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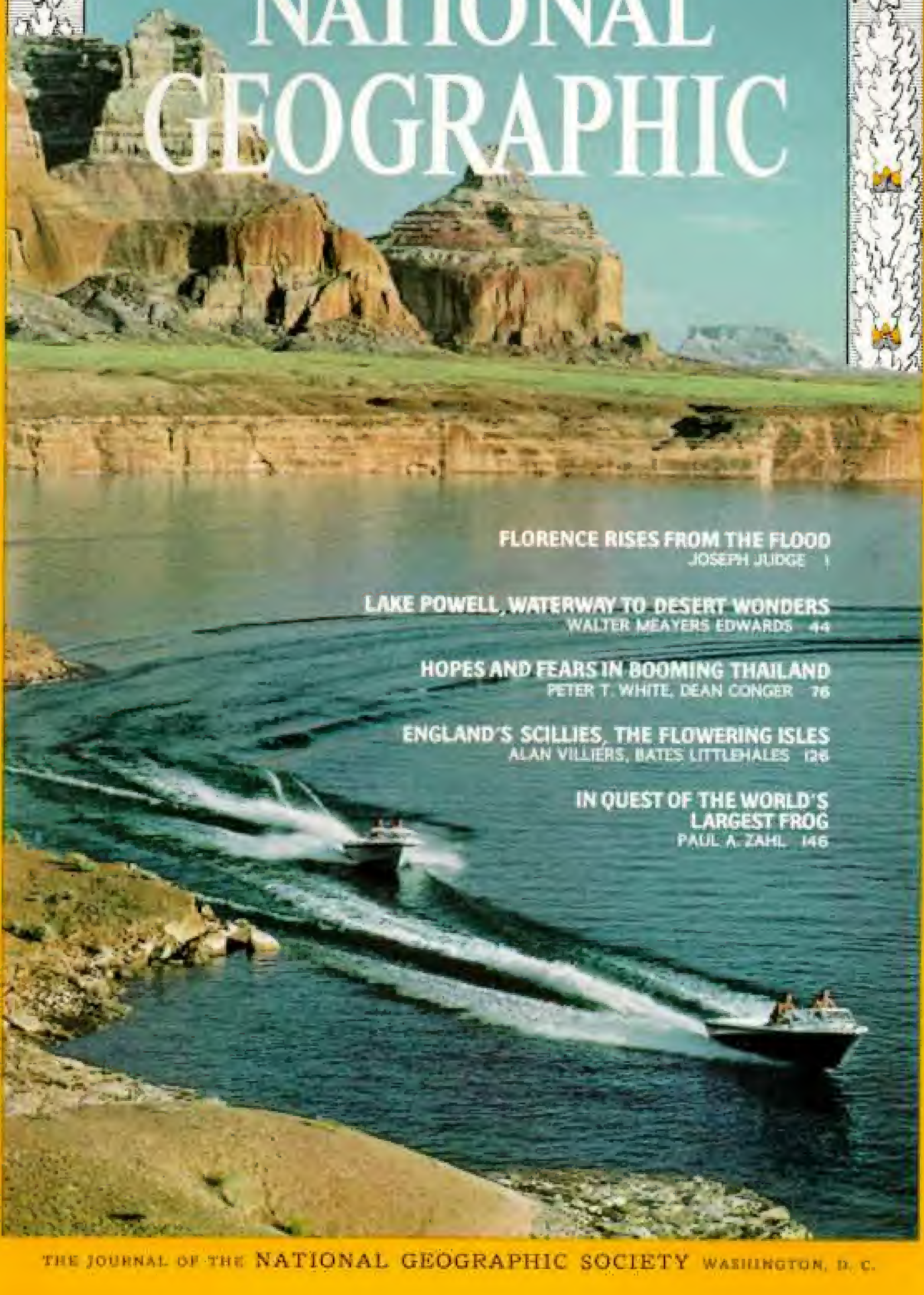
NATIONAL GEOGRAPHIC



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

NATIONAL GEOGRAPHIC SOCIETY

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COVER: Jet boats furrow Lake Powell in the new Glen Canyon National Recreation Area (pages 32-3).

NATIONAL GEOGRAPHIC MAGAZINE

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But people began using up the land on the Island, leaving less and less food and shelter for birds. The door to migration was closing. That's when the Doctor and his friends started moving the earth. People and organizations got together, bought the necessary land, hired earth-moving equipment, scooped out stagnant swamp-beds, changed them to fresh-water lakes by sinking artesian wells. They planted bird food, cleared underbrush, tested soil, grew shrubs and flowers, brought in pheasants, quail, minnows, crawfish, crickets, earthworms, and even bees for pollination. They traded the scooped-out soil as full payment for the excavating. Any trees that had to be cut were sold for lumber. Now the birds are thriving, and the people have a beautiful park. Next time you hear a bird sing, it could be through the courtesy of Dr. Caillard and his friends. Listen carefully and you'll get this message: the wise use of nature's gifts ...animal, vegetable or mineral ... is the responsibility of every American. Each one of us can help, probably more than you suspect.

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The Dauphin Island Sanctuary represents the work of the Alabama Ornithological Society, the Audubon Society, Bellingrath Gardens, Dauphin Island Park and Beach Board, 4-H Club, The Mobile County Commission, Mobile County Wildlife and Conservation Assn., Mobile Garden Club, State Department of Conservation and many public-spirited individuals.

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Discover America by car—it's worth seeing and saving

News becomes history: the miracle of Florence

WHEN THE NORMALLY peaceful Arno River rampaged through Florence last fall, endangering many of mankind's greatest treasures of art and learning, the GEOGRAPHIC sent a skilled team to record and evaluate the tragedy. Staff writer Joseph Judge (left) searched out eyewitnesses and heroes of the miracle of recovery. Assistant illustrations editor Thomas R. Smith (center) selected the cream of 3,500 photographs; staff artist Robert W. Nicholson (right) made a graphic map-painting. Result: the 43-page presentation that leads this issue.

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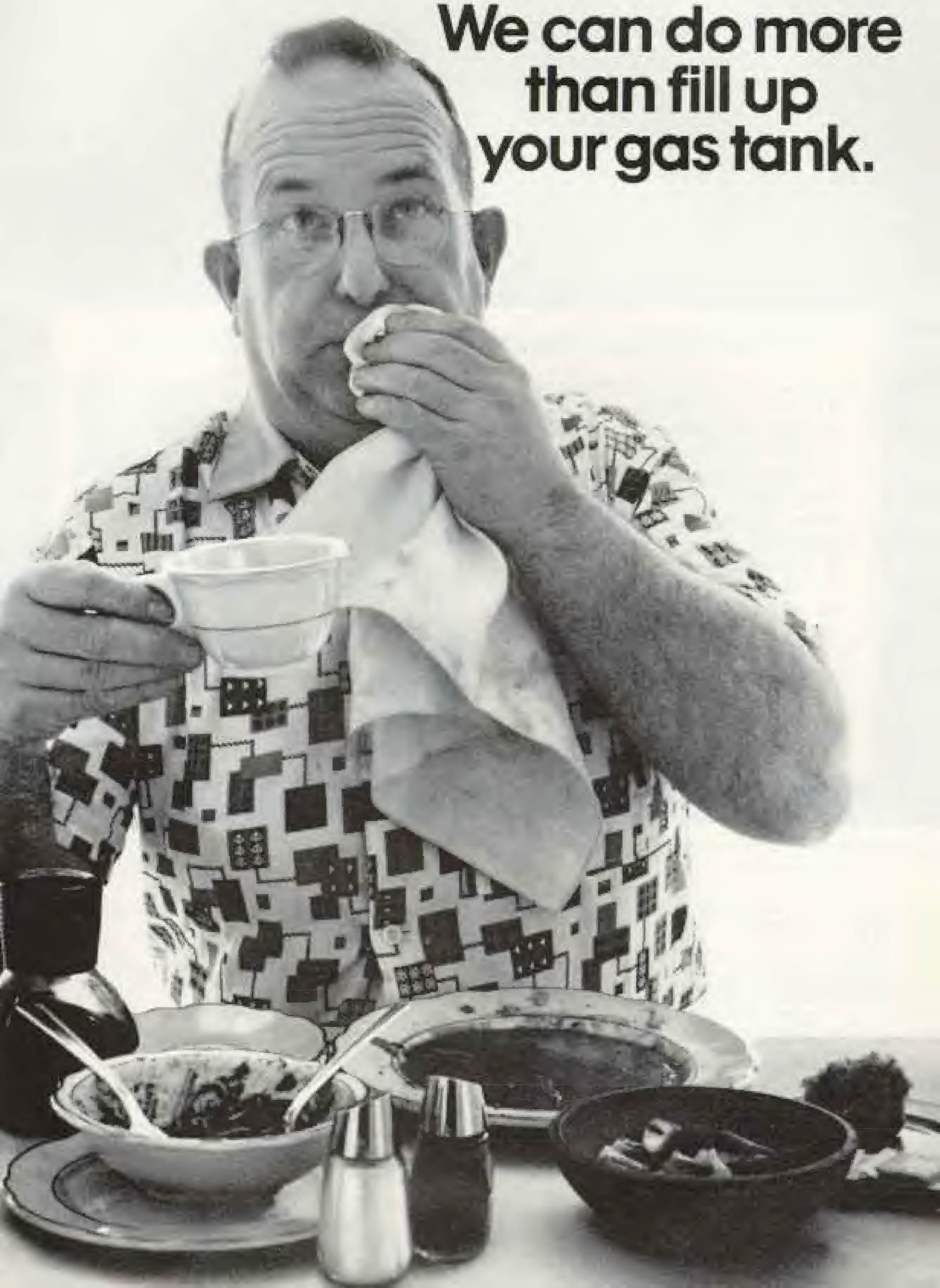

