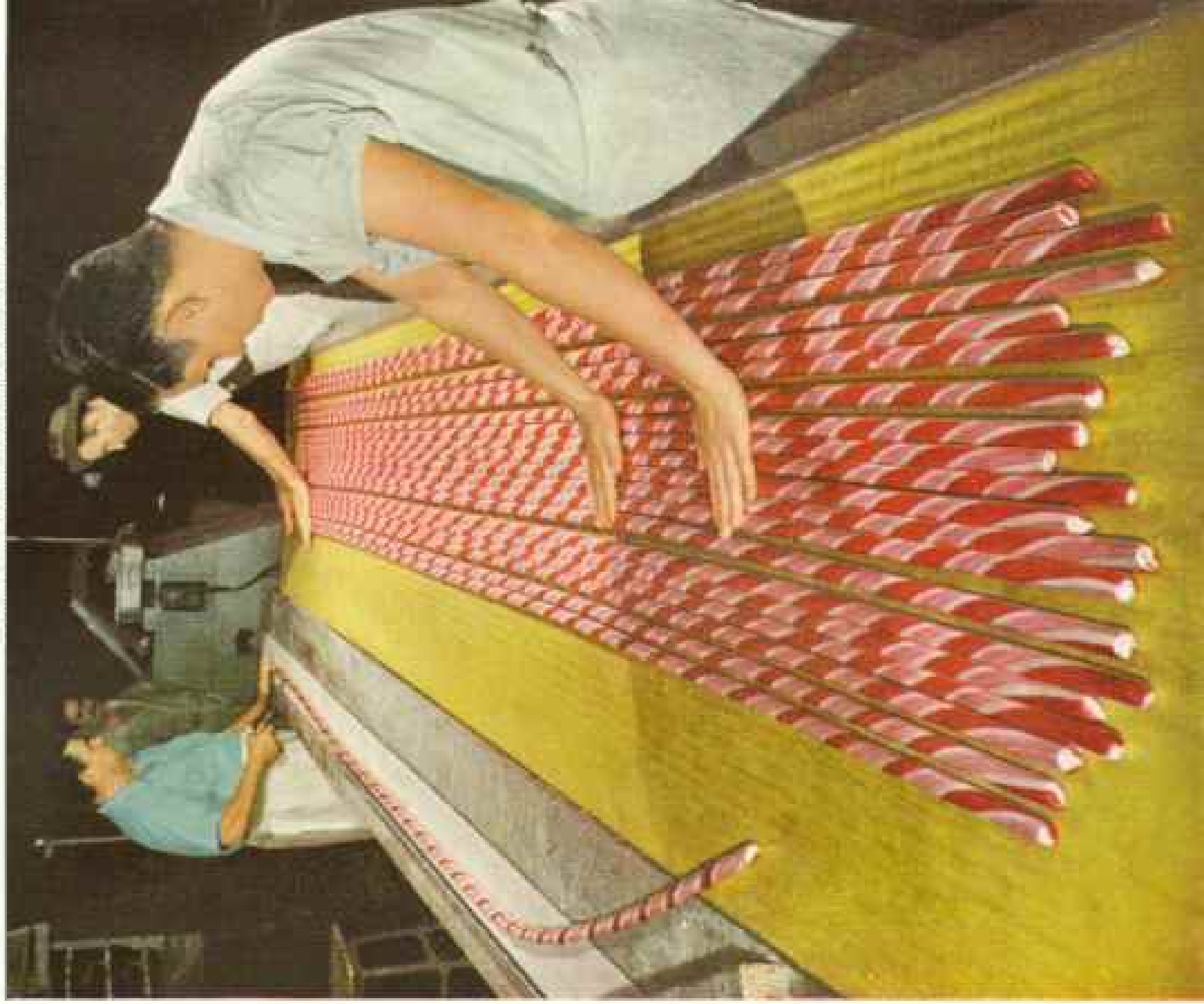
Only seven men—two living today—have known the formula for Coca-Cola. An Atlanta druggist who discovered it in 1886 gave up his interest for less than \$2,000. For investors the beverage has been a veritable gold mine; the Candler family sold its stock in 1919 for \$25,000,000 to Ernest Woodruff and associates. Some 50 million people a day buy a Coke, a soft drink available everywhere except in the Iron Curtain countries. The familiar bottle took its design from the hobble skirt fashionable in the early 1900's; a bookkeeper with flowing Spencerian handwriting designed the trademark.

Of Such Stuff Are Dreams Made: Stacks of Bats for Baseball Heroes and Peppermint Sticks for Children

Hickory or ash, it's all the same to workmen who lacquer more than a million bats yearly at the Hanna Manufacturing Company in Athens. Right; Candy ropes made by machine are hand-rolled and cut into 8-inch sticks at the Tom Huston Peanut Company in Columbus.

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↑ Georgia State College Girls Hold Court in the Governor's One-time Mansion. Today It Is the Home of Their President.

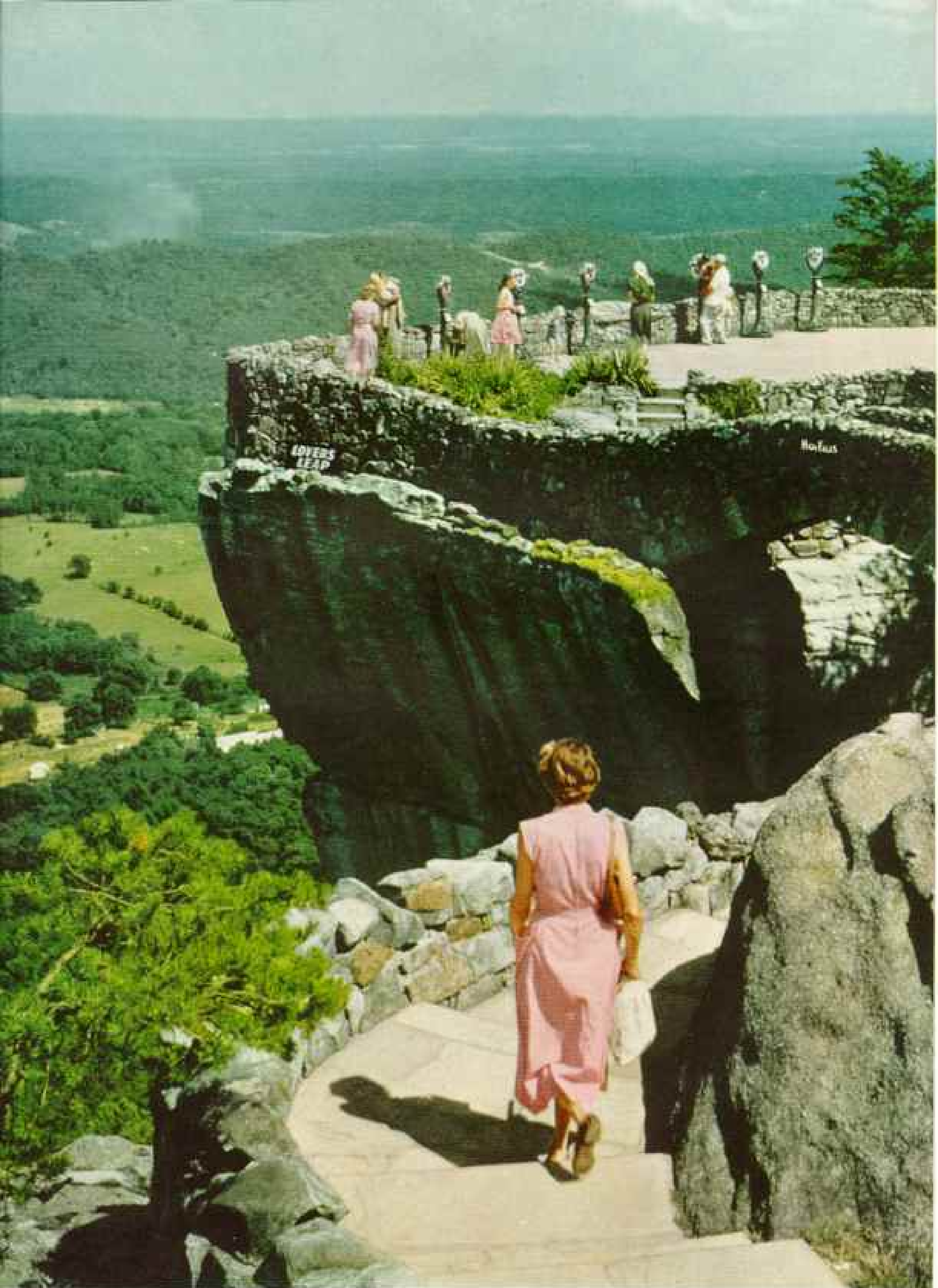
From 1838 to 1868, when the capital moved to Atlanta, this fine example of Greek Revival architecture in Milledgeville served as home for eight Georgia governors.

↓ Thomasville, the city of roses, each April holds a rose show, crowns a queen, and appoints a bevy of ladies in waiting. In 1953 the city staged its 37th annual festival. Here the queen, flanked by two of her ladies, holds a bouquet of Better Times, the variety growing on the left.

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© Kodachromes by Howell Walker, National Geographic Staff





Visitors Can See Seven States from Rock City Gardens on Lookout Mountain

Parts of Georgia, Tennessee, Kentucky, Virginia, North Carolina, South Carolina, and Alabama are visible from the precipice called Lovers Leap. This view overlooks the Chattanooga Valley which runs on into Tennessee.

Tangled vines try to strangle stubborn walls that tell of war, toil, peace, and plenty. Sea birds call; deer appear at dusk; crickets fiddle to infinity.

And my heart is at ease from men, and the
wearisome sound of the stroke
Of the scythe of time and the trowel of
trade is low. . . .

So Georgia's best-loved poet, Sidney Lanier, sang of the region in *The Marshes of Glynn*.*

In a St. Simons cemetery I stood musing before a tombstone inscription: "Sacred to the memory of — — who fell a victim to his generous courage on the 3rd of Dec. 1838. Aged 32 years 1 mo."

"Fact is," said a local historian, "he spat in the face of a man, who thereupon shot him dead."

Old Mansions Become Offices

Back on the mainland I saw in Brunswick the transition typical of present-day Georgia. New factories tower above white-columned mansions which have become offices and guest-houses. A smoky haze of industry hangs over the erstwhile sleepy port; fishing fleets crowd wharves near shrimp and crab canneries.

Brunswick Pulp & Paper Company has drawn largely on local labor for 640 mill hands and 800 forest workers. The plant began in 1938 with a 120-ton capacity; daily production now averages 430 tons of high-grade bleached sulphate pulp.

Another Brunswick enterprise, Hercules Powder Company, gets hundreds of chemical products from resin-bearing stumps that dot the cutover areas of Georgia and Florida. It annually clears close to half a million acres of land, later restored for farming, grazing, or lumbering.

North of Brunswick I went to an oyster roast beside a branch of the Altamaha River. Twenty other guests assembled in a live-oak grove as the sun set. Fires and flares lit up faces of men shoveling shellfish from steaming pits to weathered tables. With canvas glove on one hand and knife in the other, we opened dozens, dipped them into melted butter, then tossed them down.

Somewhere out in the darkness voices began to sing softly. The harmony drew closer as elderly Negro men and women filed into the firelight. As they sang they pretended to load cotton into a ship, labor on a railroad, and flail rice as did their ancestors in days of slavery.

Too soon they walked away in the night, still singing. I listened to their final bar fade in the distance, hoping it never would.

Time, like the Altamaha, flows on and brings big industry to the little town of Jesup near that river. There I watched heavy equipment clear a site for a \$25,000,000 plant to manufacture purified wood cellulose for cellophane, rayon, etc. A second newcomer plans a \$15,000,000 kraft-type paper mill.

Amid similar State-wide changes, Louisville retains a reminder of a bygone era. A sign on a square shed in the heart of town says, "Only Original Slave Market—built in 1758."

Beneath the market's rafters hangs a bell. Louis XV of France presented it to a New Orleans convent in 1772. Pirates stole it to sell at Savannah. Louisville acquired the bell to ring for slave sales, warn of Indian attacks, or announce auctions.

Shortly before reaching Augusta, I crossed the overgrown Tobacco Road. This storied trail, along which mules trundled hogsheads of leaf to a Savannah River landing, passed through my grandmother's back yard. Along it, too, galloped a contingent of Sherman's cavalry; the horses' hoofs shattered our family china, hastily buried in a shallow cache.

Trio of Giant Activities

Augusta never will be the same again. Startlingly different from the static city where I went to grade school, it occupies the restless center of a crowded triangle.

To the southeast, in South Carolina, booms the Atomic Energy Commission's biggest baby, the Savannah River Plant, with 29,600 employees; to the southwest lie the 55,675 acres of the U. S. Army's Camp Gordon; and to the northwest towers a concrete effort to tame Nature, the Clark Hill Dam. All operate within 25 miles of the once drowsy metropolis they revolutionize.†

"Full effects of Clark Hill Dam haven't begun to be felt yet," said a citizen. "It will provide flood control, aid to Savannah River navigation, and hydroelectric power, and will allow reclaiming more than 210,000 acres of potential farmland along the Savannah."

Fast-growing Augusta's population is now officially estimated at 87,500.

**Hymns of the Marshes*, published by Charles Scribner's Sons, New York City.

† For information on the vast Savannah River Plant, see "South Carolina Rediscovered," by Herbert Ravenel Sass, NATIONAL GEOGRAPHIC MAGAZINE, March, 1953.



A Cotton Picker, Stripping Two Rows at a Time, Does the Work of 50 Men

The machine harvests an acre an hour. When full, the cage holds 500 pounds of cotton, plus 1,000 pounds of seed and trash. Sixth among the cotton States, Georgia has an average yield of about one-half bale per acre.



↑ Pickers Weigh Cotton to Learn Earnings.

For every 100 pounds he gathers, a field hand receives \$2 to \$3. An average adult worker picks close to 200 pounds a day. Here, near Waynesboro, a farm foreman checks the scales.

Trucks or wagons haul the day's harvest to gins, which remove the seed for planting, stock feed, and edible oil, and press the lint into bales.

Eli Whitney, a New Englander visiting Georgia, invented the cotton gin in 1793. His machine revolutionized cotton-raising and placed it on a profitable basis.

Human Hands Pick → Most Georgia Cotton

Mechanical pickers (opposite) are gaining in popularity on big farms, for mechanization greatly reduces labor costs. Hand labor, however, harvests most of the State's 7- to 800,000 bales a year.

Despite operational improvements, Georgia's cotton land has steadily dwindled in favor of peanuts, poultry, and pasturage for beef cattle.

© Kodakimages by David Walker, National Geographic Staff



I remember when Broad Street looked as wide and empty as a football field out of season. Then I knew where the city stopped and the country began. Now industrial zones and residential suburbs spread like a river overflowing its banks.

For production of doors, plywood, and general lumber, Georgia-Pacific Plywood Company has expanded from Augusta to distant parts of the country, like big ripples from a little stone. It operates 15 mills: one each in Georgia, Alabama, Mississippi, and Arkansas; two in South Carolina; three in Oregon; six in Washington State. Augusta, the home office, has none.

Confederates Met at Washington

As the Nation reunited, with its Capital at Washington, D. C., remnants of the Confederate Government held a last meeting at Washington, Georgia. The quiet village of comfortable old homes long had no hotels. When people talked of building one in the last century, leading citizen Robert Augustus Toombs indignantly opposed the idea. Said he: "If a respectable man comes to town, he can stay at my house. If he isn't respectable, we don't want him here at all!"

Not far away is Mount Pleasant, a plantation home built by my great-great-great-grandfather. There stands a workshop used by Eli Whitney when perfecting his cotton gin in the early 1790's.

Whitney's machine started an industrial revolution about the time Georgia created its State University at Athens. The University of Georgia was chartered in 1785 and opened its doors in 1801.

Greek Revival architecture in this eminent center of learning makes Athens as classic as its name. The town grew up around the university, which numbers among its alumni Crawford W. Long, a pioneer in the surgical use of ether; Alexander H. Stephens, vice president of the Confederacy, later State governor; Henry W. Grady, orator and journalist and an early crusader for a forward-looking South; Charles H. Herty, of pine-to-paper fame; and the late Ralph A. Graves, beloved assistant editor of the NATIONAL GEOGRAPHIC MAGAZINE and author of many articles in its pages.*

Fourth and fifth generations occupy some ancestral mansions; but fraternities and sororities have taken over many. In one dwelling germinated the idea of America's first organ-

ized garden club. Formed in 1891 by a dozen women, it soon invited "every lady in Athens who might be interested in growing anything, from a cabbage to a chrysanthemum."

A short hour's drive north from Athens put me in the heart of Georgia's apple-growing country. Cornelia, a town of 3,300, calls itself "Home of the Big Red Apple" and "The Plastic Weaving Center of the World," making plastic fabrics and window screens.

In north Georgia, climate, topography, and small holdings spurred another industry—chicken raising. As cotton land wore out, the small farms turned to poultry for quicker profits than cattle would bring.

Now the State struts ahead of all the 48 in broiler production, and Gainesville can crow loudest of all towns in Georgia. Trucks piled with chicken crates dominate its traffic.

To about 600 farmers scattered over 15 counties, J. D. Jewell, Inc., delivers baby chicks and feed. After 10 weeks of gorging, the birds reach broiler size, and Jewell's trucks collect them. His dressing and packing plant processes 30,000 fryers in an 8-hour day. The finished product, boxed and frozen, goes to 26 of the 48 States.

Banquet on a Statue's Shoulder

I traveled to Atlanta via Stone Mountain, largest exposed granite dome in North America. Into its cliff face sculptors started to carve giant figures of Confederate heroes (page 292). Although now abandoned, the work progressed far enough to permit a banquet on Robert E. Lee's left shoulder. That living epaulet consisted of admirers assembled to celebrate the 117th anniversary of the General's birth.

Atlanta, capital and metropolis of Georgia, is a busy commercial center for the whole Southeast. More than 3,300 corporations, including many of the biggest in the country, operate branches here.

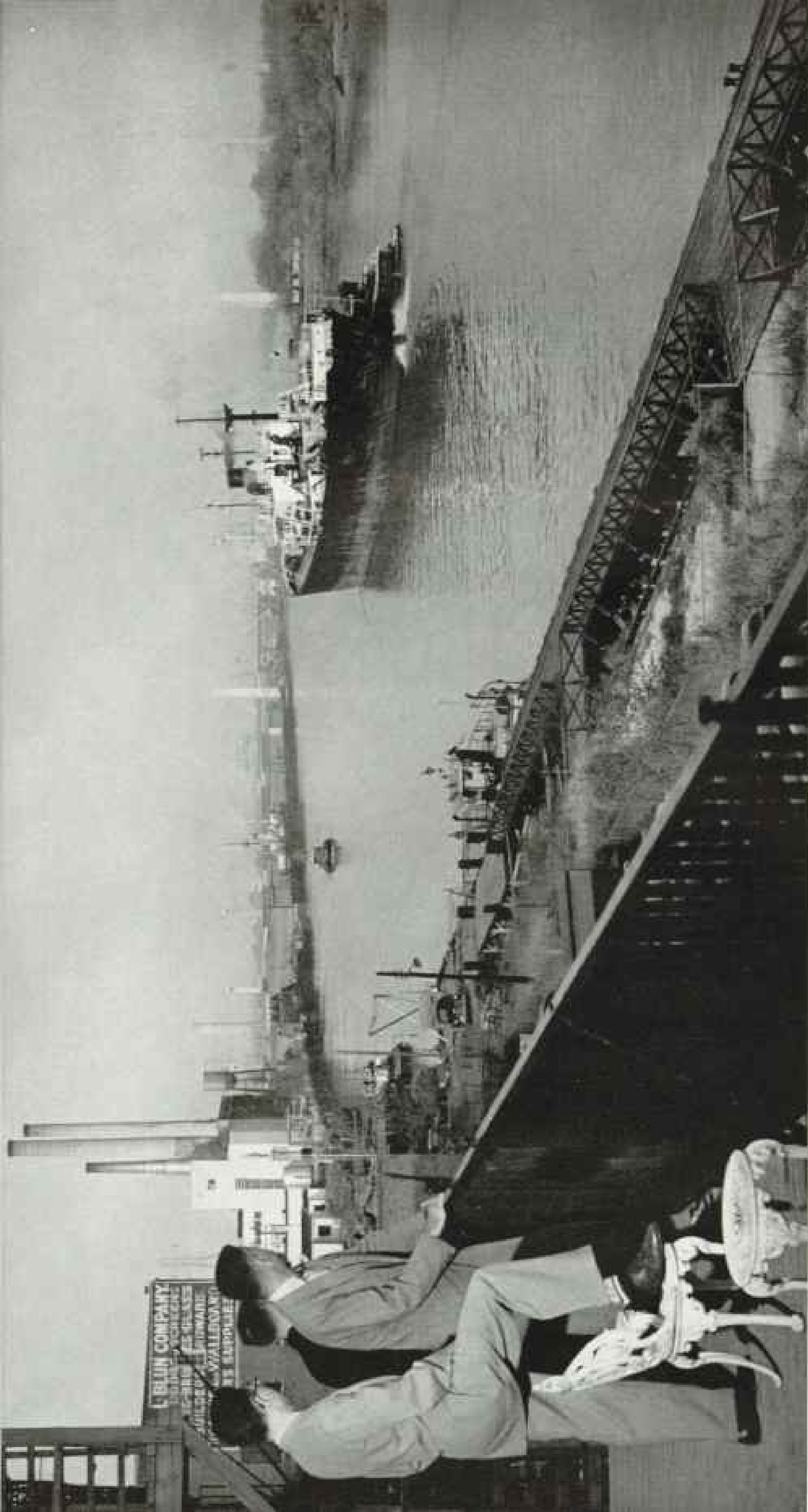
In Atlanta almost everything happens on
(Continued on page 312)

* See "Marching Through Georgia Sixty Years After," by Ralph A. Graves, NATIONAL GEOGRAPHIC MAGAZINE, September, 1926.

Fat Herefords Near Perry Graze → on Crimson Clover

Beef production is a rising star in Georgia's new agricultural program. Improved pastures replace worn-out cotton fields; even peach orchards make way for grass.





Ocean Freighters, Replacing Bygone Windjammers, Enter Savannah Harbor for Cotton, Tobacco, and Rosin

Savannah's 10-mile water front delights visitors with its iron balconies, steep retaining wall, and curving ramps paved with cobblestones brought as ballast in early English sailing vessels. When the Savannah, first transatlantic steamship, made her maiden voyage from this port in 1819, timber, indigo, rice, and cotton were favored cargo. Today indigo is forgotten; rice is making a comeback. Distant white piers will support a high-level bridge spanning the sluggish river to Hutchinsons Island, where expanding industrial plants replace cow pastures. This wooden balcony is part of the old Cotton and Naval Stores Exchange Building, now home of the Chamber of Commerce, where traders long set world prices on turpentine and rosin (page 293).

**Plaster and Paint
Recreate the Bloody
Battle of Atlanta,
July 22, 1864**

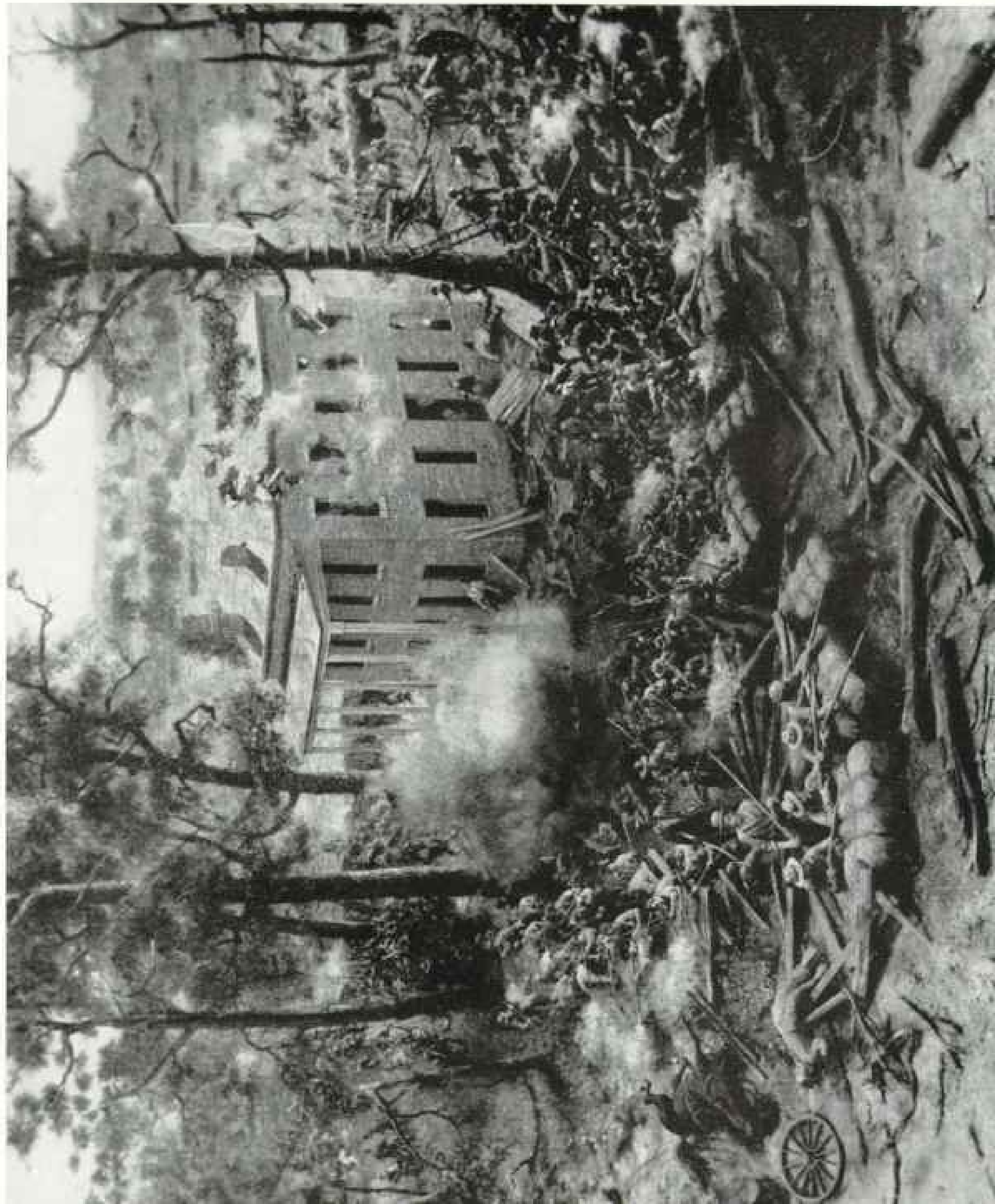
Bursting shells, crumpled bodies, and weary faces behind breastworks give sharp realism to Atlanta's treasured Cyclorama portraying General Sherman's storming of the Confederate defenses late in the Civil War.

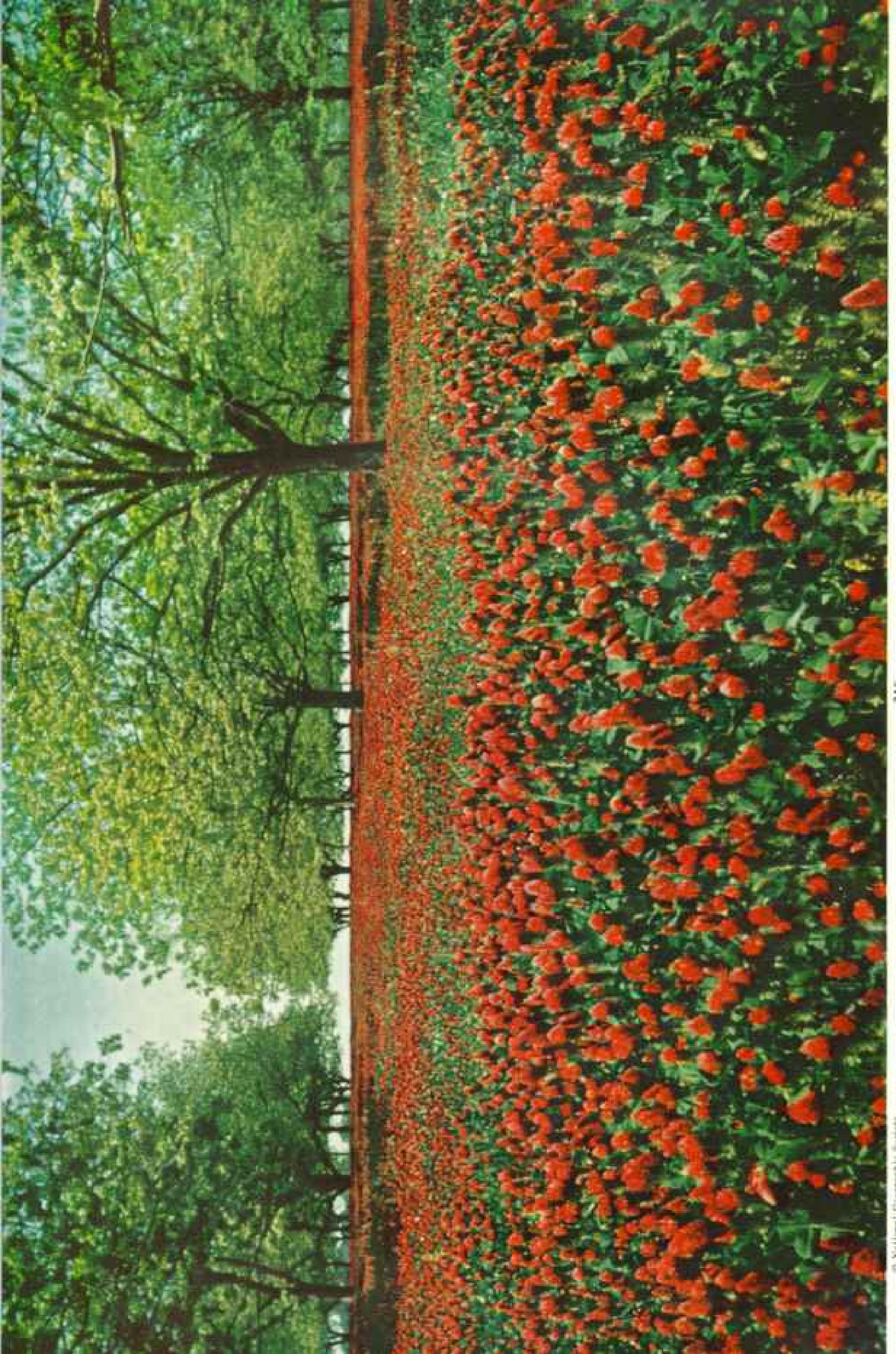
German artists, who painted the circular background in the 1880's, did their research so carefully that veterans of the battle readily recognized many of their comrades. A magazine illustrator who witnessed the fighting assisted the artists.

Models of blasted trees, railroad tracks, grass and bushes, guns and soldiers fill a clay landscape forming a 40-foot-wide foreground. They were constructed so realistically that one can hardly tell where the third dimension leaves off and the painting begins.

This section of the 400-foot Cyclorama pictures the afternoon fighting at the Hurt House as Union forces counterattacked Gen. Benjamin F. Cheatham's corps.

Kenneth Rogers, Atlanta Journal & Constitution



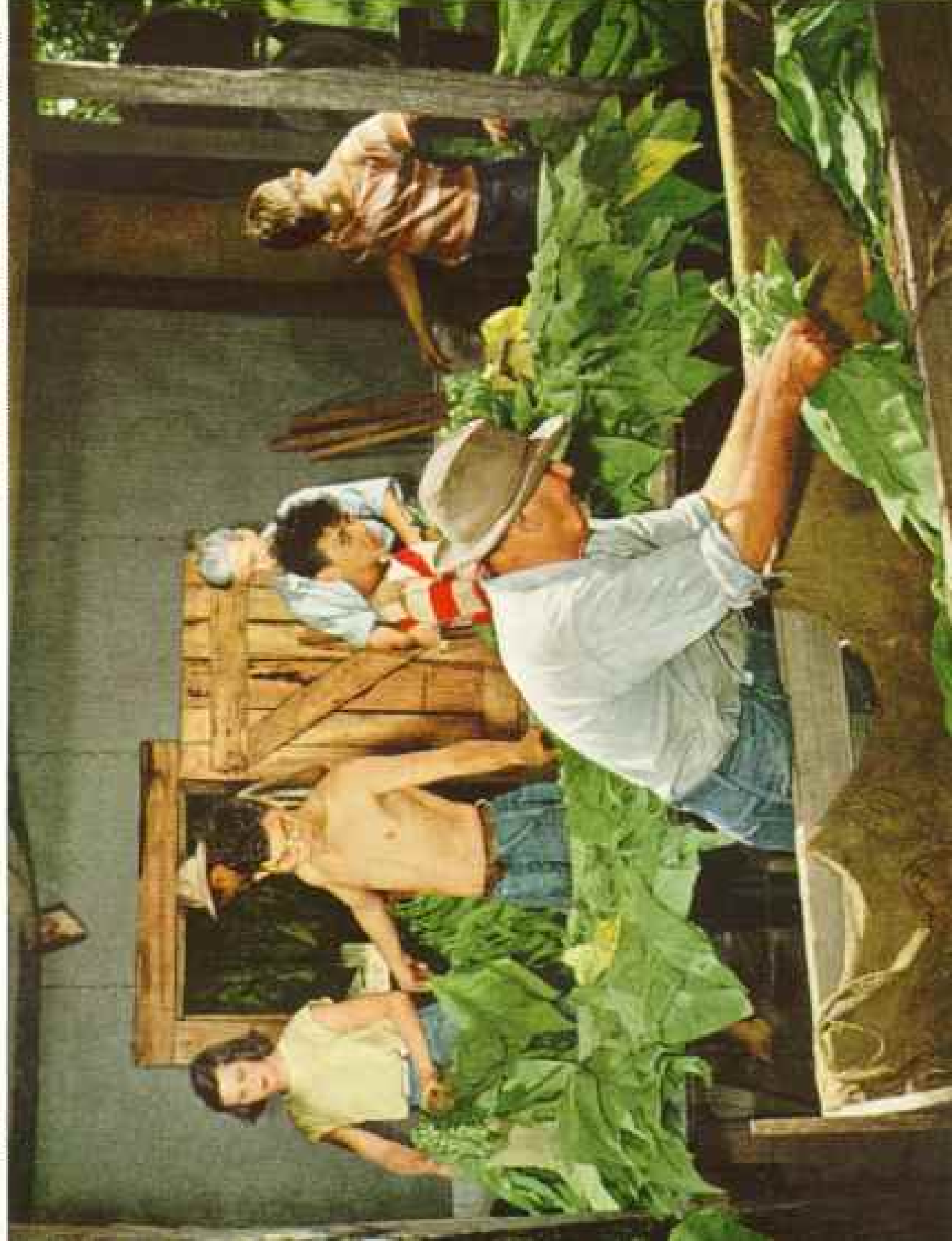


↑ Like a Tufted Carpet, Crimson Clover Covers the Floor of a Pecan Grove

→ Tobacco for cigar wrappers pushes big leaves against a cheesecloth ceiling in Grady County. A barefoot boy gathers the lower leaves of the tall stalks—an operation called priming. This farm of W. R. and Ralph Gainey cultivates 15 acres of shade tobacco with an average yield of 1,500 pounds an acre.

↘ A Grady County farm family sorts and loops cigarette tobacco fresh from a four-acre field yielding about 6,500 pounds. Tied to long sticks, the leaf will hang inside the curing house for several days.

Georgia ranks sixth among tobacco States. In 1917 the State gave only 440 acres to tobacco, then as now an expensive, demanding crop. Today it cultivates some 100,000 acres producing about 100 million pounds.



busy Peachtree Street. It's even a watershed: Raindrops bouncing to the west gutter go to the Gulf of Mexico; those to the east reach the Atlantic.

Most likely a visitor will stay at a Peachtree Street hotel. He will shop in Peachtree stores, enjoy Peachtree theaters and restaurants, ride the Peachtree buses, and pick up news at Peachtree corners. I looked in vain for a peach tree, but I didn't scrutinize all of its 14 miles.

Atlanta has been compared to a lady wrapped in a Yankee mink coat with her Confederate slip showing. I would have her holding a Coca-Cola in one hand, a copy of *Better Homes and Gardens* in the other. For Atlanta is the home of Coca-Cola and the site of countless homes, many magnificent, which the nickel beverage built.

Although as American as baseball, Coca-Cola today is nearly as universal as water. Jungle villagers and desert folk know it; Eskimos, too. Chinese characters give it a label which translates "Make Man Mouth Happy" (page 298).

Crossroads of the Southeast

Atlanta has no navigable river or harbor, but geography makes it the leading transportation center and crossroads of the Southeast (map, page 290). Every day 90 passenger trains arrive and depart, while freight yards of the Southern Railway System alone handle some 4,600 cars.

"Northern money financed the town's early development," said an Atlantan. "Lots of Yankees moved to Atlanta, and more keep arriving. It's not a typical southern city but a typical American city that happens to be in the South."

Rich's department store, however, like Coca-Cola, is Georgia-born, -owned, and -operated. Biggest of its kind in the Southeast, it caters to the entire State, even to neighboring States, and to every income. As many as 100,000 shoppers a day visit the store.

Although superficially northern, Atlanta is proud of its southern heritage. It is proud, too, to claim such residents, past or present, as Woodrow Wilson; golfer Bobby Jones; Margaret Mitchell, author of runaway best seller *Gone With the Wind*; and Joel Chandler Harris, beloved creator of Uncle Remus.

When I visited Harris's home, a literary landmark in Atlanta, his grandson read aloud several Uncle Remus stories. They brought

back to life Brer Rabbit's past, also mine.

Atlanta's prestige as an educational center stems not only from the Georgia Institute of Technology, Emory University, just outside the city, Agnes Scott College for women at near-by Decatur, and other colleges and schools for whites; Atlanta also maintains many institutions of higher learning specifically for Negroes—more, in fact, than does any other city in the country.

In Grant Park the Cyclorama portrays the bloody Battle of Atlanta, with General Sherman directing the attack (page 309).

Atlanta had reached such industrial and strategic importance that Sherman felt it his soldierly duty to batter and burn the town. Even as the ruins smoldered, Georgians stooped with worn tools to build an even greater city (page 296).

Plane Factory Would Hold a Fleet

Some of the heaviest fighting in the Atlanta campaign shook Kennesaw Mountain and near-by Marietta. To this salubrious village scores of summer visitors flocked in antebellum times. Today about 14,000 go there to work at the Georgia Division of Lockheed Aircraft Corporation. Its ground floor alone could hold 20 battleships plus 69 submarines and 24 PT boats to fill up cracks.

Taking an entire day to see the plant, I watched the many steps in construction of the B-47. This six-jet bomber carries a crew of only three; yet it outweighs by 50,000 pounds the mightiest of World War II combat planes, the 67½-ton Superfortress. Its range and speed: Georgia to California in 3 hours and 20 minutes.

I took almost that long to drive the 60-odd miles from Marietta through Atlanta to Covington. As rain fell on this place of old homes and gardens, I found shelter in a cotton mill that spins thread so thin that one pound of the single-warp yarn can stretch 12 miles.

Near Covington stands a house where some of Sherman's men stopped to demand food. The family's loyal servant told them, "The white folks ain't et yet," and closed the front door in their hungry faces. They gave up and went away.

How to Save a City in War

As a visitor to Macon, I received, from one of its Chamber of Commerce publications, this historical and psychological tip to tourists: "Macon's heritage in architecture



Towering Bamboo Arches a Path in the Barbour Lathrop Plant Introduction Garden

In 1923 Dr. David Fairchild, the Department of Agriculture's eminent plant explorer, obtained for the Nation a hobbyist's large bamboo grove near Savannah. Named for Barbour Lathrop, the donor, the grove became one of four experimental gardens maintained by the United States Government. Today the 50-acre plantation cultivates and tests about 150 bamboo species, some of which grow as well in the Southland as they do in China. Thanks to the efforts of Dr. Fairchild, a trustee of the National Geographic Society, this member of the grass family promises a valuable source of paper pulp and structural timber.

was preserved for your enjoyment by staunch Confederate defenses and by official removal of women and whiskey before converging Federal troops (which suppresses a soldier's desire for a festive bonfire)."

Amid the splendor of Macon's proudest dwellings huddles a modest cottage, the birthplace of Georgia's most celebrated poet. Sidney Lanier (1842-81) lived through the South's roughest years, but we remember him at gentle best by *The Marshes of Glynn*, *The Song of the Chattahoochee*, and *Sunrise*.

Ceramics has become a subject of major interest at Macon's Wesleyan College, which, as Georgia Female College, in 1840 became the

country's first female institution to grant women degrees. On a tour of the buildings and campus, I admired an exhibition of clay sculpture and pottery. In the music department Miss Neva Langley, a student, attracted my camera's eye. Later, she attracted the Nation's as Miss America for 1953.

Little Holes That Swallow Words

Armstrong Cork Company exemplifies Macon's recent industrial effort. No such plant existed in Georgia before this one. From southern pine it makes enough insulation board and acoustical material in a year to fill 3,000 boxcars, assurance of a quieter life.



Cucumbers Become Pickles at This Plant in Cairo

The smell of brine hangs heavy across the acres of outdoor vats at the Roddenbery Pickling Company. At season's height, millions of cucumbers pour in daily from the fertile farmland around Cairo, their bristly green skins glistening in the sun as endless belts dump them into the wooden vats for the salt-curing process lasting three months.

Only statistics can suggest the scope of this cucumber-to-pickle assembly line. Forty tons of salt go into a day's cucumber intake; for sweet pickles the day's consumption of sugar is 10 tons. The company's 800-bushel tanks hold 25,000,000 pounds of cucumbers at capacity, and produce close to 1,500 carloads of pickles in a normal year.

Besides pickles, the company processes cauliflower, onions, relishes, cane syrup, and peanut butter.

✦ Dip nets transfer pickles from vats to barrels.

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Illustrations by Howell Walker,
National Geographic Staff

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Punch Needles, Aimed Like Guns, Fire Tufted Patterns into Candlewick Bedspreads

Textiles remain Georgia's primary industry. Tufted-textile manufacturing is concentrated in northwest Georgia; Dalton alone has more than 20 mills (page 328). In this Cartersville plant, hoops stretch decorated bedspreads for easy turning. Spools above the operators feed colored yarns into the punch needles.

Manager Erv Worm and I walked a quarter of a mile around one machine. Into it flows a thick porridge of pulp for forming, pressing, drying, and cutting. We stopped beside an apparatus bristling with drills that simultaneously patterned each square foot of panel with 484 sound-absorbing holes.

"If a bad word gets caught in one of those little holes," said Worm, "only something like a crochet hook could dig it out!"

In Macon—long a champion of Greek Revival architecture, magnolias, camellias, and azaleas—170-odd manufacturing plants produce items ranging from ladies' dainty underfrills to heavy truck bodies.

"But," said an information officer in Air Force uniform, "Middle Georgia's biggest industry is Robins Air Force Base. It employs about 14,000 civilians, mostly from Macon and vicinity."

Their job, and that of an undisclosed num-

ber in uniform, consists of supplying the Air Force and keeping its planes flying.