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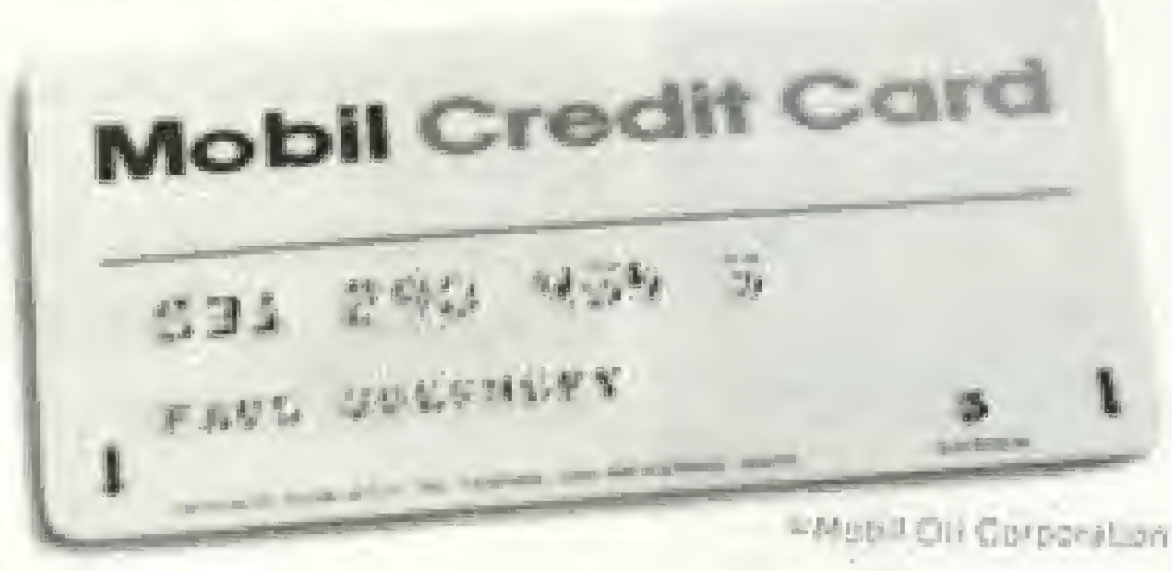

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July
1967

NATIONAL
GEOGRAPHIC

Florence Rises From the Flood

By JOSEPH JUDGE

National Geographic Senior Staff

BUT FOR THE BOOMING of heavy rain upon its high roof, the Church of Ognissanti breathed the hush of its centuries that morning—the murmur of matins, the fragile tinkling of altar bells, the dance of candlelight in the cloud-darkened nave.

Suddenly a cry of alarm exploded in the quiet: "*L'Arno è fuori!*—The Arno is out!"

The frightened band of Franciscans—17 priests and brothers—rushed to the front doors. It was 7 a.m. on November 4, 1966, and the agony of Florence had begun.

Across an elegant piazza, angry breakers of foam lashed the concrete wall along the Arno's northern bank. The river had already broken through farther upstream, and a swift brown tide streaked with sediment and oil was rushing toward the priests down Borgo Ognissanti (foldout map-painting, page 10).

Quickly they bolted the heavy wooden doors of the church with a stout iron bar and began carrying pews and confessionals to the broad marble step before the high altar.

While they worked, the Arno swelled over the embankment; the waters pounded against the church doors. The old wood groaned against the grip of the iron. Then, with a crack like a rifle shot, the bar snapped.

"It was as though a huge and angry giant had smashed his way in," Father Costantino, Guardian of Ognissanti, told me as we

Living city of the Renaissance surrounds its domed cathedral in this summer view from Fort Belvedere, before the disastrous flood of last November 4. Today Florence again welcomes pilgrims to its treasures.

wandered through the ruin a few weeks later. A square-shouldered man in his fifties, he still wore the weariness of the ordeal.

When the doors burst open, a thundering wave swept down the long nave and broke in a torrent of foam against the altar. Oil-black crests clawed at 15th-century masterpieces—Sandro Botticelli's fresco "Saint Augustine," Domenico Ghirlandaio's "Saint Jerome" and "Madonna of Mercy."

One of the priests, Father Pietro, plunged into the cold waters and struggled toward the doors, hoping to force them closed. He was driven back, numbed and exhausted, as the Arno dug at his knees and dragged him down.

Oily handprint of the flood smears a 10-foot-high signpost pointing the way to a museum commemorating Michelangelo and to Santa Croce, a church he knew well.

"This saved me," he said with a self-conscious smile. He held up the end of a long curtain rope that he had clutched and hung onto before his companions fished him back with the help of a cane.

By early afternoon, the Arno had plunged deep into the labyrinth of Florence. A strong tide from the city swept into the church from the opposite direction, and with a final irony slammed shut the very doors the Arno had first broken through.

For days afterward, the priests of Ognissanti looked down from their windows upon the devastation. And all Firenze Bella around them looked like a lake bottom, slimy and reeking, seemingly buried forever.

FIRENZE BELLA. Beautiful Florence, the mother country of Western man. It is fair to say that much of what we know today of painting and sculpture, of architecture and political science, of scientific method and economic theory, we owe to the artists, politicians, statesmen, bankers, and merchants of the Renaissance—that explosion of intellectual and artistic energy in Italy between 1300 and 1600. And Florentines stood at the turbulent center of the Renaissance.

Here the Middle Ages climaxed in the cosmic journey of exiled Dante through Hell, Purgatory, and Paradise; here the wandering Petrarch sang the first sweet notes of modern poetry and inspired Boccaccio to develop the modern prose narrative.

In Florence, Galileo pursued his studies of motion that would lead eventually to Newton and the law of gravity. First man to gaze through a telescope upon the moons of Jupiter and the lunar landscape, Galileo changed forever our concept of the universe.

Here Machiavelli, watching in his own time the tragic progress from autocracy to republicanism to tyranny, left a legacy of political thought that still instructs statesmen.

But Florence's greatest glory was its galaxy of artists—Cimabue and his great pupil Giotto; Masaccio, Uccello, Fra Filippo Lippi, Botticelli, Leonardo da Vinci; the sculptors Ghiberti, Donatello, and mighty Michelangelo; the architects Brunelleschi, Alberti, Michelozzo, to name but a few. Many of their works remain in place in a city essentially unchanged for 400 years.

These thoughts of Florence were common to the world on November 4, when the first news of tragedy crackled across continents. At dawn the Arno River had risen from its banks. The sleeping city, an incomparable treasure house of art, had been engulfed in a roaring tide of silt-laden water and fuel oil.

Was it possible? How did it happen? What had been lost? What could be saved?

Those questions were on our minds as a NATIONAL GEOGRAPHIC team—illustrations editor Tom Smith, artist Bob Nicholson, and I—hastily prepared for a sad mission. We went to Florence to record a disaster—little knowing that in the weeks and months to come we would also report a miracle.

Bending to a heartbreaking task, nuns and a student volunteer join in reclaiming Florence. They clean out the sodden wreckage of a religious-articles shop near the cathedral. In one day and night, churning water that struck without warning brought incalculable grief and despoiled one of mankind's richest centers of art. But the Florentines set in motion a miracle of recovery. Today this shop—like most others swamped by the Arno—has reopened.

EKTACHROMES FROM MONDADORI PRESS (ABOVE) AND SCALA © N.G.S.

Martyrdom of a masterpiece: Single greatest loss to art, Giovanni Cimabue's "Crucifix" lies damaged beyond repair, in contrast to its appearance before the flood (right). "The father of Florentine painting" portrayed the agony of Christ about 1280 for the Church of Santa Croce, the Westminster Abbey of Italy, whose tombs hold Michelangelo, Galileo, and Machiavelli. Resting on chairs behind the defaced Cimabue, more-fortunate works await emergency treatment in the church's museum. Invading water marked its 20-foot depth on the walls with a greasy film of *nafta*—thick, black furnace oil flushed from the city's fuel tanks. The grease smudges the "Last Supper" of Taddeo Gaddi, bottom panel of the 14th-century frescoes on the far wall.

Monuments from an age of giants, the Cathedral of Santa Maria del Fiore, center, and the octagonal Baptistery, left, draw admiring visitors before the flood. They stand on the site of a Roman town that became Europe's most accomplished city. Florence's scores of churches, palaces, museums, and libraries preserve the genius of the Renaissance—the intellectual awakening of the 14th, 15th, and 16th centuries that bequeathed to Western man new concepts of art, letters, politics, science, and economics.

But the "Miracle of Florence" has now occurred. The city has been cleansed. An extraordinary salvage operation, staffed by hundreds of student volunteers of many nationalities, has reclaimed most of the books. The panel paintings are resting in a special "hospital"; art experts now believe that many feared lost will eventually be saved.

Some, of course, will not. The priceless "Crucifix" of Giovanni Cimabue, revered for 700 years, will never again be seen as it was (preceding pages). Many panel paintings important to the history of art may be beyond salvage. Perhaps the greatest loss of all is the availability of so many thousands of manuscripts and books; even though they have been rescued physically, they will remain out of reach of scholars and historians until final binding, recataloguing, and reshelving—and that may be a matter of many years.

Still, Florence again wears its old and cherished look. By the time the first summer tourists arrived, almost all the hotels and pensions had reopened; the museums and galleries displayed most of their treasures. The damaged shops wore bright new paint, and the craftsmen were back at their workbenches. A tragedy of nature had been turned into a triumph of human courage.

SNOW WHIRLED from a silver sky and the wind turned back the narrow silver leaves of olive trees as we drove from Rome toward Florence in its winter of disaster. Amid the haunting hills of Tuscany, we paused at the ruin of a medieval church; before us a drear landscape of empty highlands receded like washes of tawny water color toward the gray Arno Valley.

Stripped of their forests through the ages, the clay slopes of northern and central Italy turn fluid with the rains of autumn; their pasty debris chokes the beds of rivers, forcing them out of their banks. Thus every winter brings its floods—130 in the past 50 years. And it was on these once-fertile slopes that last November's fury had risen.

A lone farmer, his narrow back hunched against the cold, climbed a path through the olive grove and greeted us in English.

"The flood? Yes, some will tell you the animals knew," he said. "They say no birds flew in the whole valley the day before, and how could a bird fly through such a rain?"

On November 3 and 4 last year, the Arno watershed received a third of its annual average rainfall in two days. Nineteen inches of rain fell in 48 hours. . . .

It was 7 p.m. on November 3 when Signora Ida Raffaelli heard the mechanical shriek of a siren from Levane Dam, straddling the Arno

PHOTOGRAPH FROM SCALA © N.G.S.

35 miles upstream from Florence (map, page 16). She and her family, who live in one of four houses below the dam, did not believe that the warning was real. Two hours later the siren sounded again.

"I was appalled to see the gates slowly opening," she later told a reporter, "and immediately an enormous wall of water started coming down the Arno toward us. I screamed to my sister and we ran for our lives."

Why were the gates opened? How much water was released from Lèvane's 6,409,000-cubic-yard reservoir? A heated controversy sprang to life in the weeks after the flood. A government commission inquired into the charge that Lèvane opened its strained gates because the operators of a second dam at Penna, farther upstream, failed to open their gates until too late, and then had released more water than Lèvane could handle.

This much is certain—enough rain fell on all northern Italy in two days to flood 750 villages and 3,000 miles of highway, to drown more than a hundred people and 50,000 cattle in a wide area from the Po Valley southward. In this national catastrophe, whatever happened at the beleaguered dams in Tuscany may be considered contribution and not cause.

More to the point, perhaps, is the Florentine proverb, "*L'Arno non cresce, se la Sieve non mesce*" (The Arno never rises up, unless the Sieve fills its cup). Before midnight, while

the Arno Valley was filling, the Sieve River was pumping unknown tons of high-velocity sludge through the narrow confluence east of Florence.

The telephone rang shortly after midnight in the home of Lt. Col. Nicola Bozzi, chief of the Florentine *carabinieri*. He had retired early in anticipation of a busy day on the fourth, a national holiday celebrating the 48th anniversary of the Italian armistice in World War I. The city's narrow streets and dozens of piazzas were decked with flags—the red Florentine lily on a field of white, and the Italian tricolor of green, white, and red (right), all drooping now in torrential rain.

"*Pronto!*"

It was a distress call relayed from the Valdarno district. The Arno was raging out of its banks. Roads were sinking. Families were marooned on rooftops.

Colonel Bozzi could not have known it, but water was already beginning to trickle into the basements of riverside homes east of Florence. Cats moved away on silent feet. In deserted streets the covers of old sewers began to bubble and bleed thin streams.

(Continued on page 17)

Furious cataracts, laden with rubble, roar through the streets and toss automobiles about like corks. Trapped citizens watch the frightening spectacle from a balcony overlooking an intersection near the cathedral. Anticipating a holiday, most Florentines were asleep when the Arno River surged over its banks at dawn. Within hours, 17 people perished in the city as 11,000 abandoned their homes.


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CIT

THE GREAT FLOOD OF FLORENCE

NOVEMBER 4
1966

Striking at dawn, the Arno's torrents engulf the sleeping Renaissance city. Map shows important buildings and extent of the flood.

PALAZZO PANDOLFINI

SAN MARCO

LIMIT OF FLOOD

MERCATO CENTRALE

MEDICI CHAPEL

SAN LORENZO

STAZIONE SANTA MARIA NOVELLA

To book-drying area in heating plant, five blocks

SANTA MARIA NOVELLA: Oil streaks frescoes in Spanish Chapel and Strozzi Chapel

LOGGIA DI SAN PAOLO

SAN PANCRAZIO

SAN PAOLINO

OGNISSANTI

PONTE ALLA CARRAIA

A R N O

PONTE AMERICO VESPUCCI

SAN FREDIANO IN CESTELLO

CASERMA GENERALE SANI

PORTA SAN FREDIANO

N

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ROBERT W. NICHOLSON
GEOGRAPHIC ART DIVISION
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SANTISSIMA ANNUNZIATA

MUSEO ARCHEOLOGICO *Water bursts floor upward, shattering exhibits; 9,000 priceless Etruscan artifacts sucked into mud.*

GALLERIA DELL'ACCADEMIA DI BELLE ARTI

SANTA MARIA DEGLI ANGIOLI

SANTA MARIA MADDALENA DEI PAZZI

TEMPIO ISRAELITICO (SYNAGOGUE)

SANT'AMBROGIO

PORTA ALLA CROCE

VIA CAMARO

LOGGIA DEL PESCE

MERCATO SANT'AMBROGIO

SANTA MARIA DEL FIORE (DUOMO) *Pouring into archeological excavation of early church, water cracks marble floors.*

TEATRO DELLA PERGOLA

GALLERIA BUONARROTI (CASA DI MICHELANGELO)

SAN GIUSEPPE

PALAZZO MEDICI-RICCARDI

OSPEDALE DI SANTA MARIA NUOVA (HOSPITAL)

GIOTTO'S CAMPANILE

MUSEO DELL'OPERA DEL DUOMO

PALAZZO NONFINITO

BARGELLO

SANTA CROCE *Only tide swamps Westminster Abbey of Italy. Huge flooding damages Giotto's "Crucifix," damages Gaddi's "Last Supper."*

BIBLIOTECA LAURENZIANA

PALAZZO PAZZI

DANTE'S HOUSE

BADIA

TEATRO GIUSEPPE VERDI

BIBLIOTECA NAZIONALE CENTRALE *Cascading from its banks, the Arno drenches more than one and a half million books, including centuries-old manuscripts.*

BAPTISTERY *Buffeting waters wrench five of the ten panels from Ghiberti's "Doors of Paradise" and damage Donatello's wooden "Magdalene."*

SAN FIRENZE

MUSEO HORNE

SANTA MARIA MAGGIORE

ORSANMICHELE

PALAZZO UGUCCIONI

PALAZZO VECCHIO

PIAZZA DELLA SIGNORIA

PALAZZO DEGLI ALBERTI

SAN GAETANO

GALLERIA DEGLI UFFIZI

VIA DEL CASTELLANI

PIAZZA ANTINORI

PONTE ALLE GRAZIE

MERCATO NUOVO

PALAZZO DAVANZATI

VASARI'S ENCLOSED GALLERY

MUSEO DI STORIA DELLA SCIENZA

PALAZZO STROZZI

SANTI APOSTOLI

MUSEO BARDINI

PONTE VECCHIO *Cars and trees hurled by river gut jewelry shops, but 600-year-old bridge holds.*

PALAZZO RUCELLAI

PALAZZO CORSINI

SANTA TRINITA

PALAZZO FERRONI

LIMIT OF FLOOD

SANTA FELICITA

PONTE SANTA TRINITA

SAN JACOPO SOPR'ARNO

FORTE DI BELVEDERE

PALAZZO DEI FRESCOBALDI

PALAZZO GUICCIARDINI

SANTO SPIRITO

BOBOLI GARDENS

PALAZZO PITTI

PALAZZO AMERIGHI

PALAZZO GUADAGNI

SANTA MARIA DEL CARMINE

LIMIT OF FLOOD

To Limonaia, one block

13

SWOLLEN INTO A RAGING TORRENT, *the Arno engulfs the beloved city of the poet Dante. Partially dammed by the Ponte Vecchio (Old Bridge), downstream at left, and other spans, the angry river sluices into the venerable heart of Florence. Waters pollutedwith silt, sewage, oil, and carrion maroon the mayor in the tower-topped Palazzo Vecchio, center, and swirl around the cathedral, right – both under construction when Dante served as city councilman in 1300. Before the flood (inset), the tile-roofed Tuscan city banks under a warming sun.*

Vivid reminder of earlier tragedy, this contemporary lithograph records an 1844 flood. A jeweler salvaged the print from his wrecked shop on the arcaded Ponte Vecchio after November's deluge. Florence bears scars of a major flood in almost every century. Pointing finger on a plaque in the Via dei Neri (right) fixes a 1333 inundation at 13 feet 10 inches. High-water mark of 1966 shows 28 inches higher.