In unsettled early times, when the State government hopped from place to place, Macon hopefully reserved a central city lot for the capitol. The property still has a restricted title. Before going at last to Atlanta in 1868, the honor of serving as capital shifted from Savannah to Augusta and back to Savannah, then to Louisville and Milledgeville, but never to Macon.

Milledgeville Takes Pride in the Past

In Milledgeville I attended a pageant; it re-enacted the Secession Convention of January, 1861. A man in Confederate uniform ceremoniously replaced the Stars and Stripes with the Stars and Bars as the band vigorously struck up "Dixie." The crowd erupted into cheers and rebel yells.

The performance proceeded through the war



A Mechanical Shovel, Scooping Away Red Overburden, Lays Bare a Fine White Clay for Industry.

Middle Georgia, especially the Macon area, is the State's richest source of kaolin, a raw material for brick, tile, pottery, paper sizing, and insecticides. These deposits supply about two-thirds of the Nation's needs.

Fragrant Pine Forests Far from Sea Supply Naval Stores

Georgia contributes three-fourths of the Nation's and one-fourth of the world's production of gum naval stores. Probably these products were originally called naval stores because shipbuilders were the first important users of pine pitch. Today turpentine and rosin go into scores of familiar products, including adhesives, plastics, linoleum, paint, soap, and shoe polish.

← A Valdosta worker empties pine gum from a cup fixed to the tree just below the scars. Pine sap runs best during spring and summer.

↓ In Valdosta a distillery hand dumps the pine gum into a receiving vat for processing.

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—Lincoln, Lee, Grant, Appomattox. Again the standards were interchanged; the United States Flag waved over the capitol, and the band solemnly played the national anthem. Everyone dispersed quietly, not seeing very well.

About Milledgeville there's something sad but glorious. Many residents cling to ancestral white columns that cotton built. And something makes me feel that each home keeps an old hair trunk of cherished memories: a gray uniform, a battle flag, a white-satin slipper, a book with a magnolia petal pressed between the pages.

"Peach State" Has Yielded Peach Lead

Sentimentally, Georgia's automobile license plates carry the legend, "Peach State." Actually, California could claim the title at present, if it went to the State producing the most peaches. Yet Georgia still grows annually between three and four million bushels.

Pink and white petals spray hills of central Georgia at peach-blossom time (page 324). But one month later, purebred Herefords and Black Angus, brisket-deep in crimson clover, steal the regional show (page 307). The gay cover crop carpets open fields and spreads under hundreds of pecan trees (page 310).

Harvesting an estimated 45½ million pounds of pecans in 1953, the State takes another agricultural first place. Orchards grow thickest around Albany, chief pecan processing center in the State.

One of the fastest-expanding communities in the entire Southeast, Albany epitomizes the changes occurring throughout Georgia. The city takes to new industries as smoothly as farmers trade mules for tractors. Albany has become the leading market, the "little Atlanta," of southwest Georgia.

Among new enterprises moved to Albany are food processors from Wisconsin, fertilizer works from Illinois, chemical laboratories and a thread mill from New Jersey. And here under construction rises what is to be the main Marine Corps Depot of Supplies east of the Rockies.

Georgia Grows a Wonder Grass

Grazing land around Albany fattens animals for a local meat-packing plant which handles 2,200 cattle a month. And the pastures are improving with the help of the Georgia Coastal Plain Experiment Station at Tifton. Here, under Dr. Glenn Burton, a remarkable

grass called Coastal Bermuda was developed. At Tifton one acre of this grass has supported nine cows or yielded eight tons of hay.

Dr. Burton's gift to cattle farming thrives throughout hot and sometimes drought-stricken summers. While the unusually dry season of 1952 burned up millions of dollars worth of cotton and peanuts, larger livestock sales offset the loss.

Instead of too little water, Okefinokee has too much. This eerie swamp covers 660 dismal yet enchanting square miles of southeast Georgia. Long before white explorers penetrated the damp fastness, red men fished and hunted among the lily marshes of Okefinokee, where ageless cypress trees stand in tea-colored water up to their knotty knees (pages 322 and 323).*

Through miles of pines I went west to Valdosta, wondering how this inland town got the name "naval-stores capital of the world." The answer comes down from sailing days, when pine pitch calked the seams of wooden ships. Much of the tree gum came from the heavily wooded section of south Georgia. It still does (page 317).

In Thomasville, city of roses, the favorite flowers climb street lamps and telephone poles. They blossom in public squares, embellish every private garden, ramble over cemetery walls, and even cover fences around the municipal ice plant (page 301).

Not the Same Old Corn

Just out of Thomasville is Greenwood Plantation, now owned by John Hay Whitney. The "big house," built in 1835-45, has been called one of the Nation's finest examples of Greek Revival architecture.

The Komarek brothers, Ed and Roy, have managed Greenwood Plantation's 18,000 acres since 1945. In that year they decided to explore the field of corn and its relation to southern agriculture. They consulted experts, and, in cooperation with State and Federal agencies, tested various crosses.

Out of the cooperative effort has come a popular high-grade hybrid. Before 1946 Georgia corn seldom averaged more than 25 bushels per acre. Now it is not uncommon for the new hybrids to yield 50 to 100 bushels an acre (page 321).

Corn is grown on more than a third of
(Continued on page 327)

* See "Okefinokee Wilderness," by Francis Harper, NATIONAL GEOGRAPHIC MAGAZINE, May, 1934.

SUFFER LITTLE CHILDREN
COME UNTO ME AND FORBID
THEM NOT FOR OF SUCH IS THE KINGDOM OF



"Suffer Little Children to Come Unto Me, and Forbid Them Not"

Martha Berry in 1902 founded the Berry Schools near Rome, Georgia, for mountain children. Today her schools and colleges enroll 1,000 boys and girls. Inez Henry, who studied under Miss Berry 30 years ago, today is assistant to the schools' president. Here she reads Bible stories to elementary pupils at Possum Trot.



Hybrid Corn Gets Its Tassels Plucked

Hybrid corn results from crossing inbred lines. It brings a much higher yield than normal field varieties, but does not perpetuate itself as a stable breed. Each crop must be grown from seed obtained by controlled cross-pollination. Here two rows of male seed corn retain their tassels; six female rows on either side have none. Female tassels are pulled by hand (as in inset); male tassels are left to cross-fertilize the females.

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Okefinokee's Bearded Cypresses Stand in Swamp Water up to Their Knotty Knees:

Indians named the 660-square-mile marsh "land of trembling earth" because floating islands of matted vegetable growth swayed under their weight. This guide poles a boat among lily pads near Waycross.

**Dog and Tractor
Keep a Boy Happy
Down on the Farm** →

Tractors have generally replaced mules and horses in agricultural Georgia. Increasing use of farm machinery helps solve the problem of dwindling rural labor. Mechanization of farms has more than trebled since 1940. Tractors alone multiplied seven times; by 1955 they totaled 65,000 plus. This boy lives near Blairsville.

↓ **Swimmer Captures
Alligator by Hand**

Okefinokee (opposite), one of the most primitive swamps in North America, is a vast wildlife sanctuary, a living natural-history museum. Alligator, bear, deer, wildcat, raccoon, possum, otter, and snakes find more security there today than at any time since the coming of man. Birds in increasing numbers recognize Okefinokee as a refuge. Some 50 species of fish, including tiny tropical varieties, find abundant food in its waters.

The swamp drains to the Atlantic Ocean on the southeast via St. Marys River and to the Gulf of Mexico in the southwest via Suwannee River.

© Kodachrome by Howard Walker (top);
Kodachrome by Kenneth Bessy

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Some Georgia Peaches Walk, Talk, and Climb Trees

Peaches grow in almost every section of the United States. In the most northerly areas they are picked in September. In Georgia the harvest begins as early as May and winds up in July. Only California and South Carolina outdo the Peach State in growing peaches. Blossoming orchards paint central Georgia pink in early spring.

The State's peach industry had its start in the 1830's when settlers from South Carolina set out small orchards, especially around Marshallville. About 40 years later Samuel Rumph of Marshallville originated the leading freestone variety, the Elberta, which he named for his wife. To facilitate marketing, he invented special crates and devised refrigerated fruit carriers. Another member of the Rumph family developed the popular variety known as Georgia Belle.

Repeated frosts in recent years reduced fruit crops in all parts of the State. Orchards, like cotton fields, are making way for expanding pasturage.

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Azaleas and Palms Fringe Sea Island Golf Club's Course, Site of a Cotton Plantation in Colonial Times

The club, which lies on Saint Simons Island, belongs to the Cloister, a resort on adjoining Sea Island. Close by, Gen. James Oglethorpe, founder of Georgia, defeated the Spanish at the Battle of Bloody Marsh in 1742 and saved the colony for Great Britain.

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A Paratroop Trainee at Fort Benning Practices Free Drop from a 250-foot Tower

Practice on towers before leaping from planes reduces hazards of the parachute-jumping course at the Nation's largest infantry school. Students—all volunteers—usually make five drops, learning to roll properly on landing. When this soldier is hoisted to the top, a trigger automatically drops him. "Butterflies" may tickle his stomach on the rise, but his 12-second free drop to plowed ground will lack the sickening sensation of a plunge from a plane.

Georgia's harvested cropland and is second to cotton in crop value.

In Bainbridge, several years ago, the Georgia Factory for the Blind was established. About 150 sightless workers daily turn out 300 mattresses, 1,000 brooms, and a varying number of mops.

"Making mattresses particularly suits our employees," said superintendent Vaughn Terrell, himself totally blind. "Their extra-sensitive touch gives them the feel of a comfortable product.

"Our real goal here," he explained, "is to be people instead of blind persons. I mean people living normally and meeting their obligations to society like average citizens. Idleness is the strictest prison on earth; you can't describe the self-satisfaction of doing something worth while."

At Christmas the factory holds a party. Every employee brings a gift for a fellow worker. On one of these occasions, Terrell heard a guest sobbing, and asked why. They were tears of pleasure, the blind man explained. For the first time in his life he had been able to buy someone a gift with money he had actually earned.

More Power to Georgia

Better light that helps save eyesight is one of many gifts which REA (Rural Electrification Administration) brought in the 1930's. Before that time large blocks of the farming population had no electricity; now more than 90 percent of Georgia's farms are electrified.

Army Engineers have completed one big multipurpose dam (Clark Hill) and are building two others in the State. In addition, three more have been authorized and several other sites are being studied for possible future authorization. Georgia Power Company has built a dozen major dams on the State's rivers.

One of these rivers, the Chattahoochee, flows through America's foremost infantry school. Fort Benning, seven miles south of Columbus, Georgia, covers an area four times that of Washington, D. C.

In a typical year about 50,000 military students pass through the Infantry School (opposite page). Among them are some 300 officers from 23 foreign countries.

Columbus, one of the South's leading textile centers, hums with enormous mills. One I saw has floor space enough for 18 football fields. Other Columbus factories turn out everything from candy to coffins, peanuts to

pottery, soft drinks to disappearing stairs (page 299).

Despite the crescendo of its commercial commotion, the city appears to live as peacefully and comfortably as it did more than a century ago. I felt far less aware of its industries than of its parks and homes on spacious grounds in the shadows of arching oaks and tall, dark magnolias.

Warm Springs, Shrine to FDR

North of Columbus I drove through piney Franklin D. Roosevelt State Park to Warm Springs. Near here the late President of the United States made his part-time home in the Little White House. As one of 114,000 visiting this national shrine each year, I walked through the building where FDR died in 1945.

Everything, including the house itself, is little save the memory of the man who defied the crippling effects of polio. In 1931 he said, "I will build a cottage here and begin a new life."

The same spirit pervades the Georgia Warm Springs Foundation. Established a quarter of a century ago by Roosevelt, the sanatorium treats nearly 1,000 patients a year for the aftereffects of infantile paralysis.

Not far from Warm Springs I jolted through an unexpected covered bridge and continued north to Allatoona Dam (page 320). In March, 1952, this dam saved Rome, Georgia, from serious damage by flood.

"What used to be Rome's biggest bugaboo is now its greatest asset—the Coosa River," said a Roman. "With the Allatoona Dam we can control its flow and open up valuable city property once useless on account of floods. Why, back in 1886 a steamboat actually floated along our main street."

Just outside Rome a girl named Martha Berry lived on her father's plantation. One day about the turn of the century she was sitting in her log-cabin playhouse when some poor children appeared. She invited them in and told them Bible stories, for it was Sunday. At sundown the little guests left for their homes in the hills, but they returned a week later with more friends.

Stirred by the eagerness of these underprivileged children to learn, Martha began riding daily into mountain communities to teach the isolated folk. Both old and young were her pupils.

In 1902 she opened the first of the Berry Schools in a log cabin. Today 1,000 girls and

boys, young men and women attend the elementary and high schools and college (page 319). Numerous brick and stone buildings have risen on the 30,000-acre campus two miles north of Rome.

Miss Martha Berry died in 1942, a teacher to the last. Her schools carry on through public subscription and endowment. All students beyond elementary grades live on the premises. All work two days a week; almost all work their entire way. Their motto: "Not to be ministered unto but to minister."

Through the mountain wilderness Miss Berry unlocked to opportunity, my car wound north to La Fayette in Walker County. From there I hoped to drive directly to Trenton in Dade County, northwesternmost corner of the State, but a landslide blocked the only road.

Dade County Forces Highway Action

When I arrived in Trenton via Chattanooga, Tennessee, headlines of the Dade County *Times* declared: "Secession from Georgia by Dade Is Again a Possibility."

Talks with the town barber and newspaper editor brought me up to date on Dade's disagreement with the State. They said that in 1860 the county, impatient of wrangling over secession, voted to withdraw from Georgia and the Union. Another vote on July 4, 1945, returned the Independent State of Dade to the original fold.

Now road trouble revived the issue. A highway blasted over Lookout Mountain in 1941 gave Dade its first good highway link with the rest of the State. Repeated landslides kept cutting it off.

Because the State had not repaired the highway by June, 1952, Dade again hit the warpath to "secession." But permanent repairs later that year quieted the furore—and Dade remains happily in the Union.

To travel east from Trenton, I had to go west into Alabama. I re-entered Georgia at Cloudland, and drove north to Cloudland Canyon, once known as Sitton's Gulch. The deep, rocky "Little Grand Canyon" seems as unlikely here as Idaho potatoes in Maine.

In Chickamauga and Chattanooga National Military Park I visited the oldest and largest battle park in the United States. A century before the area bristled with Federal bayonets, housewives peacefully plied their needles on candlewick bedspreads. Now in Dalton modern machinery gives that tufted look to cotton coverlets, bath mats, accent

rugs, and wall-to-wall carpeting (page 315). One tufted-textile firm here started in 1932 with a solitary worker and now has 600.

East of Dalton I climbed with a road between Chatsworth and Ellijay to wind through some of the grandest mountain country in Georgia. After the humid heat of the plains, the highland air seemed clean as the smell of rain on young leaves.

Georgia Marble Travels Far

Rounding Mount Oglethorpe, southern terminus of the Appalachian Trail from Maine,* I rolled to Tate and its marble quarries, where men work 200 feet or deeper in open cuts. Batteries of pneumatic drills channel out 12-ton blocks with such regularity that quarry walls appear built up like the massive temples of Upper Egypt.

Since its beginning in 1884, the Georgia Marble Company at Tate has quarried a volume of marble roughly equal to a solid mass a city block long, high, and wide.

Georgia marble, used for monuments and buildings, occurs in several tints: from a pale silver-gray like the mist of a rainy day to snowy white; from old rose to light pink veined in greenish-black.

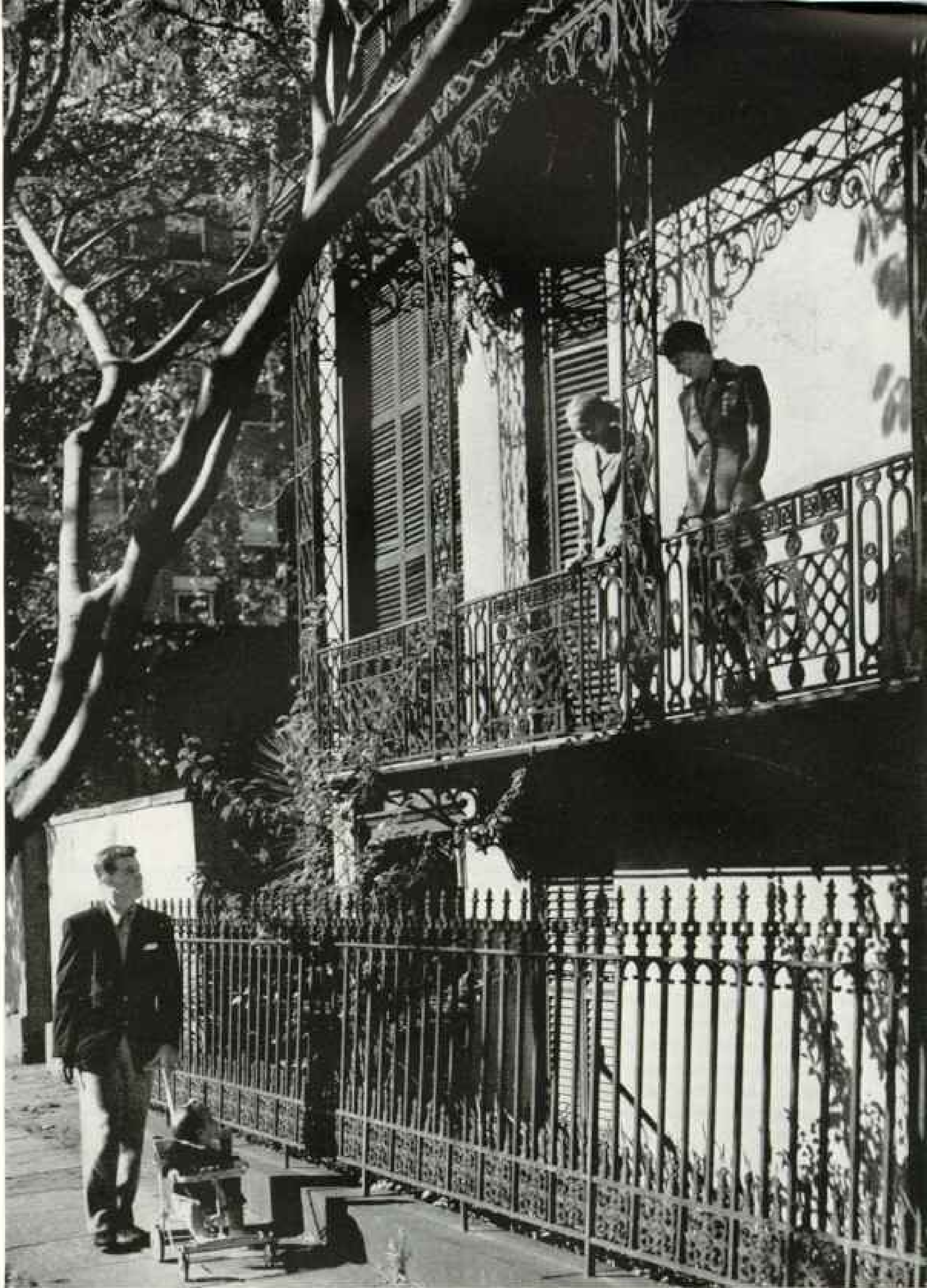
Outstanding works in Georgia marble include the New York Stock Exchange, the capitols of Rhode Island and Puerto Rico, and the Field Museum in Chicago. In Washington, D. C., the Folger Shakespeare Library, Pan American Building, Corcoran Gallery of Art, and the Lincoln Memorial statue display the beauty of the southern stone.

Northeast of Tate lies Dahlonega, in 1830 the scene of a sizable gold rush. Eight years later a U. S. mint was established there. Cherokee Indians had named the place Talonega, meaning "yellow metal." Today the fields are idle because the price of gold doesn't pay for the labor to win it here.

My car snaked through these hills, rounded Vogel State Park's Lake Trahlyta, delightful as its lyrical name, and climbed to the 4,784-foot summit of Brasstown Bald, highest point in Georgia.

Exhilarated by the view, but plagued by gnats, I started slowly down the gravel road. I soon stopped—something the steep grade discouraged on the way up—to admire flowering mountain laurel, rhododendron, wild red

* See "Skyline Trail from Maine to Georgia," by Andrew H. Brown, NATIONAL GEOGRAPHIC MAGAZINE, August, 1949.



Iron Lacework Traces Delicate Patterns of the Past on Many a Savannah Home

French royalists fleeing rebellion in Hispaniola a century ago introduced elaborate ironwork like this on the State headquarters of the Colonial Dames of America, once home of Girl Scout founder Juliette Gordon Low.



A President Lines Up His Putts, Even as You and I

Augusta National Golf Club's course provides a severe test for the expert, yet paradoxically allows the average golfer to turn in a better-than-usual score. Cemetery, President Eisenhower's caddy, holds the flag.

and orange azalea. Streams raced and beat me to the valleys.

Passing hamlets with the intriguing names of Dewey Rose and Hard Cash, I reached Elberton, the "Granite City." Twenty quarries in the vicinity furnish nearly a third of all America's monumental granite. Shaping, polishing, decorating, and inscribing cemetery memorials, 64 factories rub rocky elbows at Elberton.

Farm's History Reflects Georgia's

Seven miles from the Granite City, I paused for an afternoon at Rose Hill Plantation. Stephen Heard, a former acting governor of Georgia, built the big house in 1810. Successive generations of his family lived there up to 1945. Then John Wade Johnson, a northerner, bought the property.

Mr. Johnson said that Rose Hill's history

began with peach orchards; but fruit farms farther south glutted the market with earlier harvests. So Rose Hill gave up peaches and got down to cotton, like most of Georgia. In cotton it stayed until Johnson started raising cattle and reforesting the land.

His plantation spreads over 400 acres, three-fourths of it in pasture. Woodland covers the rest, richer each year by some 25,000 seedlings.

The story of Rose Hill reviews the State's main farming trends through the settled centuries: orchards, cotton, pastures for cattle, pine for pulp and lumber.

All over Dixie's Empire State agriculture advances with industry. Yet, with all its changes and plans for tomorrow, old Georgia remains the soul of the South. The State stands for a gentle way of life which no true southerner forsakes or forgets.

New National Geographic Map Portrays 331 Romantic, Strategic West Indies

TO THOSE lucky enough to cruise among the Caribbean's treasure islands, and also to those who can travel there only in fancy, the new map supplement, "West Indies," will be a welcome guide.

On this map, mailed to the 2,150,000 member families of the National Geographic Society with this number of their Magazine, these tropical islands are presented in entirety, as well as most of the Caribbean Sea, southern Florida, and parts of Central America (including Panama) and northern South America.*

The map also will provide a useful reference while reading the articles on Jamaica and Gulf Stream marine life in this issue.

Depicts a Sailor's World

The map, 37½ by 29 inches and on a larger scale (55.24 miles to the inch) than any chart of the area previously published by The Society, is a pattern in 10 colors of sparkling seas strewn with thousands of islands, from spume-soaked rocks no bigger than a rowboat to the bent cigar of Cuba, 700 miles long. Originally the region was inhabited chiefly by Arawak and Carib Indians; the latter gave their name to the Caribbean.

It is a sailor's world this West Indies map portrays, a region of busy sea traffic, where the swift and deadly aircraft carrier overhauls the grimy tramp, where the long, low tanker hails the gleaming, white-sailed yacht.

High-pooped Spanish treasure galleons once plowed these same Caribbean sea lanes, which pirates and buccaneers made a byword for swashbuckling adventure. Here, too, the proudest ships of Britain, France, Spain, and the Netherlands fought for possession of islands called "Indies" because the earliest voyagers thought they had discovered the Indies of the Far East. Today, vessels deep-laden with fruit, sugar, iron and aluminum ores, with coffee, copra, cacao, petroleum, and new-spun rope and twine, ply these warm seas.

The map gives helpful nautical information to the skipper of banana-boat or pleasure cruiser in navigating Caribbean waters. Ocean currents, prevailing winds, depth contours, and some 1,700 soundings are shown.

Important deeps are indicated, including the most abyssal in the map area, the Milwaukee Depth (30,180 feet, more than 5½

miles) in the Brownson Deep north of Puerto Rico. A note just above Habana, Cuba, explains how the Gulf Stream is formed.

Today's abundant navigational guides by contrast excite renewed admiration of the man who discovered the Caribbean, aided by little more than his own driving desire to find a new route to India. In that search Christopher Columbus visited or sighted nearly every prominent piece of land in or near the West Indies, after his first landfall, on October 12, 1492, at San Salvador in the Bahama Islands. Of the large present-day countries on the map, Columbus missed only two, the United States and the one named for him: Colombia.

Prominent in Caribbean affairs, as on the map, are Cuba, Hispaniola, and Puerto Rico. Sugar-bowl Cuba is the world's largest exporter of the cane sweetening; it supplies nearly a third of the sugar used in the United States.

Hispaniola accommodates two independent nations, Haiti, with two-thirds of the population, and the agriculturally rich Dominican Republic, with two-thirds of the area.

Puerto Rico (inset 5) on July 25, 1952, became the Commonwealth of Puerto Rico associated with the United States. Under their new Constitution and compact with us, Puerto Ricans now enjoy local self-government and pay no taxes to the United States.

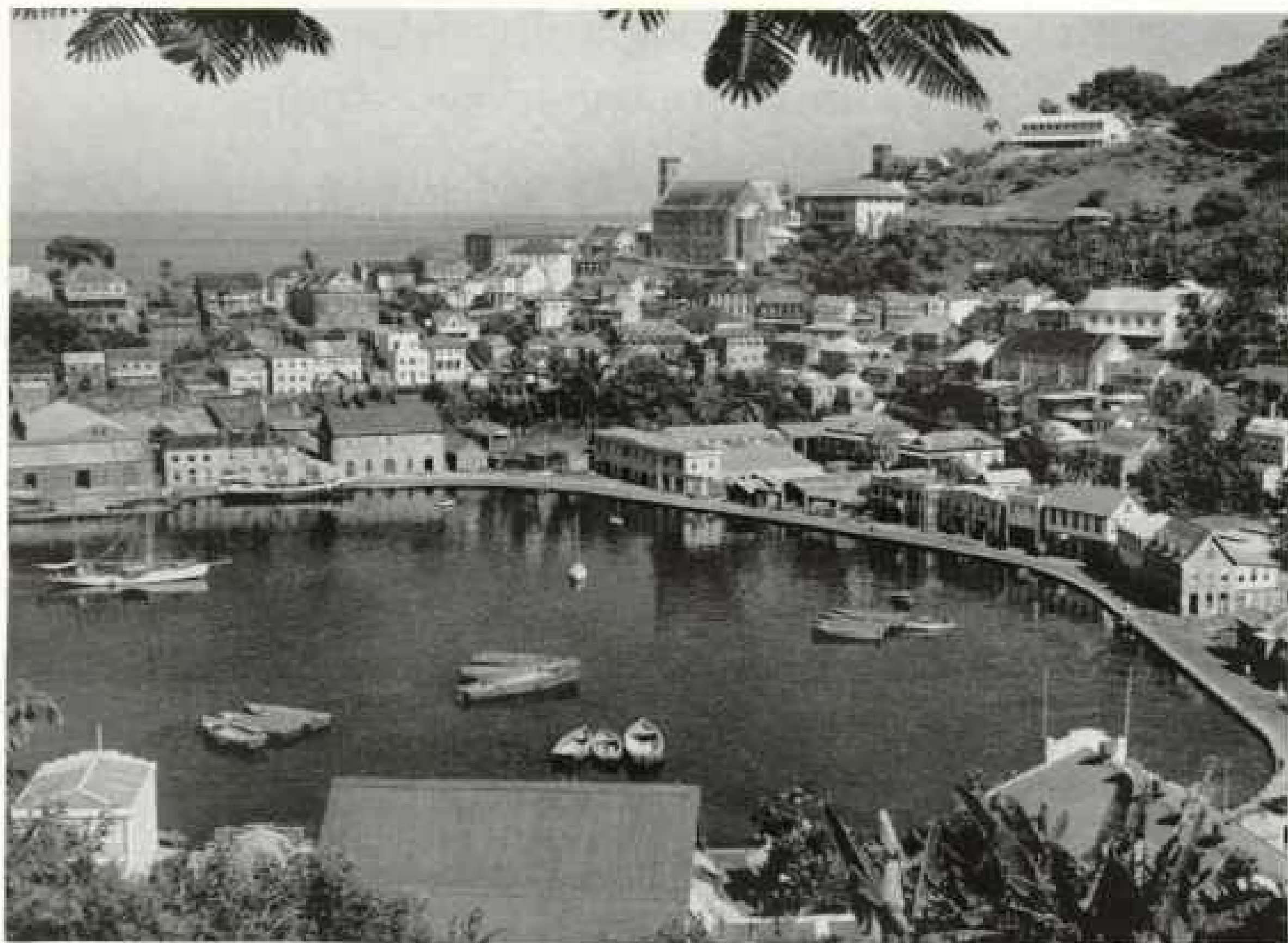
World's Highest Coastal Mountains

The map reaches from the man-made cliffs of Miami Beach's white hotels to the soaring Sierra Nevada de Santa Marta in Colombia.

The Sierra's highest peak, Cristóbal Colón, lifts its snow-tipped summit to 18,947 feet within 30 miles of the Caribbean. It is the loftiest coastal mountain mass in the world and one of the highest from its immediate base.

Thirty large-scale insets of major islands, island groups, and cities embrace the main map area. Colors of the up-to-date insets identify proprietor nations—yellow for United States territory, pink for British, purple

* Members may obtain additional copies of the map of the West Indies (and of all standard maps published by The Society) by writing to the National Geographic Society, Washington 6, D. C. Prices in the United States and elsewhere, 50¢ each on paper; \$1 on fabric; Index, 25¢. All remittances payable in U. S. funds. Postpaid.



St. George's, Grenada, Sits on a Gallery of Hills Around a Volcano's Flooded Crater

Cacao and nutmeg, Grenada's money crops, spice the dockside air. Bougainvillea, hibiscus, and frangipani color streets and gardens. Brick and stone have replaced wood since fire destroyed St. George's in 1775. Capital of Britain's Windward Islands, the town owns one of the West Indies' finest harbors.

for French, and orange for the Netherlands.

Except for the three island republics of Cuba, Haiti, and the Dominican Republic, most of the Caribbean islands are territories of foreign powers. One of the Lesser Antilles, Saint Martin, has successfully divided its loyalty between France and the Netherlands ever since 1648.

Though the West Indies were originally claimed by Spain, and though the culture and traditions of some islands still are Spanish-flavored, that nation no longer has a single possession here.

Not a few of the West Indies, among them several of the Virgin Islands, appear almost as untouched today as they did to Columbus. In bygone times pirate captains often banished disobedient crewmen to these isolated spots as punishment. Once, as anyone who knows his *Treasure Island* recalls, there were 15 men on the Dead Man's Chest. That island of the British Virgin group appears at the right-hand border of map inset 4.

The Netherlands islands of Aruba and

Curaçao (insets 25 and 26) process, in their refineries, a giant share of the oil of neighboring Venezuela. That nation, incidentally, is the world's leading crude-petroleum exporter and the second-largest producer after the United States. Jamaica (inset 29) recently has shot into the limelight as one of the world's major suppliers of bauxite, ore of aluminum (pages 341, 346, and 347).

The West Indies provide many sites for military and naval bases vital to hemisphere defense. Those noted on the map include air and naval bases on the Bermuda Islands, shown here in inset 30, although they do not fall within the main map area.

To both sailor and landsman the idyllic West Indies hold one annually recurring threat—hurricane! Any time from August to November these destructive storms may whirl northward across the region. Almost a third of them originate in the western Caribbean. Constantly improving warning techniques have, however, sharply reduced loss of life and property from the storms.

Once a Haunt of Buccaneers, This Ever-Summer Isle Lures Vacationists
and Prospers from Newly Exploited Aluminum Ore

BY W. ROBERT MOORE

Chief, Foreign Editorial Staff, National Geographic Magazine

With Illustrations from Photographs by the Author

WHEN Queen Isabella of Spain reportedly asked Christopher Columbus to describe the appearance of Jamaica, which he had discovered on his second voyage to the New World, the admiral had a quick, graphic answer. He crumpled a sheet of paper in his hand and displayed it before her—a demonstration especially apt if, perhaps, the paper chanced to be vivid green!

Either the admiral or his crew must have talked at greater length with the royal historian, Andrés Bernaldez, for he recorded that Jamaica "is the fairest island that eyes have beheld; mountainous and the land seems to touch the sky; . . . and all full of valleys and fields and plains. . . ."

Sharing Columbus's Landfall

Following much the same track southward from Cuba that the Admiral of the Ocean Sea had taken in 1494, I watched the island's crumpled hills swell on the horizon above the blue Caribbean. Mine, however, was the vantage of an airplane.

Bigger and bigger the island loomed, its cloud-tufted Blue Mountains humping high against the sky. Soon we came abreast of the north coast only a few miles from St. Ann's Bay where Columbus made his first anchorage. Santa Gloria he had named it then "on account of the extreme beauty of its country."

We crossed a fantastic blue bay and palm-studded strand, raced over white coastal homes, lush fields, and bush, and gazed upon green valleys threading deep among the mountains.

Suddenly the land dropped away. The south shore came in view, with Kingston sprawled along it. Tilting down for a landing, we spiraled over Jamaica's capital, snugly spread between its broad harbor and a green backdrop of hills (see the National Geographic Society's new ten-color map, "West Indies," a supplement to this issue).

Below us in the business district rose no tall skyscrapers, but two- and three-story structures. Jamaicans long ago learned that Mother Nature can be unsteady in her moods. Did she not, in 1692, shake down and engulf wicked old Port Royal, Kingston's predecessor? Older residents recall, too, how Kingston itself tottered during an earthquake in 1907.

Around the crowded downtown area extended a garland of private homes set in spacious gardens, many of them color-splashed with bougainvillea, fiery poincianas, and other flowering plants and trees.

Beyond the city, blue Kingston Harbour lay like a big lake within the shielding arm of land called the Palisadoes, probably named from rows of treetops that sailors saw as they neared the port. The Palisadoes give Kingston a superb landlocked anchorage for shipping and one bulge of land wide enough for the city airport.

However you approach this delightful Caribbean island, you run head on into eventful history.

Planes roaring down on the airport shake the bones of that 17th-century cutthroat, buccaneer Henry Morgan, buried somewhere on this narrow land strip.

Port Royal Was Buccaneer Base

Ships steaming through the entrance channel stir up the waters over ghosts and sunken ruins of Port Royal, which was swallowed by earthquake and sea in a single great gulp. Before it perished, this boisterous sea haven had gained an unenviable reputation for "battle, murder, and sudden death."

Buccaneers in pilfered silks swaggered about the streets, noisily squandering their ill-gotten pieces of eight. At Fort Charles, now a crumbling relic, forgathered English seamen who helped shape early British naval prowess.

Kingston, with 205,000 inhabitants, has little in common with its wicked forebear

across the harbor. Ebon police, clad in spotless white coats, gleaming sun helmets, and dark trousers, direct an orderly but crowded traffic along the streets. Rush hours bring a sudden congestion of buses, bicycles, and bantam British cars.

Kingston's markets, shops, and street stalls now offer, not pirate loot, but raffia-decorated purses, bamboo and palm baskets, hand embroideries, and jipijapa hats, their name apparently of Indian origin (page 354). There isn't a single earringed, swashbuckling buccaneer around!

"Salubritie of Ye Ayre"

Jamaica is a tropic isle that lives up to expectations. Some 150 miles long and 50 miles across at its widest, it is a goodly piece of land. Nowhere, however, is one ever far from alluring scalloped bays, sandy beaches, and superb headlands that gird its coast.

Three centuries ago a visitor appraised the island thus: "Ye temperature of ye Climent, and Salubritie of ye Ayre, may be very well deserned in ye good complection and long life of ye inhabitants, who here attain to greater age than those in many of ye neighbouring islands. It is likewise watered with pleasant Springs and fresh Rivers, and wanteth noe store of safe convenient Harbours for Ships. . . . For briefe, it affords, or can produce, whatsoever, or most things, affected by man, either for pleasure or profit."

The mountains, of which 7,402-foot Blue Mountain Peak is the highest, provide vertical variation in "Ye temperature of ye Climent," ranging from the tropics to coolness of temperate latitudes.

In summer, sea and land breezes perpetually fan the warmer coastal areas to temper the sun. Alternation of dry and rainy seasons provides variety.

Island Named for Abundant Waters

The very name Jamaica derives from the island's ancient Arawak title, *Xaymaca*, variously translated as "Isle of Springs," or "Isle of Many Rivers." These rivers wind through fern-embroidered folds in the hills, rush down the mountainsides, or leap rocks in fairy waterfalls.*

As for Jamaica's produce for "profit," there are broad fields of sugar cane, coconut and banana plantations, spices, and Blue Mountain coffee. Industrially, the island

makes cooking fats, margarine, and soap from coconut oil; it produces sugar and rum from its cane fields, operates fruit canneries, weaves textiles, and is developing a growing number of small manufacturing enterprises.

Newest source of wealth is bauxite, ore of aluminum. Since 1952, three companies, two American and one Canadian, have been mining huge deposits of the mineral discovered on the island.

More and more visitors explore this Caribbean land spot for the pleasures of its gleaming beaches, the undersea life of clear coastal waters, and superb game fishing.

During World War II when I made an earlier visit to Jamaica, barrackslike wooden buildings at Mona on the hills above Kingston housed more than 1,000 evacuees from Gibraltar and heavily bombed Malta.

In 1948 these camps became temporary home to the newly founded University College of the West Indies. Today the college has largely graduated from the old structures and moved into fine halls and residences of concrete and glass.

Morgan, Buccaneer Who Went Straight

"Here's quite a treasure," said my friend Dr. Kenneth Hill, Professor of Pathology, when we visited the library a few months ago. He showed me four rare volumes, illustrated with remarkably accurate color engravings, describing several Caribbean islands, but especially Jamaica. They were written by Sir Hans Sloane, a British doctor, and published in 1707 and 1725 (page 358).

In his Introduction, Sloane told of giving medical treatment for dropsy to Henry Morgan (he referred to him as Sir H. M.) shortly before that buccaneer-turned-lieutenant-governor died at a little over fifty.

In Kingston's Institute of Jamaica Museum and at Port Royal I came upon other reminders of Morgan, who sallied out of Jamaica to loot Spanish treasure ships from Cartagena, take Portobelo and Maracaibo, sack Panamá, and harass other cities in the Caribbean circle. The church at Port Royal shows communion pieces known as Morgan silver.

The story of Jamaica, however, is far more than a chronicle of buccaneers.

Set in the floor near the altar in the

* See "Jamaica, the Isle of Many Rivers," by John Oliver Le Goffe, NATIONAL GEOGRAPHIC MAGAZINE, January, 1927.



Queen Elizabeth Accepts a Bouquet from Loyal Jamaicans in St. Ann's Bay

Flying in from Bermuda last November, the British royal visitors motored from Montego Bay to Kingston. En route they stopped at the courthouse in St. Ann's Bay, close to the spot where Christopher Columbus landed on his discovery voyage in 1494. Here the Duke of Edinburgh bends to pet a stray dog.

Kingston Parish Church is the tomb slab of brave John Benbow. From chasing corsairs in the Mediterranean, this English admiral came to rout pirates from the Caribbean.

When, in 1702, the French fleet under Du Casse began prowling here, Admiral Benbow hunted down and repulsed it, but died "by a wound in his leg" sustained in the battle.

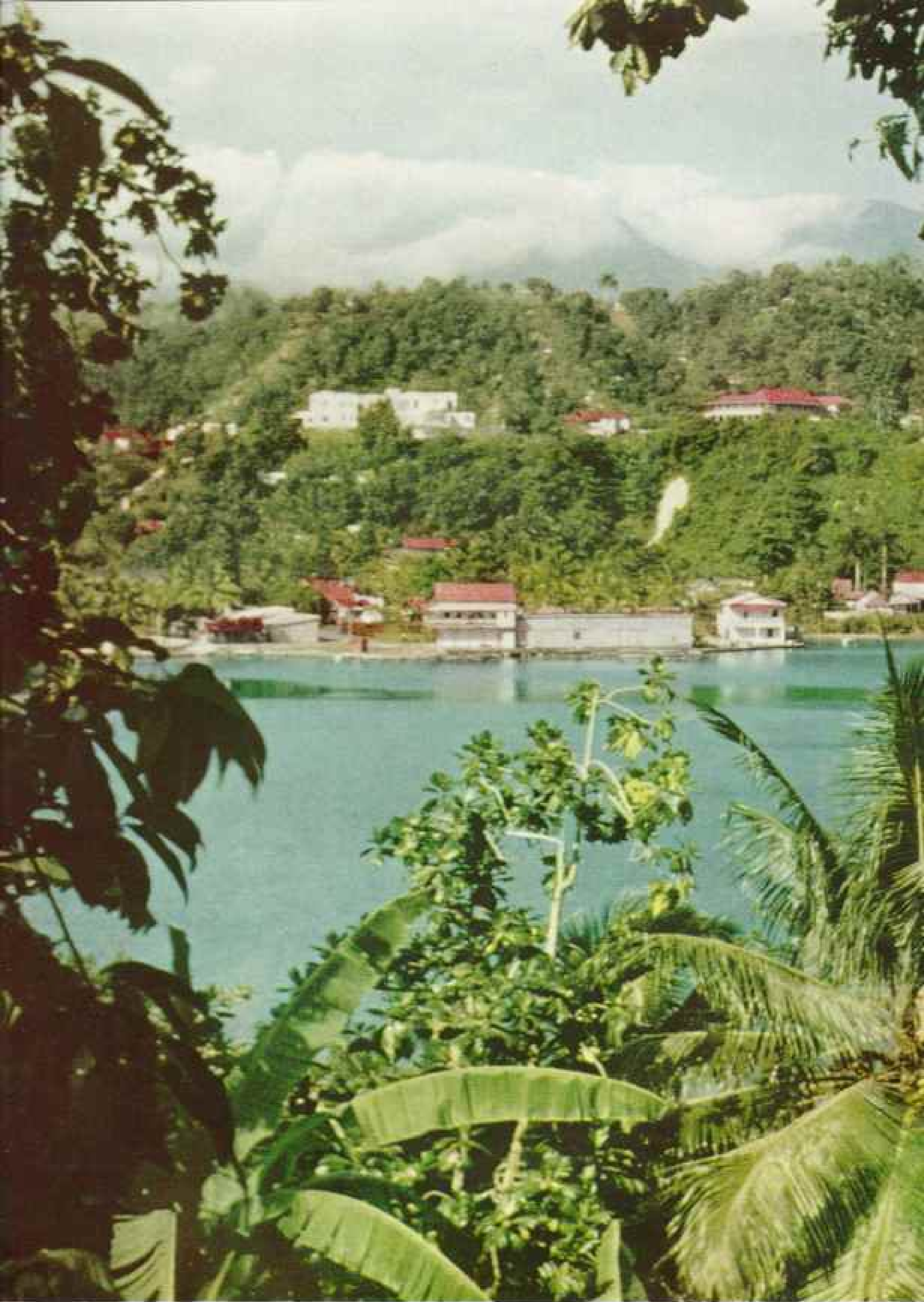
Admiral Edward Vernon cruised Jamaican waters in 1739 and 1742 when fighting the Spanish in "The War of Jenkins' Ear." That war won its name when the sloop *Rebecca*, bound home from Jamaica in command of a Capt. Robert Jenkins, was boarded by Spanish coast guards. With a slash of his sword one cut off the skipper's ear and told him to show that to his King.