Trapped in a basin, Florence catches the fury of an entire watershed (maps). Four months' normal rain in only two days sent tributaries raging into the Arno; operators of two over-taxed dams opened floodgates on November 3. The next day the river exploded into Florence. Rain loosed floods on all northern Italy, drowning more than 100 people and engulfing 750 villages, together with Venice, Pisa, and Florence.

COURTESY GUSTAVO MELLI; SCHLESINGER BY SALVADOR KORAN © N.G.S.

Sometime after midnight, east of the city, death claimed one of its early prizes. I could learn only the given name of the girl—Marina. With her father and mother she was swept along by the torrent. For a while they clung to a table; until her father, half-drowned, lost his grip. He and his wife somehow survived, but three days would pass before Marina's small body emerged from the ruined fields. She was among the first of 35 known to have perished in the Florence region.

Shortly before 3 a.m. Alberto Maffei, who worked in the Jolly Club near the famous Ponte Vecchio, stepped outside to look at the river. Its deep-throated roar could be heard even above the banging rhythm of "The Yellow Submarine." He noticed lights winking in the jewelers' shops that lined the bridge. Paris Venturi, Gustavo Melli, and other store owners had been warned by a worried night watchman and were saving what they could. When they trained their flashlights down upon the stream, they could see a furious lip of foam rising up the ancient arches and the brown back of the river hurtling with frightening speed under their feet.

UNWARNED, UNAWARE, and expecting a holiday, Florence slept. While the river mounted, rains lashed in sheets against Brunelleschi's magnificent ribbed dome over the cathedral, an architectural masterwork of the Renaissance. It pounded the familiar copy of Michelangelo's "David" that stands before the towered Palazzo Vecchio, begun in 1298 and still the seat of Florence's city government (page 43).

The rain streamed over marble plaques that recorded what the city had forgotten—the high-water marks of past calamities—the disastrous flood of November 4, 1333 (below), which "rushed into the city with such fury that it filled all Florence"; the terrible flood of September 13, 1557; and that of November 3, 1844, marked today by memorial tablets at heights up to 7 feet. Now, on November 4, 1966, the angry Arno rose as never before.

As the milky light of dawn seeped into a black night, the river began to pour unchecked into the poor districts of Gavinana and San Frediano on the south bank. Exploding through the windows of cellar homes, wrenching away doors, plundering the small material savings of lifetimes, the waters here took the aged—a 71-year-old man, a husband and wife of 74 and 52, a man of 81 who yielded without a struggle.

At 7:26 a.m. electric clocks stopped all over the city. At that moment, the most easterly of the seven bridges, San Niccolò, was being swallowed, and the full fury of the flood was upon Florence.

The breakneck tide chewed away the embankments of the streets called *Lungarno*—Along the Arno—that parallel the river. It swept up automobiles and hurled them against lamp posts and street signs (pages 8-9), tore out concrete walls, and began to batter the Ponte Vecchio with trees, oil drums, and other debris. It also began to flush from hundreds of drowning basements the thick black *nafta*—fuel oil—of central heating systems.

Thus it was no ordinary alluvial flow that began to swamp classical Florence, but a thick slime of liquid mud bearing black rivers of oil, carcasses of animals, and the roiling contents of sumps and sewers, the very matter of Dante's *Inferno*.

Where small piazzas open along the northern bank, the river poured in at 40 miles an hour. At the Piazza dei Cavalleggeri, it formed a wide brown waterfall spilling tons of mud and debris directly into the basement stacks of one of Europe's richest libraries, the Biblioteca Nazionale Centrale (foldout, page 12).

Equivalent to our Library of Congress, the Nazionale is Italy's largest library, containing more than three million volumes. The miles of shelving in the path of the river held several important collections—the most notable those bequeathed by Magliabechi in 1714 and the Palatina collection donated in 1771. The stacks also held hundreds of thousands of bound newspapers and journals—one of the prime sources for modern Italian history. In all, more than a million and a half volumes disappeared under the tide (page 25).

A few minutes' walk downstream, Dr. Maria Luisa Righini Bonelli, the attractive scholar who directs the Institute and Museum of the History of Science, was sleeping in its ground-floor apartment.

"My husband was in Brazil," she told me, "so I worked late and stayed in the apartment here. I heard a rushing sound, and when I opened my eyes, water already had reached my bed. When I opened this window . . ." she held her hand level with the sill, "the river was here."

Appalled, she began to carry upstairs what she could of the museum's irreplaceable collections—original instruments used by founders of modern chemistry, medicine, and physics. But the waters mounted until they

Bombarded by uprooted trees hurtling at 30 to 40 miles an hour, the 600-year-old Ponte Vecchio withstood the assault. Debris mats its bruised upstream face. Logs and wreckage of a bridge upriver shattered the jewelry shops that nest over the arches. In the 16th century, Grand Duke Cosimo I ordered that jewelers and goldsmiths replace butchers then occupying the clutter of buildings. He linked his Pitti Palace to the Uffizi with the covered gallery that runs atop the shops. The famed bridge has stood up to every flood since an earlier span surrendered to the rampaging Arno in 1333.

swirled waist deep on the ground floor; sick at heart, she had to abandon one of Edison's first phonographs; Brambilla's surgical instruments of ivory, gold, and ebony; Pietro Leopoldo di Lorena's laboratory bench of chemicals.

Carrying what she could, she made 28 precarious trips along a third-story ledge between the museum and the Uffizi. Thus she managed to save some 35 smaller treasures—including several of Galileo's telescopes—and her own life (page 28).

FATHER GUSTAVO COCCI, Prior of Santa Croce, had no idea of impending disaster until he stepped from his church into the rain. A torrent was pouring into the piazza before him and rising around the base of Dante's statue (page 29); cars were already awash in a fetid mass of mud and oil.

The vast church behind him had been standing since the late 13th century. Its tombs held the bones of such famous men as Michelangelo, Machiavelli, Galileo, the composer Rossini, and a host of others.

Here in the church and its museum can be found the beginnings of Renaissance art. Wealthy Florentines hired artists to glorify the huge walls and cover the chapels with illustrations of the life of Christ and that of St. Francis. Among the first was Cimabue, whose "Crucifix," painted about 1280, held a special place as one of the masterpieces marking the transition from Byzantine to Renaissance art. His pupil Giotto, the first master of Renaissance realism, adorned Santa Croce chapels with frescoes that served as models for the young Michelangelo and other giants yet unborn.

Rallying the downhearted, Mayor Piero Bargellini consoles a woman taking empty bottles for an emergency water ration. The heroic 69-year-old art historian roamed his ruined city for a month, bringing comfort and help where he could—then collapsed from exhaustion.

Heaped like scrap, tumbled automobiles clog a narrow street; some 16,000 vehicles shared the fate of these stained and battered hulks. Fiat, Italy's largest car maker, gave owners generous allowances on wrecked Fiats in trade for new models.

Drowned in furnace fuel, Baccio Bandinelli's white marble "Pietà" (below) lies awash in reeking sludge that gushed into the crypt of Santa Croce. But Michelangelo's celebrated "David" (right) stood safely above the vile tide that left a glaze of

ENTRANCHEMENT BY HILLY HARRIS © M.G.M.

ooze on the floor of the Gallery of the Academy of Fine Arts (fold-out, page 11). An unfinished work by the same master sculptor and painter shows at far right.

DAVID LEES FOR LIFE MAGAZINE © 1955 TIME INCORPORATED

It was not yet 7:00 when the Arno raged through the doors of the church and lapped against the altars before the tombs of Michelangelo and Galileo. The two cloisters beside the church filled with 15 feet of muddy water. In the adjacent museum, Cimabue's "Crucifix" was battered—and finally engulfed—by the black tide. The oily surface rose over Taddeo Gaddi's "Last Supper" (page 4). Smashing through into other rooms of the museum, the flood ravaged panel paintings by Bronzino, Salviati, and Vasari. Then it bored like a wild mountain torrent through medieval streets toward the Uffizi.

TO THE MILLION PILGRIMS who flock to Florence each year, the Uffizi is the reigning queen of Renaissance art galleries. The massive building was built by Giorgio Vasari between 1560 and 1574 for the Medici Grand Duke of Tuscany to house government offices (hence, *uffizi*). Today one of the world's finest and largest collections of art fills a splendid setting of marble hallways and rooms.

For 400 years the State Archives has lived, not a little uncomfortably in recent decades, in lower floors of the gallery. Its collections include invaluable papers of the Medici family and the Florentine governments, republican and ducal, during some of mankind's most exciting and formative centuries.