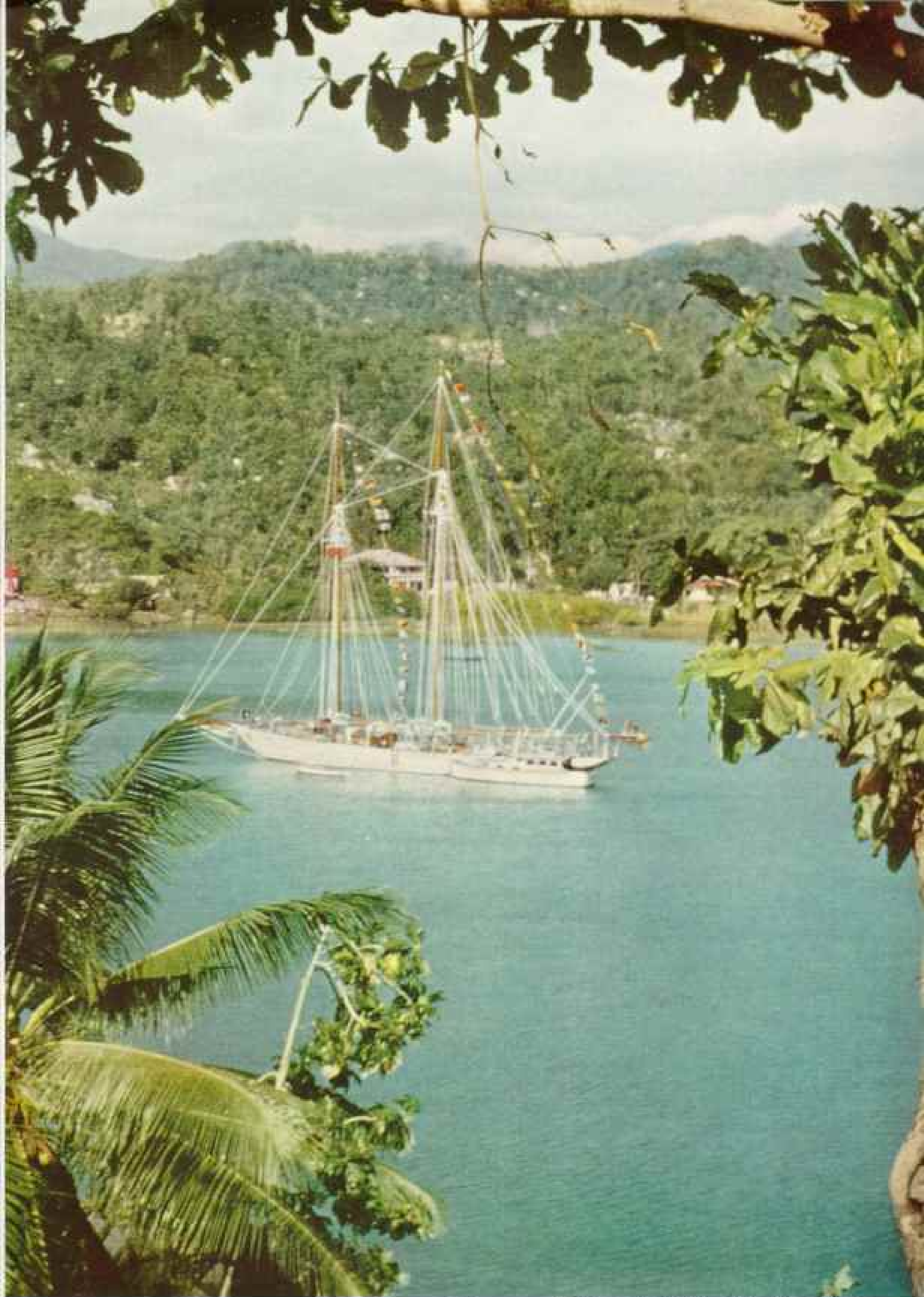
Seven years later this ear (or another which may never have listened to tavern tales in Port Royal) was displayed, pickled in a bottle, before an angry House of Commons.

Admiral Vernon vowed vengeance, saying he would take Portobelo from the Spanish with six ships only. And he did.

A Scuttlebutt of Grog

"Old Grog," British sailors then called Vernon, because of the grogram cloak he wore. The grog they still drink bears Vernon's nickname because he ordered their ration of rum diluted with water—a half pint of rum to a quart of water mixed in a scuttlebutt, or cask, kept for that purpose.





Zaca, an American Yacht, Makes This Banana Port Her Base

Incidentally, it was for this same Admiral Vernon that George Washington's home, Mount Vernon, was named.*

To Jamaica, in 1782, also came victorious George Rodney, bringing into Port Royal nine battered prize ships, including the flagship *Ville de Paris* of the French Admiral de Grasse. Britain's hold on all her West Indian colonies had been at stake in that battle.

Here, too, came Capt. William Bligh, of H.M.S. *Bounty* fame, to introduce the first breadfruit trees to the island. A source of inexpensive food, they flourish today throughout Jamaica (page 358).

The Fort Charles batteries at Port Royal once were commanded by a 21-year-old hero in the making, who later won indelible fame at Trafalgar—Horatio Nelson.

His coat of arms is still in place above a sally port. And a plaque set into a weathered brick wall bears these words:

IN THIS PLACE
DWELT
HORATIO NELSON
You who tread his footprints
remember his glory

Talking with the commanding officer of the Kingston garrison, I was invited to visit the military rest camp in the mountains at Newcastle. Like a Shangri La, the camp perches on a shoulder of the Blue Mountains.

Motoring from the capital to this lofty aerie, we drove out past the gardens of King's House where the governor lives, beyond sprawling suburbs, and past the Hope Botanical Gardens. As we rose into the hills, the loops, twists, and zigzags in the route provided breath-catching views of the whole Kingston area and the broad grounds of University College.

Yankees Were Guys Called "Joe"

Along the climbing, serpentine path we passed a few countrymen's houses. Near one, two ebon-hued women were picking breadfruit, thanks to tough old Captain Bligh. Farther on, we met a group making a holiday of cutting grass near the roadside.

"Marnin' George," they called with toothy smiles as our army car drew up. For some reason local folk call British soldiers "George."

American soldiers, stationed in Jamaica during World War II, were called "Joe," or "Yahnkee."

A gay, smiling, happy-go-lucky people are

these Jamaicans. Here, as throughout most of the West Indies, the island's 1,500,000 inhabitants are largely of Negro ancestry. Early Spaniards brought some, and for years the British imported others. Slavery was fully abolished in 1838.

"A Worra You da Say?"

The local lingo has a strange sound to the untrained ear, and at first I failed to get the gist of their odd English expressions.

My driver invariably introduced a comment with "Them say—"

Them say, for instance, "A worra you da say?" meaning, "What are you saying?"

In local vernacular the bumblebee becomes a "bungo-bee," and the familiar red-blossomed poinciana tree becomes "fancy Anna."

Proverbs here have a homely humor and philosophy with backgrounds in both Africa and Europe. Take for example: "Rockstone in riber (river) bottom neber know sun hot." "Seben year neber too long fe wash 'peckle off a guinea hen back." "No cuss alligator' long mout' till you cross riber."

The military cantonment at Newcastle occupies a series of steep terraces 3,700 feet above the sea. There the air was fresh. Soldiers on holiday lounged in the sun.

In the terrace wall, backing the parade, plaques bear the arms of British Commonwealth detachments which have served in Jamaica. That stationed on the island at the time of my visit was the First Battalion of the Royal Welch Fusiliers, which later guarded the Queen and her consort during their visit, November 25-27, 1953.

From Newcastle a mountain route leads through Hardwar Gap to Buff Bay on the north coast. It climbs to 4,079 feet, highest of any main highway in Jamaica.

Two lower-level roads cross the eastern part of the island. One winds through delightful hill vistas to the attractive Castleton Gardens. Thence it plays hide-and-seek with the Wag Water River to the sea at Annotto Bay. The other touches Spanish Town, probes Bog Walk, and vaults the mountain ridge to north-coast towns.

Outward-bound from Kingston another day, I chose this latter route. Motoring across Liguanea Plain toward Spanish Town,

(Continued on page 344)

* See "Mount Vernon Lives On," by Lonelle Aikman, NATIONAL GEOGRAPHIC MAGAZINE, November, 1955.



Factory Workers at May Pen Shred Sisal for Rope and Twine

Acres of sisal, an agave often mistaken for cactus, grow in south Jamaica. Crushers extract long tough fibers from green spiky leaves. Unraveled by hand, the threads are twisted by machine.

Jamaica Welcomes Queen Elizabeth II on Her World Tour

Visiting the Legislature in Kingston, Elizabeth II and the Duke of Edinburgh heard the Speaker, C. C. Campbell (in wig), extend a "loving and sincere welcome." Mr. Campbell also expressed gratitude to Great Britain for constitutional reforms representing a vital advance on the road to self-government for 1,500,000 Jamaicans.

The island has an elected House of Representatives of 32 members, a Legislative Council (Upper House) of 15, and an Executive Council of 11

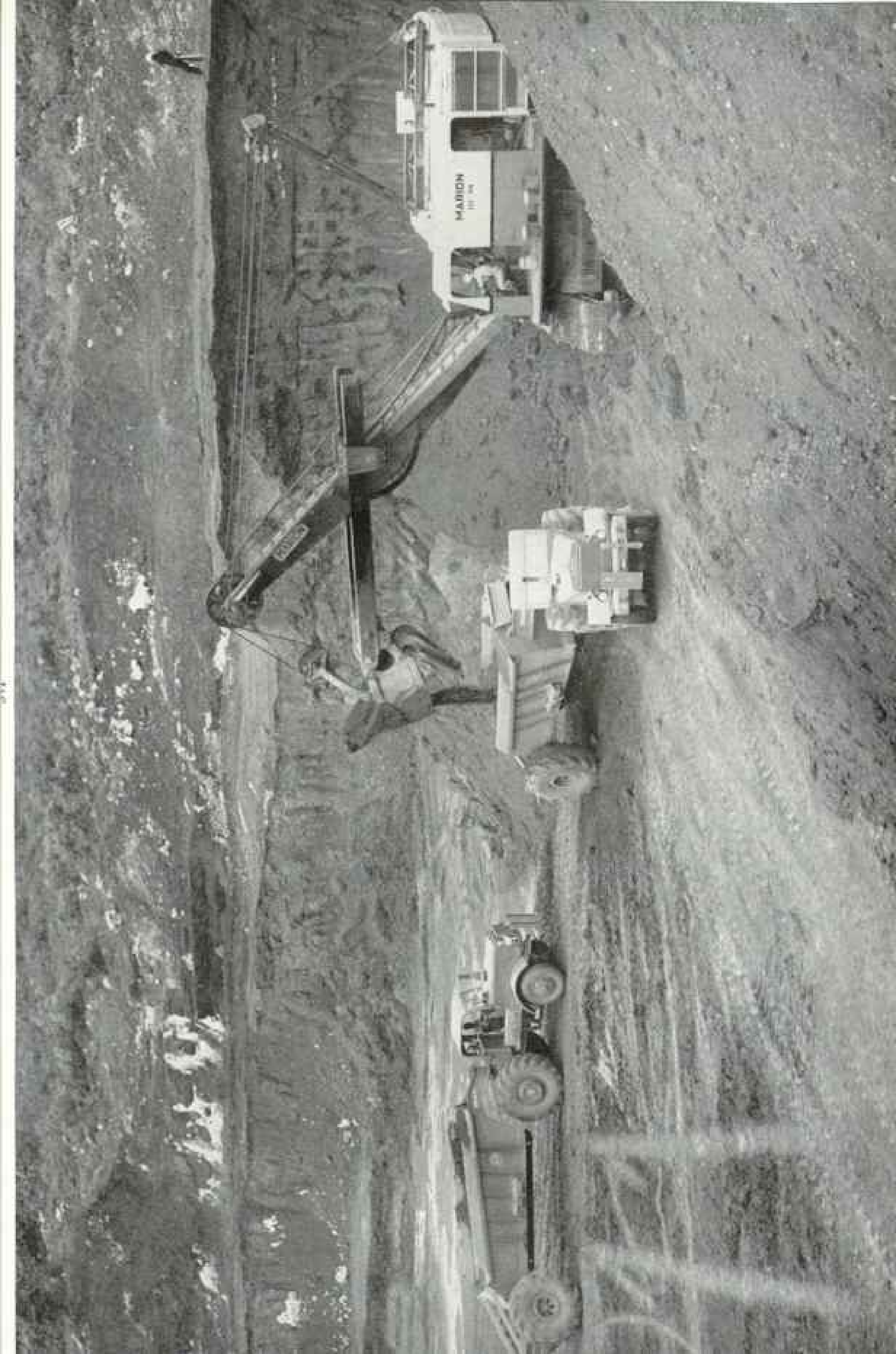
(page 344).

Power Shovel Scoops Rich Bauxite

In 1942 Jamaica discovered that red earths in the center of the island were approximately 50 percent aluminum ore. Easily accessible, the earth needs only to be dug from open cuts, as in this property of Reynolds Jamaica Mines, Ltd.

This cut measures about 40 feet in depth. Ore is shipped to Corpus Christi, Texas, for processing (page 347).







✦ Montego Bay Flies the United States Flag Beside Britain's in Honor of American Naval Visitors

✦ Jamaica's Governor Sir Hugh Mackintosh Foot (on grey horse) salutes the Royal Standard at Kingston's celebration of Queen Elizabeth's Coronation (page 348).
Right: Members of the Jamaica Military Band, in vivid Zouave uniforms, take part in the Trooping of the Colour.

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© Hutchinsons by W. Robert Moore. National Geographic Staff



we met marketers on their way to town. Some walked, carrying baskets on their heads. Others rode donkeys that bore panniers bulging with foodstuffs (page 360).

Midway between Kingston and Spanish Town stands a colossal ceiba, or silk-cotton tree. Tom Cringle's Cotton Tree, people call it, recalling *Tom Cringle's Log*, a book by Michael Scott published in 1836, picturing 19th-century West Indian life.

Local folk assert that the venerable tree is a haunt for the *duppies*, or ghosts, that supposedly roam Jamaica.

Spanish Town Became English Capital

We stopped to see Spanish Town. It was the island capital once—twice in fact. Spanish colonists coming to Jamaica built the town of Villa de la Vega here in 1534. Later it became their capital under the name of St. Jago de la Vega (St. James of the Plain).

When the British won the island under General Robert Venables and Admiral William Penn, father of William Penn, founder of the Commonwealth of Pennsylvania, they first established the seat of government at Port Royal but soon transferred it back to St. Jago.

Tombstones and memorials set in the flooring and in walls of the cathedral church of St. Catherine hark back to early days.

History still re-echoes through the main square of Spanish Town. Here stand the old House of Assembly and the porticoed façade of King's House, early home of Jamaica's governors. An elaborate monument to Admiral George Rodney shows the naval hero in classical Roman garb, flanked by two cannon taken from the conquered warship, *Ville de Paris*.

In the museum beside the monument I saw the papers of the ships Rodney took. Here, too, were documents from the infant American Continental Congress, dated April 3, 1776, giving "Instructions to the Commanders of Private ships or vessels of war which shall have Commissions or Letters of Marque and Reprisal authorizing them to make Captures of British vessels and cargoes." John Hancock had signed one, John Hay another. The fact that these papers are in Jamaica attests that the ships carrying them, bent on captures, had ended up captured.

The Assembly building recalls the start of self-government in Jamaica. In the early 1660's the island was granted a representa-

tive constitution which provided for a Governor, a Privy Council, Legislative Council, and Assembly.

In 1866 the House of Assembly voted its own abolition, to make way for a reforming Crown Colony government. Only on November 20, 1944, did Jamaica regain full representative government.

Now everyone over 21 years has the right to vote. The British Crown appoints the governor, but the island elects its own House of Representatives, consisting of 32 members, a Privy Council of six, and a Legislative Council (the Upper House) of 15.

The constitution as amended in June, 1953, provides for a Chief Minister, appointed by the House of Representatives, and seven other elected Ministers. These, plus the Colonial Secretary, Attorney General, and the Governor as Chairman, make up the Executive Council. The Labor party controls a dominant majority of seats.

The plain about Spanish Town is verdant with cane fields and banana plantations, irrigated by water drawn from the Rio Cobre.

I detoured to a large banana plantation to watch workmen cutting fruit for shipment to England. In the fields a foreman on horseback rode among the banana plants, directing laborers cutting the mature stems.

With a single slash of his sharp knife, a cutter would topple the upper part of the plant, deftly catch the stem of bananas on his knee, and sever the stalk.

Other workers, balancing fruit on their heads, carried it to the roadways, where donkeys, ox wagons, or trucks picked it up. From the fields the bananas were hauled to a railway siding for immediate washing, loading, and transport to a ship waiting at Port Antonio. To avoid spoilage, loading into cooled holds of ships must be completed within 24 hours after cutting.

Banana Trade Has Revived

"In our best prewar year, 1937, Jamaica shipped some 27,000,000 stems of bananas," Richard Williams, director of the All Island Banana Growers Association, told me. "Lack of wartime shipping, leaf spot, Panama disease, and land erosion brought our trade down to less than 5,000,000 stems. The hurricane that swept across the island in 1944 hit us a bad blow. Our 1945 crop was only about 2,000,000 stems.

"Since then we've developed a new variety



So Clear Are Montego Bay's Waters that Sailboats Seem to Float on Air

Visitors stretch out on the warm sands of Doctor's Cave beach (background). Others come here to take part in the annual Montego Bay regatta, which starts from this point, usually in April. Inland from Montego Bay rears a rugged range of limestone hills known as the Cockpit Country (page 359).

of banana, called lacatan, which has whipped the Panama disease. By spraying every three or four weeks we keep leaf spot down. We are also fighting soil erosion and promoting the use of fertilizers by an educational program.

"We've not done too badly," Williams went on. "We're now up to about 10,000,000 stems a year. And remember that 75 percent of our crop is produced by people having 10 acres or less."

From Spanish Town I took the road to Bog Walk. Highway and railway wind up through the wild gorge of the Rio Cobre.

Bog Walk is an unpicturesque name for such a delightful tropical defile. Actually, the name is a corruption of the Spanish *Boca de Agua*, Mouth of the Water.

The fickle Rio Cobre has won as many curses, perhaps, as laudatory adjectives. When heavy tropical rains come, the placid

river becomes a raging demon. At one bridge, heavily buttressed with concrete to withstand floods, a marker high up on the bank (you have to crane your neck to see it) records two almost unbelievably high water levels of the river in spate.

When the rains come to Jamaica it can really rain! Late one afternoon, when I was at Port Antonio, the skies opened, unloosing a deluge. By next morning 16.95 inches of rain had fallen. The following night 15 inches more came roaring down. As much as 27 inches have been recorded in a single day.

Hard to believe is the measurement of 135 inches in eight days quoted for the flood of 1909!

"The river is down," say the Jamaicans when the water is up. Riding a jeep in central Jamaica one day we came to a ford and found the river "down."



A Road Cut Near Mandeville Exposes Red Aluminum Ore Capping White Limestone

Soil tests made during World War II led to the discovery that red earths across the middle of Jamaica were rich in bauxite, an aluminum ore. Today the island has reserves good for an estimated 50 to 60 years.

Two American companies and one Canadian firm strip deposits extending to 100 feet in depth. Alumina Jamaica, Ltd., the Canadian, operates an alumina-extracting plant near Mandeville. Kaiser Bauxite Company and Reynolds Jamaica Mines, Ltd., ship ores to the United States for processing.

After stripping off deposits, the mining companies replace topsoil. On leased lands held in reserve they graze herds of cattle and improve the bloodlines with imported bulls. Elsewhere they plant fruit orchards and hardwood stands.

← *Heliconia*, a wild plantain, grows in the tropical verdure of the Rio Grande Valley near Port Antonio. Though it is a relative of the banana, the plant produces no fruit.

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Photographer: W. Robert Moore, National Geographic Staff

From shore, the surging yellow tide looked bad. From midstream, with water pouring through the body of the car, the situation looked far worse.

The engine spluttered and died. There we sat stranded until a truck came along and towed us to shore.

From the Rio Cobre we twisted up over Mt. Diablo, a devil in name only, for it affords splendid views back across the District of St. Thomas in ye Vale and into St. Ann Parish, "Garden Parish" of Jamaica. There the pleasant town of Moneague attracts vacationists to its 1,200-foot elevation.

Rich Bauxite Deposits Discovered

Thanks to efforts of the Department of Agriculture and a St. Ann landholder, Sir Alfred D'Costa, Jamaica became aware of hitherto unrealized assets. D'Costa and others were puzzled as to why Wynne grass and corn did poorly on the red soils cupped among the hills. Sample tests made in 1942 proved that the red earths actually contained nearly 50 percent aluminum oxide (opposite).

Wider search has revealed perhaps 300,000,000 tons of bauxite, giving the island one of the largest easily accessible sources of aluminum known anywhere.

Here in St. Ann Parish, eight miles inland from the coastal town of Ocho Rios, Reynolds Jamaica Mines, Ltd., a subsidiary of Reynolds Metals Company, of Louisville, Kentucky, has built a 17 million dollar plant.

The ore, dried and nodulized in large kilns near the open-cut mines (page 341), is transported by aerial cableway to Ocho Rios Bay. There storage silos and a huge pier permit the loading of ore ships at the rate of 1,400 tons an hour.

"We now are shipping some 750,000 long tons of dry ore a year to Corpus Christi, Texas, where we've built a plant to handle the island bauxites," said William S. Cole, Jr., Reynolds's resident manager.

Mine Company in Beef Business

"Have you seen our other produce?" asked Mr. Cole when we had returned from the earth cuts, the laboratories, and the drying kilns. "We're very proud of our cattle," he explained. "Our herd has grown to about 9,000 head and produces some of the island's finest beef. Bulls imported from Texas improve our stock."

Production of fruits and crops makes some

of the leased lands actually more productive now than before mining began, I learned.

Other mining operations, which I saw later, lie in Manchester and St. Elizabeth Parishes on the opposite side of the island. Four miles north of Mandeville, Alumina Jamaica, Ltd., a Canadian affiliate, has built a plant for the production of alumina (refined aluminum oxide) right on the spot.

At the time of my visit, the plant's output was some 180 metric tons of alumina a day, but workmen were busy on a new extension to increase it to 450 tons.

"Our plans allow for an ultimate production of 1,000 tons a day," said Dr. D. A. Bryn Davis, the managing director. "It takes roughly three tons of bauxite to produce one ton of alumina," he explained as we watched the red earth pour into ball mills and vanish into vast caustic soda digesters, eventually to emerge from the drying kilns as powdery white alumina.

"Two tons of alumina yield one ton of metallic aluminum. Our present output is being shipped to Norway, but shortly it will all go for reduction at the new aluminum smelters at Kitimat, British Columbia."

Alumina Jamaica, like Reynolds, also breeds cattle, cultivates citrus groves, and reforests leased land with hardwood trees.

Ore Reserves Good for Half Century

Southwest of Mandeville, the Kaiser Bauxite Company mines more than 1,000,000 tons of bauxite a year. Its first shipload sailed for the Kaiser plant at Baton Rouge, Louisiana, on February 10, 1953 (page 352).

"How long will Jamaica's bauxite reserves last if mined at the present scale?" I asked the managers of all three companies.

"About 50 or 60 years, perhaps much longer," was the consensus. Further explorations may reveal additional workable deposits.

The approach to Ocho Rios on the north coast speedily diverts one's mind from ore production. The road squirms through a rocky ravine known as Fern Gully. Ferns bank the road and slender shafts of sunlight spear through overhanging trees.

Just short of Ocho Rios we turned up a steep hill to Shaw Park Hotel. Surrounded by swaying palms and flower gardens, the high-perched hotel faces toward the sea—a sea so blue that its waters seem stained with dye (page 357).



Kingston, Jamaica's Capital, Puts On a Gala Display for Coronation Week

King Street, one of the city's main arteries, decorated shops with flags and bunting. Throngs packed the thoroughfare to view evening's bright lights and window exhibits. Streetside flower stalls, ever a brilliant sight, did a thriving business.



Portraits of Queen Elizabeth II and Duke of Edinburgh Survey Loyal British Subjects

Kingston grew up after an earthquake in 1692 destroyed its parent city, Port Royal, which occupied an arm of land around the harbor. Called the wickedest city in the Caribbean, Port Royal was a haunt of buccaneer Henry Morgan. Kingston itself survived heavy earthquake damage in 1907.

The coastal highway skirts the sea through coconut plantations and past sickles of sandy beach. In some places the road hangs on a narrow rock shelf high above the water; elsewhere it dips close to the curling waves.

Since World War II these shores have seen a boom in new hotels, bungalows, and beach clubs. In the Ocho Rios region are the Silver Seas, Jamaica Inn, Glitter Beach, Coral Cove Hotel, Tower Isle Hotel, Sans Souci, and other vacation retreats. Here, in truth, is a place to linger and savor the philosophy of the Jamaican proverb: "Too-much-hurry get dey tomorry, tek-time get dey today."

Just west of Ocho Rios, Dunn's River rushes down the hillside and plunges into the sea. Only a few steps link a waterfall shower and a swim in the salty Caribbean.

Waterfalls Sacrificed for Power

Roaring River, just beyond, once roared amid coconut trees and banana plants. Until 1947 its surging mass of water tilted over a rocky cliff in a white frothing waterfall, then cascaded to the coast.

In that year, engineers completed a diversion dam and pipeline to a hydroelectric plant. Now generators hum, producing some 3,500 kilowatts of electrical power. Normally dry, the waterfall was "turned on" for last year's visit of Sir Winston Churchill.

A few miles westward St. Ann's Bay and Dry Harbour indent the coast. After his first visit here in 1494, Christopher Columbus paid an unanticipated call in 1503. On his fourth voyage to the New World, a severe storm forced Columbus to seek shelter just as he was setting sail for Spain.

The great admiral beached his two ships, worm-eaten and in bad repair, and propped them up against storm and tide. For a long, weary year he and his crews lived in huts built on the decks. His men were diseased and mutinous, and gout so plagued the discoverer that often he could not stand.

Finally, in June, 1504, loyal Diego Méndez sent a caravel from Hispaniola. In it the gallant admiral sailed again, never to return.

On the sands along this shore I watched other boats being beached. They were small sailing craft bringing in some of the gayest colored fish I have ever seen. The blue, yellow, red, and other gaudily tinted fish seemed better suited to an aquarium than the dinner plate.

One fishing crew had captured a 300-pound turtle, worth, they said, about \$40 at the market. The main hunting ground for these giant turtles is around the Cayman Islands, northwest of Jamaica.*

Hurricane Damage Repaired

At Rio Bueno I came upon a group of people cutting coconuts and drying copra. Some split coconuts with big knives; others carried the broken nuts to hillside racks to dry in the sun. Still others bagged the dried, oil-rich chips of copra for dispatch to an oil-extraction plant.

In 1944, a destructive hurricane roared across Jamaica. It destroyed more than 70 million coconuts, and uprooted or snapped off some 1,750,000 trees. Where the blast hit full force, whole plantations were leveled. A hurricane on the south coast in 1951 destroyed another 511,000 trees.

But the industry has made a rapid comeback with new plantings, and future yield is expected to surpass the pre-hurricane crop.

A few miles inland from Falmouth we dropped in for a visit at Good Hope ranch. Good Hope once was a rich slave-operated plantation. Several of its hand-hewn stone buildings, erected in the mid-18th-century, still stand. The big estate house commands a wide sweep of mountains beyond grazing pens and coconut groves.

Several hundred cattle and many horses graze on Good Hope's pastures; a large number of the cattle are boarded and fattened for slaughter. I watched plantation women-folk working beside their men, cutting and husking coconuts for copra.

During winter months Good Hope entertains many dude ranchers; its guest book reads like a social register.

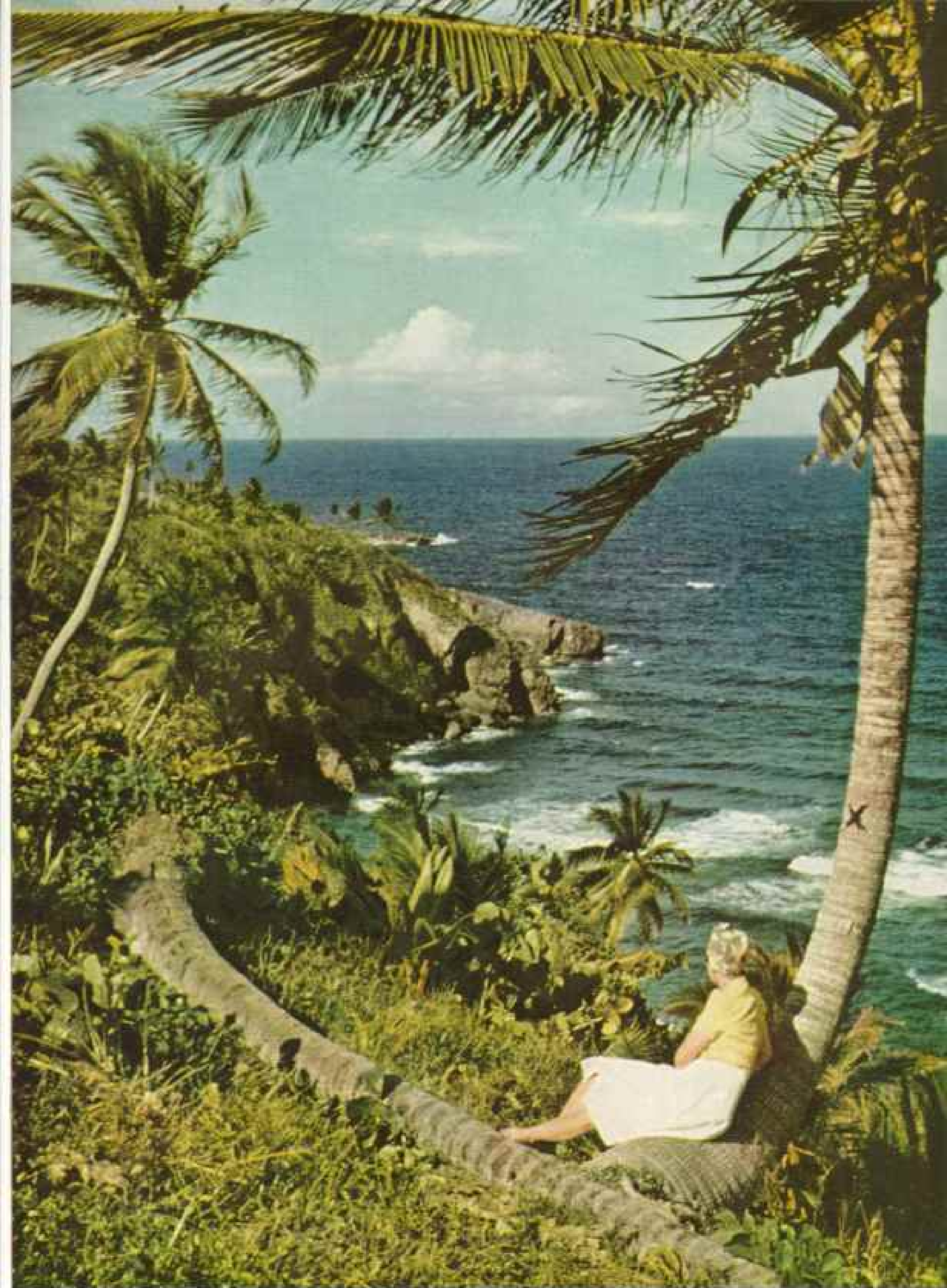
Sea Brightly Phosphorescent

From gracious Good Hope we journeyed to Falmouth. In the right weather, near-by waters put on a spectacle of eerie grandeur. So brilliant is phosphorescence in Rock Bay that fish or persons swimming there at night seem bathed in blue electric fire.

"On stormy nights before rain," said a resident, "low dark clouds glow with light reflected from the broken surface of the water."

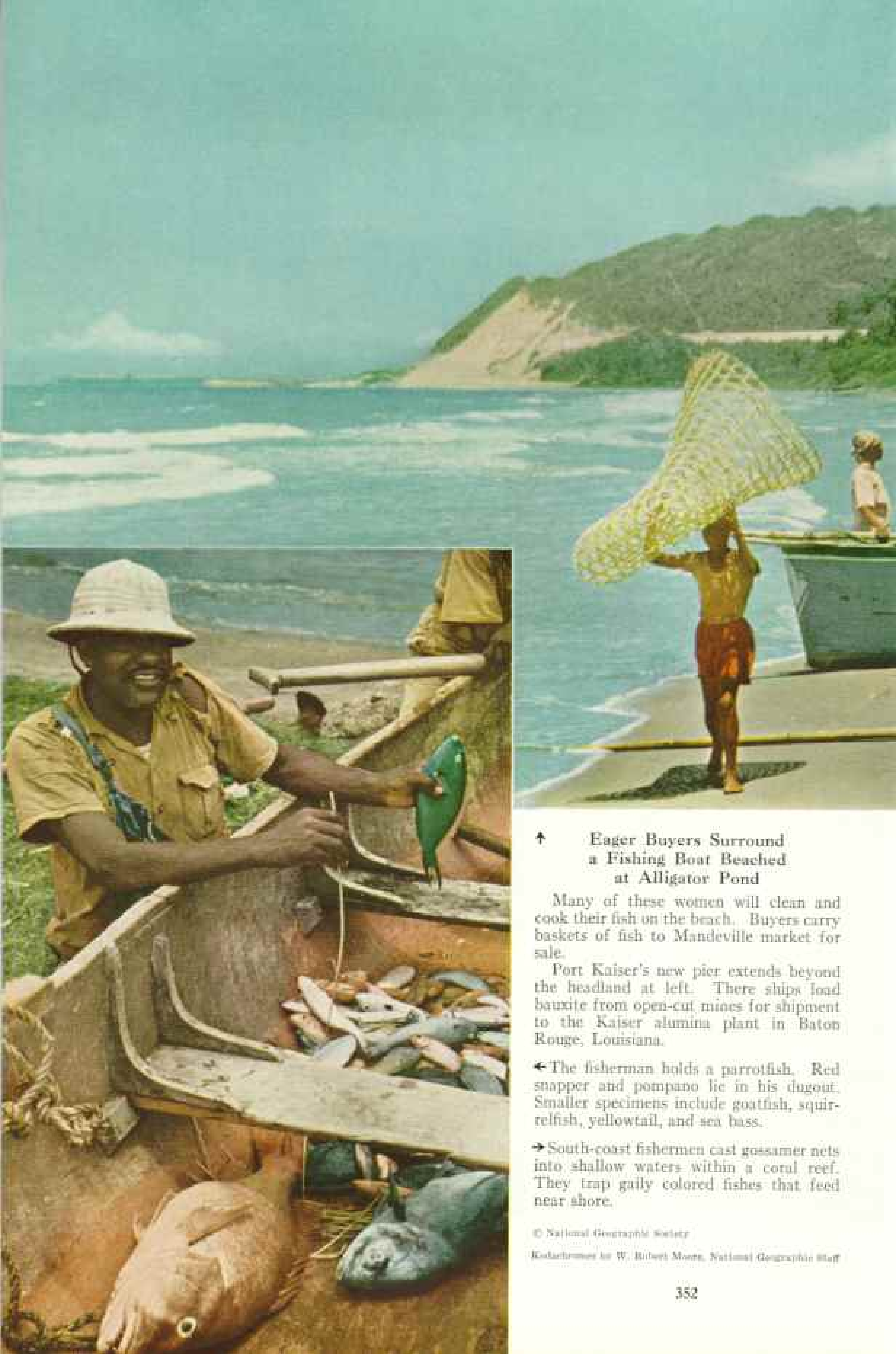
(Continued on page 359)

* See "Capturing Giant Turtles in the Caribbean," by David D. DUBOIS, NATIONAL GEOGRAPHIC MAGAZINE, August, 1943.



Sea Breeze and Surf Forever Caress Palms and Rocks on Jamaica's North Coast

Here summer fingers all year round, but the fallen log suggests the hurricanes that sometimes desolate these pleasant shores. A storm in 1944 toppled many of the island's coconut palms.



↑ **Eager Buyers Surround
a Fishing Boat Beached
at Alligator Pond**

Many of these women will clean and cook their fish on the beach. Buyers carry baskets of fish to Mandeville market for sale.

Port Kaiser's new pier extends beyond the headland at left. There ships load bauxite from open-cut mines for shipment to the Kaiser alumina plant in Baton Rouge, Louisiana.

← The fisherman holds a parrotfish. Red snapper and pompano lie in his dugout. Smaller specimens include goatfish, squirrelfish, yellowtail, and sea bass.

→ South-coast fishermen cast gossamer nets into shallow waters within a coral reef. They trap gaily colored fishes that feed near shore.

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Kodachrome by W. Robert Moore, National Geographic Staff







↑ Reapers Load Wagons High with Sugar Cane

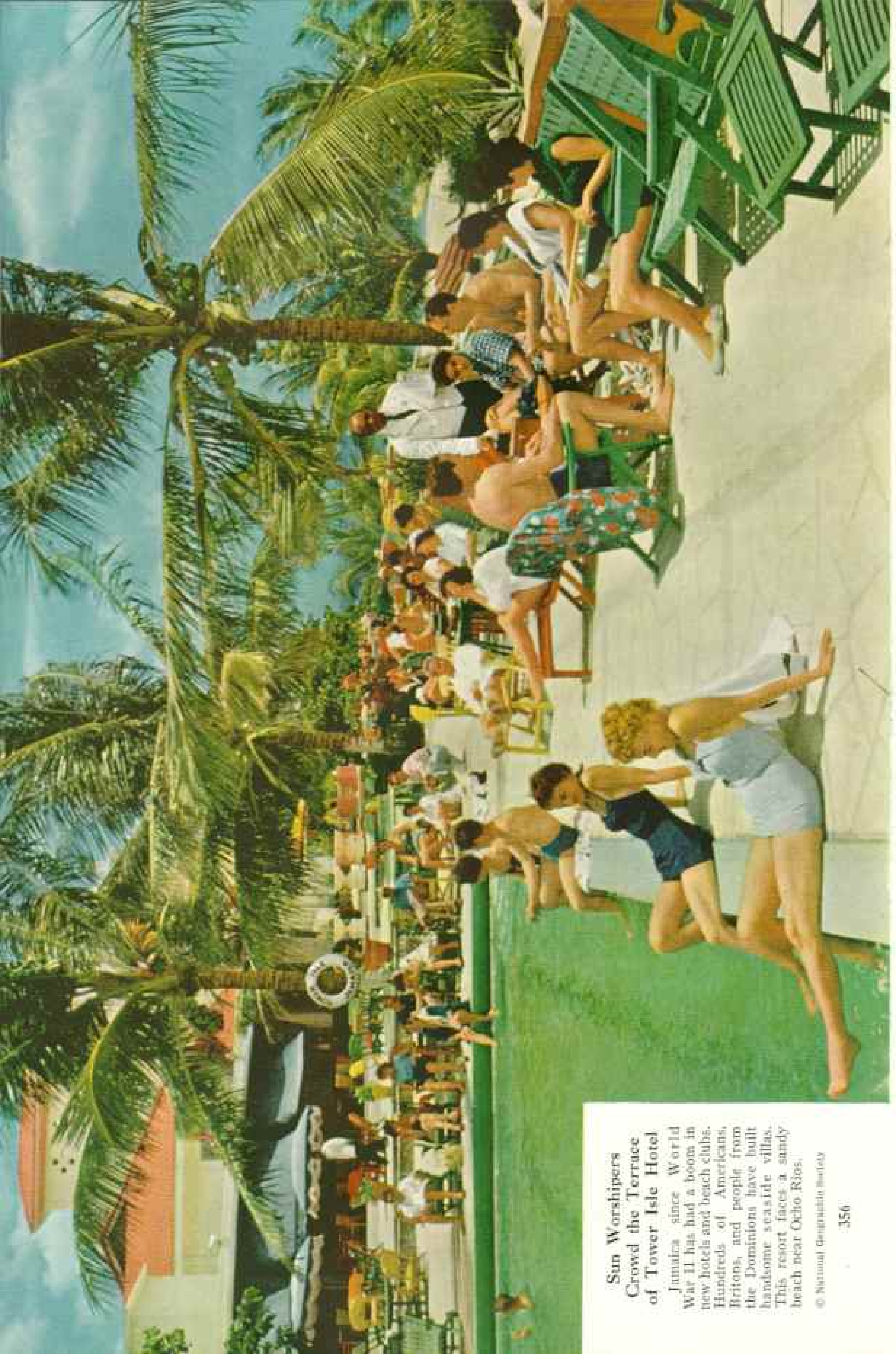
Sugar, with its side products of molasses and rum, is Jamaica's leading agricultural industry. Rich bottom lands have produced sugar since the days when Spain owned the island.

The Blue Mountains, whose pinnacle rises 7,402 feet, look down on this estate near Annotto Bay. Teams of four to a dozen oxen will haul the loaded wagons.

→ Negroes load sugar cane on one of Jamaica's 21 large sugar estates.

← Girls decorate jipi/japa hats and bags, which are made of grasses and dyed raffia. One worker strings seed necklaces.





**Sun Worshipers
Crowd the Terrace
of Tower Isle Hotel**

Jamaica since World War II has had a boom in new hotels and beach clubs. Hundreds of Americans, Britons, and people from the Dominions have built handsome seaside villas. This resort faces a sandy beach near Ocho Rios.

Shaw Park Hotel Overlooks Palm-fringed Coast and Ultramarine Sea. Its Swimming Pool Gets Water from a Mountain Stream

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Illustrations by W. Robert Moore, National Geographic Staff

↑ **Students at University College Scan a Rare Volume of Natural History**

This book, one of four published in 1707-25 by Sir Hans Sloane, illustrates Caribbean flora and fauna. University College of the West Indies was established at Mona in 1948. Many of its 350 students come from other islands to study the arts, sciences, and medicine.

↓ **Breadfruit Was Introduced to Jamaica by Captain Bligh of H.M.S. *Bounty***

This Pacific island fruit was intended as a cheap starch food for slaves, but it proved less popular than the banana. Inset: Orange-red akee, a native of West Africa, will burst open when ripe. Its thick cream-colored arils, or meats, are used in soups.



Westward, beyond Falmouth, is Montego Bay, internationally famed as a winter resort. Several new luxury hotels and private winter homes have recently been built here. Others are going up. Facetiously, people call the region the "Gold Coast."

Montego Bay deserves its reputation. Here are crystal waters, coral wonderlands where vividly colored fishes swim, and flower-embroidered hills.

You can shoot alligators—or pick oysters from trees! Out in the bay lie the Bogue Islands, actually not islands at all, but thick masses of mangrove trees standing stilt-legged in the water. Clusters of oysters cling to these exposed roots.

Runaway Slaves Hid in Hills

The railroad from Montego Bay to Kingston curves southward through the edge of the Cockpit Country. Roads, too, probe this region of bush-covered limestone crags, cliffs, and deep land sinks, known also as the "Land of Look Behind," where in years past travelers had to keep alert for ambush.