The Uffizi is the terminus of one of the distinctive landmarks of Florence. In a typical gesture of grandeur, Grand Duke Cosimo I commissioned artist and architect Vasari—his *Lives of the Artists* proved him also no mean biographer—to build an enclosed gallery running from the sprawling Pitti Palace, on a height south of the Arno, past the Church of Santa Felicita, over the jewelers' shops on the Ponte Vecchio, along the Arno, and into the Uffizi by means of a regal stone staircase. On the other side of the great office building, a stone archway high over Via della Ninna connected with the Palazzo Vecchio. Thus the Duke could stroll from home to work without getting wet (foldout, pages 11-12).

On November 4, that part of Vasari's gallery nearest the Uffizi was lined with a collection of self-portraits by some of the world's most noted artists—Raphael, Titian, Rubens, and Corot among them.

"Naturally, I thought of them first," Dr. Luisa Becherucci, Director of the Uffizi, told me. "If the Ponte

"Worse than the war!" cried sorrowing Florentines as they surveyed devastation like that of the seemingly bombed Via Cimabue, a street of artisans near Piazza Beccaria. In an exceptional display of violence, the flood stirred an explosive brew of stored chemicals that blasted apart warehouses. Water damaged tools and materials of 7,800 workshops that carry on Renaissance craftsmanship in leather, wood, textiles, straw, and precious metals.

An antique dealer of the Piazza Mentana spreads what he can salvage to dry in the sun (right). Of 6,000 small merchants who suffered losses, all but a handful are now back in business.

Vecchio went, and we were all sure that it would, it would tear the gallery out with it."

Alerted by the gallery's watchmen around 7 a.m., Dr. Becherucci called Professor Ugo Procacci. The distinguished Superintendent of Fine Art for Florence and neighboring regions in turn warned Dr. Umberto Baldini, Director of Restorations. The fourth member of the cast appeared in the racing figure of Dr. Mazzino Fossi, an official of the Superintendency of Monuments, who had tried to get across to the Pitti Palace, found the Ponte Vecchio blocked off, and dashed ahead of the waters to the Uffizi.

Doctors Becherucci and Fossi made a daring foray to Vasari's gallery, arriving a little after 9 a.m. While a swollen river cannonaded the Ponte Vecchio with oil drums and trees and coiled wildly around the arches below them (pages 18-19), the scholars and a few

Sodden treasury of learning, the National Library resurrects from a basement tomb of mud thousands of volumes dating from as far back as Renaissance times. Sawdust to sop up the water and ooze covers the floor of the main lobby. The Arno spilled books from miles of shelves. As the waters subsided, student volunteers donned gas masks because of the stench of sewage and disintegrating leather bindings and hauled the volumes to the first floor. Smeared with mud, a girl gently carries a book to a truck that will take it to a restoration center. More than a million and a half volumes in this library were damaged; the total for the city exceeded two million.

custodians managed to carry out about twenty of the paintings.

"I made them stop," Dr. Becherucci said. "I feared for their lives. I did not think we would go back."

Meanwhile, Dr. Baldini, braving waters streaming into the Uffizi, made his way to the restoration rooms. There 100 paintings—by Simone, Masaccio, Fra Filippo Lippi, and other masters—were imperiled. With the help of Dr. Fossi and several custodians, Dr. Baldini began moving the paintings, some huge, upstairs. Lacking a key, he had to break down a heavy door to reach the last of them.

In the same building, but nearer to the river, the 40 basement rooms of the State Archives—whose four miles of shelving held 40,000 volumes—were filling with black mud.

When Superintendent Procacci arrived, after a tortuous trip through streaming streets,

he went to save the rest of the self-portrait collection in the gallery.

"He was gone before we knew it," Dr. Fossi recalled. "Baldini and I chased him, but he had wings on his feet. We couldn't catch him until he had reached the stone steps. We tried to stop him, but he broke out of our grip, furious at us and shouting that he was of age and we had young children. Finally we all went with him down the stairs."

The three men began to take the paintings out, carrying the smaller ones and skidding the larger ones across the polished tile floor. The long gloomy hall was trembling and groaning as the furious waters pounded the arches beneath it.

"Procacci," shouted Dr. Baldini, "do you recall Vasari's complaint 400 years ago when he built this gallery?"

"Unhappily I do," replied Dr. Procacci. "He regretted that the Grand Duke's impatience forced him to use inferior materials."

Baldini and Fossi worked their way farther and farther down the gallery. Occasionally they would part the pale curtains on the small windows and look out. They watched the Arno scoop a handful of automobiles out of a small piazza across the river and hurl them, before they could sink, against the battered Ponte Vecchio. The famed jewelry shops shattered like matchboxes. Each time the river smashed a heavy oil drum or automobile or

EXTRAORDINARY (ABOVE) BY LEE THROP; EXTRAORDINARY (CENTER) AND [illegible] BY BALTHASAR KORAB © N.G.S.

tree against the bridge, a harrowing boom would thunder down the shaking corridor.

Dr. Baldini found some small consolation, he told me, in a stream of quiet invective against 19th-century painters who insisted upon fuller-length portraits than the Renaissance head-to-waist style, making their works twice as difficult to move.

Dr. Becherucci and a few custodians waited at the end of the corridor and transferred the portraits to the safety of the steps. Shortly after 10 a.m. the last of the paintings came out. Asked what he thought about after saving so many priceless works of art, Dr. Baldini told me with a candid smile: "My automobile."

Infinite care attends the book restoration (far left). At Fort Belvedere, a Renaissance fortress, volunteers from many countries painstakingly separate sections from volumes shorn of their leather bindings.

Literary laundry hangs in the heating plant of the railroad terminal. Here, pages are washed and pressed to expel excess water, then hung up to dry for four to six hours.

Music from ages past, trucked from Florence, fills a hallway at the Vatican Restoration Institute in Rome. Dom Mario Pinzuti, the Director, examines 13th- and 14th-century choir books from the cathedral. Constant changing of absorbent paper placed between pages dries the parchment.

Indeed, the loosed Arno was churning 16,000 vehicles in a terrible brew as it raced through the heart of Florence, along Via de Castellani and Via de Leoni—where real lions were once kept as symbols of the city—and around the Bargello.

THE BARGELLO is to sculpture what the Uffizi is to painting. Since 1865 the 700-year-old building (foldout, page 11) has housed one of earth's finest collections of sculpture—including noted works by Michelangelo and Donatello.

Michelangelo's statues disappeared under 13 feet of oily water; terra cottas by Niccolò Tribolo and Vincenzo Danti toppled and fell; a bronze by Pierino da Vinci whirled away and was broken. The waters rolled on toward the Piazza del Duomo. Witnesses there recall with awe a square sloshing with a few inches of water one minute and a stupendous whirlpool the next.

Here stand the three structures that most often identify Florence: the octagonal Baptistery, the great cathedral dedicated to St. Mary of the Flower, and Giotto's graceful bell tower (pages 1, 6-7, and foldout, page 11). Brunelleschi's soaring dome, once the largest in all

She risked her life to save Galileo's telescope. Dr Maria Luisa Righini Bonelli, Director of the Institute and Museum of the History of Science, braved rapidly mounting waters to rescue the treasure, carried here with an Arabian celestial globe of the 11th century and a Galileo telescope lens framed in ivory.

Slimy quagmire surrounds a statue of Dante in the spacious square of the Church of Santa Croce. Impounded by

Christendom, crowns the cathedral that all Florence calls Duomo, from the Latin *domus*, house. To the devout Italian, the word has a special meaning. "House of God."

On three of its eight sides the Baptistery wears famous doors, but without question the most famous and beautiful doors anywhere are those of the east side. When sculptor Lorenzo Ghiberti finished them in 1452 after 27 years of labor, Florence stood in awe. Michelangelo in later years remarked that they were worthy to be the Doors of Paradise —and so they have been called ever since. The 10 bronze panels, depicting scenes from the Old Testament, seem painted in molten metal, so perfect is their detail and perspective.

As the three torrents spilled into the piazza, the thunder and vibration could be heard and felt blocks away. Sometime after 10 a.m. the black-crested tide crawled up the Doors of Paradise and began pounding them against the stone jamb. The beautiful panels loosened, first one, then another. Finally five plunged into the swirling muck, but a protective gate kept them from being swept away (pages 36–7). Inside, Donatello's wooden Magdalene stood hip-deep in water.

Breaking into the cathedral, the Arno rose

buildings, waters here rose to a depth of 20 feet—deepest inundation in the city. Michelangelo, while working in Rome in 1543, wrote a nephew about buying a house near Santa Croce and cautioned that "every year there the cellars flood."

to five feet in the nave, made a shattered raft of 200 movable pews, fell upon Giovanni Balducci's "Last Supper," and wrecked the pavements of both sacristies.

From the Duomo, most tourists take the Via dei Servi to the quiet piazza bordered on the north by Santissima Annunziata, the Florentines' own favorite church. Here, a legend says, an angel painted the face of a Madonna while the artist Bartolomeo slept. Here brides still come to leave their wedding bouquets. And here, also down Via dei Servi, the Arno came.

It swept into the square at 10:45 a.m. and turned its cataract into the cellars of the Archeological Museum, housing a collection of Etruscan artifacts second only to that of the Villa Giulia in Rome. Under intense pressure, the floors exploded filthy geysers into the Etruscan collection. Ivories and bronzes rained from the shattered cases. Vases were sucked into the ooze; sarcophagi tumbled. Treasures captured from time and the earth returned to a primeval slime.

THROUGHOUT WEALTHY FLORENCE, the Arno was smashing treasure after treasure. In the Horne Museum near Santa Croce, a distinguished collection of paintings, sculpture, furniture, and books from the 14th to the 18th centuries was drowned in 14 feet of water. Across the river, musical instruments of the Bardini Museum's famed collection from the 16th to the 19th centuries were disintegrating into mud-coated fragments (page 41). In the Strozzi Palace (foldout, page 11), 250,000 books of Florence's renowned public library, the Gabinetto Vieusseux, were engulfed.

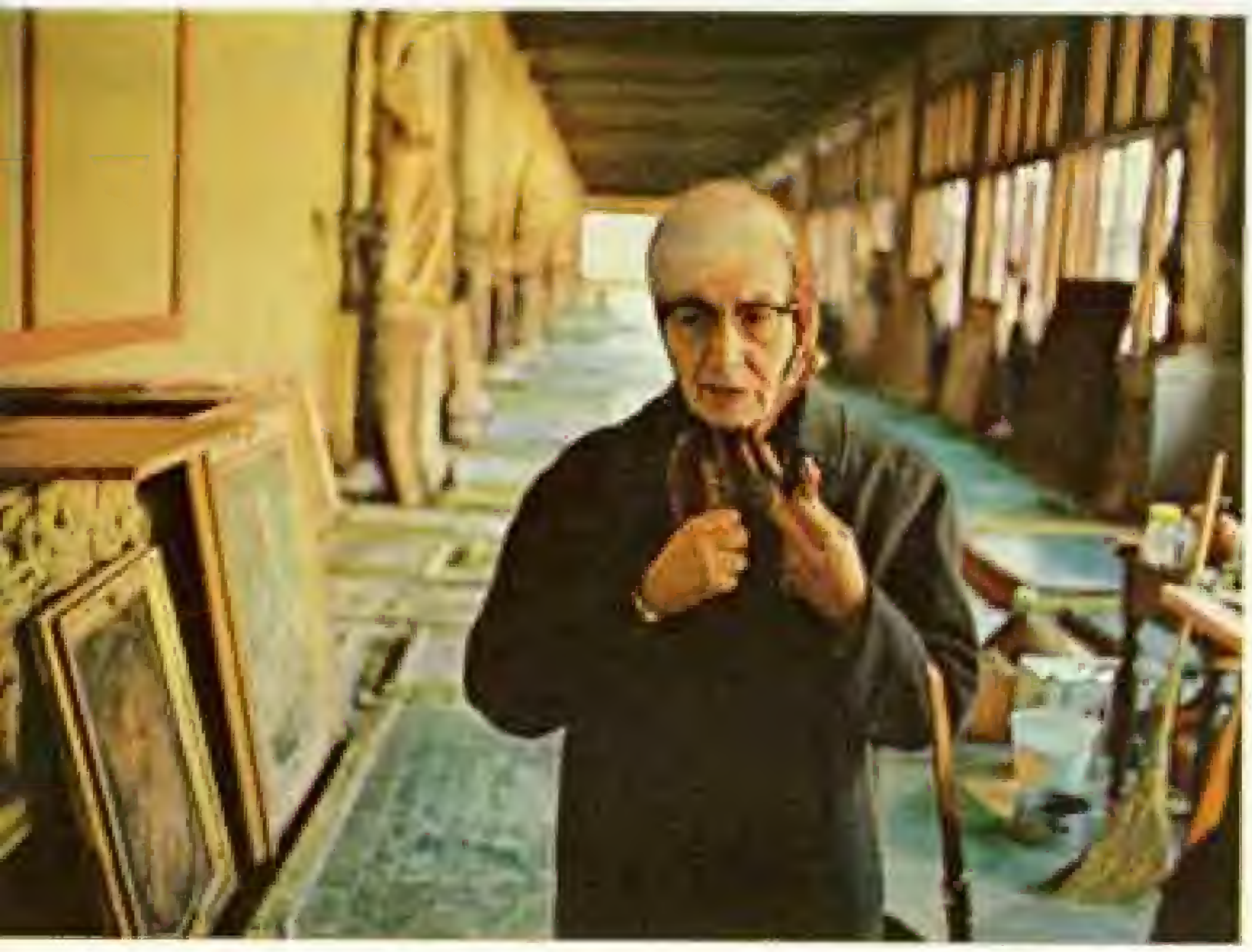
Around 11:30 a.m. a terrific explosion from chemical warehouses rocked the Piazza Beccaria (pages 22-3 and foldout, page 12), and a column of smoke billowed into the rain. All over the city, the horns of cars—short-

In a race with rising water, scholars and custodians work feverishly to rescue more than 300 paintings on the ground floor of the Uffizi, one of the world's most cherished galleries. In this re-creation by GEOGRAPHIC staff artist William H. Bond, Professor Ugo Procacci—Superintendent of Fine Art for the Florence region—passes an 18th-century portrait of the poet Vittorio Alfieri to Dr. Umberto Baldini, Director of Restorations. Others strain at a large canvas by Gerard van Honthorst, a 17th-century Dutch painter. To gain quick entry to this locked storage room, salvors broke the window behind Dr. Procacci, then tore away the bottom half of the metal grille to remove paintings. Concerned for the men's safety, Dr. Luisa Becherucci, the Uffizi's Director, watches from a stairway.

"It was a day of great excitement and exhilaration," recalls Dr. Becherucci. "We worked into the night, and when it was over, we sat down exhausted, and the real meaning of the loss swept over us."

Responding to the crisis, students remove paintings from the Uffizi for drying, as two others swab mud from the doorway. An army of young people from a dozen nations of Europe and the Americas pitched in, dropping notebooks for boots and shovels. Many—including 500 from the United States—were in Florence to study. Months after the flood, volunteers from around the world still worked without pay to dig mud from cellars of the *popolo minuto*—the little people—who nicknamed the benefactors "blue angels" for their work clothes and tireless good deeds.

Hospital for art fills the Limonaia, a winter shelter for lemon trees at the Pitti Palace (below). To forestall paint blistering and chipping as the wooden panels began to dry and contract, workmen rushed to convert the Limonaia, installing insulation and humidifiers. Art works arrive (below, right) covered with Japanese mulberry paper to prevent the paint from flaking. Technicians spray nystatin, an antibiotic, to arrest the growth of mold.



Anguish and fatigue mark the face of Dr. Becherucci as she surveys paintings along the second-floor gallery of the Uffizi. Original estimates of time needed to restore some art works have dropped from 20 years to two or three; other treasures may prove beyond repair.

circuited by water—blared a mournful monotone. That steady din and the rushing of powerful currents formed a dreadful sound.

"Worse than the war! Worse than the war!" A dazed people, clambering into upper stories and onto rooftops, found no comparison for the tragedy that was overwhelming Firenze Bella. In the days to come they would learn a terrible litany of the saints, a *litania dolorum* cataloguing the disaster of Florentine churches: Sant'Ambrogio, 11 feet of water;

San Jacopo sopr'Arno, its altarpiece drowned; Santa Maria Maddalena dei Pazzi, heavy oil up to 8 feet; San Niccolò sopr'Arno, 10 feet; Ognissanti. . .

NO ONE CAN RECALL with any precision when the longest day ended, for night came early, fusing into the darkness of afternoon. The waters remained, a restless lake over all classical Florence. In the Uffizi a human chain had just completed the last of the three rescue labors, saving the paintings from a storage area (painting, pages 30-31). In Santa Maria Novella, the great Dominican church, the flood's worst oil stains marked Uccello's frescoes in the refectory, those in the Strozzi Chapel, and the powerful frescoes of the Spanish Chapel (page 38).

The mourning of widows, cry of children, and wailing of cats added to the night's terror. Isolated, without light or heat or telephones, a stricken city waited for dawn.

Centuries ago, Bernardo Cennini, a goldsmith, had coined also a phrase—"*Florentinis ingeniis nihil arduni est*—Nothing is beyond the powers of the Florentines." On the morning of November 5, 1966, as the people wandered unbelieving from their doors and looked upon the ruin, it appeared that this time Cennini might be proven wrong.

A modern-day artisan, a gunsmith who specialized in antiques, groped through the wreckage of his cellar workshop.

"Nothing left," he said. "all carried off—tools, thousands of parts collected for 30 years, patterns, everything."

His story was being repeated in every street. Six thousand shops where merchants displayed Florence's famed specialties in gold and leather, wool and wood, were wrecked. Everywhere the lament: "All my father's lifetime, and now mine, too, washed away."

MAYOR PIERO BARGELLINI, art historian turned public servant, had spent the long night of November 4 marooned in his office, offering what hospitality he could to an assortment of castaways that included a newly married couple and an escaped convict. As morning came, he went out into the streets—and for days afterward he became the symbol of a city resolved to heal itself (page 19). He wondered, as did others, where the hands would be found to dig out the buried books, clean the churches, minister to the paintings, excavate the reeking cellars, restore the shops.

By some miracle of communication, those hands appeared. On the day after the flood, the first troop of what became an army of students appeared on the streets of Florence.