It was a dangerous district, hard to control. Here were the "Maroon towns," named from the Spanish word *cimarrón*, meaning "runaway slave." These refugees hid in the hills and were called Maroons. Twice they rebelled and caused much bloodshed in Jamaica. Eventually, in 1842, they received rights as British subjects.

Westward from the up-and-down Cockpit Country we detoured into Westmoreland Parish to see sugar cane harvested.

We passed a big cattle ranch where handle-bar-horned herds of hump-shouldered zebu, or Indian cattle, grazed in the pastures. Brought here for crossbreeding purposes, the zebu (or Brahman) has produced a strong disease-immune stock.

In the cane fields we watched spans of these tough white beasts hauling wagons to the mills. Fields were boggy from rain; as many as a dozen or more oxen wallowed in the mud, tugging at a single loaded wagon.

Sugar Oldest and Richest Industry

Not only Indian cattle but also people from India work on these big sugar estates. Immigration of the Indians stopped in 1921, yet many estates remain miniature Indias today. More than 21,000 of these folk still live in Jamaica.

Sugar-cane growing is the oldest industry

that has consistently sweetened Jamaica's commercial life. Rum, sugar's secondary product, has given added stimulation. With production dating from Spanish days, sugar still is a leading crop. Only bananas have occasionally surpassed it.

Traveling through Savanna la Mar and on to Black River we came upon another of Jamaica's products; along the river logwood was corded high.

It was raining. Water that streamed through the log piles and stood in pools on the ground was stained a bright reddish-brown, making logwood's use apparent. From it, as also from fustic logs which are cut here, commercial dyestuffs are extracted.

Tropical rains still gushed from the skies as we headed for Lacovia. Water covered the highway. We sloshed through veritable rivers among the groves of logwood trees, whose secondary product, incidentally, is the honey that bees garner from their blossoms.

Before we reached Lacovia the rain stopped. Along the famed Bamboo Avenue, golden shafts of sunlight probed holes in the lacy-leaved canopy arched overhead.

Under-blanket Sleeping in Tropics

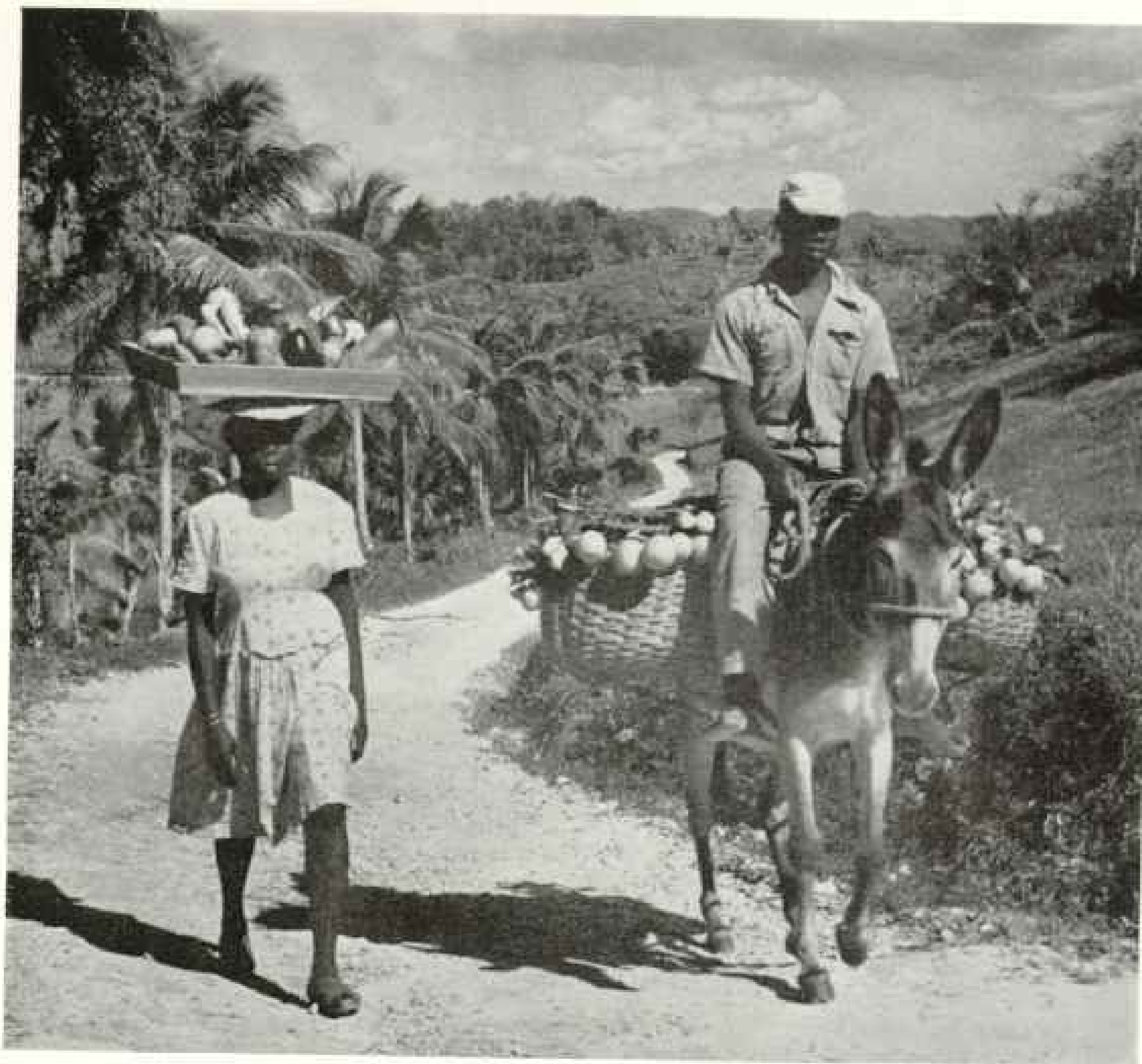
That night at Mandeville, up 2,000 feet, I slept under blankets. For this same privilege many people flee the tropical lowlands to vacation in Mandeville. Coolness apart, this small town affords quiet charm in the midst of a spacious, rolling plateau.

Pleasant homes, a stone church, and the wide village green suggest a peaceful English town. But there the resemblance ends. Palms dust the blue sky; red bougainvillea and flaming poinciana splash gardens with color.

The morning market in Mandeville is piled with yams; oranges; and tropical fruits brought by donkey or on the heads of dusky folk. Gaudy gingham of market women lend local color unseen in England.

For years Mandeville was the finish line for a strange Black Marathon. Every morning colored runners carrying baskets holding 20 to 30 pounds of fish jogged up the mountain from Alligator Pond on the seacoast—a grueling 20-mile route. But eventually trucks took over the transport.

Alligator Pond itself has lost none of its color and activity, though Port Kaiser's bauxite pier is within sight. Beside the truckers who haul fish up to Mandeville, scores of



Man Rides, Woman Walks. Rural Jamaica Goes to Market

The woman carries cassava roots, eggplant, and pumpkin from the family garden. Oranges form part of the donkey's load. Young coconut palms line the road.

local people swarm down to the shore when the fishing boats return. Boats, nets, and fish traps clutter the beach (page 352).

Near by, in the shade of coconut trees, I saw workmen hewing a new dugout canoe from a huge cottonwood log. Months of painstaking work convert a forest tree into a superbly shaped fishing craft.

From Alligator Pond and Mandeville we cruised through pasturelands, orange groves, and farms to May Pen, which is a center for packing and canning of citrus fruits and juices, and also supports a sisal rope factory.

In the fields I watched colored men and women cutting the thick leaves of the sisal plant and followed donkeys and carts carrying the bundles of sisal to a machine for

crushing and shredding. Freed of the green pulp, the crushed fibers were hung outdoors on pole racks to dry.

At the factory, women cleared the fiber of wads and knots before the sisal was fed into the whirligig rope-twisting machines (page 339).

Rice Grows on Former Air Base

During World War II the United States acquired land between May Pen and Old Harbour on 99-year lease for an air base. With the closing of the base, the land has reverted to local use. Rice fields, in a new agricultural expansion project, now flourish close to the old airstrips.

The eastern end of Jamaica held other



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Holiday-makers Ride Bamboo Rafts Down Jamaica's Rio Grande

Flowing out of the mountains, the river froths over sparkling rapids. These polemen maneuver their craft between jutting rocks. Passengers enjoy sun, swimming, and picnic lunches.



Goggle Fishermen Fill Their Canoe with Trophies from a Montego Bay Reef

Two divers, assisted by a boatman, collect coral, sea fans, conch, and starfish. They breathe through snorkel diving masks, which admit air as they float face down. When they dive, a cork stopper blocks off water. A spear gun lying in the boat enables the men to hunt redfish and bonito.

attractions. To see them, I circled the Blue Mountains, whose slopes grow the island's famous Blue Mountain coffee. Beyond, along the east coast, the road skirts the wild John Crow Mountains.

No part of Jamaica offers more visual thrills than the road along the northern shore. Here is the landlocked inlet called the Blue Hole, or Blue Lagoon, its unbelievably blue waters girded by high banks crowned with palms and breadfruit trees. Here is Port Antonio, from which fantastic numbers of bananas have been shipped (page 336).

A popular day's delight is to raft down the near-by Rio Grande, a trip on bamboo craft poled by local guides past green-clad hills and over cascading waters (page 361).

Along this shore, too, served both by rail

and highway, are Hope Bay, Buff Bay, and Annotto Bay, all linked by curved scimitars of sandy beach, by coconut-studded hills, and lush green vales.

Jamaica Calls the Traveler Back

To me, there seemed to be no end to the delightful trails that thread Jamaica, land of perpetual summer.

"Next time you come," said my companion who was seeing me off at the Palisades Airport, "why not——"

"All aboard," shrieked the loudspeakers, drowning out the rest of his sentence.

"Next time! Why not?" With what better words could one leave this Isle of Many Rivers, less than three hours' flight from Miami?

Daring "River Rats" Ride White Water Through Western Cliff Lands
Where Now-extinct Reptiles Met a Mysterious End

BY JACK BREED

With Illustrations from Photographs by the Author and Justin Locke

"THIS river is strictly a one-way street," said Bus Hatch. "Once we enter the canyon of the Yampa, there's no turning back. So if any of you fellows want to reconsider..."

His glance traveled deliberately over each member of the little group. Our three rubber life rafts, loaded with sleeping bags, food, ice chests, a two-way radio, and camera equipment, were drawn up on the muddy shore under the cottonwoods at Lily Park (map, page 364).

Ahead of us lay 75 miles of white water twisting and tumbling through some of the West's most spectacular gorges, the bright-hued cliffs and caverns of Dinosaur National Monument. We grinned back at Bus. Why should we reconsider?

Canyons Best Seen from Boats

In a sense we had no choice. If we were to see Dinosaur in its true dimensions and color, it would have to be by boat. A plane could take us over it, yes. But from the air these canyons of Utah and Colorado tend to lose much of their brilliance and grandeur; with such vast distances lying beneath one, from horizon to horizon, even fissures half a mile deep become mere ditches.

Nor are there any improved roads through the monument's 328 square miles, except for an 8-mile stretch of bumpy gravel from Jensen, Utah, to the headquarters. By car or packhorse one can jounce cross-country to some of the rims of the Green and Yampa Rivers, but such a view of Dinosaur is fragmentary compared with the perspective one gets from the depths of the gorges themselves.

Bus Hatch smiled. "Well, don't say I didn't warn you. Let's shove off, then."

I clambered aboard Bus's raft with Tom Vint, Chief of Design and Construction of the National Park Service. Conrad Wirth, its Director, and Howard Baker, Director of its Region Two, teamed up with Don Hatch, Bus's son. Into the third boat went Ronnie Lee, Assistant Director of the Park

Service; Jess Lombard, superintendent of the monument; and jovial, cigar-chewing "Boon" MacKnight, a rancher from Jensen (page 365).

We felt we were in pretty good hands. Bus, a jolly, plump little contractor from Vernal, Utah, was one of the small and select group who have run the Colorado River down through the Grand Canyon. That was a good many years ago, but Bus has kept in trim by taking on most of the West's other major rip-roaring streams. His son Don, a school-teacher from Salt Lake City, is a "river rat" of no mean skill himself; and Boon made up in high spirits and resourcefulness what he may have lacked in experience.

As for our boats, they looked ugly but dependable. Navy craft, they were designed to hold 10 men each and were certainly never intended for inland use. But their rubbery flexibility and buoyancy gave them obvious advantages over wooden skiffs.

To enliven their appearance a little, Bus had painted bright-red stripes along their sides and a legend in silver: "Hatch River Expeditions" (page 384). As a finishing touch, we christened each boat after one of the various dinosaurs that had wallowed in this region in ages past: *Stegosaurus*, *Plesiosaurus*, and *Allosaurus* (page 373).

Closed Season on Dinosaurs

We had made the acquaintance of these beasts the previous day over at the Dinosaur Quarry, where Jess Lombard had shown us the vast rock "graveyard," 40 feet high and wide and 400 feet long, from which a million pounds of petrified dinosaur bones have been removed since its discovery in 1909 (pages 367, 372, and 383).

"My big problem here," Jess had begun, "is to—but watch that tourist car coming up the road. You'll see."

He walked over to the dusty auto and said hello.

A 12-year-old in the back seat popped her head out of the window. "Can you tell us

where the dinosaurs are?" she asked eagerly.

"Young lady," said Jess, "I'm afraid you're a bit late. You missed 'em by about 120 million years. But we do have a nice museum that'll tell you all about the ones that used to live here."

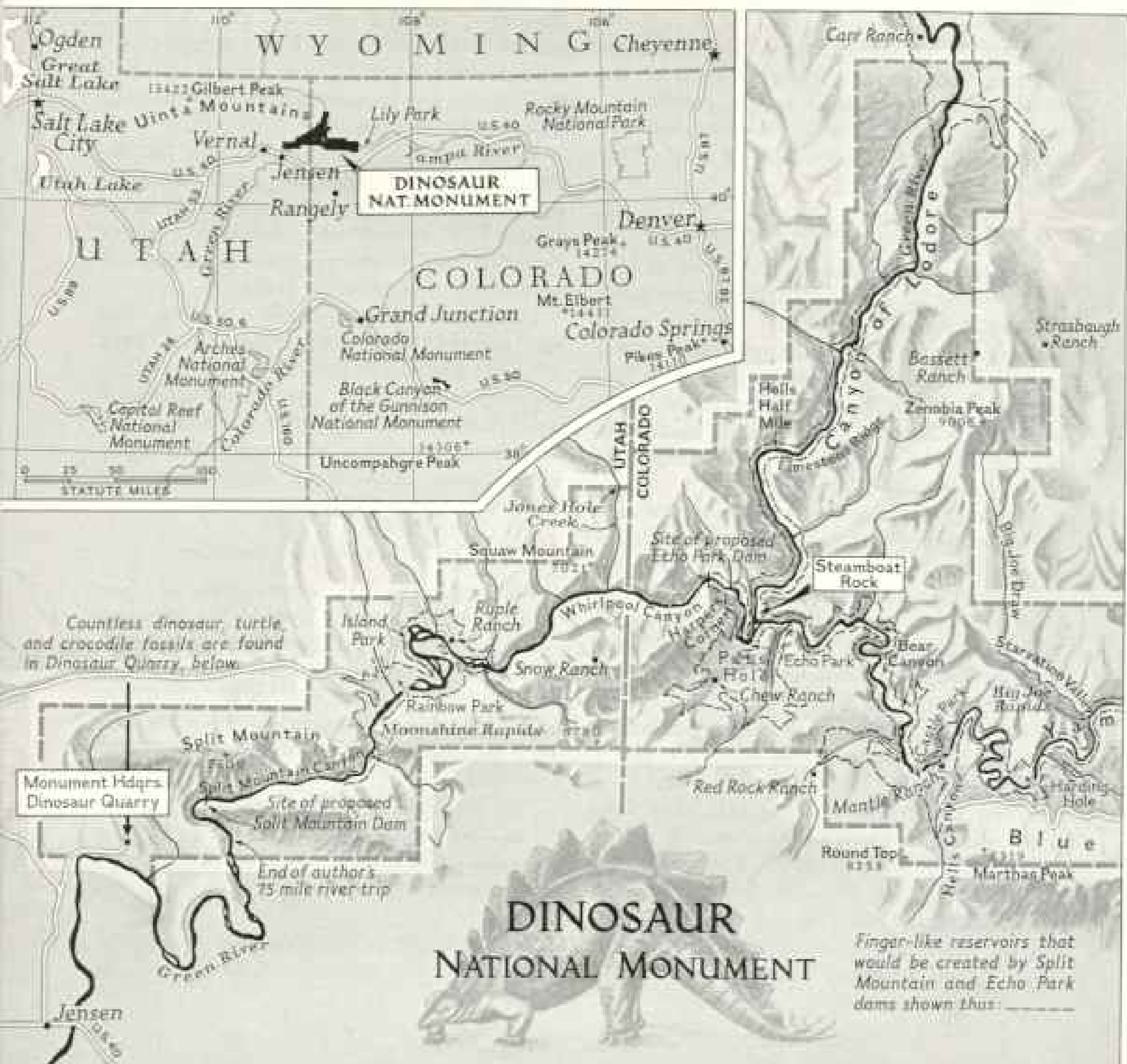
The kids moaned their disappointment, their father muttered something about people who listed a place on the map and got other people to drive for miles on a dirt road only to find nothing at the end of it, and the car turned around and drove off.

Jess grinned wryly. "The other day, a State highway patrolman found a family from the East parked alongside U. S. 40. They'd been sitting there waiting in the hot sun for hours. Said a man had told 'em if they sat there long enough they might see a

dinosaur cow and calf cross the road there!"

For the first few miles of our journey down the Yampa we had leisure enough to study this country in which giant sauropods and smaller dinosaurs of other groups once really had lumbered about. The river, yellow brown with silt, was at this stage a sluggish stream about 150 yards wide and a quarter of a yard deep; we had to use our oars more often than our outboard motors.

I tried to imagine this country when the dinosaurs owned it. A lot different, of course. This would have been the Jurassic period. No Rocky Mountains, no dry canyons; just a huge plain from central Utah to the Mississippi, with a fringe of active volcanoes showering ash and dust over the interior from time to time. A tropical land, it must have been,





† Ready for Rapids—Nine Men Who Crossed Dinosaur National Monument in Rafts

The National Geographic flag accompanied author-photographer Jack Bued (in swim trunks) on the exciting run through the Yampa and Green River gorges.

Other members of the expedition were (left to right) Boon MacKnight, Don Hatch (standing), Conrad Wirth, Bus Hatch, Ronnie Lee, Howard Baker, Tom Vint, and Jess Lombard (pages 365 and 384).

← Dinosaur National Monument straddles the Colorado-Utah border. Its heart is Steamboat Rock, where the Yampa and Green Rivers join (pages 368, 376, and 378).

Two high dams have been proposed within the monument to further the Bureau of Reclamation's plans for developing power and irrigation resources in the upper Colorado River basin. One would span the Green River canyon a mile downstream from Steamboat Rock, submerging most of the "steamboat" (page 366). The other would rise in lower Split Mountain Canyon (page 380). Their impounded waters would drown rapids, parks, and glades, as indicated on the map.

thick with vegetation, warm and moist.

In these dank lowlands several kinds of dinosaurs had developed about 115 to 120 million years ago. Some of them were no bigger than a modern cow; others, like the brontosaurus, were 80 feet long and weighed 40 tons. Most of them were vegetarians; it took half a ton of fodder a day to keep the biggest of them happy. Others were carnivorous, like the vicious allosaurus with his monstrous jaws lined with serrated bread-knife teeth (page 373).

Tiny Brain for Massive Body

All of them had been a bit stupid. An elephant has about nine pounds of brain for some four tons of body. The average sauropod had to get along with a 1-pound brain for his whole 40 tons of bulk. Essentially a cold-blooded reptile, he was doubtless torpid a good deal of the time, immersed whenever possible in swamps that helped support his overblown body.

What killed the dinosaurs that ended up in the monument's geologic boneyard? Nobody is quite sure. Perhaps a suffocating blizzard of volcanic ash. Perhaps a flood. Perhaps, even, the subtler enemy of bacterial plague. Whatever it was, it struck down hundreds of them at once, big and little. Rivers washed their carcasses against a great sandbank, and there they piled up, to be covered layer after layer by sand and silt.

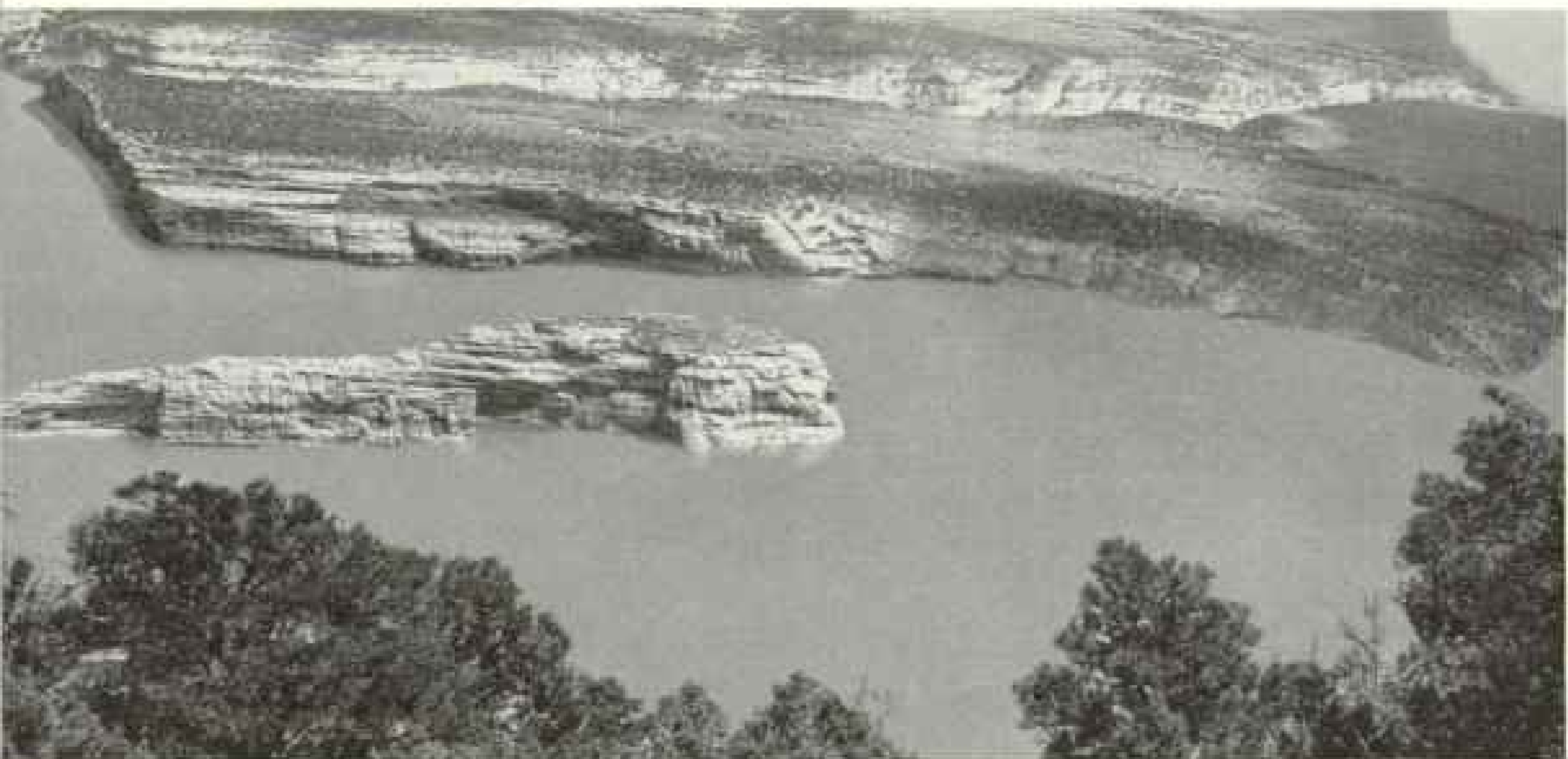
Silica impregnated their bones, hardening and petrifying them. The entombing sand





If Echo Park Dam Goes Up, Canyons Will Become a Lake, Steamboat Rock an Island

Proposed Echo Park Dam would flood this gorge to a depth of 570 feet and impound more than six million acre-feet of water some 40 miles up two canyons. It is part of the billion-dollar Colorado River Storage Project, which anticipates the irrigation of 380,000 acres, generation of power, and other benefits for Wyoming, Utah, Colorado, New Mexico, and Arizona. Echo Park Dam, costing \$176 million, would not disturb Dinosaur Quarry (page 363). Though inundating scenic canyons, it would create a playground for anglers and boatmen. Illustrations are from the same photograph, one retouched to show the reservoir.

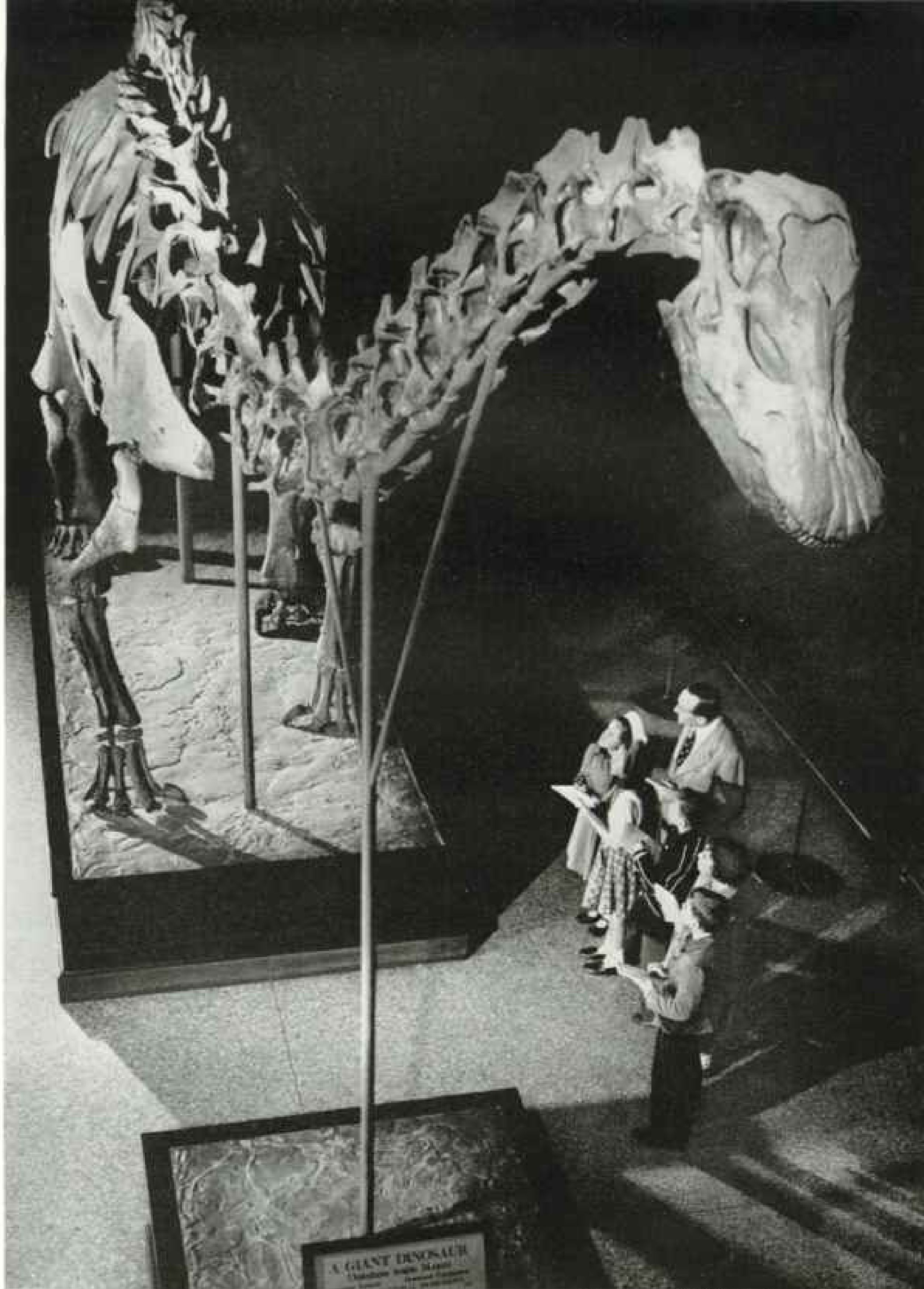


became the solid stone of the Morrison formation. Here the bones might well have lain deeply buried for the rest of time, had not the earth strained again and thrust up the Uinta Mountains, tilting the dinosaur beds and exposing the fossilized remains.

Cowboys roaming the area in the 1880's and 1890's spotted these odd rocks but guessed little of their significance. One rancher used a big stone as his doorstep for 20 years without knowing the imprint on it was left by a dinosaur's foot. Not until 1909 did Dr. Earl

Douglass, exploring for Pittsburgh's Carnegie Museum, discover the main sandbank deposit, one of the world's richest paleontological treasure-troves.

That was one gift of the Uinta uplift. The other was the creation of the Green and Yampa River canyons themselves. To protect the big fossil quarry, President Woodrow Wilson set aside 80 acres as a monument in 1915; to protect the magnificent adjoining canyons that soon became better known and appreciated, President Franklin D. Roosevelt



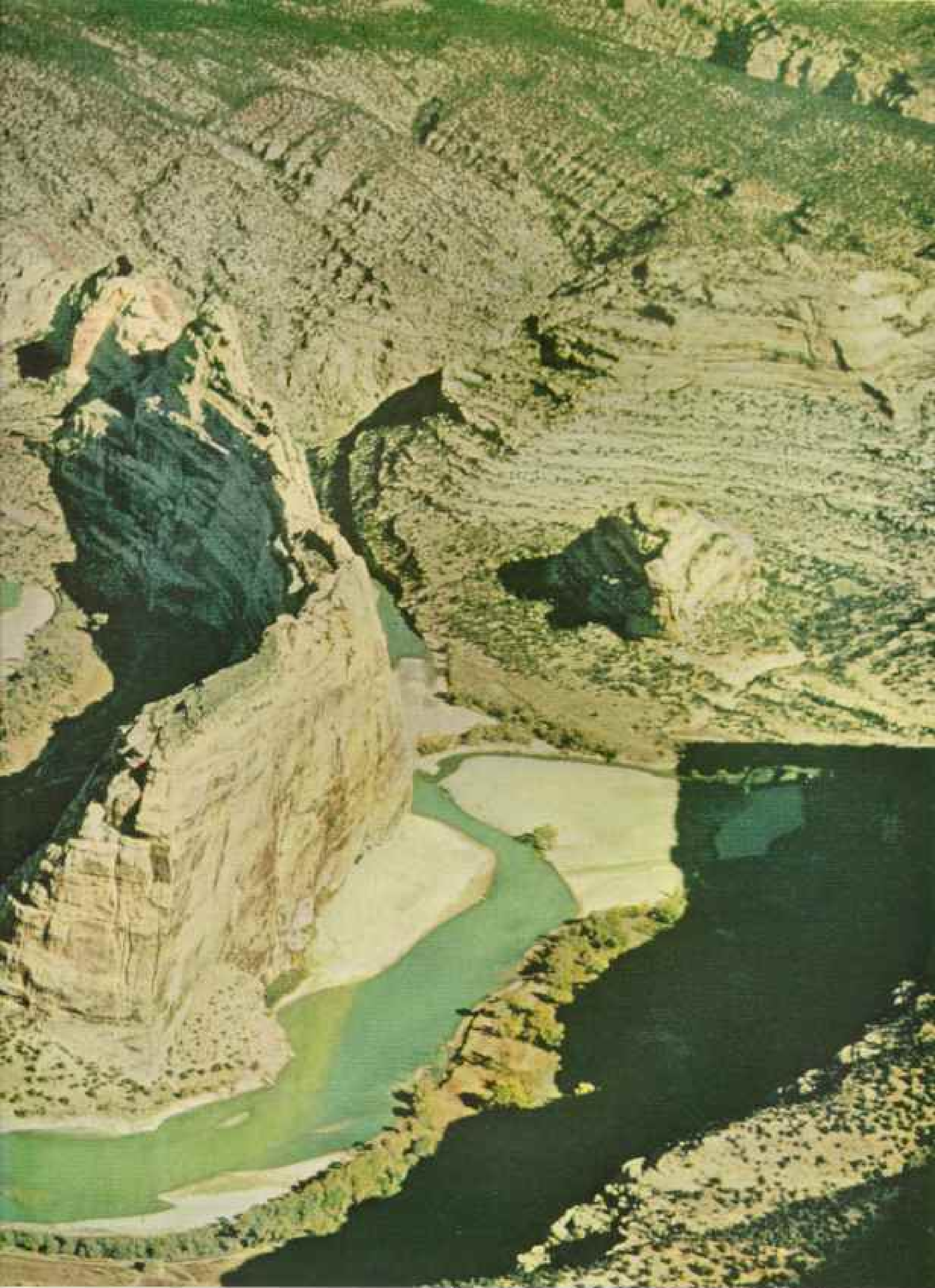
Diplodocus, a Swamp-dwelling Vegetarian, Breathed Through the Top of Its Head

Bones of this 70-foot-long giant at the U. S. National Museum, Washington, D. C., came from Dinosaur Quarry. The world's largest dinosaurs weighed 10 times as much as an elephant; the smallest were no bigger than chickens.



Dinosaur Monument's 700-foot-high Steamboat Rock Juts into Green River

Proposed 525-foot Echo Park Dam would span the canyon a short distance downstream (left) and flood a large part of this valley in northwest Colorado. Far below, a motor trail from U. S. 40 crosses the foreground.



Echo Park Lies in Deep Shadow at the Confluence of Canyon Rivers

Here the Yampa, flowing across the shadow on right, joins the Green, which drops out of the deep Canyon of Lodare. Echo Park takes its name from Steamboat Rock's startling resonance (page 378).

vastly enlarged the reserve, increasing its total area to 209,744 acres.

Of this ample real estate, our immediate preoccupation lay with a canyon just ahead, a few miles upstream from Harding Hole. Our placid period adrift on the Yampa was drawing to a close; distant but distinct came the roar of white water ahead.

Stopping our outboard motors, we tipped up the propellers to avoid concealed rocks and drifted silently toward our first rapids. The canyon walls converged. It looked as if the river were turning into a broad staircase, each step capped by curling spray.

Rubber Boats Flexible in White Water

In other years I had run many of the West's rivers, always in wooden boats. Instinctively I flinched a little now as the first ripple glistened ahead of us and Bus swung the bow straight into it. But nothing happened. Our rubber boat simply buckled in the middle, folded itself over the rocky steps like a caterpillar, and slithered down to calmer waters.

Tom Vint, relaxing against a pile of sleeping bags in the stern, looked disappointed. "Is that all there is to a rapid?" he asked.

"That's just a wee one," said Bus as he hopped from the oars to the outboard motor. "We'll hit some real ones soon enough."

On a sandbar beneath Yampa Canyon's lofty walls we sat down to a typical river rat's lunch of bean stew and sandwiches. We needed no further explanation of how the Yampa had earned its title, "river of no return"—a name applied, incidentally, to more than one river of the West. We could not possibly have climbed its 1,400-foot cliffs, nor could we have found enough banks or ledges to let us hike back upstream (opposite). I began to be glad I had no appendix.

Back on the river, we had chugged only a little distance down quiet water when Don Hatch in the neighboring raft called out, "Look ahead!"

I expected to see a huge log or rock thrusting up to puncture our rubber compartments. Instead, I could just make out the half-submerged body and craning neck of a dark bird.

"Canadian honker," said Bus. "We'll see lots of them in here. They stick around during the summer to raise their young."

More Canada geese now came into view. They made no attempt to fly but swam placidly ahead of us, sometimes diving to come up many rods away. We saw beaver,

too, swimming close to the banks, and occasional deer bounded up the talus slopes.

"You can see why early trappers liked this country," Bus remarked. "The wildlife is protected from all sides, except from the river. Look up along the banks, back in the elder groves; you'll see some small cabins rotting away. That's where the mountain men of the 1830's and 1840's used to camp. And, speaking of camping, we'd better pick out a spot ourselves."

It was only 5 p.m., but the sun sets early and rises late in these narrow canyons. Shadows were already making navigation difficult, and the toll of propeller pins broken on submerged rocks was running high (page 385). Rather than risk the remaining three miles of dangerous white water to Harding Hole, we pitched camp on a grassy slope in Starvation Valley, at the head of Big Joe Rapids.

Soon savory T-bone steaks were sizzling, and dozens of sourdough biscuits were turning a crusty brown in our Dutch oven. The life of a river rat, we found, puts a keen edge on any appetite. Long before the sun's last rays had left the canyon's rim we had cleaned our plates and climbed into our sleeping bags.

In the morning Bus ordered a reconnaissance of the rapids below. We hiked over rock rubble and through mazes of driftwood and flood-piled debris. At the narrowest point of Big Joe's defile we found the water raging over huge boulders, boiling into holes with whirlpool centers, and plunging downstream in roller-coaster fashion, with waves 8 and 10 feet high.

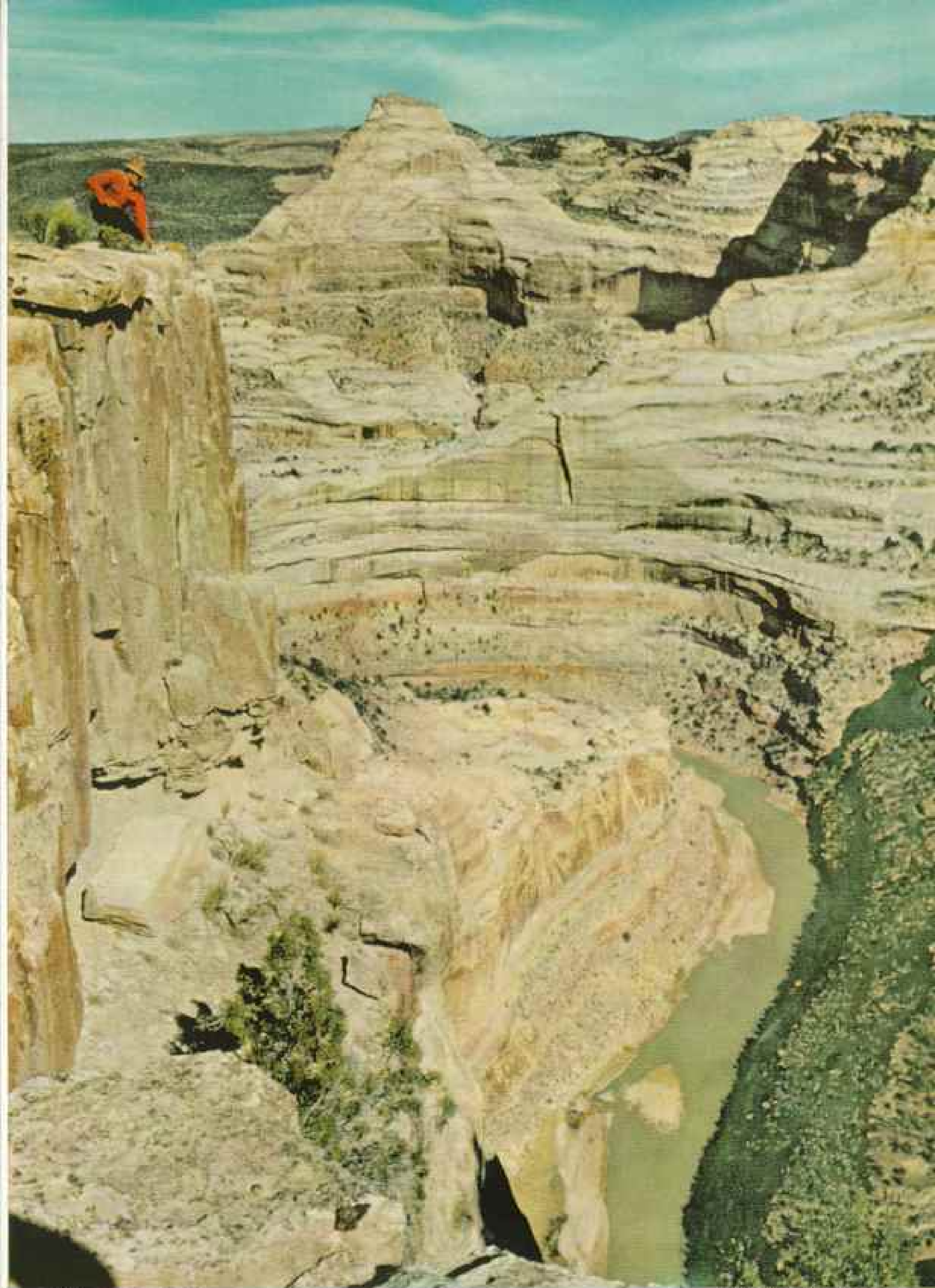
Logs Test Rapids' Violence

Bus, Don, and Boon MacKnight stood on a promontory and studied the maelstrom. Then, to get a better idea of the stream's currents and obstacles, Don clambered back upriver and tossed in several logs. We watched one of them swirl past the shore and plunge suddenly into a foaming caldron. It never came up.

"Stay clear of that one!" yelled Bus.

Other logs rode safely through the waves, only to be slammed against the bank or some projecting boulder. It looked as if we might be in for a rather rough trip.

Bus wanted to go first. After more than half an hour's inspection of the rapids, he eased his boat into the stream. The rest of us, he said, should watch from the shore and be ready to help.



Colorado's Yampa River, Catching Its Breath, Lazes Through an Oxbow Gorge

Once this region was a plain, with the river writhing across it. Since the Rockies started rising, the Yampa has entrenched itself 1,400 feet between these sheer cliffs. Its bed still follows the ancient goosenecks.



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Justin Laska

Preserving Dinosaur Bones for Science

Boon MacKnight, rancher, canyon guide, and monument handy man, shellsacs a fossil vertebra embedded in Dinosaur Quarry (page 383).

Standing in the stern to see better, Bus gunned his engine and pointed the bow toward mid-river. From our position he seemed to be heading for the worst waves of all. But he must have spotted an opening, for he shot forward into the spray—and vanished!

He reappeared again in a moment, skimming the crest of a wave, his rubber raft buckling from stem to stern as it followed the contour of the river or bent around a stubborn rock. Spume flew over Bus's head, drenching him. But he never took his eyes off the river for a second. I was covering his descent with my movie camera, and before I had exposed 10 feet he had cleared the last rapid, cut his motor, and was sculling the boat inshore. Cheers from all hands.

Don was next. Disdaining an outboard engine, he used only oars. His passenger, Connie Wirth, stood in the stern and rode the raft down like an aquaplane.

Now it was Boon's turn. Tightening his life jacket and lighting a fresh cigar, he climbed into the last boat and steered it cautiously toward the stream's center. Boon, we knew, had made only one other trip down the Yampa. Beneath his banter, which added much to the expedition's gaiety, we felt he might be a little worried.

Boon started well enough. Then, just as he hit the first real drop, his propeller struck a submerged boulder and sheared the pin. The boat went completely out of control and sailed straight into the biggest whirlpool in the stream.