Patrick Matthiesen, a 23-year-old graduate student at the University of London, symbolized the spirit of these volunteers. Hearing of the flood on his radio, he dropped everything, obtained a Land-Rover from his brother-in-law's farm, ferried the Channel, and raced off to Italy, towing a pump. The pump went to work in the Uffizi, and Patrick's truck became the ambulance in which Donatello's crippled "Magdalene" was carried from the Baptistery to the Uffizi Gallery (page 40). Ghiberti's Doors of Paradise were hauled off in a cart for later restoration.

Phone calls from Professor Sergio Camerani, Director of the State Archives, and Professor Mina Gregori of the University of Florence turned out a battalion of young men and women from American universities who were then studying in Florence. They joined countless others in a human chain that scooped 40,000 volumes from the muck of the Archives.

At the National Library hundreds of students, many wearing gas masks against the stench of sewage and decaying leather, labored for three weeks to recover more than a million dirty, wet volumes (pages 24–5).

Clad in Churchillian coverall and rubber boots, Director Emanuele Casamassima of the National Library proved himself a superb field general in the operation to rescue Florence's libraries; he did not go home for at least a month. He proposed drying the soggy stacks in the state-owned tobacco barns of Tuscany. He also pressed brick kilns and textile plants into emergency service.

Trucks on loan from the Italian and U. S. Armies, loaded by the volunteers, carried their unusual cargoes to industrial sites in Prato, Perugia, and as far away as Rome (page 27).

While the cheerful blue-jeaned and booted army of students was racing mold and decay, the network of world scholarship crackled with distress signals. Dr. Myron Gilmore, then director of the Harvard study center at the famous Bernard Berenson villa "I Tatti," became a focus of United States aid.

In the United States itself, leading historians of art and Renaissance scholars such as Bates Lowry and Fred Licht, both of Brown University, Frederick Hartt of the University of Pennsylvania, and others quickly formed the Committee to Rescue Italian Art (CRIA). By mid-November this effort had raised enough to send the first planeloads of scientists and fine-arts conservators, headed by Lawrence Majewski of New York University, to Florence. (Among them was documents expert Harold Tribolet of R. R. Donnelley & Sons Company, printers of the GEOGRAPHIC.)

To Dr. Paolo Emilio Pecorella of the Archeological Museum, the disaster had a painfully

Shower of talcum dries a statue of St. John the Baptist in the National Museum of the Bargello. A poultice of benzene and powder draws moisture and oil from the porous stone. Water rose 13 feet high in the Bargello's exhibition room of Michelangelo sculptures. They too received the talcum treatment, followed by a scrubbing with detergents that removed all but the most stubborn oil stains.

"Doors of Paradise," Michelangelo called these gilded bronze portals on the Baptistery. Ten panels, created by Lorenzo Ghiberti in the 15th century, illustrate incidents from the Old Testament. Water raging at 35 miles an hour wrenched the doors open and dashed them back and forth. Five panels tore loose. The protective gate kept them from being swept away. Workmen (right) cart panels off for repair. Broken-off head of the plowman, in a scene depicting the story of Cain and Abel (far right), was found later in the mud.

familiar aspect. While others were moving out the debris as fast as possible, workmen here were blocking up doors with bricks and mortar so that nothing might be removed.

"It is all here," he said, "and when the mud has dried, it will be like any other archeological dig—but in my own museum."

The damaged frescoes—Dr. Procacci's staff listed 80 single frescoes and 12 fresco cycles in need of cleaning—presented a similar demand for time-consuming work. Art experts had already worked out a laborious means of transferring old frescoes to solid new bases. One as large as the Gaddi "Last Supper" could take months to transfer. But the immediate problem—beyond cleaning with solvents—remained the battle against humidity (page 39).

CRIA's Dr. Frederick Hartt, an honorary citizen of Florence because of his labor to rescue works of art during World War II, had warned against optimism. His gentle face, sometimes tear-stained, became familiar to millions of television viewers in England and the United States when the first documentary of the flood was released before Christmas.

"We cannot know the full effects of the flood for some time," he said. "The water, rising up through the walls by capillary action, could eventually flake off the paint."

I had a startling vision of a group of horrified tourists standing in the Spanish Chapel watching the great frescoes scatter down in pretty little snowstorms. Time, money, and watchful waiting will be needed for many months before the frescoes can be judged safe.

In the Bargello, Michelangelo's statues seemed to be molting. They wore fluffy skins of talcum powder to draw out the moisture and some of the oil (page 35). Then powerful detergents were put to work on the stains.

Aside from one or two stubborn streaks, the Bargello's collection now looks not much the worse for the Arno's visit.

So, too, at the History of Science Museum, the relics that Signora Bonelli had been forced to leave behind in the rising waters—including Edison's phonograph—eventually were recovered and restored to their cases.

The greatest cultural losses were the panel paintings and the books, and here again the Herculean efforts of the student volunteers and the ingenuity of experts combined to save much of what had been feared lost.

ONE COLD MORNING, when a weak sun had finally broken through the overcast, I walked across the Ponte Vecchio—an orderly hive of workmen banging and mending and building—up the Via Guicciardini, past the huge Pitti Palace, and into the Boboli Gardens. I was looking for one of the most unusual hospitals in the world, and found it in a greenhouse.

Dr. Baldini, one of the heroes of the Uffizi, welcomed me in a scene of peace. The paths of the woodland about us were broken by misty rays of streaming sunlight; in the distance marble nymphs and Roman generals gleamed against the dark shrubbery.

"We are lucky that the Medicis liked lemons," Dr. Baldini said. "These gardens have had, since the 1500's, one of the finest collections of lemon trees in the world. During the winter the trees are usually moved into the large building, the Limonaia, which is now our hospital. Come and see my patients."

"Hospital" was an apt term for the Limonaia. Here, in a room more than 340 feet long and 30 feet wide, stood row on row of double-decker steel beds (pages 32-3). Lying on them

Malignant stain sullies the skirts of the faithful in "The Church Militant and Triumphant," a 14th-century fresco attributed to Andrea di Bonaiuto in the Spanish Chapel of the Church of Santa Maria Novella. Even after the flood, water continued to rise in the thick walls by capillary action. To check the moisture, hot air from blowers was channeled along the base of the wall. The fresco represents the glories of the Dominican Order at the end of the Middle Ages. Emperor, Pope, clerics, and devout gather before the cathedral of Florence. Above them the saints and martyrs enter the gates of heaven, and St. Peter guides the Ship of the Church through stormy seas.

PHOTOGRAPHED BY COLIN SIMPSON © SUNDAY TIMES AND THOMAS A. SMITH (OPPOSITE) © N.G.S.

Gently, so gently. Uffizi restorer Alfio del Serra swabs the face of St. John the Baptist in the Museum of the Church of Santa Croce. Scholars attribute the fresco "St. John and St. Francis" to Domenico Veneziano, a 15th-century pioneer in new painting techniques. Restorers, facing for the first time art injured by fuel oil, experimented with carbon tetrachloride, benzene, methylene chloride, and other solvents to remove the stains.

were more than 240 saints, angels, Virgins, and Biblical figures, each panel wore a small white tag like a patient's chart, which recorded the humidity of the wood and rate of shrinkage.

We wandered through the ward, pausing at the stricken Cimabue, and hovering over a Madonna of one of Giotto's followers.

"These panels were generally made of poplar," Dr. Baldini said. "The artist would prepare a panel by coating it with a fine plaster mixed with glue, called gesso. The paint-and-gesso layer and the wood backing have different rates of expansion and contraction." We paused before a huge 15th-century altar panel.

"You see what happens. At a certain point the wet wood keeps expanding, but the color cannot, so it begins to break. That is the reason for the mulberry tissue." He carefully lifted a corner of the almost transparent material, frequently miscalled rice paper.

All over Florence I had noticed paintings coated with this absorbent paper. It was the standard emergency bandage for damaged works of art.

"If the color has moved or flaked, it will still be there under the paper. But then we have the same problem in reverse. As the wood dries, it shrinks faster than the gesso and color. Sometimes the gesso has crumbled and flakes off, taking the paint with it. It is essential that we have slow, controlled drying of the panels, and that is what this building gives us. With luck, we will be able to salvage most of them."

THE LIMONAIA was prepared—a new concrete floor, an inside roof of plastic, a humidity-control system—in 12 days. When the first of the "patients" were moved in, on December 6, they looked in dreadful condition because of mold, but that worrisome problem has been conquered by spraying with nystatin (page 33), an antibiotic sometimes used to cure diaper rash.

A young Englishman, John Schofield, a student at the Slade School of Fine Art in England, was one of those who came to Florence to help out. He was carefully brushing the fungicide on the undersides of the panels.

"You know, it has always been the height of my ambition to work with these masterpieces, and here I am. But I never thought it would be under these conditions. Look at all this mold—green, black, white, pink."

John's hundreds of student colleagues were busy throughout the city and its environs, but

Tortured figure of Mary Magdalene, carved by Renaissance master Donatello about 1453, receives first aid from Aldo Cencetti of the Uffizi. The maelstrom swirling into the Baptistery soaked the wooden statue to the hips, but did not fling it from its pedestal. Restorers were astonished to find traces of the original paint revealed by the flood.

two of the major efforts—at Fort Belvedere and at the heating plant of the railroad station—were directed toward the major salvage effort in Florence: rescuing the books.