Leaping from his seat in the stern to amidships, Boon grabbed the oars and pulled the boat about till it headed downstream. It was lucky that he did; otherwise his engine might have been knocked off. As it was, his raft bounced onto the rocks of the far bank.

Skillfully he maneuvered it through the remainder of the white water. As we pulled him in to shore, we announced a rechristening of the defile. Henceforth it would be "Big Boon Rapids."

Below "Big Boon" the Yampa widened, and we entered the pleasant little amphitheater called Harding Hole. Here, by prearrangement, we met Charlie Mantle and his sons, local ranchers who wanted us to help them round up some cattle that had strayed across the river.

Roundup of Marooned Cattle

Charlie, a handsome, weatherworn range rider, told us the animals had probably wandered across during the winter when the Yampa was frozen.

"They come down this side by way of a little pass and stumble over on the ice. When the spring thaw begins, they're marooned. Matter of fact, that's how a lot of the deer you saw upstream got stranded over there."

Spurring his horse forward, Charlie tried to ride it into the Yampa. But the cow pony, as stubborn as it was smart, had no intention of fooling with a river that looked so swift and deep.

"Hey, Bus," called Charlie. "Tie this critter to one of your boats and we'll tow it across. Once the other horses see it on the far bank, they'll follow without any fuss."

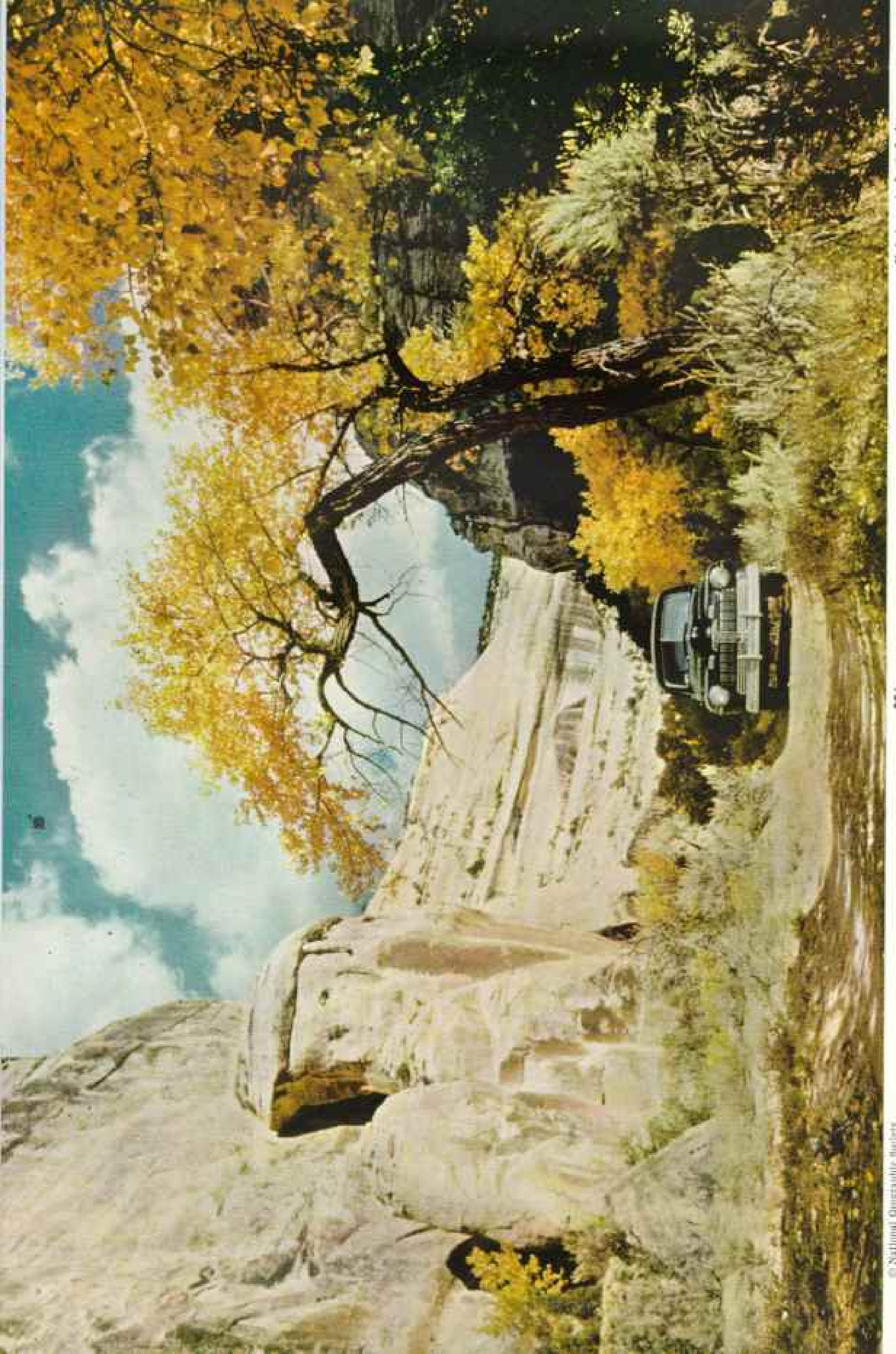
So Charlie sat in the stern, holding his pony's reins, while Bus thrashed with his



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A Ferocious Plaster Monster Rewards Visitors Who Ask to See the Dinosaurs

This roadside eye-catcher near the monument's entrance resembles ancient allosaurus, a flesh eater. The original had eagle-like claws and spike teeth but not this model's light-bulb eyes. Half its 34-foot length was tail.



↑ Cottonwoods Flame
in Hells Canyon

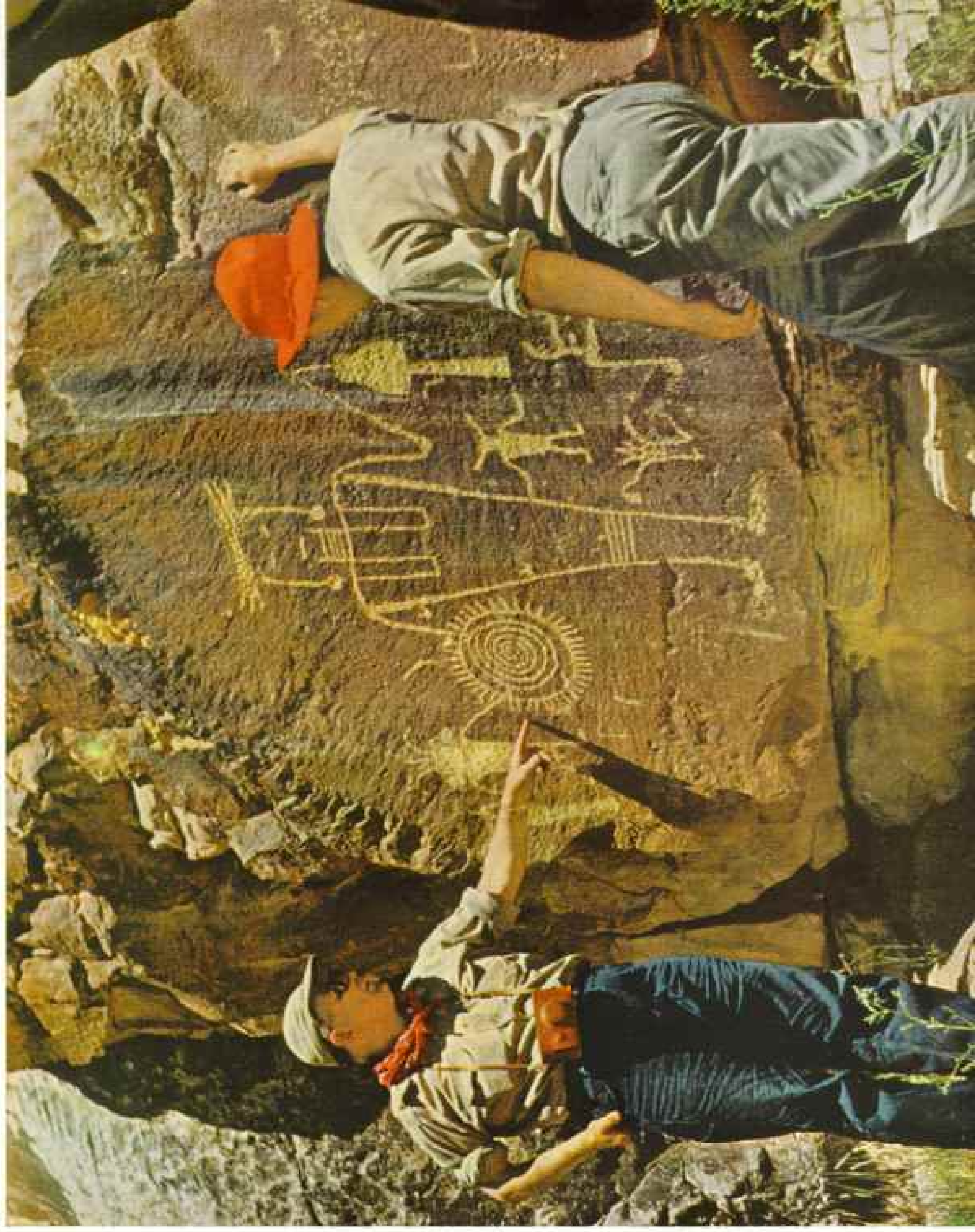
Leaning rocks challenge visitors approaching the Mantle Ranch at Castle Park, Colorado (page 384). This rough motor trail is one of half a dozen penetrating the monument to points directly on the Yampa or the Green.

→ Vanished Indians
Left These Murals

Scholars attribute the monument's abundant pictographs to an Indian occupation 10 to 15 centuries ago. These art displays include paintings in red ochre as well as the line and intaglio carvings shown here.

Standing in Island Park, Utah, Conrad L. Wirth (left), Director of the National Park Service, and Ronald F. Lee, Assistant Director, note a similarity between these horned and square-shouldered human figures and those drawn by early Basket Maker and Pueblo Indians who lived farther south. The dominant figure, that of a warrior, appears to hold a shield in his right hand.

© Hoffmann by Jack Brown





Spectacular Folding Streaks the Downstream Face of Steamboat Rock

Seen from Harpers Corner, tilted layers of shale and sandstone at the north end of the "steamboat" curve upward from the riverbank. Finally standing on end, they create a thin saw-toothed ridge.



Here the Rock Curtains a Confluence

Green River is seen before (top) and after (bottom) its junction with the Yampa. (page 368).

oars and fought the boat across the Yampa without losing more than a quarter of a mile downstream. Mounting his horse, Charlie trotted up the far shore. Across the river the other ponies pricked up their ears and, when urged to the brink, plunged in and swam over.

Reunited, the Mantles disappeared into the brush on the trail of the missing steers. A whoop and a holler soon announced their return, the strays bucketing down through the elders. Waving their lariats, the Mantles stampeded the cattle into the stream and followed after. Submarinelike, the steers vanished beneath the swift water and, as far as we could see, walked across on the bottom.

When they emerged, we helped the riders chase the animals back up the pass toward the Mantle Ranch at the upper end of Castle Park (page 374). We were greeted at the gate by Queda Mantle, Charlie's attractive daughter.

"Come on in," she said. "You're just in time for some of mother's cherry pie."

"Homemade?"

"We grow the cherries right here in the canyon. Peaches and vegetables, too. With our cows and chickens, it means we don't have to go out much for supplies."

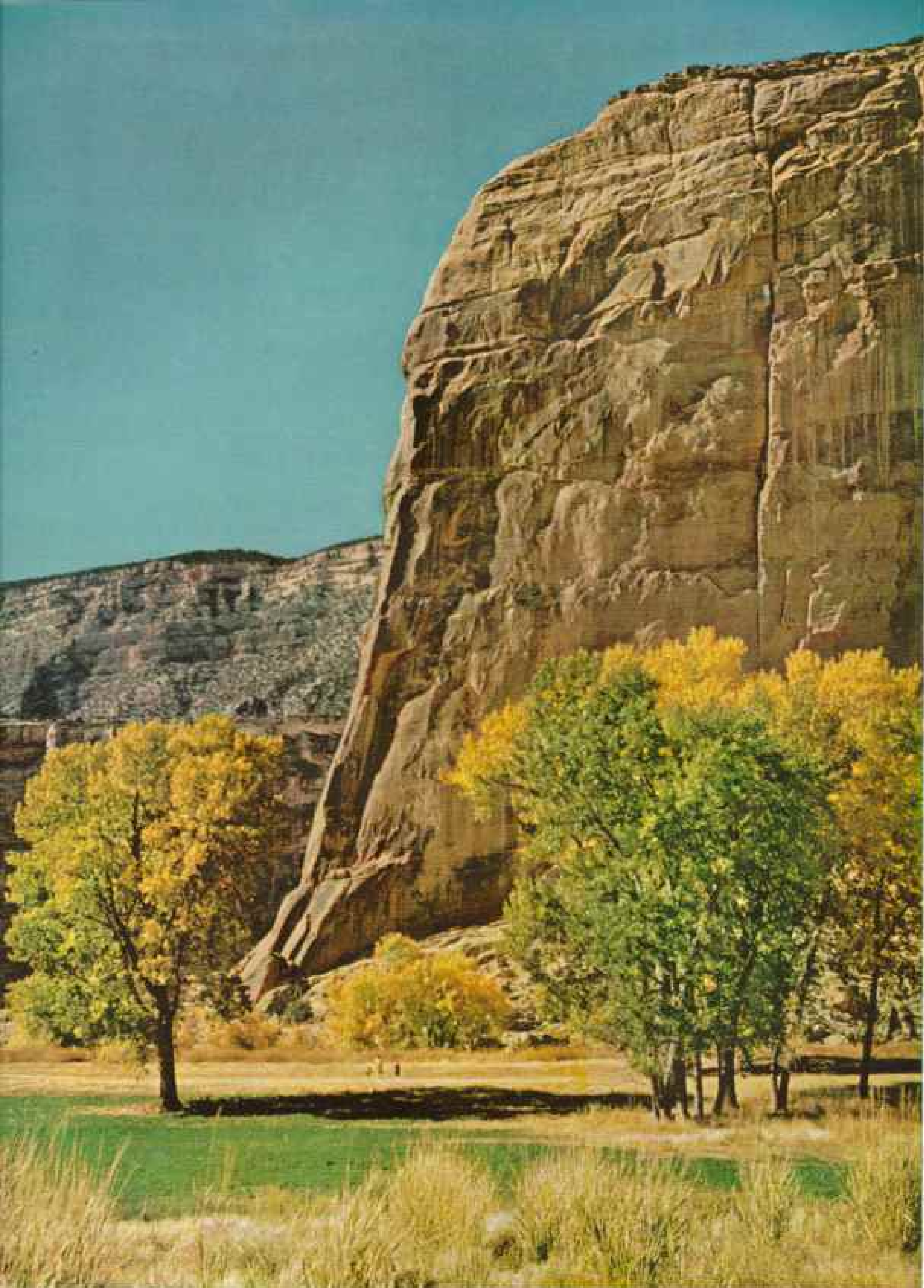
They were lucky in this, I thought. The nearest shopping center would be 90 miles away.

Plane Spots SOS in Snow

"I wouldn't say we were lonesome," put in Charlie. "We've got an electric-light plant (doesn't always work!) and a radio, and the ranch work keeps us busy. Got a piano, too—see it over there? Hauled it in by wagon and team before there was any road. This is our home, always has been, and we wouldn't want to be anywhere else. But winters—well, Mrs. Mantle and I got sick a few winters ago, so now we pack up in November and don't move back till April. One of the kids tends the place while we're away."

Their bout of illness must have been a little frightening. The ranch had been well stocked with supplies; but when pneumonia struck, it was obvious they would have to get out somehow. In the ranch yard they trampled out a rough SOS in the snow.

Fortunately, a flying neighbor spotted the signal from the air. He quickly arranged to have emergency medicines and food dropped by plane, while a highway crew prodded by urgency plowed through the mountainous drifts to the ranch—in time.



If Flooded, Steamboat Rock Will Look Even More Like the Bow of an Ocean Liner
Should Echo Park Dam be built, the tip of the 700-foot rock would become an island 180 feet high. Autumn foliage borders the Green River. Harpers Corner's cliffs rise on the left (page 368).

From Mantle's place to the river's junction with the Green, the Yampa flows through some of the most dramatic canyon scenery in the West. Here cliffs of white sandstone, streaked with lines of black and brown, tower a sheer 1,400 feet above the water.

Drifting down toward Steamboat Rock, we lounged on our sleeping bags, looked up at the ribbon of blue sky visible through the canyon's lips, and contemplated in silence the ever-changing contrast of highlight and shadow on the cliff walls. No engine sputtered to break the spell; only occasionally did an our splash the surface.

Presently, however, Tom Vint sang out, "Steamboat round the bend!"

As we turned the Yampa's last crook, we saw ahead of us the massive wall of Steamboat Rock, marking the river's wedding with the Green (opposite and page 368).

This section of the monument is known officially as Echo Park for the rock's resonant qualities; we rather preferred the older name, Pats Hole, after a hermit who lived here for nearly 50 years. Pat had chosen his hideaway well; cliffs 1,000 feet high walled his home, and for a floor he had a meadow carpeted with grass and shaded by cottonwoods and box elders.

We pitched our camp across from the rock and soon were joined by ranger George James, fire guard Roy Templeton, and trucks from the monument's headquarters with fresh supplies and mail. Jess Lombard produced his specialty, hot corn bread, and our guests contributed hamburgers and ice cream.

High-angle Look at Canyons

Next morning we jumped into one of the trucks and a jeep and ground in low gear up and up 2,500 feet to Harpers Corner, a ledge projecting above the Green River a few hundred yards west of Steamboat (page 376).

From this vantage point, visitors courageous enough to stand at the outer edge can look down upon the canyons of the Green and the Yampa in three directions. Straight below us the Green wound like a brown thread through its rose-white walls. To the east the serpentine Yampa coiled into the distance. To the northeast Zenobia Peak, rising 9,006 feet above sea level, formed the eastern rampart of the brilliant red Canyon of Lodore.

Jess Lombard took a quick look over the rock lip and reported: "It's so darn far down there, all your uncles look like ants!"

Connie Wirth, Ronnie Lee, Tom Vint, and Howard Baker pored over their maps, figuring where they might put a ranger station, a viewing platform, trails, and other Park Service facilities to make the region attractive and safe for visitors.

Connie discussed the future of the area. "We have plans to develop a national park here. But this will only be possible if the dams don't come in."

Proposed Dams Would Drown Rapids

He was referring to the two great dams for power, irrigation, and flood control, which the Bureau of Reclamation of the U. S. Department of the Interior has proposed building within the monument. One of them, to be thrown across the Green below Echo Park, would back up water through the canyons of the Yampa and Lodore, flooding the hidden ranches, the tree-studded glades, the miles of rapids we had already traversed. The other dam, at Split Mountain, would wipe out the white-water passages of the Green and inundate the Island Park sector.

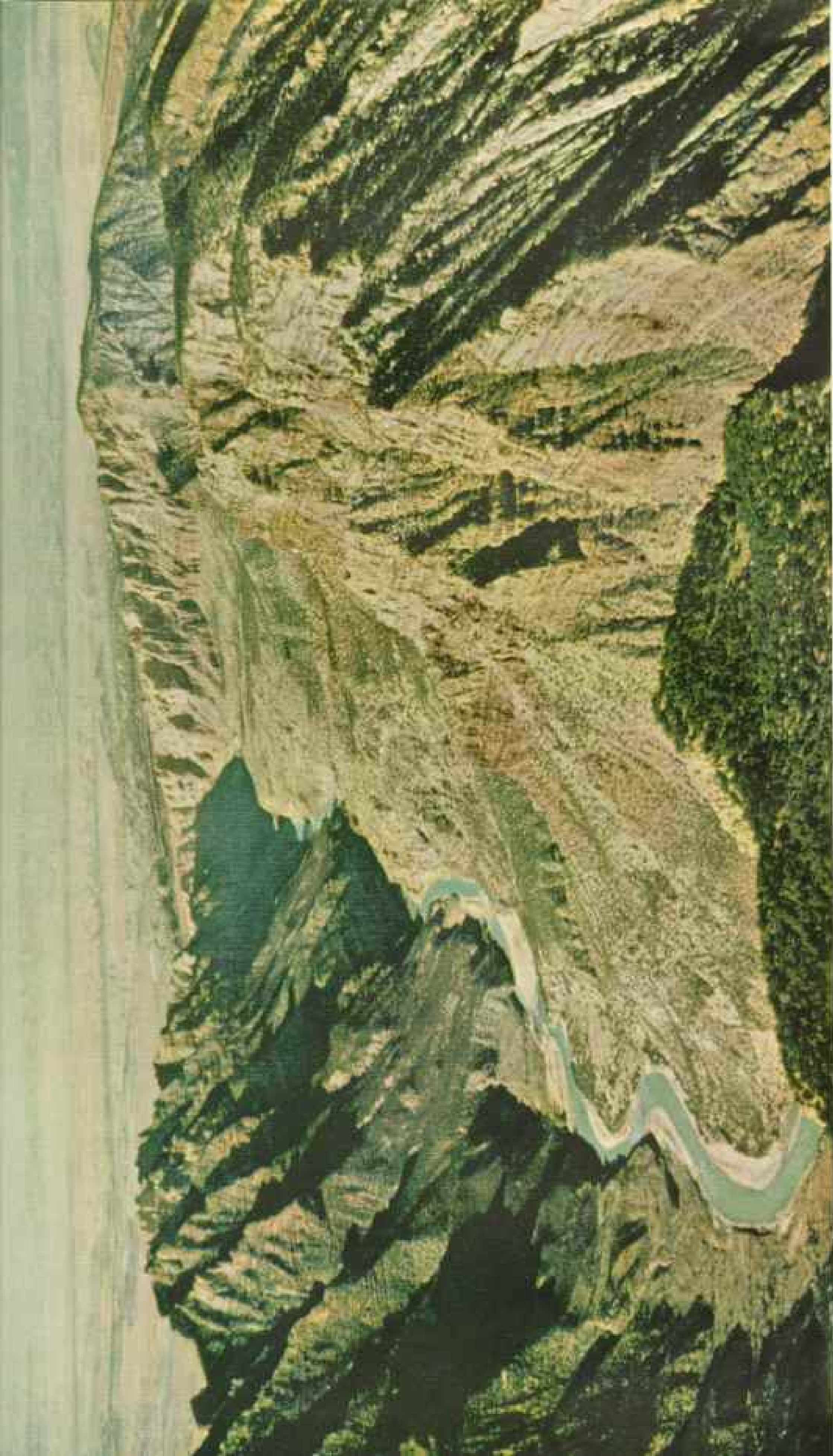
"See that white mark up there on the side of the cliff?" asked Bus later as we climbed into our boats across from Steamboat Rock. He pointed to a small gash high on the rock. "That's where the water'll come, if they build the Echo Park Dam. Old Steamboat will be practically sunk!"

We took a last fond look at this bold, bowl-like crag before the river swirled our boats past it and down into the Green's impetuous run toward Whirlpool Canyon. The banks were no longer sheer, as up on the Yampa, but broken and strewn with boulders and rock slides; juniper and scrub pine clung to every crevice (page 390).

We cut short our afternoon stint on the river to give everyone a rest and pulled our boats ashore at 4 o'clock near the mouth of Jones Hole Creek. Ronnie Lee and Howard Baker took their fly rods and headed up the creek to cast for trout. The rest of us stretched out under the elder bushes for a nap.

Our final day on the Green started auspiciously with Ronnie's call, "Fresh trout for breakfast!" After we had done our duty by them, we donned our Mae West life jackets and shoved off.

Most of the morning, all we needed was a single oar to use as a rudder; the rushing Green did the work, bearing us swiftly along.



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Green River, Confined Between Slopes 2,700 Feet High, Plunges Through Split Mountain Canyon, Utah

Split Mountain Dam, if built, would turn the valley into a narrow lake. Ribbonlike rock ledges just beyond the distant cliffs contain the productive fossil diggings that gave Dinosaur National Monument its name (opposite and page 383).

Chief Ranger George James Describes a Dinosaur Fossil in Monument Headquarters Near Jensen, Utah

A foot trail from this museum leads to Dinosaur Quarry (page 383). There a veritable graveyard preserves the petrified skeletons of huge reptiles that died under mysterious circumstances some 130 million years ago. To date, a million pounds of bones have been quarried for display in various museums. These seventh-graders from Rangely, Colorado, marvel at the contrast between the thighbone of a human (on wall) and that of a dinosaur. Their science instructor, Frank Watson, takes notes.

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© Illustrations by Justin Fackler



Several times, as high waves tossed our rafts, we shipped water; but our confidence in these wonderfully resilient craft was now unshakable. Almost before we knew it, we had slipped through Whirlpool Canyon into a broad meadowland called Island Park, seven miles below Jones Hole Creek.

We made rendezvous with our trucks at Ruple Ranch and acquired a new river rat for the last dash down through Split Mountain Canyon—Dave Canfield, superintendent of Rocky Mountain National Park. Loading most of our camping gear into the trucks, so that our rafts would be even more buoyant for the white water ahead, we secured our life belts and pushed off again into the stream from a point near Rainbow Park.

Slicing Through Split Mountain

Bus, as usual, had words of caution for us. "I've run boats through all the canyons of the West," he said. "Through the Grand Canyon, the San Juan, the Snake, the Salmon. But none of them has any worse sections than you'll find through Split Mountain Canyon today. None of 'em."

It wasn't long before we discovered he hadn't been fooling. From Split Mountain the roar of water rose up to greet us with deafening impact (page 380). "Big Boon" Rapids had looked formidable enough, but this seemed a young Niagara—rocky cascades, huge waves, countless hidden boulders, tightly spinning whirlpools. This was the beginning of Moonshine Rapids (page 388).

We pulled over to the shore to reconnoiter the situation downstream. For nearly half an hour we threw logs into the water and studied the beating they took. Then Bus and Don climbed into the same boat for a trial run, Don in the stern, handling the outboard motor, Bus gesticulating from the bow.

The route they picked lay near the shore. Though rocks were more prominent there, the water seemed quieter. Down they skimmed, spray flying, the raft bucking and rolling (page 389). Once in the middle of the rapids, where the river grew shallower, Bus yelled, "Cut the engine!" and jumped back himself to man the oars.

Don sat down and held on. Bus, twisting around so that he could see downstream, zigged and zagged the boat in and out of the great boulders. Not once did he scrape rock or ship anything but spray. Seconds later they were safely through.

The next two boats came down in like fashion, Bus and Don teaming up again as helmsman and engineer, but with passengers coming along for the thrill of the ride.

No one, I think, enjoyed the run more than Connie Wirth. Teetering in the stern, he would jounce the raft up and down to make it hit the waves higher, hooting and cheering each time the boat smacked the water with an extra-hard jolt.

As for Tom Vint, he sat in the bow, grinning broadly and waving the spume-soaked flag of the National Geographic Society.

For the rest of the afternoon we skidded and floundered down similar rapids in Split Mountain Canyon, with several close calls. Once Bus lost control of our boat for a second, and we caromed off a projecting boulder. MacKnight's boat, close behind, crashed into us, broadside. We tipped badly, but slid off. Had we been in wooden boats, we would certainly have cracked up and lost all our cameras and gear, if not our lives.

By twilight we had passed the site of the proposed Split Mountain Dam. The canyon opened up, the river grew more peaceful, and soon we could see ahead of us, on a sandbar, the trucks which had come to pick us up for the last time. Our voyage through Dinosaur country was over.

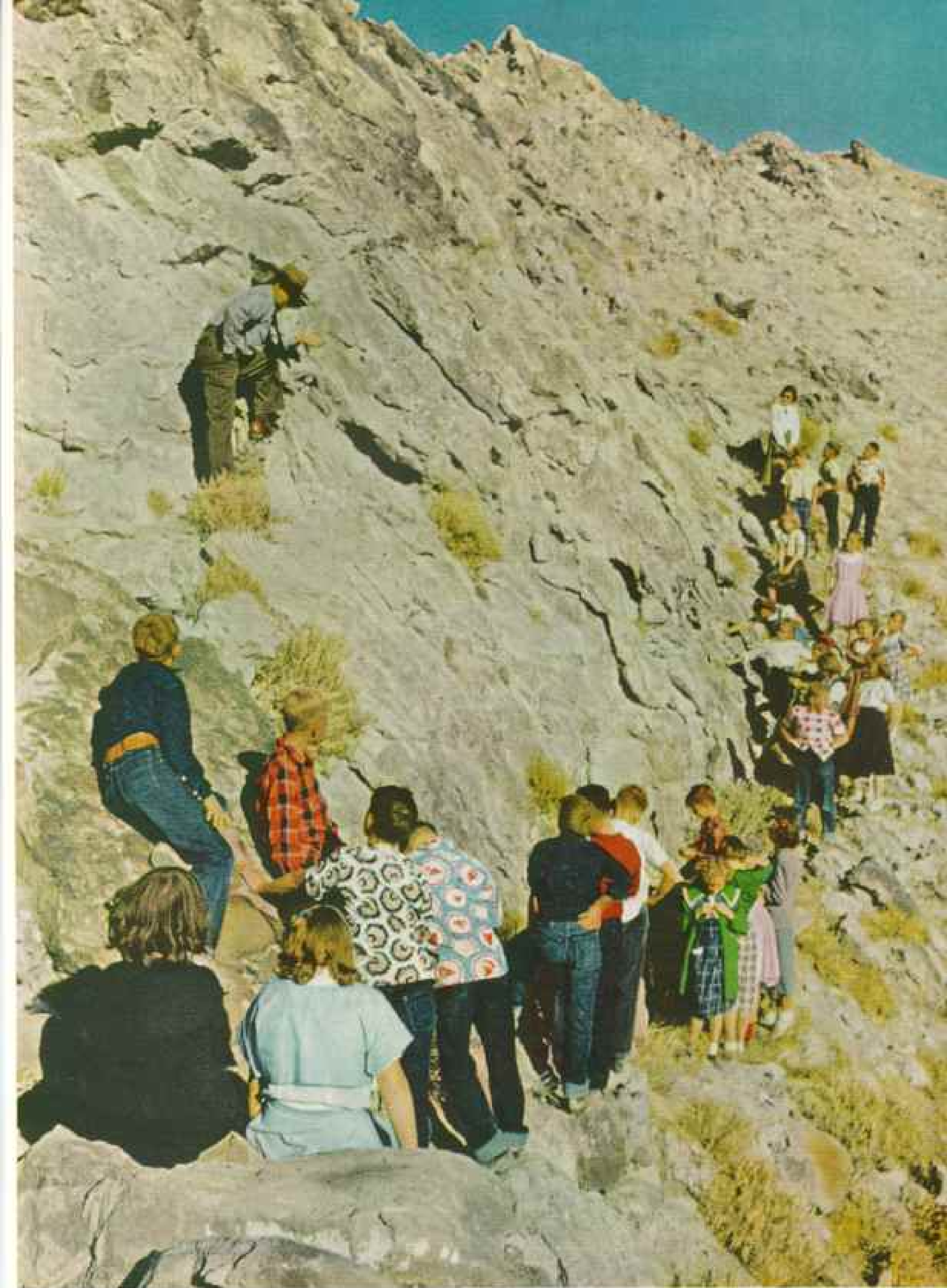
To celebrate our successful venture, we drove up to Jess Lombard's comfortable quarters near the quarry. Over cool drinks we rehearsed our daring deeds, and Jess formally presented each of us with a metal miniature of a prehistoric reptile, welcoming us into the "Order of the Dinosaur."

River Rats Get Rewards

We thanked him, but thought the honor not sufficiently specific. Connie Wirth came up with the suggestion that anyone who ran the river from Lily Park to Pats Hole should be dubbed a "Yampa," and anyone who did that and also the second leg down the Green from Steamboat Rock through Split Mountain Canyon be called a "Grampa."

To this Tom Vint made one amendment: "If a fellow shoots the rapids on both the Yampa *and* the Green through Lodore Canyon to the foot of Split Mountain, he ought to be named a 'Great Grampa.'"

Our trip had qualified us only to be Grampas. But we made a solemn compact to return someday and earn the right to be called "Great."



Students Examine a Giant Fossil Hidden in Dinosaur Quarry

Reptiles, trapped perhaps by flood, lay buried in sand for eons. Sand became sandstone; seas invaded the area and receded, and mountains rose. Here a string of vertebrae blends almost invisibly with the rock.

Park Officials Thread Carryons in Rubber Boats

Many of Dinosaur's most spectacular sights are known only to the venture-known few hundred who run the Yampa and Green by boat or raft each season.

Author-photographer Jack Breed joined five National Park Service officials and three experienced canyon pilots in a 4½-day 75-mile run down the two rivers across the monument. Embarking in Navy life rafts at Lily Park, Colorado, they emerged near monument headquarters in Utah. The party included Mr. Wirth (ashore with arm raised); Mr. Leo (page 375), and Jess H. Lombard, superintendent of Dinosaur Monument (both standing in far raft).

Here on the second day the boatmen paused for lunch beside the Yampa. At this point the gorge opens on Castle Park, so called for the fortreslike cliff on the far bank.

Close by, rancher Charlie Mantle and his wife have made a home and raised five children 90 miles from the nearest shopping center. Fruit trees, a truck patch, poultry, cattle, and horses make the Mantles almost self-sufficient.

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Pioneers Named This Yampa Dell Starvation Valley

Boon MacKnight flips the flapjacks; Ronald Lee seasons his breakfast. Their ice chests fitted into the rafts' watertight compartments.



Shallow Rapids Took a Heavy Toll of Propeller Shear Pins

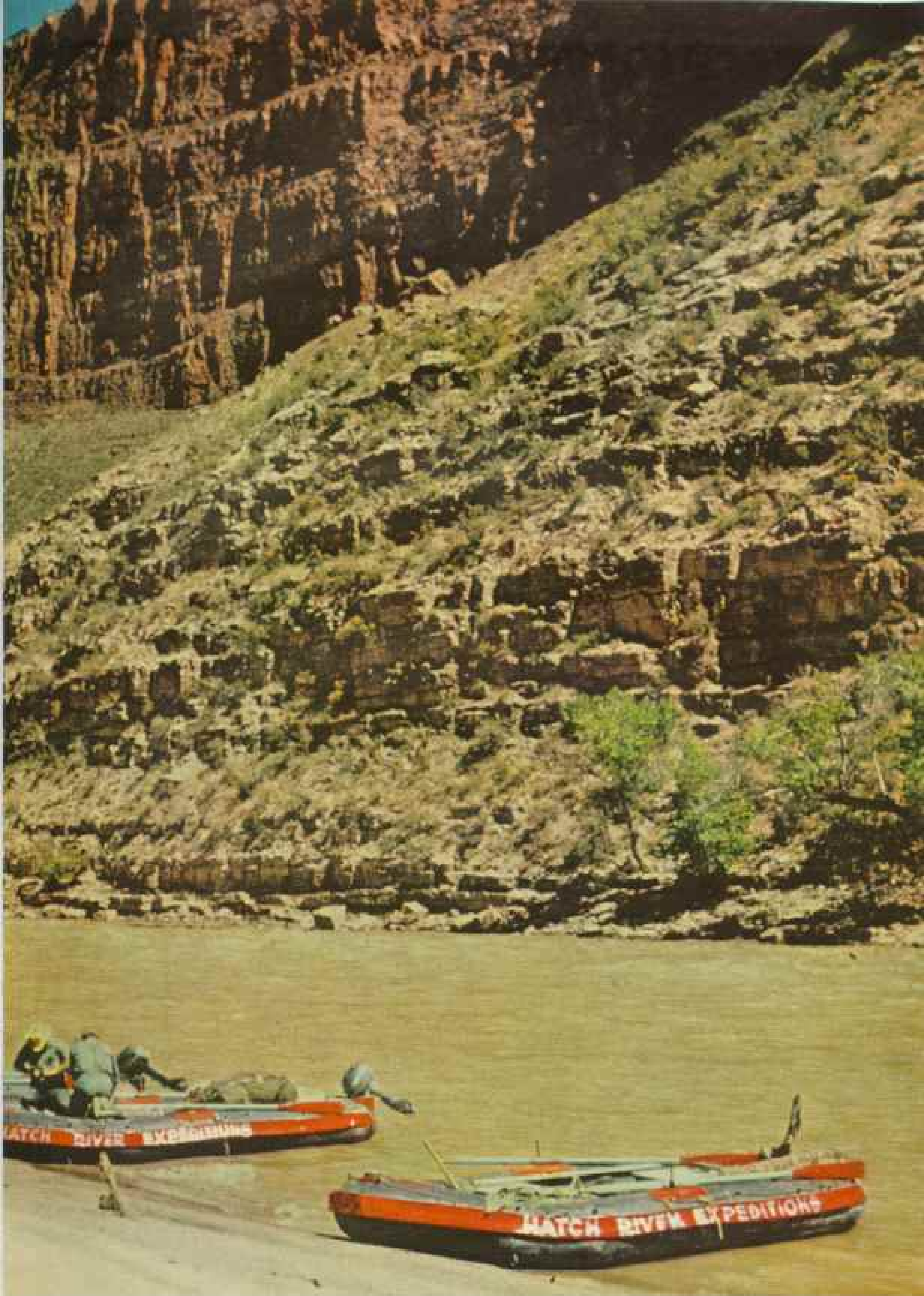
Pilot Bus Hatch replaced the soft metal keys 10 times or more a day. Stout wooden brackets adapted outboard motors to the rubber rafts.

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© Mechanisms by Jack Brouil







Boatmen Secure Equipment Against Rocks and Rapids Ahead

River Admirals Map Strategy at Moonshine Rapids

Many a boat has come to grief in this churning stretch where the Green River begins its rampage through Split Mountain Canyon (opposite). Channels change from day to day as the turbulent stream shifts boulders.

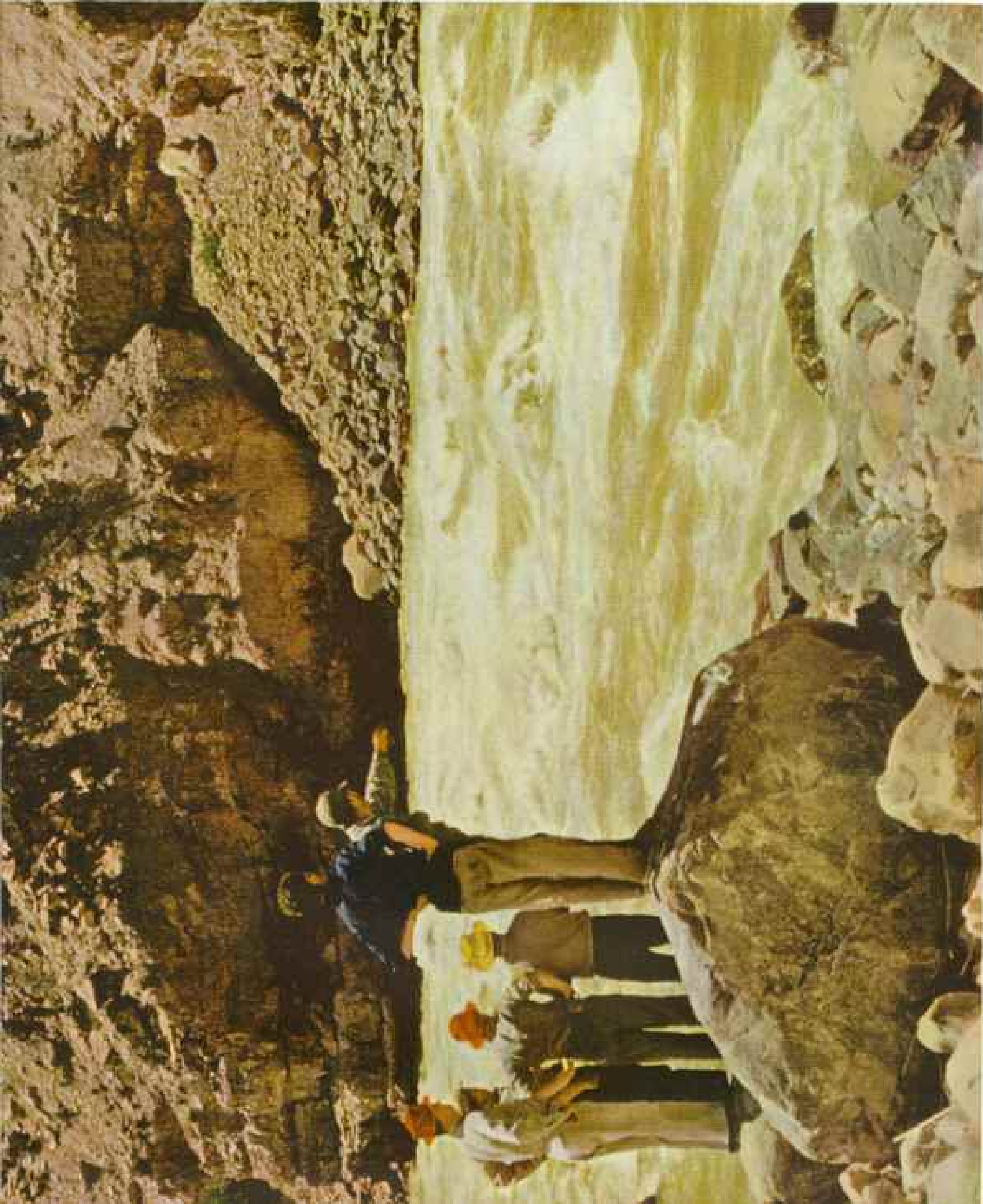
Here chief pilot Hatch points out a hidden hazard to his son Don. Everything else is forgotten; the world revolves around these rapids.

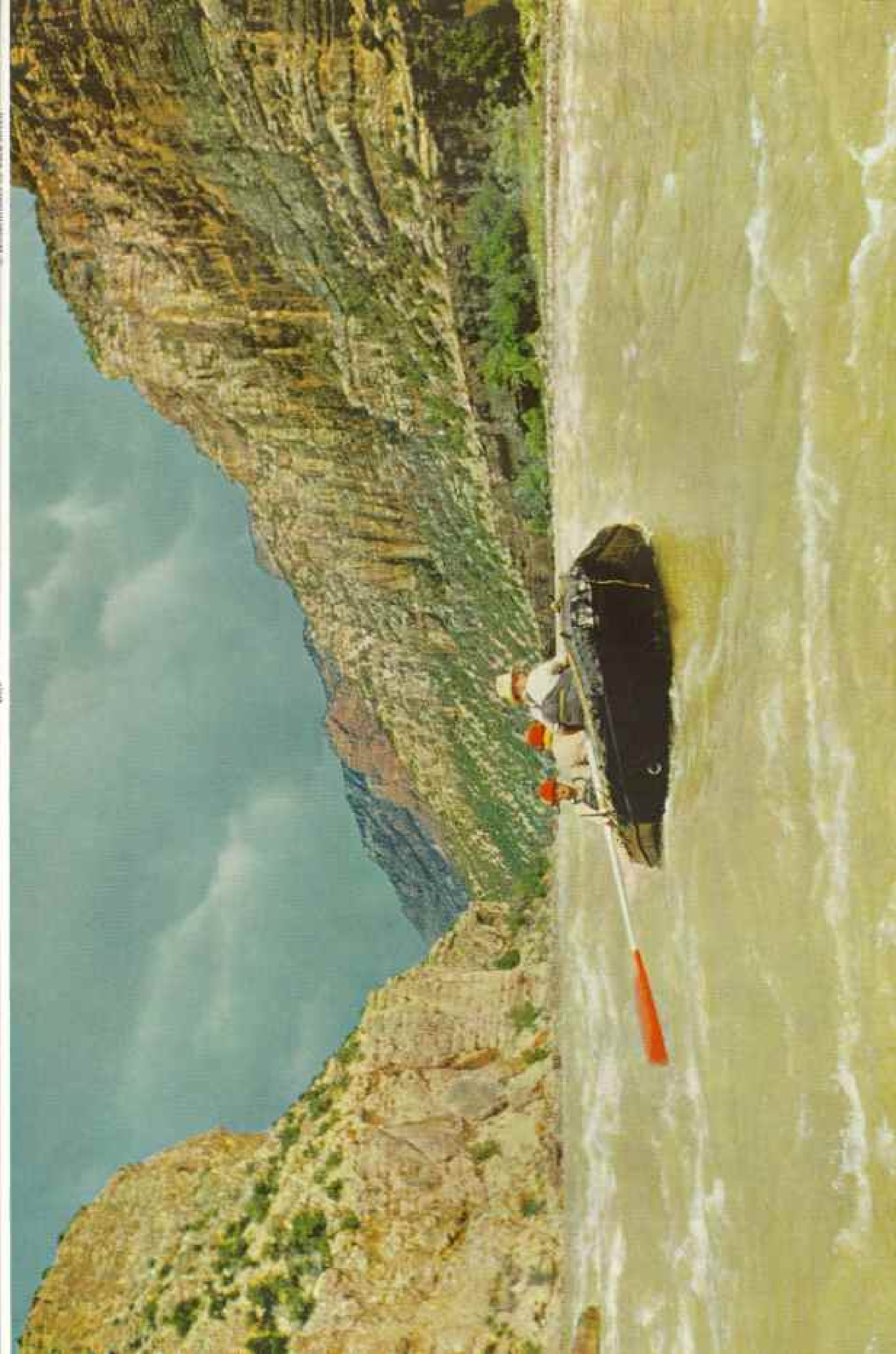
Tossing logs into the torrent, the Hatches watched them bounce against rocks and shore. After half an hour of study, father and son took the three rafts through in turn without mishap.

▼ Storm clouds threaten above Split Mountain Canyon. Boon MacKnight, who scorned the outboard motors used by the other boatmen, plies oars as his raft descends bow first.

This head-on view emphasizes the Navy rafts' breadth and low center of gravity. Where the going was roughest they buckled and slithered through in caterpillar fashion.

© National Geographic Society







Scrub Pine and Juniper Dot Split Mountain's Corrugated Wall

Gliding for the moment on smooth water, the voyagers have passed the mid-point of their last and riskiest day's run. Several swift rushes in Split Mountain's gorge lie ahead.

A Marine "Pied Piper" Lures Queer Creatures with a Light Bulb
in Nocturnal Studies of Humble Dwellers in Warm Seas

BY PAUL A. ZAHL

With Illustrations from Photographs by the Author

THE night was dark and windless, and a blanket of warm air lay heavily on the sea. Knifing us along at 16 knots, the propeller churned up a wake of silver-white phosphorescence that dimly illumined the boat and its passengers.

There were four of us: my wife, myself, and two Negro Bahamian crewmen. We had set out from the Bimini Islands an hour earlier, crept through the mouth of North Bimini's harbor to the shoal-free waters of the open sea, and then opened the throttle to full speed ahead on a due westward course. If continued, this course would have taken us across the Gulf Stream.*

But it was not our purpose to cross the Gulf Stream. We planned to stop squarely upon it, beyond the submarine wall that defines its eastern edge. This wall forms one side of a half-mile-deep, 50-mile-wide gorge through which one of the mightiest of earth's sea rivers flows northward (see the National Geographic Society's new map, "West Indies," a supplement to this issue).

At my signal, the wheelman flipped off the switches. Our bow nosed down abruptly, and after the wake's wash had flattened, a great black quiet settled over our world. The sea was a millpond this night—no swells to lift and drop the little 20-foot open-decker, not even the lapping of waves at its sides.

Night Draws Life to Surface

We had purposely chosen a moonless night. Only on such nights do some of the Gulf Stream's strangest creatures leave the depths and swim upward toward the surface. These were the objects of our search—a search that was to lay useful groundwork for later studies of deep-sea species in the turbulent waters of Italy's Strait of Messina.†

Our lure was neither baited hook nor tow net, but an electric light. Primitive fishermen had discovered the principle for us—that on a dark night many species of marine life will rise to a light or gather around it, like moths around a flame (pages 393 and 400).

Here now in the Gulf Stream we would apply this ancient knowledge in an attempt to explore, and to extend if possible, what has been called man's last earthly horizon—the sea, with its enormously diverse and mysterious population of living things.

Pictures accompanying this article depict some of the weird and bizarre creatures attracted by our lure. They also show some equally strange forms that we collected near the shores and reefs of the Bimini Islands during daylight hours.

We hooked up our storage batteries, and immediately the darkness fell back before the bright glow of a 50-watt bulb encased in a glass-walled watertight lantern (page 404).

Downward Look into a Watery Void

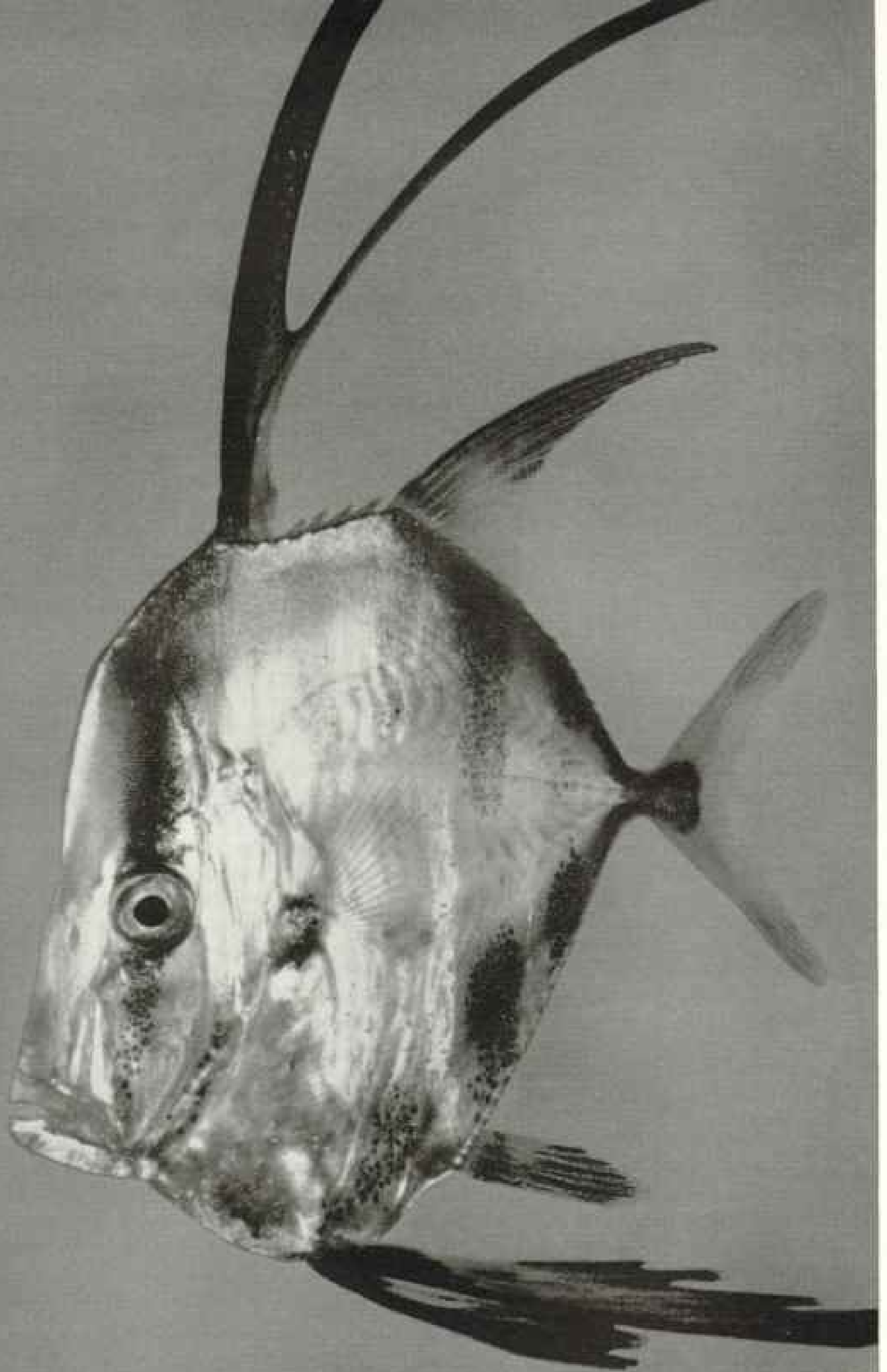
I picked up the lantern and, using its heavy rubber-sheathed current-carrying cord as a suspension rope, lowered it into the sea to a depth of about a foot. Then I secured the cord to the end of a narrow slab of wood screwed onto the starboard gunwale and projecting over the water about two feet.

Now a new and rather scary world unfolded. We were floating upon an insubstantial watery firmament. The eerie penetration of light into the sea gave us the feeling of looking into a starless astronomical void. These Gulf Stream waters near the Great Bahama Bank are among the world's clearest; we could see down perhaps 50 feet before darkness and the unknown again took over.

But gradually, as our four pairs of eyes searched the ebony depths, they seemed to become sprinkled with stars, as if someone at

* Popularly, the Gulf Stream may be thought of as a great ocean river, drawing on Caribbean and tropical Atlantic waters. Between the Straits of Florida and Cape Hatteras, though technically known as the Florida Current, it is widely called (as here) the Gulf Stream. The Antilles Current, an offshoot of the North Equatorial Current, joins it north of the Bahamas. Oceanographers give the name Gulf Stream only to the combined system between Cape Hatteras and the Grand Banks.—The Editor.

† See "Fishing in the Whirlpool of Charybdis," by Paul A. Zahl, NATIONAL GEOGRAPHIC MAGAZINE, November, 1953.



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The Lookdown Wears a High Brow and Stares Haughtily Along a Steep Nose

Nicknamed horsehead, the lookdown ranges from Brazil to Cape Cod. It averages seven or eight inches at maturity and provides good sport and a tasty dish for the angler. This young specimen, as big as a half dollar, trails tendrillike fins several times its length. Adults display much shorter and less handsome fin structures. The author's wife, unfamiliar with the difference, proclaimed this catch a new or rare species.



Light-fishing in Bimini's Bay, the Author and His Bahamian Crewmen Spy Their Quarry

Dr. Zahl spent nearly every night for 10 weeks in Gulf Stream waters between Bimini and the Florida Keys. To lure sea creatures, he used the old trick of hanging a light in or above the water, drawing marine life like a flame attracting moths. His helpers are employees of Lerner Marine Laboratory, Bimini Islands.

the controls of a planetarium were methodically switching on the heavenly lights. And the stars began moving toward us.

These glowing specks were, of course, tiny sea organisms attracted by the light: pin-head-sized crabs, Lilliputian shrimp, minute larvae, fish too small to be recognized as such, and hundreds of other planktonic things that writhed inward toward the center of illumination. Like miniature moons, their bodies reflected the light of our electric "sun," making them visible to us.

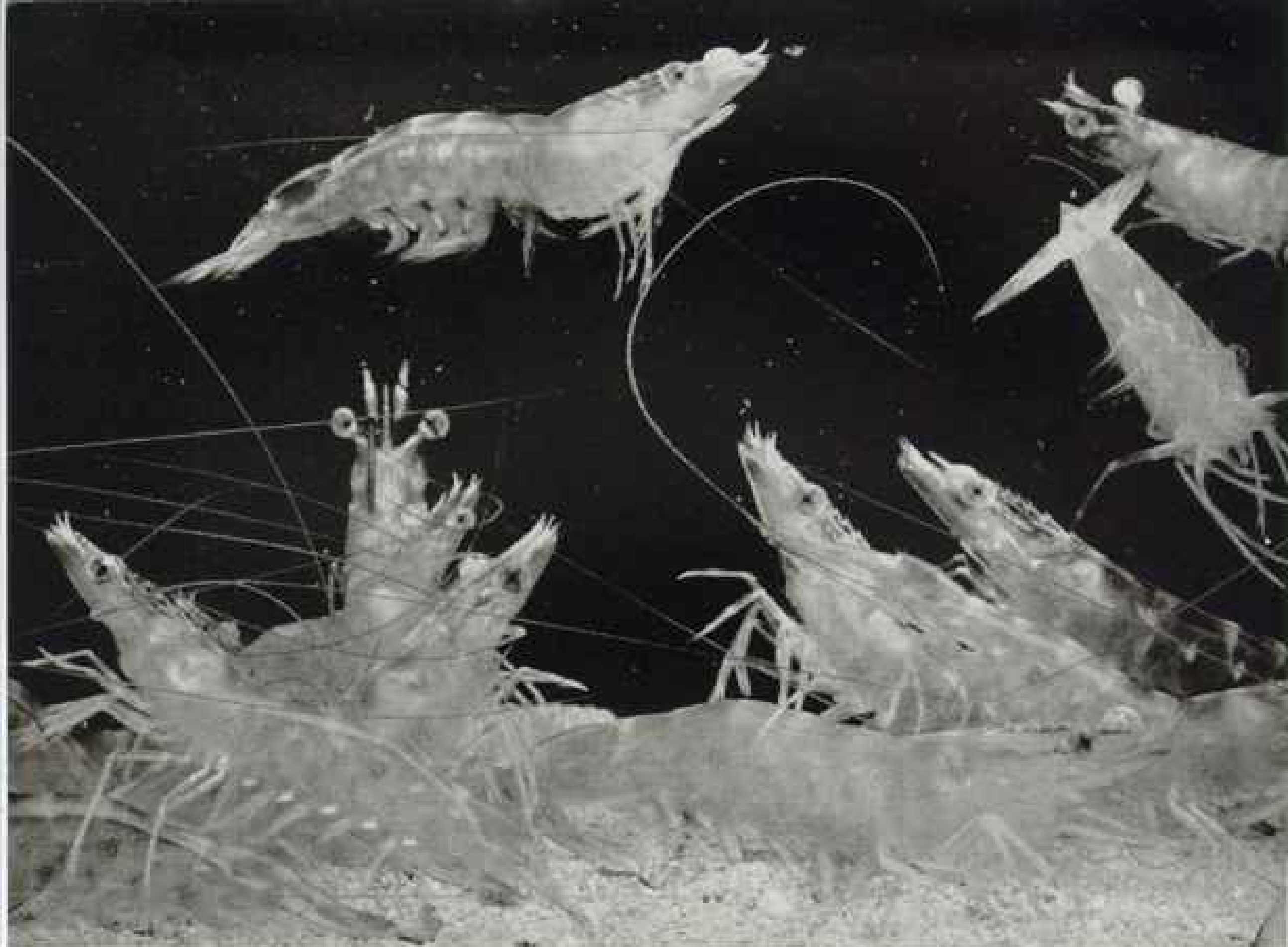
The "sun" was only about two feet from our watching eyes, and these flashing bits of protoplasm were soon within easy reach of our hand nets (see above). But plankton was not our quarry, and all eyes strained in search of larger fauna—eels, squid, perhaps even shark.

Then, as so often happens at sea, came the unexpected. Suddenly a cometlike something darted out of the blackness. It swished up to the lantern, stopped short for a second, and then zoomed back into the darkness.

Bombarded by Flying Fish

Before Pedro, one of our helpers, could say "Flying fish!" another apparition sped through the galaxy, and another, and yet another. There was confusion on board as, half blinded by the light, we grappled on the dark deck for the long-handled dip nets.

There were thuds like near-by cannonading as several of the foot-long fishes, also blinded, crashed against the illuminated white side of the boat. The previously serene sea seemed to turn mad as others of this light-attracted



Goggle-eyed Shrimp Swim Excitedly in a Melee of Legs and Twisted Antennae

These edible 4-inch grooved shrimp have antennae longer than their bodies. They propel themselves with five sets of abdominal swimmerets. Color may be a speckled gray, brown, blue, or pink, depending on food.

school of flying fish zipped around the boat, smashed into it, or sideswiped the light.

Perhaps fortunately for our vulnerable heads and torsos, none of the school took to the air; they arrowed about a foot under the surface. The impact of a 1-pound fish, traveling at 30 miles an hour, might have been a knockout blow. By the time we had the larger nets in hand, most of the school had passed. But Pedro and I each managed to net a fish.

Flight Fins Folded in Water

Hurriedly we filled a washtub with water, emptied the nets, and bent over to examine our catch by flashlight. Two beauties they were, with bellies of silvery blue grading into a vivid electric blue on sides and back. Most astonishing were the two delicately rayed pectoral fins, or "wings," which in this species of flying fish open to a spread of about 14 inches. In the tub they were folded close against the body; only in actual flight are they fully extended as planes (opposite and page 397).

But there was no time then for close scrutiny. After a moment to regain our compo-

sure, we again hung over the gunwale, peering into the depths, waiting for other game.

Then once again the unexpected diverted our attention. Drawing close to the light were little yellow-brown fragments like bits of floating seaweed. Shortly we were able to see through the camouflage and recognize the immature, so-called "butterfly" stage of the very flying fish species held in our tub.

Fairy creatures, only an inch or so long, they fluttered straight to the light, making capture simple. We used fine-mesh nets, manipulating them with the utmost care; even so, it was difficult to avoid tearing the fins or injuring the tiny bodies of these oceanic "butterflies."

What a contrast they were, these diminutive yellow Walt Disney creations, to the bright-blue adults they would grow to be! We netted 10 or 15, placing but one or two into each of half a dozen white-enamelled pails, for the sure way to kill such delicate sea creatures is to crowd them in captivity.

By now we had drifted a mile or more north toward Great Isaac Light, the distant land

beacon that was our only guidepost. Calling it an evening, we hauled in the overboard light and headed shoreward.

Within the hour we had poured out the fragile contents of our pails and washtub into proper tanks fed with running sea water at the Lerner Marine Laboratory on North Bimini.* But, alas, all the specimens were dead next morning, both "butterflies" and adults.

Dr. Charles M. Breder, Jr., ichthyologist at the American Museum of Natural History, told me later that members of the flying fish family rarely do well under artificial conditions. For one thing, these fish have a short, nearly straight digestive tube which allows for little reserve absorption; whereas most animals have a coiled intestine or some other anatomical device for slowing down the passage of food. Feeding on the sea surface, where plankton is always plentiful, these baby flying fish never have had to develop a means of maintaining a food reserve. This seems a likely explanation, at least, of their speedy death after capture.

Immature flying fish caught later were kept alive for days by loading the aquarium with tiny brine shrimp on which the fish could feed continuously.

Some Fish Are Aquaplaners

What ocean voyager has not heard the cry "Flying fish!" and hurried to the rail to see a "sock" zipping through the air a few feet above the sea's surface.

Flying fish are not wholly unique in this aerial accomplishment. Some of their relatives, the needlefish, halfbeaks, and skippers, are would-be aviators too. But not possessing the great fanned fins of the flying fish, these



Wings as Diaphanous as a Grasshopper's Support the Flying Fish

The spectacular glides of flying fish delight travelers in all warm seas. Contrary to popular impression, the fins do not vibrate in the air. Momentum comes from a sharp burst of speed under water, then a rapid sculling with the tail as the fish taxis along the surface. Updrafts sometimes catch the rigid-winged gliders and carry them forward 1,000 feet or more. Flying fish have been known to sail through open portholes. This specimen, held by the author's wife, came to a light in the Gulf Stream off Bimini (page 397).

pretenders merely skim across the water, sculled by the rapidly vibrating tail fin.

Only when evolution gave fin planes to flying fish was true flight achieved, a flight that resembles an airplane's rather than a bird's. There is no wing flapping; spread fins remain essentially rigid as the fish glides aloft (see above).

Aerial adventure among fish appears to have but one motivation—a means of escape from predators or other disturbance. Take-off is preceded by rapid acceleration close

* See "Man-of-War Fleet Attacks Bimini," by Paul A. Zahl, NATIONAL GEOGRAPHIC MAGAZINE, February, 1952.



(Natural size)

↑ **Needlefish Clamps
a Sergeant Major
in Rapier Jaws**

The unusual photographs in this color series show many of the bizarre creatures the author netted in tropical waters or collected above reefs near the Bimini Islands.

Strongylura, the elongated, staring needlefish, inhabits warm waters of the western Atlantic. Ripsaw jaws are not used as a spear. When hunting food, the fish sneaks the toothed beak alongside a victim, suddenly sideswipes and snaps, then fits the catch lengthwise into its throat by repeatedly releasing it and darting forward to seize it again, like a cat with a mouse.

Needlefish, especially when young, are often seen leaping over floating objects.

← Bluehead (*Thalassoma*, upper) and hogfish (*Lachnolaimus*, lower) belong to the wrasses, a family characterized by strong canine teeth and thick lips. Hidden in their throats are additional grinders for crushing mollusks. By gnashing these teeth, the hogfish produces a loud rasping croak. *Thalassoma*'s blue head and bright-green body are separated by a dark bar.

© National Geographic Society
(enlarged 2 and 2 times)



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© Reproductions by Paul A. Todd (upper enlarged 115 times; lower 11)

Flying Fishes Soar Through Air on Delicate Fins Spread Like Airplane Wings

Cyprinidae can leap from the water and glide for 20 or 30 seconds. Adults are silver and blue. The young (below) wear the yellow and brown of seaweed. This specimen turns its belly toward the camera.



under the surface. With the attainment of sufficient speed, the flying fish slices through the surface and into the air.

Aloft, these piscine aviators have little or no control of their flight and must continue in the direction of take-off, subject, of course, to wind currents.

How long do flying fish stay in the air? Scattered reports give only a partial answer, and no doubt capability for sustained flight varies from species to species. In the Pacific, reliable stop-watch checks have been made of periods in the air lasting from 2 to 10 seconds. Even longer flights of up to 42 seconds, and extending for nearly a quarter of a mile, perhaps aided by wind, have been recorded. The speed requisite for sustained flight has been calculated to be about 30 miles per hour.

When the flying fish loses altitude in the air and the tail touches the water, the fish again starts sculling with the tail to build up speed, then is off into the air again. This may be repeated many times during a single flight, ending at last in a headlong splash into the sea. Caught in an updraft, individual flying fish have been seen to soar upward and alight on a ship's deck 36 feet above water.

Youngsters Test "Wings" Early

Even the fluttery yellow immature fish demonstrate their flying instincts early. During daytime work on the Gulf Stream our boat would sometimes disturb a group of such little ones camouflaged in a patch of sargassum weed. Off they would skitter at a furious rate, sometimes just making tracks across the surface, often lifting an inch or two into the air.

Adult flying fish, good table fare, have long been sought by fishermen. A classic method for catching them is at night from a sailboat with its white canvas conspicuously illuminated. Under proper conditions, flying fish will be attracted in great numbers. Striking the sail, they slide down to the deck for capture. Many a mariner's tale records fish flying in through an open porthole, attracted by the cabin light.

The unpredictability of the sea was sharply brought home to me during some 60 separate attempts in Gulf Stream waters, between mid-October and mid-December, to light-lure Neptune's children within reach of our hand nets.

Never were two nights alike. One night the sea around my immersed light would

swarm with microplankton. The next night, in the identical spot and under similar conditions of tide, moon, wind, and weather, nothing would rise to the lure but, say, large surface-feeding shrimp (pages 394, 418).

Often the light would draw a complete blank. For hours we would sit and stare into ostensibly lifeless waters. Such caprice is an old story to fishermen, but to me it was new and fascinating evidence that the "unchanging" sea is indeed a place of dynamic, continuous ebb and flow.

An exciting high point was the night we saw our first eel larvae (page 414). Swimming just below the water surface, they materialized from the peripheral darkness, tiny disembodied automobile headlights. The glowing spots, each about twice the size of a pinhead, were, of course, eyes. The bodies—well, there just weren't any to be seen.

Eel Larvae Are Transparent

The first time I netted these strange creatures I thought I was getting some sort of double-structured plankton organism. But when I pointed my flashlight into the net, I saw a coiling mass of gelatinous tissue that I knew was not plankton.

Quickly I deposited the catch in an empty pail. The mystery was immediately resolved.

Coiling like serpents, though considerably flattened, were living things perhaps three or four inches long, with the transparency of clear glass. Without more delay I poured water over the creatures, and, presto, all but the pairs of eyes vanished from view.

Anyone who has had much to do with fish is aware that the brain, parts of the backbone, and even the viscera of many small fish and fry are visible through their body tissues. But when I say that the larval eels we caught that night were transparent, I mean they were like polished Lucite, animated ice. Later we placed some of these eels on a printed page; we could read the print as if nothing at all were on top of it.

One might easily reach the conclusion that these watery bodies were composed of the gelatinous stuff of jellyfish. Actually, the eels were bona-fide vertebrates, in no way related to jellyfish, possessing backbones, digestive tracts, livers, glands, hearts, skin, circulatory systems, but all transparent.

Transparency is just one fantastic attribute of the eel larva. Until it was proved, by keeping them in an aquarium, that they



Blue-nosed Angelfish Looks Like a Clown. Beware the Sharp Spines Back of the Jaws!



Silver Sides Gleaming, Hungry Fish Flash Through the Photographer's Light

Seen under the boat's electric lamp, tiny organisms swarmed in the water like dust motes in a sunbeam. At the bottom of the sea's eat-or-be-eaten food chain, such plankton fell prey to small herringlike fishes like these. They in turn disappeared down the maws of bigger fishes lurking in the shadows.

would metamorphose into real eels, larvae of this type were for years considered a distinct species unrelated to the adult eel. They had their own scientific name, *Leptocephalus*.

We caught at least three different types of leptocephali. Some individuals were flat, some wholly snakelike, some had an enigmatic single red dot, said to be the spleen, in the otherwise glassy abdominal region.

Dane Tracked Down Eel Birthplace

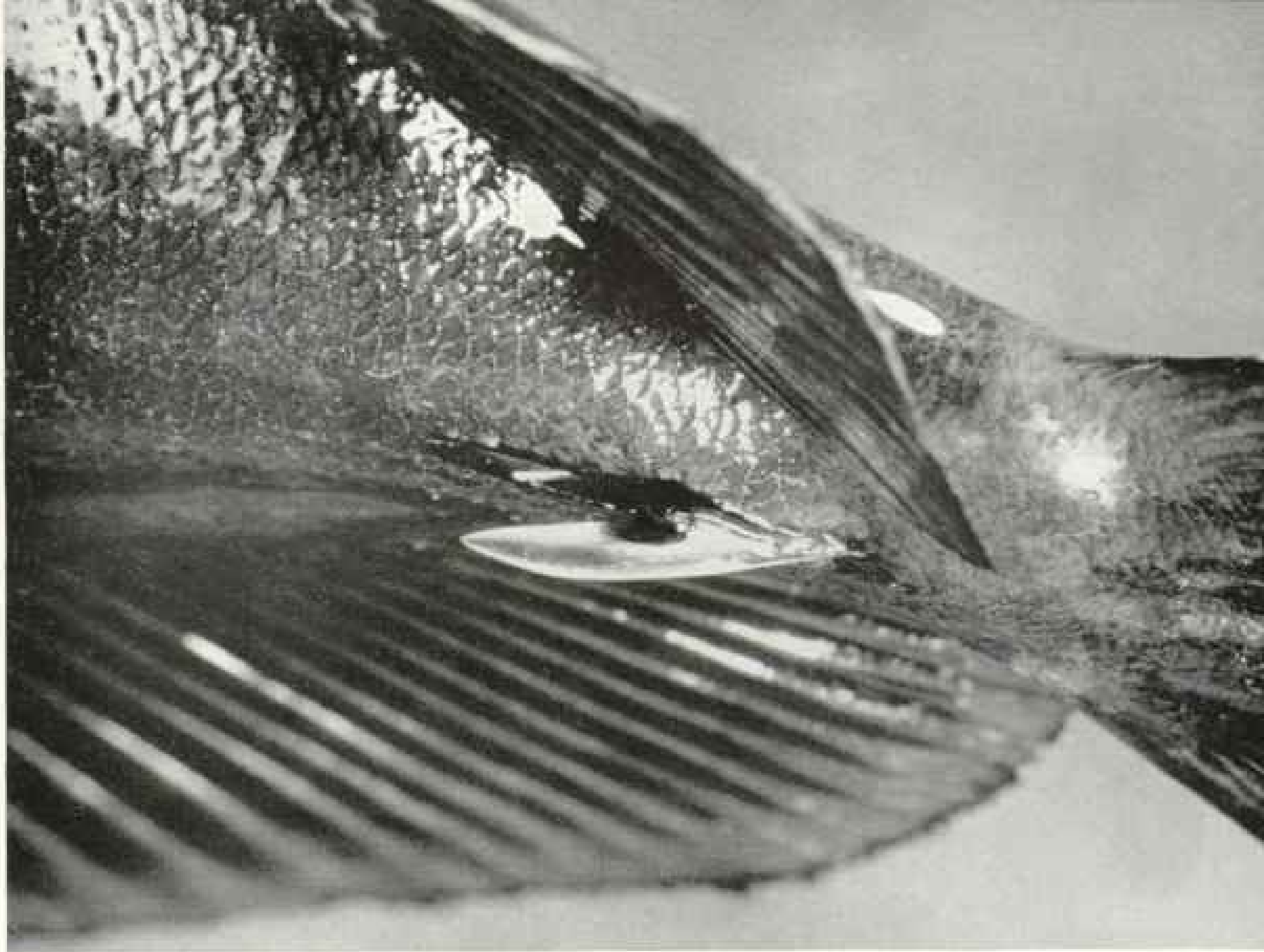
The man who first cracked the riddle of the eel's origin was Johannes Schmidt, a Danish marine specialist. His painstaking studies of the world-wide distribution of leptocephali pointed, unexpectedly, away from continental waters and, instead, toward the southwest Atlantic as the birthplace and cradle of leptocephali.

Although full details are still lacking, we now know the highlights of the life story of the common eel. After a growth period of between 5 and 10 years, or even longer, in rivers and coastal waters of the continents,

the mature eels return to the deep ocean. They migrate several thousand miles to the Sargasso Sea, a great area of the warm Atlantic lying between Bermuda and the West Indies and fed by eddies from the Gulf Stream. There the returning eels descend to a considerable but yet undetermined depth, deposit their eggs, and then apparently die.

The eggs hatch into transparent leptocephali, which soon set out on their long predestined journey to the rivers and estuaries of Europe, North America, and perhaps Africa. Those bound for Europe face a 2½-year trip, those to North America a journey of less than a year, during which time they feed and grow. By the time of arrival at their destinations they are about to enter another metamorphic phase, the elver stage. In this form they move into the rivers to grow into the common eel, so important for food in many European countries.

Now the sexes separate. The males prefer the brackish water of river mouths and estuaries; the females go far upstream.



A Scalpel Blade Opening Like a Juckknife Gives the Surgeonfish Its Name

Surgeonfish's lancetlike spines are sheathed in skin folds on either side of the tail; they can open out like the spurs of a fighting cock. Alarmed, the fish lashes its tail rapidly, sideswiping adversaries and inflicting severe wounds with the spines' sharp points. This vegetarian uses its weapons for defense only.

Eels escaping the fisherman's net return in the course of time, like their parents before them, to the Sargasso waters of their birth, there to reproduce and vanish, rounding out an amazing life cycle that raises myriad baffling questions.

A Disembodied Wraith

Internal tissues of most vertebrates, including ourselves, take color from the hues of fluids and chemicals within the body. Recall the red hemoglobin of your blood, the red-brown color of the liver, the various degrees of skin and hair pigmentation.

Yet here in this eel larva we had just the opposite situation—nothing was colored. Where were the blood, the colored liver juices, the usual skin pigments? What strange glassy form gave this species its initial transparency?

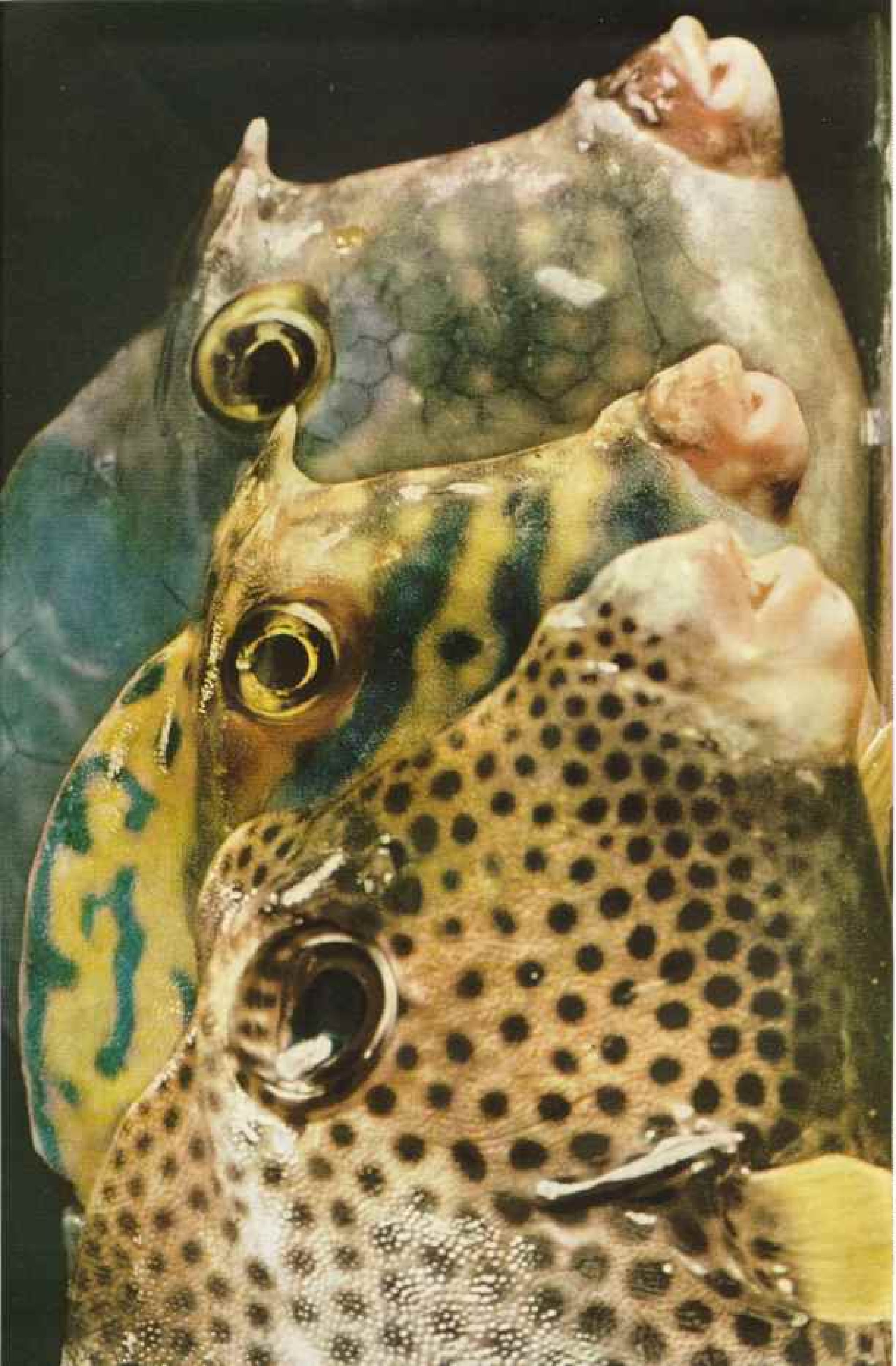
I wanted to photograph these transparent eel larvae alive. We had observed that the minute they became sick or died, their glassy transparency was replaced by an opaque milkiness; in this condition they could easily be

photographed. But to record them living was a problem comparable with that of photographing a black cat at midnight in a coal bin without flash bulbs. Even with flash bulbs, these eel critters couldn't be seen.

My troubles began as soon as I placed four specimens of leptocephali in an open-topped aquarium. Scarcely had I released the eels when they flashed up out of the water, over the lip of the tank, and onto the floor. Wriggling like mad, they made off in all directions. I tried to pick them up, but, although hard and firm, they were as slippery and evasive to my fingers as blobs of mercury. Finally I managed to scoop them up on stiff paper and pop them into the tank. In a few seconds they were back on the floor.

Hopefully I set up an escape-proof aquarium, introduced my eels, and watched them as moving eye pairs exploring their new home. Finding no exit cracks or crevasses, they burrowed into the sand, where, of course, making their portraits was impossible.

(Continued on page 407)



↑ Cowfish Carry Horns on Brows; Trunkfish (Left) Resembles a Baby Hippo

These fish feed on tiny organisms in shallow water. They can quickly change to a variety of colors and patterns, a few of which are seen here. Body scales on both species have become fused into hard plates like the tiles on a bathroom floor. The bony box enclosing each fish makes it a slow, awkward swimmer and a helpless captive out of water.

Edible *Lactophrys bicinctalis*, the trunkfish, is often baked and eaten directly from the trunk, or shell.

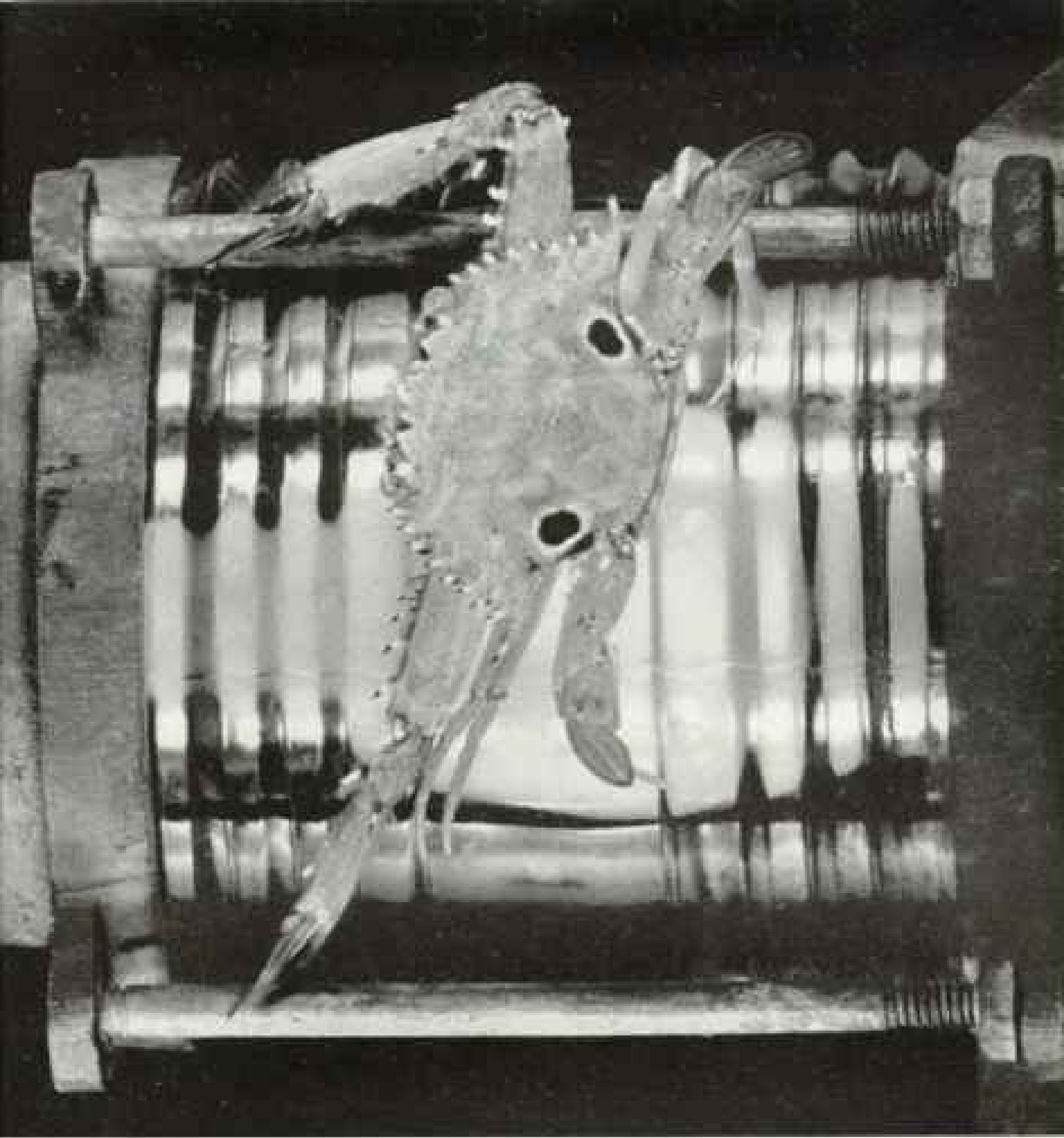
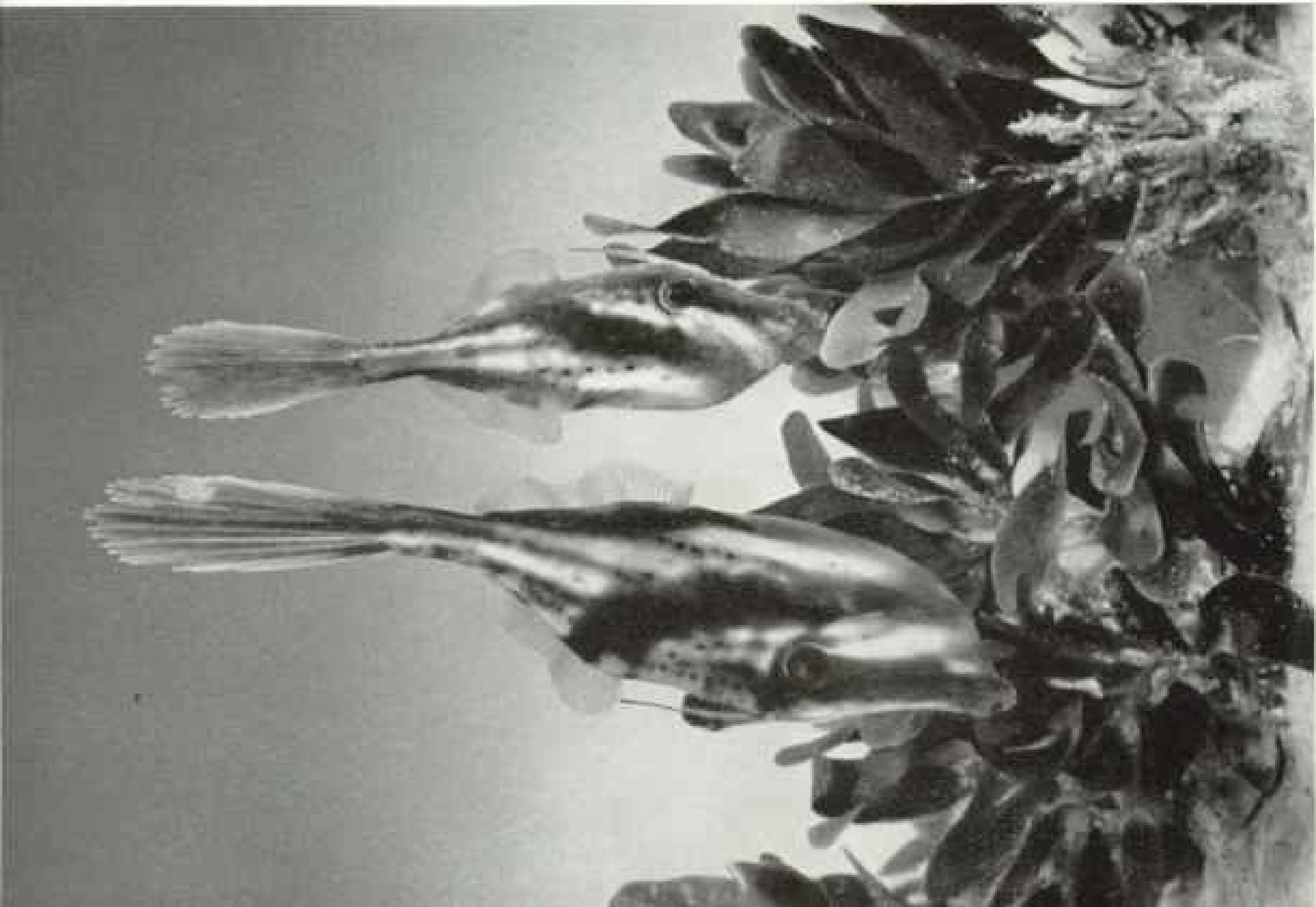
No one knows the reason for the beetling brow of the cowfish, *Lactophrys quadricornis*.

↓ Squirrelfish (*Holocentrus cernuus*) hides its bright colors in shadowy crevices during the day, but flits openly among the reefs by late afternoon. Though edible, it is not prized as a game or food fish, and its sharp spines are dangerous to ungloved hands.

→ Enormous eyes of the squirrelfish (above) come in handy for feeding at night, when the sea's upper levels approach the perpetual blackness of the depths. Red snapper's large pupil (below) similarly indicates a habitat of partial darkness. The author took this specimen on a steel wire sunk 800 feet into the Gulf Stream.

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(all other text © 1961)





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↗ *Portunus* the Crab Refuses to Let Go of the Author's Underside Light

Eyes show at top of the creature's body; black spots are shell markings.

↖ Young fleish (page 406) escape detection by standing on their heads amid clumps of grass and weed and waving tails in rhythm with the vegetation.

↘ The shark's evil fame must be attributed in part to mistaken identity. Often the culprit is the barracuda, whose knife-edged teeth and savage attack amply justify a bloodthirsty reputation. Here a small *barracuda* engulfs a shrimp.





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Redrawn from by Paul A. Zall (natural size above and 4 centimeters)

↑ **Filefish Derives Its Name
from a Sandpaper Skin**

Drifting with the tides, *Ceratacanthus* can often be captured by hand. Few would go to the trouble to catch it, however, for it has no value as food or game. Filefish skin has been used occasionally as an abrasive and match scratcher.

↓ **Pipefish Sucks Food Through
Tiny Mouth and Tubular Snout**

A slender armored fish, *Syngnathus* is a sea horse that Nature forgot to turn into an S. Size of the mouth limits diet chiefly to tiny crustaceans. The male carries a pouch like a kangaroo's to receive and incubate the female's eggs and shelter the young.



Later I examined the tank and noticed the four pairs of eyes protruding from the sand, as if on the lookout for prey. The elongate bodies appeared still to be buried and my camera remained in its case. Before leaving for the night, I dumped a handful of sea grass and some shells into the aquarium.

Next morning I cautiously approached the tank and turned on the overhead light. There were two of the elusive eels in perfect pose, head and "shoulders" as if emerging from the grass, eyes gazing directly at me. Somehow the green background had altered the effect of the light; for the first time I discerned a dim but distinct outline of heads and bodies.

Quickly I took some pictures, not really believing that the camera would record those delicate eel contours. Weeks later, when the film was processed, I was amazed and delighted to find that it had captured even more contrast between body and water than my eyes had seen (page 414).

Nature's Jet Propulsion

On nights when the moon was bright or the open sea too rough for our small boat, I would hang a light from a dock in Bimini's bay. It was placed about a foot above the water, shaded to cast downward a broad cone of illumination.

One night I was lying prone on the dock planks, net poised to capture anything that might come in. My eyes were riveted on the lighted water. Suddenly, as if by sleight of hand, a host of banana-long squid appeared, pulsating close under the light. Their lateral flaps undulated gently; their tentacles, streaming behind, were motionless.

Fascinated, but not to the extent of inaction, I lowered my net slowly to the surface and struck fast and hard. Powered as they are by true jet propulsion, the large-eyed creatures reacted with violent explosiveness. In a flash they were gone, leaving in the net only clouds of brown "ink." Squid are masters not only of jet propulsion but of smoke screening as well, talents which they developed long before man.

The squid anticipates his jet-power movement by drawing water into a body chamber lined with heavily muscled walls. When these contract, the water is expelled so violently from a vent in the "jet engine" that the squid's body darts ahead. If the motive is escape from danger, a stream of blinding ink may also be released. This ink, it has been

suggested, acts to divert the attacker rather than as a smoke screen. While the attacker's attention is on the ink, the squid is already yards away.

To elude enemies the squid has another trick: some species can virtually disappear from view without moving. This remarkable loss of body color is achieved by the abrupt contraction of thousands of tiny pigment spots in the squid's skin (page 416).

Squid Can Switch Color On and Off

When expanded, these spots are visible and give the squid its color; contracted, they and the squid are hardly to be seen. Because minute fast-acting muscles control these spots (chromatophores), rather than the slower means used by most color-changing animals, the squid can out-chameleon the chameleon in speed of color change.

Under another light at the end of the long dock I found the familiar glittering of microscopic things, scurrying, whirling, and zigzagging.

Why actually these are phototropic, or drawn to light, is not known. Plants often grow toward the light because they need the sun's radiant energy in combination with the chlorophyll in their leaves to manufacture sugars and starches from water and carbon dioxide. Small green swimming algae move toward light for the same reason. But plankton attracted to a dock light consists mostly of animal organisms wholly lacking in chlorophyll and therefore not apparently needing radiant energy for any vital process.

Each Predator Another's Prey

In the dimmer area just beyond the visible plankton were "wolf packs" of small fish attracted not primarily by the light but by this concentration of appetizing creatures. These fish in turn had to keep alert, for beyond them in the next zone outward prowled larger fish. These, more sophisticated, moved and circled cautiously, darting into the strong light only to snatch a victim, then hurrying out again. Beyond them lay in wait yet larger fish. And, ominously, still farther out, where the twilight turned to blackness, loomed an occasional darker form, possibly a shark, a chilling sight.

All these larger creatures were responding indirectly to presence of the light, taking up feeding positions in a pyramid built up from the broad base of very abundant tiny plank-

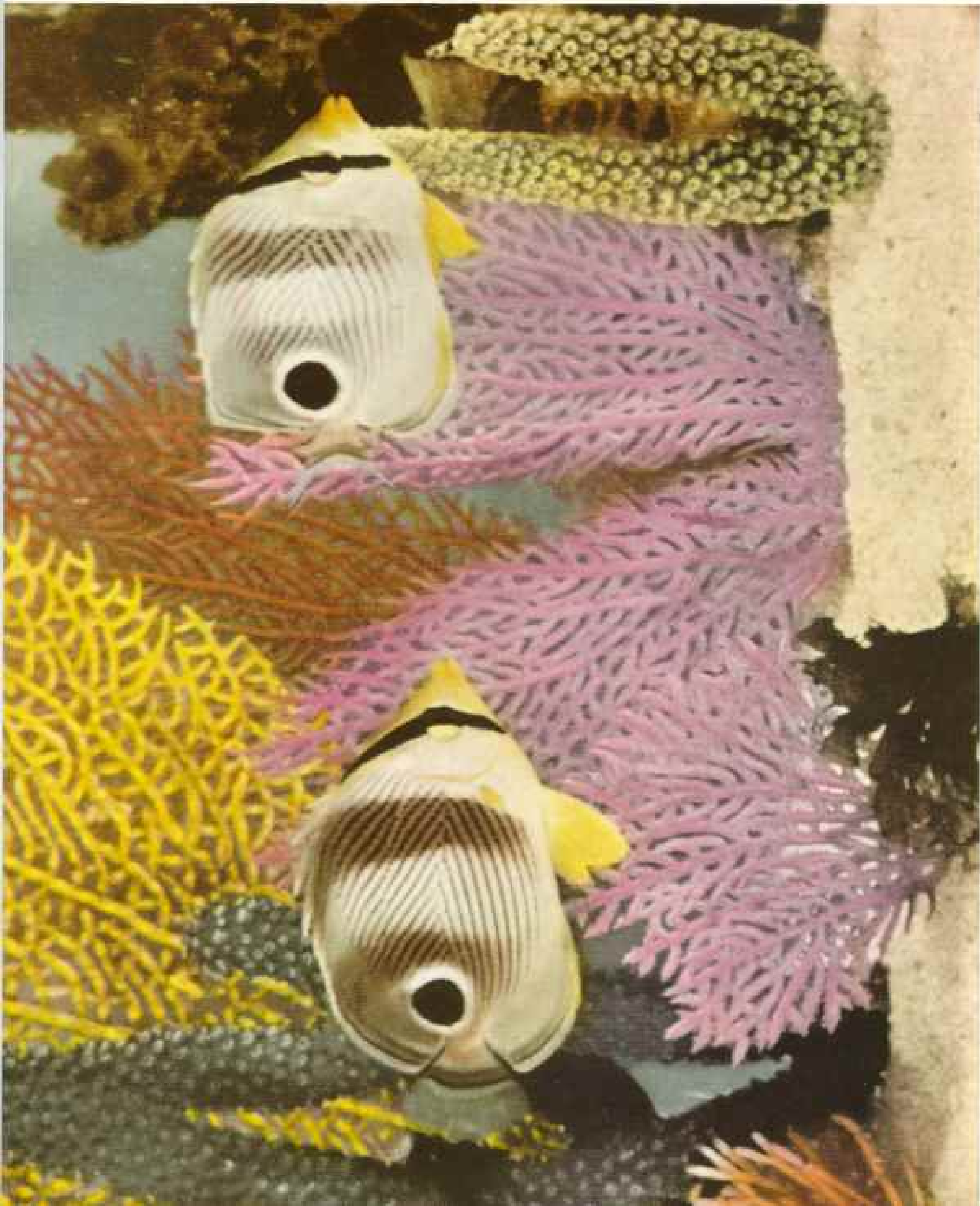
**Butterflyfish
in a Marine Garden
Wear False Eyes
Near Their Tails**

Chaetodon capistratus, the so-called four-eyed butterflyfish, wears a simple form of camouflage. A heavy bar running across the head and through the iris conceals the eye, and a bold eyelike spot appears near the tail. Thus the fish seems to head the wrong way, an illusion that it sometimes heightens by swimming backward.

Nearly 200 kinds of butterflyfishes inhabit tropical waters the world over. Vivid lemon yellows and bold stripings in many species rival the showiness of birds and insects.

Butterflyfishes are adapted to life among rocks and coral reefs. Snoutlike mouths poke into holes and crevices, seeking small crabs, shrimps, and worms. Agile, flattened bodies, seldom more than six or eight inches long, flutter sidewise or upside-down as the creatures wriggle through fissures in coral heads.

Pastel sea fans waving in the background are gorgonians, colonies of tiny animals closely related to the reef corals.



Body Inflated and Spines Erect, Porcupinefish Defies Its Enemies

Just as land animals in general give porcupines a wide berth, so do marine predators think twice before attacking the porcupinefish, *Diodon hystrix*.

This cousin of the swellfishes, or puffers, is a dumpy, ill-shaped creature, neither swift nor graceful.

The fish does not have to be agile to escape attack, for it can quickly erect a defense of sharp spikes by inflating with water or air (upper right); if with air, the fish floats upside down at the surface. When the body is not puffed up, the spines lie flat like a coat of mail (lower).

Porcupinefishes blow themselves up to pin-cushion proportions only when frightened.

The innocent-looking but powerful beak (inset) can crush shellfish. An orange starfish retreats from the scene below.

Dried skins of inflated porcupinefishes, with candles inside, make "Japanese" lanterns in the West Indies and other parts of the world. South Sea islanders hollow out the spiny balls for war helmets,



ton, the only true light lovers in the crowd.

In the world of sea carnivores almost every individual eventually ends up in another's maw. Here around the light that night the jungle aspect of sea life was nakedly exposed, the inexorable rule of the survival of the fittest.

Sometimes a snaky worm or an orange shrimp would boldly break through the zones of stratified predators, seemingly magnetized by the light. Sometimes he'd make it; more often he'd disappear en route.

Giving grace and beauty to this otherwise savage scene, a pulsating moon jellyfish or a bank of phosphorescing comb jellies now and then would drift into the area of visibility; then back to darkness again.

Sargasso "Grapes" Name the Sea

I have referred previously to that great slow-circling mass of Atlantic waters lying between Bermuda and the West Indies, sighted by Columbus on his first voyage, and named the Sargasso Sea from its surface masses of the brown algae, *Sargassum bacciferum*.

The word *sargasso* is from the Portuguese for a kind of grape, a derivation appropriate in this case, for the Sargasso algae have clusters of little yellow-brown grapelike floats that give buoyancy to their otherwise heavy weed masses.

Early claims that ships would become inescapably entangled in the Sargasso Sea are, of course, pure fiction.

Marine biologists incline to the belief that the sargassum weed probably evolved as a fixed plant growing in shallow water on the shores of the West Indies. Torn free by storms and local water turbulence, it was borne northward by the Gulf Stream. But the plant which now drifts about in vast quantities in the Sargasso Sea cannot be identified with any known land-fast species. Scientists increasingly hold the view that the drifting plants can maintain themselves indefinitely by budding.

Flying Fish Take Weed's Hue

On nearly our last night out in the Stream, early in December, sargassum weed and its bizarre assortment of animal hitchhikers came in for brief but special attention. This time the sea area illuminated by our underwater light was mottled with unusually numerous clumps of sargassum weed drifting by in the

current. Some floated on the surface; some hung suspended below it.

Our earlier experience with flying fish came to mind, for I knew that they often lay their eggs in strings firmly affixed to sargassum leaves and branches. The hatchlings make the weed their home and drift along with it northward. Mottled yellow and brown coloring of these young "butterflies" resembles that of the sargassum itself. With the attainment of adulthood's blue livery, the camouflage, of course, is no longer effective, and the fish abandon the sargassum refuge in favor of an open-water life.

I took one of our coarse nets and dipped up several fresh-looking masses of weed. We gathered around with flashlights and picked over the stuff to see what we could find. There were many little *Leander* shrimp perched among the branches. Some pipefishes of finger length but as narrow as darning needles swam slowly about the tub's water (page 406).

There were snails, hydroids, larvae of various fish, small crustaceans, several ugly nudibranchs, all faithfully reproducing the yellow-brown decor of the house in which they lived, a coloring that gave them some protection from sea birds and ocean predators.

But the pièce de résistance, which provided fitting conclusion to our light-fishing in the Gulf Stream, was *Histrio histrio*, king of the sargassum weed jungle (opposite page).

Cannibals in Miniature

Also called the sargassum fish, this creature looks like a fragment of sargassum weed, including branches, leaves, floats, and all. Its fore fins are modified into jointed armlike appendages with which it crawls among the sargassum branches in search of prey. Its movements are slothful, yet it stalks with the deadly sureness of a jungle cat. *Histrio* has a mouth large enough to swallow a fish as large or even larger than itself.

We found three of these fish in that sargassum haul, the smallest an inch long, the largest about three. Back in the laboratory, we dropped them in running sea-water aquariums—separate aquariums, for these creatures are true cannibals. Had we placed them together, there soon would have been but one, a reduction that would have added yet another scrap to the great body of evidence testifying to what a ruthless and formidable place is the sea for those who make it home.



Sargassum Fish, with Leprous Skin and Dead-tree Excrecences, Mimics Seaweed

Little *Histiogobius histrio*, a rapacious cannibal, attracts victims by jiggling a fleshy lure. It crawls on armlike fins through weeds in the Sargasso Sea. Brownish balls are "grapes" of the sargassum weed.



Parrotfish Teeth, Fused into a Beak, Can Nibble Coral

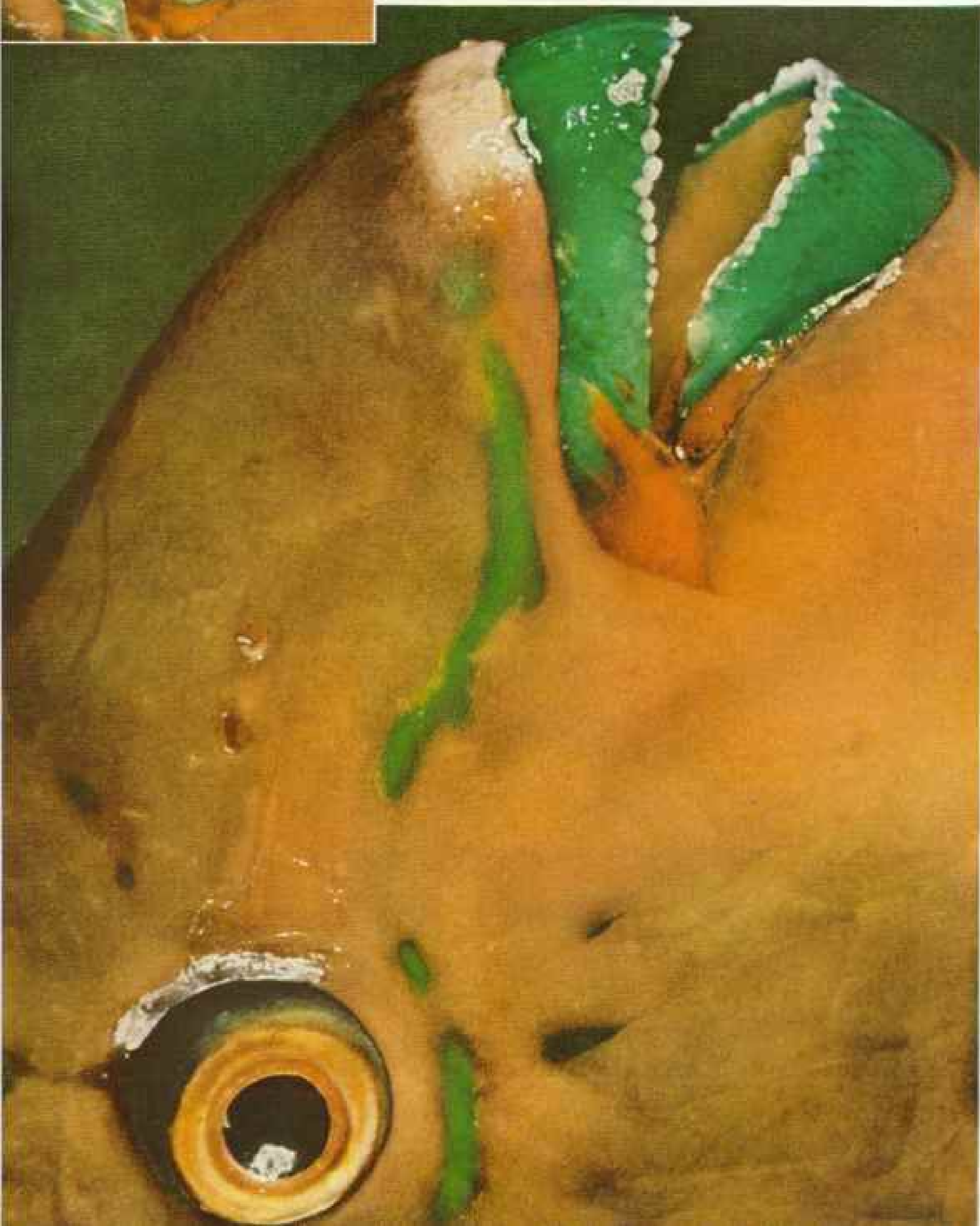
With its sharp dental plates this fish scrapes velvety vegetation from rock and coral or bites off chunks of coral to obtain the fleshy polyps within. A large specimen can easily sever a fishhook.

The parrotfish is one of the few kinds of fishes that masticate food: Aristotle wrote that it "chewed the cud." A grinding mill in its throat readily crushes coral's limestone skeleton.

Numerous species of parrotfishes decorate tropical waters.

↓ Using poisonous tentacles, a sea anemone paralyzes a cardinal fish.

© National Geographic Society (enlarged 3 times)





Baby Eels Fade into Glassy Invisibility

Night-fishing in the Gulf Stream, the author netted coiling masses of gelatinous tissue that were completely invisible in water except for shoe-button eyes. Out of water these transparent ribbons proved to be eel larvae three inches long.

For years biologists gave the generic name *Leptocephalus* to these marine animals, not knowing they were infant eels. Indeed, until the 20th century no one knew where or how eels spawned.

Systematic netting of the ocean's waters finally solved the mystery. Denmark's Johannes Schmidt proved that eel larvae were born southeast of Bermuda in the Sargasso Sea.

Many of these tiny creatures undertake fantastic migrations covering two and a half years and several thousand miles to the streams of Europe. Others move to American rivers in about a year.

The light in this unusual photograph catches blotter-thin leptocephali in a rare moment of faint visibility. Two shadowy backbones and one eye socket on the far side show clearly through glassy tissue.

© National Geographic Society
(enlarged 11 times)



A Pea-size Crab Larva with Staring Blue Eyes Seems to Float Out of a Surrealist's Canvas

Plankton, the sea's floating pastures on which many whales and fishes feed, includes quadrillions of tiny crustaceans like this crab.

(Enlarged 8 times)

415

© Koehnert/Arndt for Getty Images





↑ Atlantic Oval Squid Carry Built-in Neon Signs

When these mollusks are not swimming by jet propulsion, their tentacles dangle limply, fins undulate gently, and color cells pulsate, changing hue as they grow larger and smaller. Specimens are life size.

↓ Orange Marginella Ripples Along Like a Caterpillar

This marine gastropod, a relative of the snails and whelks, seems to take careful aim with a beady eye as it glides across seaweed on rock. Its caterpillarlike shell is about 1¼ inches long.

417

© Robert Quinn by Paul A. Ball





↑ **Banded Shrimp Sprouts Legs
Like a Water Strider's**

Stenopus, one of the most colorful of the shrimps, inhabits shallow waters around the subtropical world. Enormous antennae add tremendously to its 3-inch length. Although slender legs suggest the swiftness of a water strider, the banded shrimp moves slowly.

← Every lover of shellfish is acquainted with *Penaeus*, the common edible shrimp. Magnified four times, its stalked eyes resemble goatshiff knobs.

↓ Contrary to popular impression, life under water is far from quiet. Groans, grunts, rustling, and popping sounds often assault the ears of listening devices aboard ships.

Navy men, straining to hear enemy submarines during World War II, were particularly annoyed by interference from the snapping shrimp, *Crangon*. Disturbed, this crustacean made a popgun sound with its oversized claw. American submarine commanders, however, turned the noisy nuisance into an ally. After delivering attacks, undersea craft scooted to coral reefs to hide amid the sheltering crackle of thousands of snapping shrimp.

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(Natural size top and 4 (millimeters bottom)

418



Lifelike Man Preserved 2,000 Years in Peat

A Danish Bog Yields Remains of a Human Sacrifice That Helps Reconstruct the Life of Europe's Ancient Tribes

By P. V. GLOB

Professor of European Archeology, Aarhus University, Denmark

ALL the world over, traces can be seen of prehistoric times, of the dwellings and the graves of ancient man. But in almost every case it is only through skeletons or scattered bones, sculptures, or other handiwork that we can form our picture of early man. To see our distant ancestors as real human beings, we are forced to rely on our imagination.

But not in Denmark! In this little land exceptional conditions of preservation allow us to see Bronze Age and Iron Age Man, not, of course, living, but in some cases so wonderfully preserved as to appear to be separated from our own era not by the millenniums which in fact have elapsed, but only by a few hours' sleep.

Two large groups of discoveries provide these unique relics: Bronze Age burials from about 3,000 years ago, and peat-bog finds from the Iron Age at about the commencement of our Christian Era.

Some of the bodies found in these peat bogs of Jutland have been preserved to such an astounding degree that they show not the slightest desiccation and lie with rounded limbs as if asleep. In most cases, they are apparently offerings to the Iron Age gods.

Peat Cutters Call the Police

One of the best-preserved and most thoroughly investigated of these bodies from the peat bogs is the one found in May, 1950, in the course of peat cutting in Tollund Mose (Bog) in central Jutland.

I was in the middle of a lecture that day at Aarhus University when I received a telephone call from the police: a body had been found! They had been summoned by the peat cutters, who suspected a connection with a recent unsolved crime.

Since the police had more than once been called out previously to investigate bodies which had lain for centuries under the peat, I saw at once the possibility of a more than usually interesting archeological discovery. I started at once for Tollund Mose, a narrow peat bog among high, steep hills in a wild re-

gion of central Jutland (pages 420 and 427).

In the peat cut, nearly seven feet down, lay a human figure in a crouched position, still half buried. A foot and a shoulder protruded, perfectly preserved but dark brown in color like the surrounding peat, which had dyed the skin. Carefully we removed more peat, and a bowed head came into view.

As dusk fell, we saw in the fading light a man take shape before us. He was curled up, with legs drawn under him and arms bent, resting on his side as if asleep. His eyes were peacefully shut; his brows were furrowed and his mouth showed a slightly irritated quirk as if he were not overpleased by this unexpected disturbance of his rest (pages 421, 426).

That this rest had lasted 2,000 years was clearly shown by the seven feet of peat which had gradually formed above him throughout the centuries.

Murder Mystery—2,000 Years Old

But it was not by his own choice that this ancient man had come to rest here. This was revealed by a rope of two smooth plaited leather thongs which formed a noose around his neck, pulled chokingly tight, with the free end lying like a snake down his back.

Moreover, he was without clothing, save for a cap and a belt. The pointed leather cap on his head was formed of eight pieces of skin, with the fur inside, and had a chin strap; his leather belt was tied in a loop in front.

Clearly this man had been hanged and thereafter deposited in the peat bog. But why? It was unlikely that a mere criminal would have been treated in this way. Besides, the fine features of the Tollund man would, in the view of many, argue against such a theory.

Many questions like this presented themselves as we stood over the dead figure.

But the answers would have to wait. Now it was necessary to act swiftly to prevent the air from destroying this rare relic and to bring it as soon as possible under the care of a skilled conservator.

Careful hands covered the body again with peat, cut free the section on which it lay, and placed it in a wooden case. Thus the body was transported to the National Museum in Copenhagen (København).

Putting Clue and Clue Together

Then began the scientific investigation of this 2,000-year-old murder mystery. Ancient historical documents were searched, and accounts of similar discoveries were hunted up in the files of the museum.

In the last 200 years about 100 such bodies have been discovered in peat bogs within the Northern European cultural area, which in the Iron Age covered Denmark, northwest Germany, and the Netherlands. Most belong to the Early Iron Age, around the beginning of the Christian Era, though some are later, a few dating from the Middle Ages.

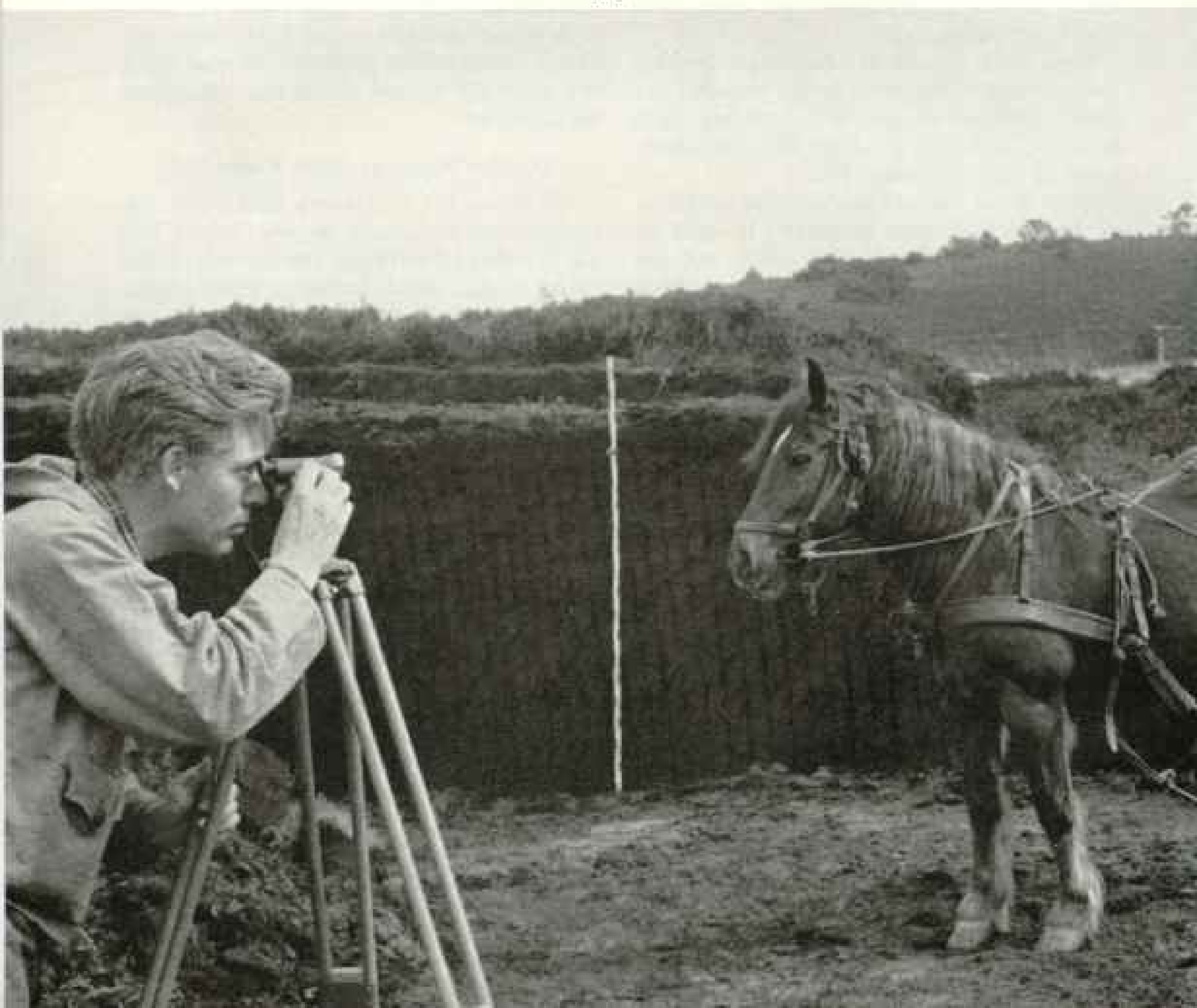
Some of the victims undoubtedly were criminals who had been executed by being tossed into lakes or swamps, a custom men-

tioned by writers of this period. The Roman historian, Tacitus, for example, writing of the German tribes shortly before A. D. 100, tells how their laws allotted different modes of execution to different types of crime:

"Traitors and deserters are hanged on trees; cowards, shirkers, and the unnaturally vicious are drowned in miry swamps under a cover of wattled hurdles. The distinction in the punishment implies that deeds of violence should be paid for in the full glare of publicity, but that deeds of shame should be suppressed."

The bodies found in the peat bogs do not entirely agree with this account, doubtless because the Germanic tribes probably had varying laws and customs. The important point, however, is that the custom of sinking criminals in bogs was definitely known.

Other victims were suicides and witches. To prevent their return to haunt the survivors, each was pinned to the ground with a stake or forked sticks.





These Limes (above and opposite)

↑ Danish Farmers Uncover Ancestors Preserved 2,000 Years in Peat

At the very beginning of the Christian Era, pagans of northern Europe offered human sacrifices to their gods and buried them in bogs, where tannic acid preserved the remains. These peat cutters found one such victim near Grønballe, Jutland (page 430).

← Dr. P. V. Glob, the author, surveys the Tollund Muse, where the Tollund man was discovered in 1950.

↓ Tollund Man Wears His Death's Noose

The braided leather rope indicates he was hanged, perhaps to appease the goddess of fertility (page 425).

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Lennart Larsson



Even royalty, apparently, was not proof against this precaution, for tradition relates that King Abel, who died in 1252, would not lie quietly in Schleswig Cathedral, where he was first buried, because his guilt for the murder of his brother troubled his rest. He was therefore taken out to a bog near Gottorp and there reburied with a stake through his body to keep him from haunting.

But the majority of those found in the peat bogs were doubtless human sacrifices to the gods, and this seemed the likeliest explanation of the fate of Tollund man.

As we sought further light on the mystery, we reviewed many fascinating peat-bog finds covering more than a century and a half.

One thing that these bodies had in common was a lack of grave furnishings, of ornaments or implements. They were scarcely ever found with other objects than their clothing. Their barrenness, in striking contrast to the rich furnishings often found with prehistoric burials, seemed to characterize the bodies in the peat as a special group.

Bodies Dated by Study of Pollen

This absence of handicraft articles long made the bodies difficult to date, but the peat geologists of our day can fix with considerable accuracy the age of anything found in the peat, even when no datable objects accompany them.

The method, known as pollen analysis, is based on a microscopic examination of the layers of peat. In them the pollen of trees and flowers, each type with its own shape and appearance, has been preserved in greater or less abundance, dependent upon the slow changes in northern Europe's climate. Now, too, we are experimenting in dating peat samples by the radiocarbon method developed in the United States.

One of the earliest discoveries we found on record was made in 1797 at Undelev in south Jutland. It was the body of a man, completely preserved even to hair and nails, dressed only in a leather cloak and shoes, lying under three hazel wands. The frightened finders reburied it with all speed.

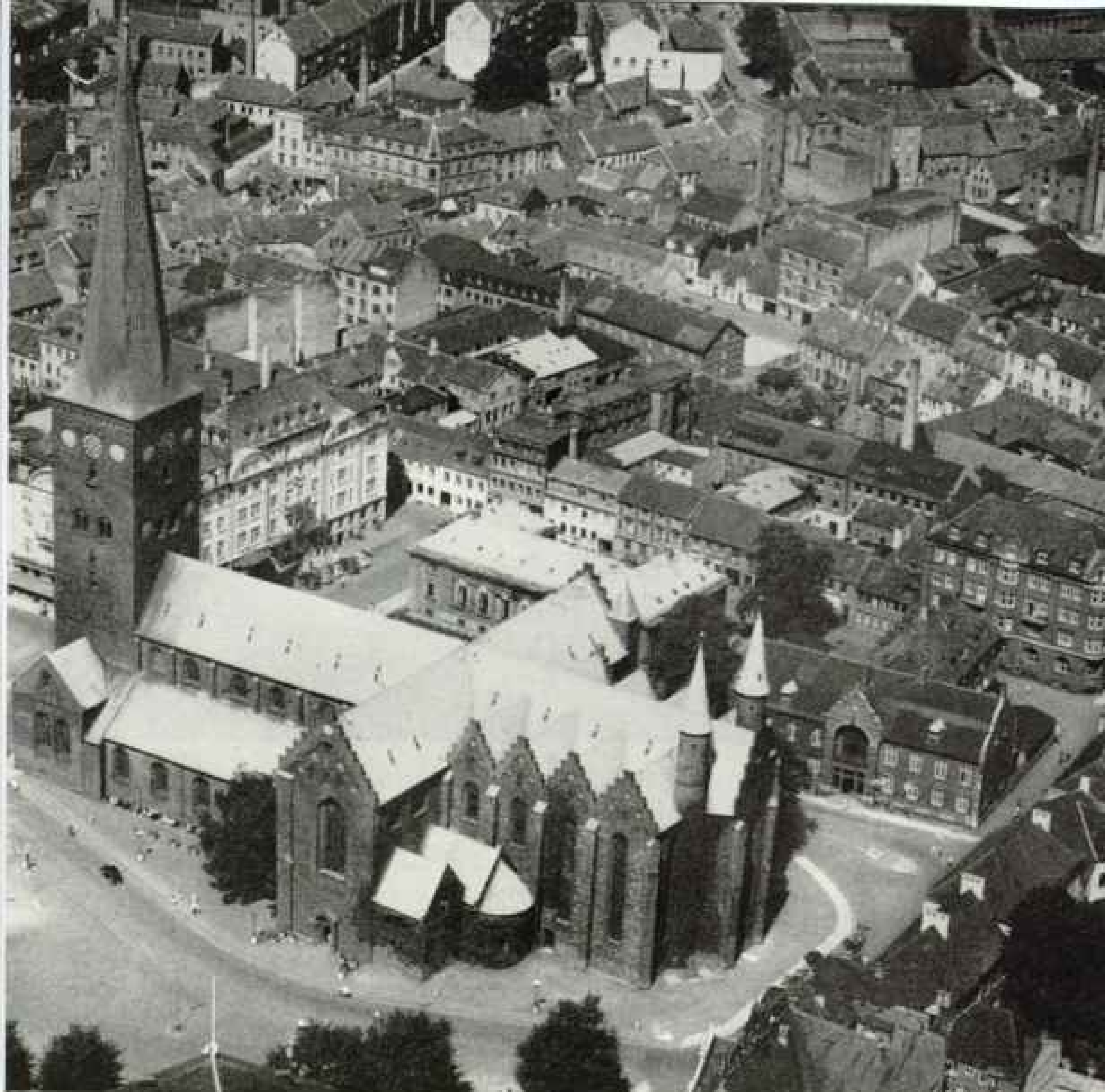
The same fate befell the body of a woman found in 1843 near Korselitse on the island of Falster, but in this case the body was again exhumed shortly after, in accordance with the personal decision of Crown Prince Frederik. The Crown Prince, later King Frederik VII, even then was a keen antiquarian and personally carried out many excellent archeological excavations.



In those earlier days interest was specially aroused by the discovery of the body of a woman in 1835 in Haraldskaer Mose near Vejle. She was clad in a leather jerkin and in woven cloth and was pinned down to the peat by means of forked sticks over knee and elbow as well as by two boughs arched over the body. Undoubtedly they were placed to prevent the dead woman from roaming as a specter.

The early identification of the body as that of Queen Gunhild, the gruesome consort of Erik Bloodaxe, was strongly—and correctly—opposed by the great Danish scientist J. J. A. Worsaae, one of the founders of scientific archeology.

Remarkable features of the men's bodies are the shortage of clothing, which often con-



Medieval St. Clemens Cathedral Is the Heart of Aarhus, Denmark's Second City

Founded in the 10th century, Aarhus ranks next to Copenhagen as a port and population center (116,000 inhabitants). Cultural attractions include Old Town, an open-air museum that preserves homes and furnishings from the Middle Ages, and Prehistoric Museum, which Dr. Glob directs. The Cathedral dates from 1104.

sists only of a leather cape or even less; the noose around the neck; and, frequently, a stick lying beside the body.

A discovery made in 1946 in Borremose in Himmerland has all three of these features. It had an important bearing upon our search for an explanation of the death of Tollund man.

Here, at a depth of 6½ feet in the peat, was found the well-preserved body of a man sitting cross-legged in a crumpled posture. The body was complete, even the skin and muscular structure being preserved.

Around the dead man's neck was a noose

formed of three cords twisted together, the ends being knotted and cut short. Moreover, the skull had been crushed from the rear and the right leg broken a little above the knee. It would appear that these injuries were violently inflicted either before or during the laying of the body in the bog.

The man was without clothing, though a small scrap of cloth was found under the head and two crumpled pieces of leather under the feet. Over him lay a 55-inch birch stick.

In the same bog in 1948 peat cutters found the body of a woman, quite fat and thickset. The body lay face downward, and the head



Weapons in a Peat Bog Tell of Wars Remembered Only in the Legends of *Beowulf*

During the fourth century Jutland suffered repeated attacks by invading Danes. In repelling them, native Jutes captured many weapons. These they destroyed and deposited in bogs as offerings to the gods of battle. When the Danes finally prevailed, the Jutes swarmed west with Angles and Saxons to invade England. These broken blades are topped by white firestone, or flint, the Dark Age match. A matchbox suggests scale.

had been crushed before the woman was deposited in the bog. She was clothed in a long woven skirt that extended up under the arms with a strap over the right shoulder.

It may be that these two persons lived their lives in the fortress which has been excavated since 1935 on a little island in the same peat bog. This fortress was established some two centuries before Christ. Surrounded by a rampart and a ditch and strengthened by palisades, it formed a place of refuge for the people of the surrounding countryside in time of danger.

By the first century B. C. a whole township had arisen on the island, with 28 farmsteads lying along a paved village street. A farmstead consisted of a long house with living quarters at one end, while the cattle were housed at the other—the usual type of dwelling in Jutland at the time to which the peat-bog bodies belonged.

The Honor of Being Hanged

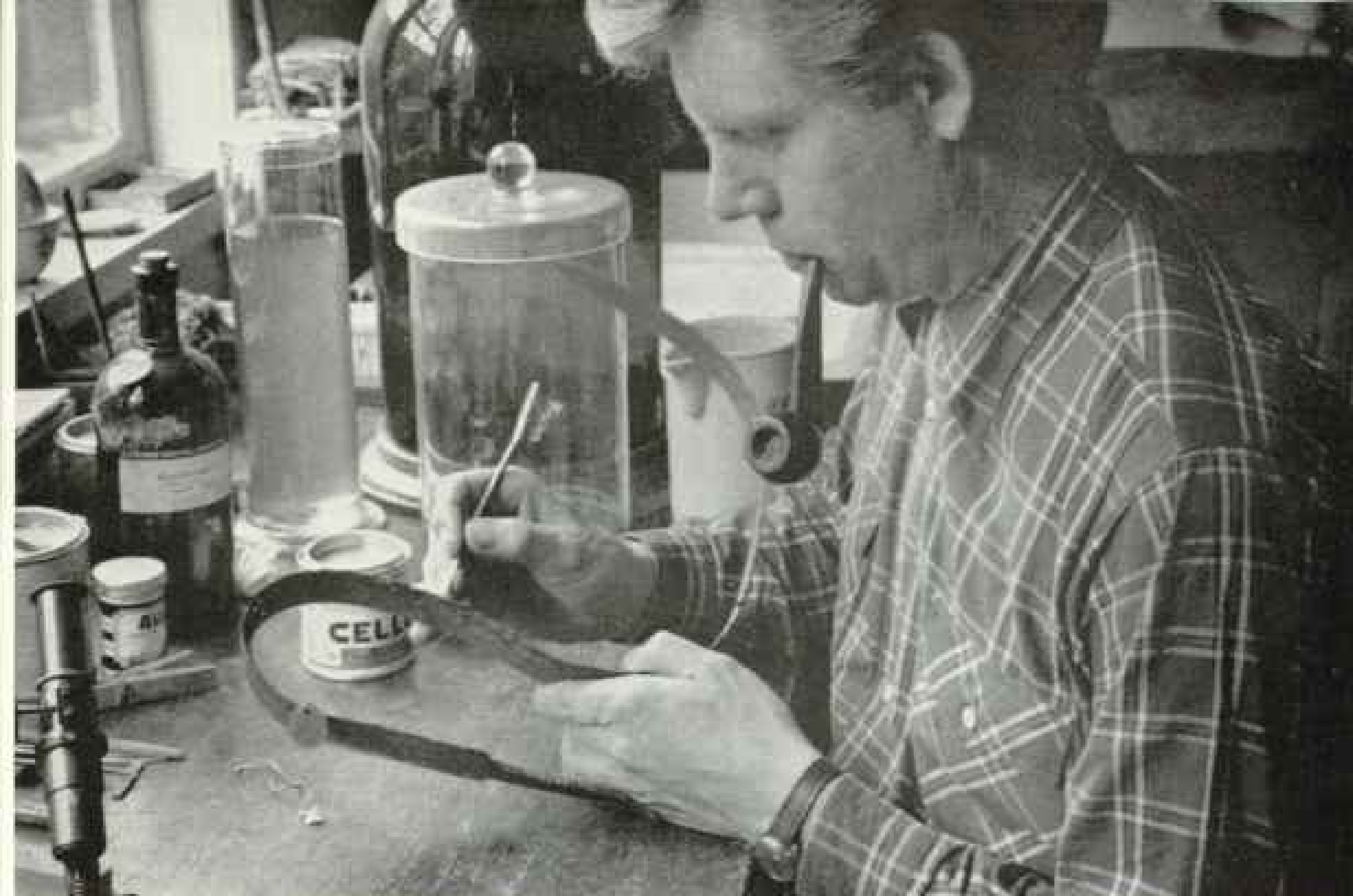
The fact that both Tollund and Borremose man had been hanged might seem at first glance to indicate that they had been criminals. However, it is unlikely that hanging

was considered by the ancient Nordic people to be a dishonorable form of punishment, for at a later period, and up to the introduction of Christianity, hanging was connected with offerings to the gods.

Hanged men belonged to Odin, one of the chief gods in the closing period of heathendom, the wise and cunning one-eyed god who demanded his offering of hanged men and would not be cheated.

Thus an old tale relates that Odin once demanded as payment for his aid the lives of King Vikar and some of his best warriors. Vikar's people were sorely grieved and unwilling, but Odin persuaded the king's own foster brother, Starkad, to attempt a stratagem. He placed a noose around the neck of the king and thrust at him with a reed, saying, "I now give you to Odin." In the same instant a bough to which the noose was attached sprang upward, strangling the king, while the reed changed into a spear, Odin's weapon, and pierced his body.

Here we have a description of hanging as an offering to the gods, but at the same time a remarkable account of a reed transformed into the spear of the god. This perhaps finds



This Sword, Twisted Like Wire, Was Buried 1,500 Years Near Illerup, Denmark

Working from a knowledge of Denmark's climatic changes, archeologists date finds in peat bogs by pollen analysis. After the last Ice Age, arctic birch was replaced by pine, pine by oak, and oak by beech. Thus the age of a peat layer and the objects found in it may be determined by the dominant tree pollen. Here the author examines a sword excavated with a hoard of other weapons sufficient to have equipped an army.

a parallel in the sticks which in so many cases are laid upon the bodies of the hanged men from the bogs. The stick may well have symbolized the spear.

The absence of clothing on most of the men seemed, too, to have significance. It is unlikely that the Germanic tribes normally went about in such scanty garb, particularly at this time when the climate was cold and damp, the period in which trousers are first discovered in western Europe.

Festivals Appeased Fertility Gods

Remarkable in many respects was the case of the Borremose man. His fine narrow hands gave the impression of never having been used to heavy work. Significant, too, was the hanging rope, which was cut short and knotted at the ends so that the twisted strands resemble the metal collars, the torques, of the period. Such torques have been found, offered to the gods, in more than a hundred cases.

Such odd details in connection with bodies, particularly those from Tollund and Borremose, indicate that these were no ordinary criminals but sacrifices to the gods. But to

which gods? And why were they sacrificed? We can never hope to obtain a definite reply, but an explanation can be offered.

The men from Tollund and Borremose lived at a time in the Iron Age when fertility cults were of great importance and when the goddess of fertility was worshiped as the principal deity. It is possible that the two men were sacrificed to her and deposited in the bogs in connection with the main fertility festivals in the spring which were designed to ensure the forthcoming harvest. Fertility festivals survive to this day in hamlets of Europe in the form of Shrovetide revels and "beating the bounds"—a ceremonial procession around the boundaries, when young people are ritually whipped.

Tacitus tells us of these Iron Age peoples and the Scandinavian fertility goddess:

"[These people] are distinguished by a common worship of Nerthus, or Mother Earth. They believe that she interests herself in human affairs and rides among their peoples. In an island of Ocean stands a sacred grove, and in the grove stands a car, draped with cloths . . . [in which rides the goddess]. . . .

"Then follow days of rejoicing and merry-



Tollund Man's Face Reflects Serenity, as if He Were Asleep

Time has been extraordinarily kind to the peat-bog burials. Egyptian mummies appear dried and shrunken; Peruvian mummies rarely retain facial expressions. Many ancient Roman busts lack the vitality shown by Tollund man. His face appears to be the finest preserved through the ages.

Two thousand years have passed since care put the wrinkles on Tollund man's brow and laughter drew the crow's-feet about his eyes; yet they can still be seen. Even the bristles of his beard and the pores of his skin are clearly discernible.

The pointed cap was fashioned from eight pieces of skin, with the fur inside, and held on by a chin strap.

▼ Tollund man met death wearing only this peaked cap, hangman's rope, and leather belt. Freed from his peat tomb, he here lies ready for scientific study. Archeologists are preserving only the head, although the feet appear to have endured the ages almost as well.

Photograph by Lemart Larsson





Danes Cut Peat from the Centuries-old Bog Where Tollund Man Came to Light

Here peat cutters found Tollund man buried seven feet deep. Thinking him the victim of a recent crime, they called in police. The author solved the mystery by identifying the body as that of a sacrifice to pre-Christian gods. Peat deposits in Denmark cover some 200 square miles. To reclaim land for cultivation, workers cut out the peat, drain the bog, and restore the topsoil. These freshly cut blocks await removal from the bank.



Danes Get a Glimpse of Prehistory at a Public Showing of Gravballe Man

After this exhibition in Aarhus the body was withdrawn to be tanned for permanent preservation (page 430). Recently a 30-year-old Iron Age man and a teen-age girl turned up together in a bog near Schleswig, Germany. Her shaved head indicated they had been executed for violating marriage laws.

Opposite, bottom: G. Lange-Kornbak of the Prehistoric Museum arranges Gravballe man's hair. He found the throat cut by knife or noose, evidently to placate the Nordic gods.

making in every place that she honors with her advent and stay. No one goes to war, no one takes up arms; every object of iron is locked away. . . .

"After that the car, the cloths, and, believe it if you will, the goddess herself, are washed clean in a secluded lake. This service is performed by slaves who are immediately afterwards drowned in the lake."

This description undoubtedly gives a picture of the spring festivals, and it is significant that the ceremonies included human sacrifices in the lakes. Many of the bodies described above were deposited in lakes and sometimes held down with forked branches. Later these lakes became overgrown and turned into peat bogs.

Worship of this goddess commenced in Denmark in the middle of the first millennium B. C. We possess representations of her, from this very period, the end of the Bronze Age, in a number of small bronze statuettes which represent her in the same form as all fertility goddesses from all periods the world over—a naked woman with exaggerated femininity, the universal picture of the life-giving "Mother Earth." And all these

small goddesses wear around their necks a twisted double torque. These torques resemble to a convincing degree the nooses that lie around the necks of the Tollund and Borremose men.

When one looks upon the face of Tollund man, wonderfully preserved for 2,000 years, one cannot see in his expression that of a criminal, tortured and hanged for some brutal crime. It is rather the face of a man who in supernal exaltation took the noose around his neck knowing that he went to his great goddess, to Nerthus and her fair handmaidens, and that by his death he ensured the life of his people for the coming year.

Autopsy Reveals Tollund Man's Food

An investigation of the stomach contents of the Tollund find throws an interesting side-light on the question of the food eaten by prehistoric man. This autopsy established that the man had eaten no animal food in the period before his death, but only a porridge made of grain seeds and various plants.

The porridge had consisted chiefly of barley, linseed, gold-of-pleasure, and persicaria—all cultivated plants. But it contained also

Grayballe Man Gets His First Medical Test in 20 Centuries

Stained by peat, this body was discovered in May, 1952. Since that time scientists have X-rayed him, probed his teeth, and examined his stomach contents. They hope to determine the precise date of his death by measuring radioactive carbon in the liver.

◆ Grayballe man's hand gave police possibly their oldest set of fingerprints. They proved as clear as any taken from a living person. Fingernails are still intact.

Chris. Christiansen (right), P. V. Gled (center), and Leimart Larsen

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a considerable number of wild plants, such as sorrel, white goosefoot, charlock, shepherd's-purse, heartsease, and many others. We see that the seeds of wild plants and weeds formed an important contribution to the food stocks of ancient man.

Thus in many ways Tollund man brings us face to face with the past. His handsome and fantastically well-preserved countenance makes a stronger and more convincing impression on us than the work of the most inspired sculptor could achieve.

New finds are still being made. A striking recent discovery of an exceptionally well-preserved man occurred in May, 1952, in Nebelgaard bog near Gravballe, central Jutland. He was naked and his throat had been cut. At our Prehistoric Museum in Aarhus scientists have worked on him ever since (page 429). The police have even taken his fingerprints!

Tanners Help Preserve Gravballe Man

By the radiocarbon method the well-preserved liver will provide an accurate determination of the date of death. Until this test is applied, only an approximate age (about 2,000 years) can be given the body.

Most of the bodies found to date have disintegrated in the course of excavation or soon after. Only the head of Tollund man, for example, could be preserved for posterity. In the case of the Gravballe man, the Prehistoric Museum is working on a way to achieve total conservation by various tanning techniques.

By this method, the natural process that commenced in the bog 2,000 years ago and preserved the man up to our day will be carried to its logical conclusion. The project was undertaken with the advice and lively interest of the Danish Guild of Tanners. The museum shortly will be able to exhibit a perfectly preserved prehistoric man (page 428).

A thousand years older than these bodies are the large mounds of the Bronze Age, fifty thousand of which lie scattered over the 16,576 square miles of Denmark. In these grave mounds lie the chieftains of the Bronze Age and their families, buried in coffins of hollowed oak trees and clad, not as elsewhere in the world, in special grave clothes, but in the everyday clothing they wore during life.

In Jutland, in cases where an iron-oxide formation, "hardpan," formed around the coffin soon after burial and hermetically sealed its contents, the hollowed oak trunk still survives in its original rounded form and preserves within its walls the woven clothing, the hair, the skin, even the eyebrows of the dead. When the lid is lifted, the thin layer of skin that remains still shows the expression of the face.

One of the most recent of the oak coffins to be discovered (in February, 1921) was that from Egtved near Kolding in southeast Jutland. There, lying at full length on her back, was a young woman with fair hair of page-boy cut, dressed in a short-sleeved jumper and a skirt of knee-length tassels.

A braided hair ribbon lay behind her head, and around her waist she wore a belt with an ornamental disk, decorated with spiral patterns. She had a comb of horn, and on her wrists were two beautiful bronze bracelets. In front of her face a little box, of linden raffia, contained a leather pricker and a spare hair ribbon. By her feet stood a birch-bark jug which had contained cranberry wine, made bitter with bog myrtle and sweetened with honey—a drink to refresh the dead girl on her way to the realms of the departed.

Child Buried with Woman

At her left side lay a bundle of cloth wrapped around the burnt bones of a child 7 or 8 years old—perhaps her own child who thus shared its mother's grave, or mayhap a little maidservant, accompanying her mistress on her last journey.

For a short while after the coffin was opened, the outlines of the face could still be seen, the face of a beautiful young woman with long eyelashes, who had lived and died more than 3,000 years ago. In the coffin, by the side of the woman, lay a yarrow flower, used from time immemorial to stop the flow of blood; it shows that the burial took place on a summer's day.

Half a score of similar discoveries, of men, women, and children, have been made in Jutland, and they give us some of the earliest examples of clothing in all the world as well as a glimpse of those ancient people themselves.

INDEX FOR JULY-DECEMBER, 1953. VOLUME READY

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The Society's notable expeditions have pushed back the historic horizons of the southwestern United States to a period nearly eight centuries before Columbus. By dating the ruins of vast communal dwellings in that region, *The Society's* researches solved secrets that had puzzled historians for 200 years.

In Mexico, *The Society* and the Smithsonian Institution, January 15, 1939, discovered the oldest dated work of man in the Americas. This stone is engraved, in Mayan characters, November 4, 291 a. c. (Spanish Conquest). It antedates by 200 years anything else dated in America, and reveals a great center of early American culture, previously unknown.

On November 11, 1935, the stratosphere flight of the world's largest balloon, *Explorer II*, sponsored by *The Society* and the

U. S. Army Air Corps, reached a world-record altitude of 72,395 feet. Capts. Albert W. Stevens and Orvil A. Anderson took aloft 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* and Palomar Observatory of the California Institute of Technology. This project will photograph the vast reaches of space and provide for observations all over the world the most extensive sky atlas yet made.

In 1945 *The Society* sent seven expeditions to study the sun's eclipse on a 5,325-mile arc from Burma to the Aleutians.

A Greek cargo ship sunk in the Mediterranean 2,200 years ago was found and investigated in 1952-53 by the National Geographic Society-Calyxus Marine Archeological Expedition led by Capt. J.-Y. Cousteau of the French Navy.

The National Geographic Society and the Royal Ontario Museum in 1951 explored and measured newly found Chubb meteor crater, 11,500 feet in diameter, in northern Quebec.

The Society and individual members contributed \$100,000 to help preserve for the American people the finest of California's sequoias, the Giant Forest in Sequoia National Park.

One of the world's largest icebergs 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 in 1938.

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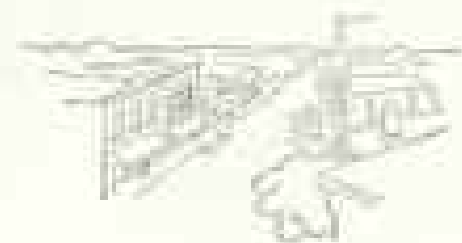
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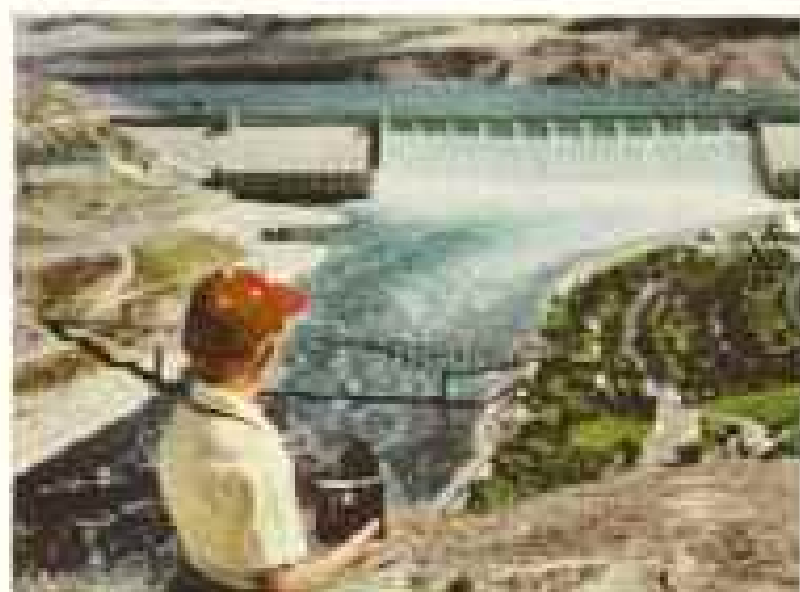


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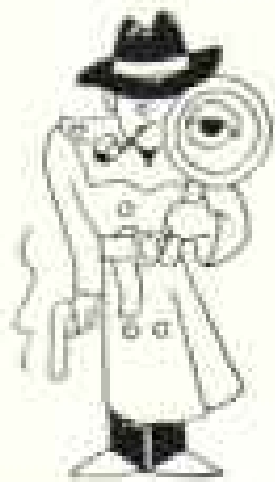


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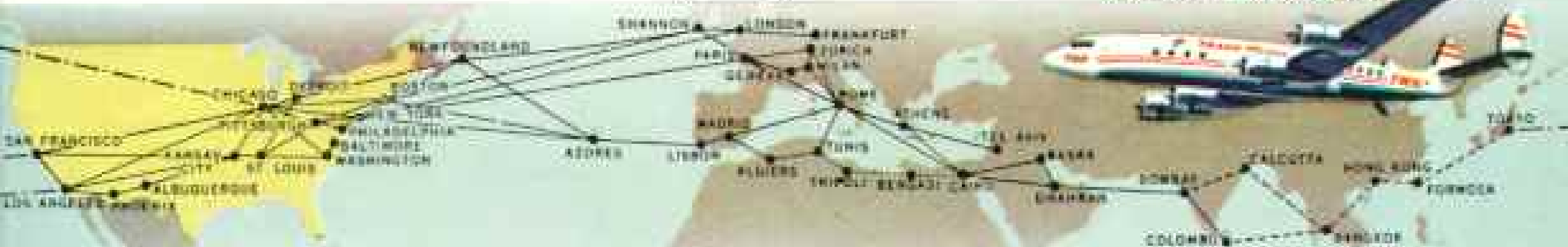
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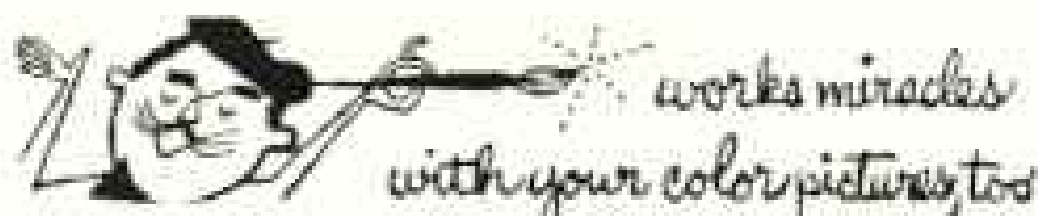
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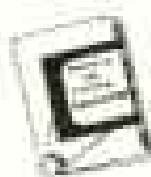
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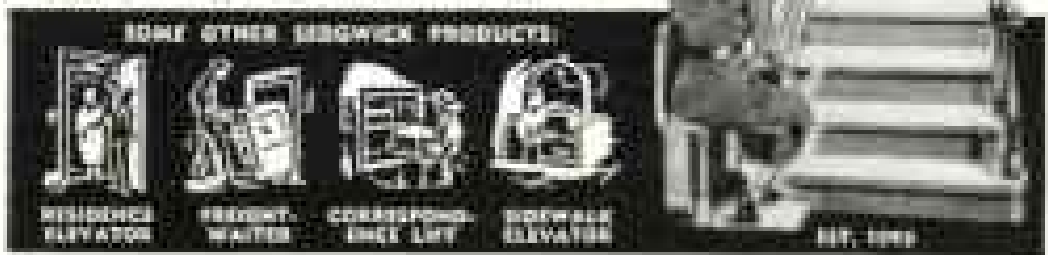
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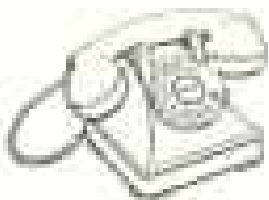


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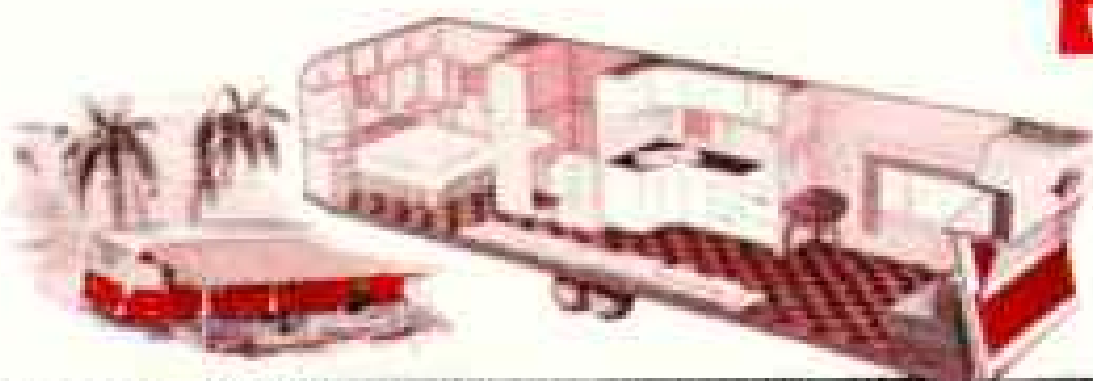
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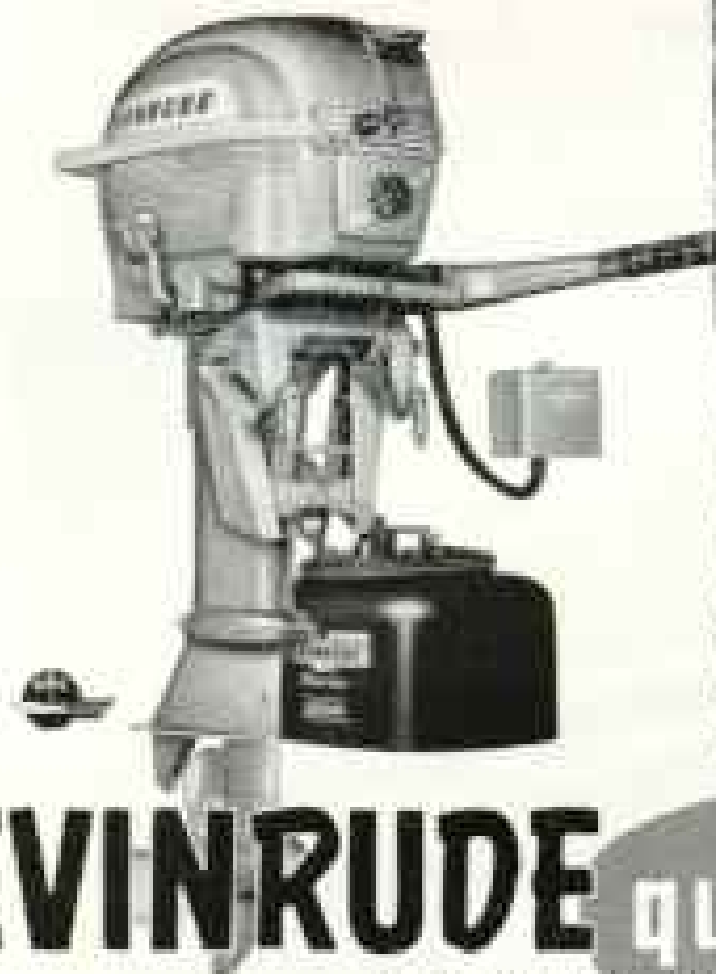
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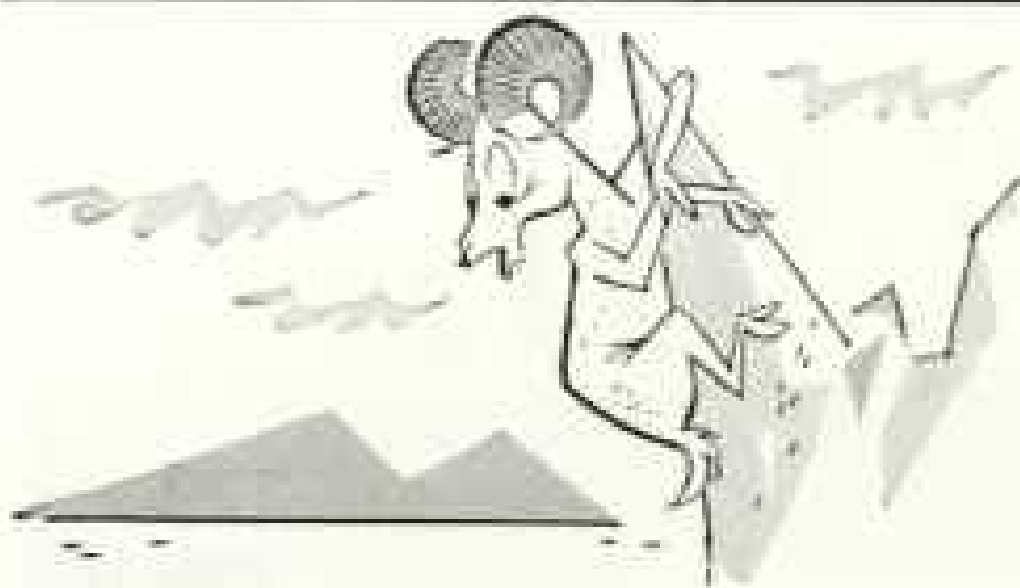
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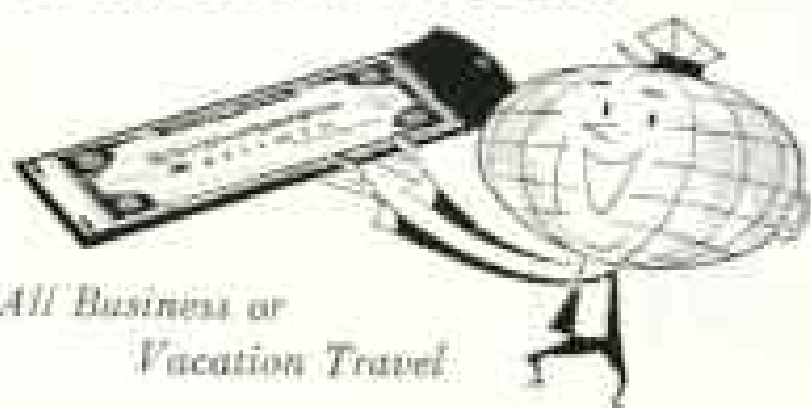
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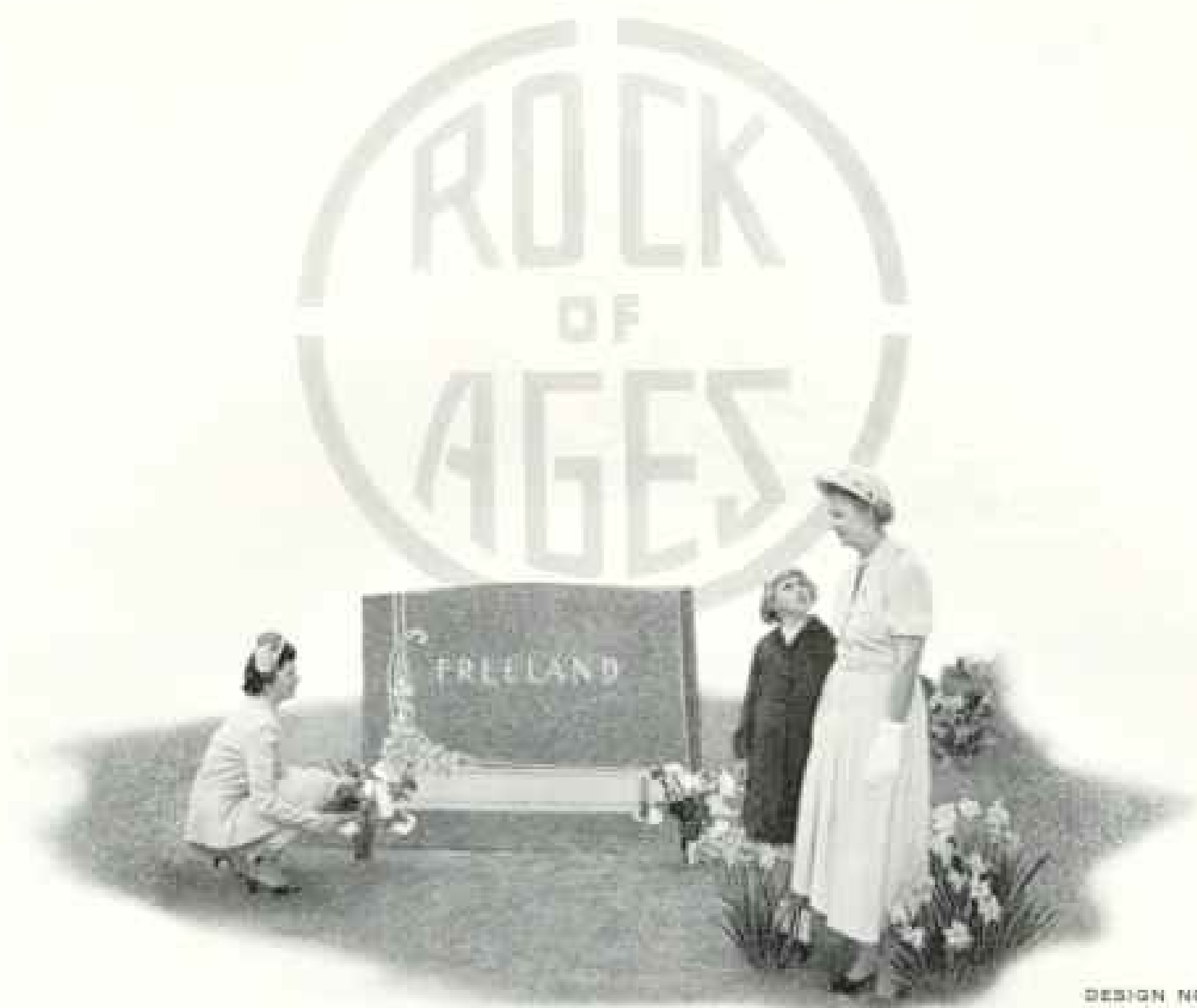
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The Passion flower

ITS LEGENDARY SYMBOLISM:

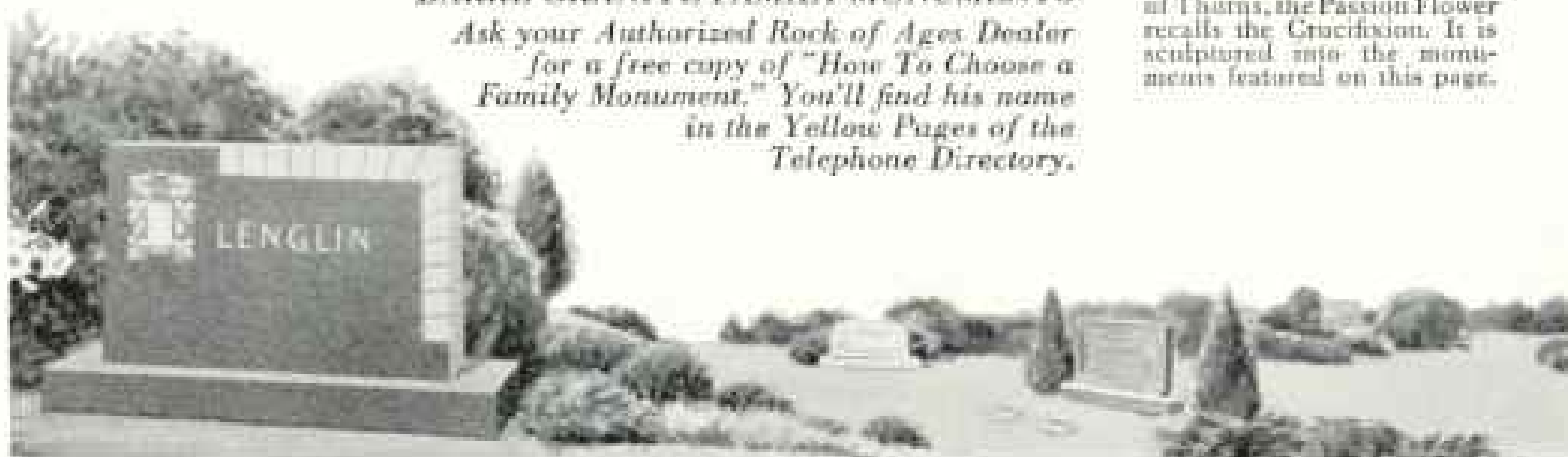
With its five stamens representing Christ's wounds on the Cross, and its center circle resembling the Crown of Thorns, the Passion Flower recalls the Crucifixion. It is sculptured into the monuments featured on this page.

ROCK of AGES

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Your HEART never takes a "holiday"

Think for a moment of the work of your heart. In one hour it beats well over 4,000 times and pumps over 200 gallons of blood throughout the body. On and on it works for you . . . with only a fraction of a second's rest between beats. In fact, the heart is one of the hardest-working organs in the body.

Since the heart can never take a "holiday," it is wise for everyone . . . especially those who have reached middle age . . . to observe certain rules of living that may help the heart by lightening its load.

1. Keep your weight down. As we grow older, the heart finds it harder to do the extra work which excess weight places on it. While a normal heart is handicapped by obesity, the burden of excess pounds may be a particularly serious hazard for the heart that is impaired.

2. Make moderation the keynote of your daily living. When you rest, so does your heart. This is why sufficient sleep every night and plenty of relaxation are so important. You may help spare your heart possible strain if you avoid all excesses such as too much work under tension or strenuous exercise taken in "spurts."

3. Have all heart symptoms promptly investigated. Such symptoms as pain or a feeling of oppression in the chest, shortness of breath, rapid or irregular heartbeat cause untold worry and anxiety. While these symptoms may indicate heart trouble, they frequently are due to other causes and may be of little importance. Under any circumstances it is wise to have such symptoms promptly checked by your doctor.

4. Do not neglect periodic medical examinations. Regular check-ups often reveal heart disorders in their earliest stages when the chances for control . . . and perhaps cure . . . are best. It is wise to have complete examinations yearly . . . or as often as the doctor recommends.

Although heart disease is a major health problem, important gains are being made against it. Methods of diagnosis have become more exact and means of controlling many heart conditions increasingly effective. As a result, more and more heart patients today can lead happy, useful lives . . . and frequently enjoy their full span of years.

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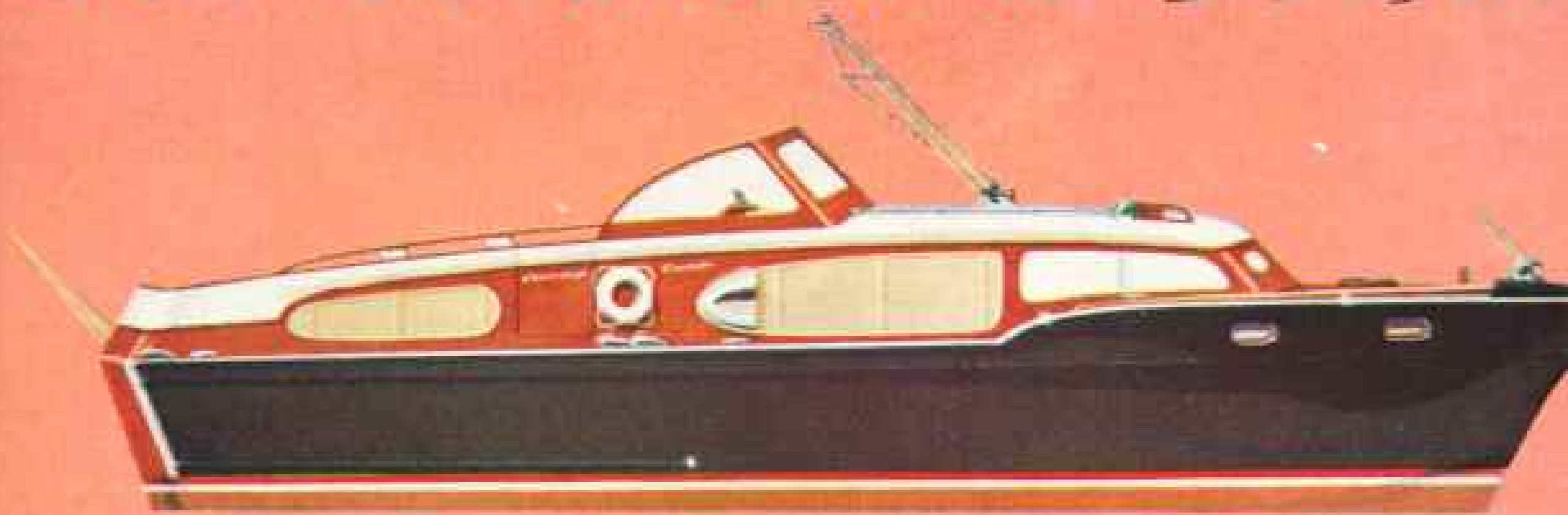
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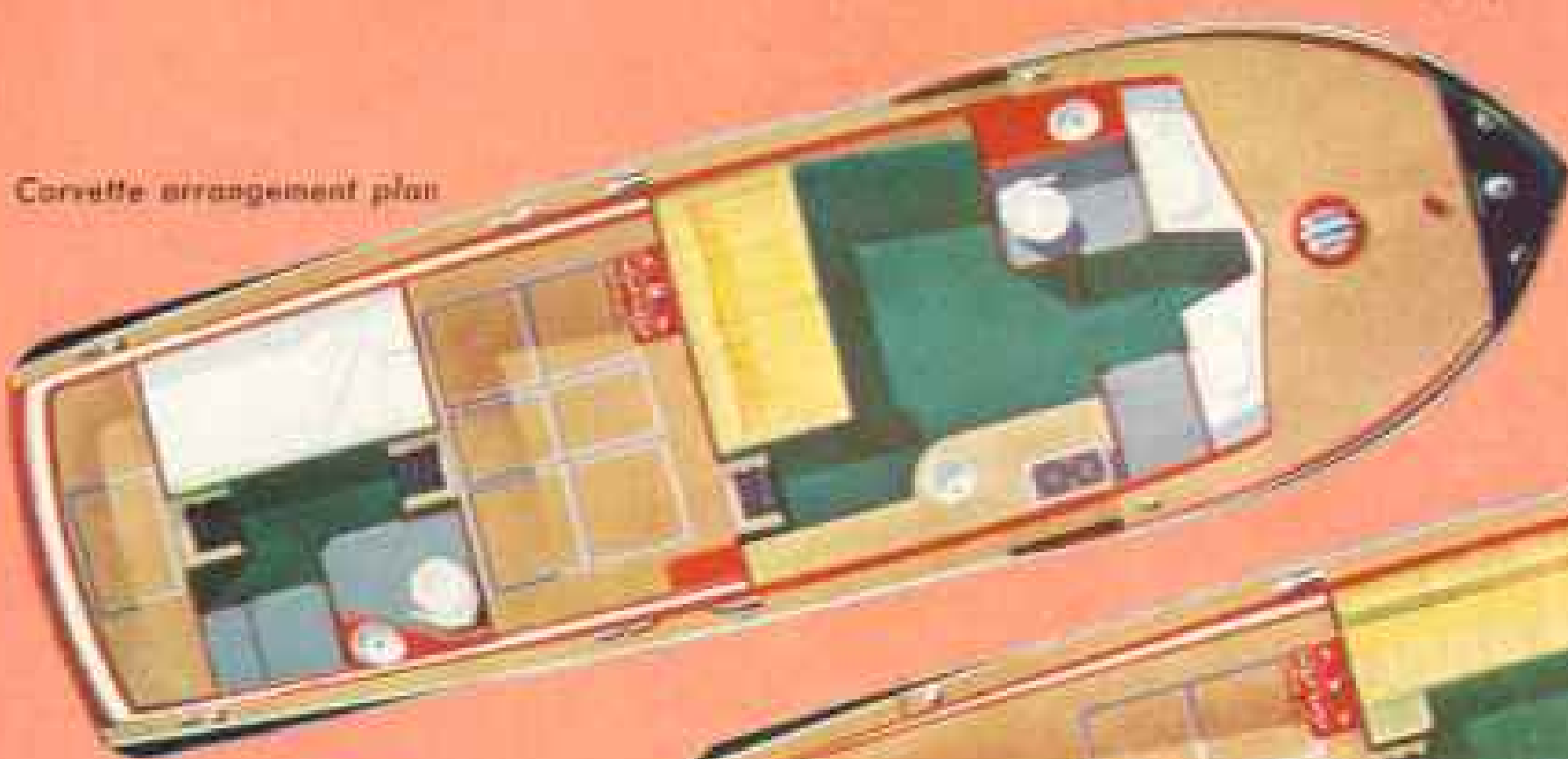
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Corvette arrangement plan

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Commander arrangement plan

NEW Commander has selection of interior arrangements in either a six-sleeper (right) or a four-sleeper (with same forward cabin as Corvette, above). Broad one-level cockpit; hard top with side and aft curtains over bridge; chair-height picture windows; exceptional comfort. See a friendly Chris-Craft Dealer today! Buy now!



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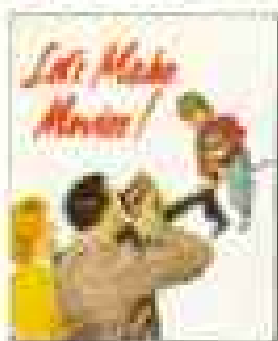


Cine-Kodak Royal Magazine Camera,
16mm. (left), $f/1.9$ lens, \$179.95. The
"Magazine 3," \$110. Cine-Kodak
Bellant Camera 8mm. (center). With
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Brownie Movie Camera, 8mm. (right),
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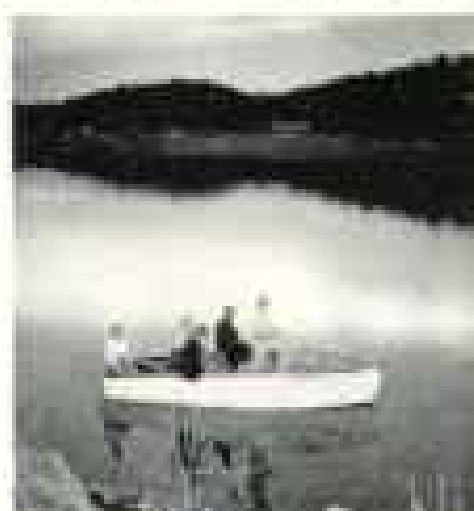
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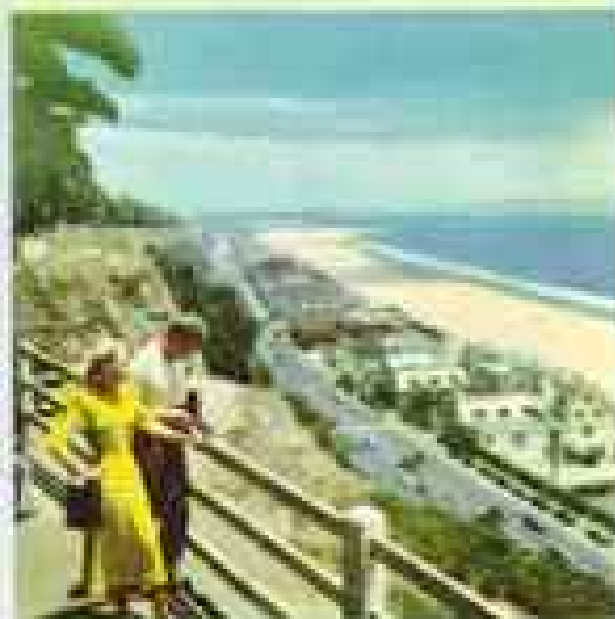
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