In the frigid topmost part of old Fort Belvedere, on a high hill south of the city, I found Mr. and Mrs. Roger Powell, British bookbinders, supervising an international crew of students in the rescue of the National Library's most valuable volumes. Quiet scholars both, the Powells in their way seemed more permanent than the fort.

"When the British Museum called," Mr. Powell said, "my partner Peter Waters, together with Dorothy Cumpstey and Anthony Cains of the museum staff, came to Florence at once to set up this team."

Mr. Waters, a younger man, arrived carrying a lunch basket filled with cheese, bottles of wine, and bread.

"Dreadful place for a picnic," Mr. Powell said, blowing warmth into his hands. At long tables nearby the students were carefully cleaning dried mud from piles of books (page 26). "But cold inhibits the *muffa*," Mr. Powell continued. "That's the word for mold, by the way: in Florence these days, the three most despicable words are all ugly ones—*nafta*, *fango*, and *muffa*—oil, mud, and mold."

"We were lucky, though, about the oil," Mrs. Powell said. "The National Library was one of the few places where oil did little damage."

The desperate measures adopted in the frantic hours after the flood were evolving into a systematized assembly line. During the day trucks loaded with dried books from the conscripted tobacco barns, brick kilns, and textile plants climbed up to Fort Belvedere, where shelving had been erected in the stone rooms. The British team of experts examined each volume for its condition and rarity and then marked an instruction sheet for the student volunteers.

Because the young people came from many nations and spoke many tongues, the team used the international system of highway signs—the same characters with which motorists in Europe are familiar. The "Stop" sign, for example, meant "Do not touch."

The Powells estimated that most of Florence's books can be saved, though none can

say when they will all be given new bindings.

Once sorted and carefully taken apart at Fort Belvedere, the dried books were given a bath! The washing, pressing, and drying of the separated pages were done at the heating plant of the Florence railroad station—and a more unlikely place for the saving of a great library cannot be imagined.

In the cavernous rooms, filled with huge boilers and jungle gyms of pipes, students stood at a bank of washbasins and submerged the old handmade pages in plain tapwater mixed with fungicide. The dried pages were apt to become brittle because the old sizing had run and gathered in puddles; the washing flushed out this old glue. The crucial factor was that the old inks and handmade papers could be washed without damage. Finally, the individual pages were flattened in a press and hung out to dry (pages 26-7).

Sally Lou Smith, an American binding expert now living in London, was supervising the world's oddest wash. Occasionally a cloud of steam erupted from the boilers with a mighty *whoosh*, as the heating plant went about its normal business.

Their song stilled, treasured musical instruments in the Bardini Museum lie twisted and broken. Rare large spinet of the 16th century, its sounding board cracked, rests between a cittern (right) of the same period and 18th-century instruments of the lute family. Director Ennio Regoli holds the split back of an 18th-century violin. 41

"We used to jump," Mrs. Smith said, "but we've grown used to the noise. And these people have been just wonderful; we've strung lines on all of their favorite pipes." And indeed the whole place was filled with pages hanging in the air like tattered sails.

After drying at the heating plant, the books were returned to Fort Belvedere and given a treatment with thymol crystals to prevent mildew. By late February, the entire book-salvage program had been moved to the National Library. Workmen had installed a large ethylene-oxide gas chamber in the garden to fumigate large numbers of volumes at once. Originally the unit had been designed to sterilize powdered soup, not books.

Thus the rescue work was going on, with a growing feeling of hope in each passing week. Five months after the flood, CRIA had raised nearly $1,500,000 and was girding for the long-range problems of restoration that must now follow the first aid.

EVEN THOUGH the saving of paintings and sculpture and books held the world's concern, my most indelible impressions are of the courage of the *popolo minuto*—Florence's "little people."

The flood did its worst where human beings could least afford it. Years ago the small craftsmen—the makers of mosaics, the woodcarvers, the leather and textile workers, the jewelers—settled near the river, where water power would turn their small machines. Florence is probably the last European city where an economy rests so heavily and happily upon handcraftsmen and small manufacturers, many of them using the tools and techniques handed down through generations.

The image of Florence after the flood was that of small shop owners sweeping out the remains of their life's work. But they are, after all, Florentines. Their determination to carry on was voiced by Marcella Battagli who, with her parents, runs a small leather-goods shop near the Arno.

"We now have to start again from the beginning," she said, "but we will continue. My parents' lives and more than 25 years of my own life cannot be destroyed in one night."

The days immediately after the flood were difficult for the artisans, but slowly life and hope revived. With aid from such organizations as UNESCO, the Anglo-American Relief Fund, and the Florentine Relief Fund, spearheaded by Senator Claiborne Pell of Rhode Island, Florence's craftsmen were getting back on their feet.

History meanwhile added an ironic footnote. Two "lost" notebooks of Leonardo da Vinci, discovered in the National Library of Madrid, were made public shortly after the disaster. They included a long-forgotten drawing from the great Florentine's elaborate scheme to control flooding of the Arno with a complex of canals, dams, and reservoirs. The 450-year-old plan might have saved Leonardo's city much grief. But it was never carried out, and Florence in its valley has lived its history of disasters. What measures may yet be taken to protect it remain the long thoughts of tomorrow.

For now, it seems enough to hail the "Miracle of Florence." The city has regained in full its former appearance. Familiar hotels and pensions are again open. Visitors are finding thousands of shops doing business as usual, and best of all, the artisans are back at work. Countless acts of courage and determination and the support of a sympathetic world have made it possible for beautiful Florence to rise, like Botticelli's Venus, from the waters.

Perhaps the scene I will remember most from the dark winter days was a troop of blue-clad mud diggers swinging their way through the chilly streets of Santa Croce. These young people from England, Switzerland, Belgium, the United States, France, Denmark, Germany, Spain, Austria, the Netherlands, and Brazil were clearing cellars still filled with the evil muck weeks after the churches and palaces had been cleaned.

I watched until the troop of diggers turned a corner and vanished from sight. But I could still hear them. Mud-splattered, cold, and tired, they were singing. THE END

Bridging the centuries, pageantry brings the Renaissance to life beneath the soaring, floodlit Palazzo Vecchio. A 20th-century copy of Michelangelo's "David" stands under blue and gold emblems of Florence; the original rests in the Academy (page 21). Ceremonies in period costume herald a game of *calcio*, a soccerlike contest that citizens played to show defiance of enemy artillery fire during a 1529-30 siege. Exhibiting similar mettle, Florentines have nursed back to health their Firenze Bella—Beautiful Florence.

LAKE POWELL:

Waterway to Desert Wonders

Article and photographs by WALTER MEAYERS EDWARDS
National Geographic Staff

LIKE A SHINING MIRAGE beheld by some lost prospector in the desert, a vast new lake grows in the West behind Glen Canyon Dam on the Colorado.

Early in 1963, huge steel gates dropped across the tunnels that for four years had diverted the Colorado around the growing concrete plug, and the river began to rise. The resulting lake will back up 186 miles.

Glen Canyon Dam, flooding one of the Colorado's least-known and most placid stretches, lies 75 miles upstream from Grand Canyon, which beauty-loving Americans agree must never be despoiled by a dam. The Glen Canyon project is part of the Colorado River development program that began with the great Hoover Dam, completed in 1935.

New Lake Draws Hundreds of Thousands

To an astronaut, the nine-trillion-gallon reservoir of Lake Powell rising behind Glen Canyon Dam would resemble a gigantic bolt of forked lightning spread across the Arizona-Utah desert (map, pages 54-5). To some people, it represents irrigation, flood control, electric power, recreation, and beauty—a man-made miracle. To others it demonstrates the ways in which the splendor of nature, revealed through eons of geological change, can be drowned by the works of man in an instant of cosmic time—a tragic error.

But good or bad, it has been done, and even a tamed river may offer more gifts than its conqueror is capable of comprehending.

Before the dam was built, each year's visitors to Glen Canyon could be counted in the hundreds. Though the area is remote from large population centers and still relatively little known, nearly 360,000 people swarmed there last year. At the height of the season 1,200 boats were launched weekly, with more than 700 cruising there on Memorial Day weekend alone. Visitors are drawn not merely by the crystal water and the abundant sunshine, but also by the multicolored, cliff-adorned, canyon-carved setting, unrivaled by any other large lake in the world.

Name Honors Explorer of a Century Ago

I first encountered this desert land in 1962, before the Colorado started to fill the sheer-walled canyon that twists away to the northeast from the damsite, 120 miles north of the nearest city of Flagstaff, Arizona. At that time, floating downstream on a raft, I saw it much as it must have appeared a century before to the man for whom the lake is named —Maj. John Wesley Powell, dauntless explorer of the Colorado and a founder of the National Geographic Society.

"Past these towering monuments, past these mounded billows of orange sandstone, past these oak-set glens, past these fern-decked alcoves, past these mural curves, we glide hour after hour, stopping now and then, as our attention is arrested by some new wonder . . ."

Drifting along, I could imagine Powell—in his thirties, a bewhiskered veteran of the Civil War that had cost him an arm—standing in his boat, leading his expedition down the Colorado in 1869.

For two months and 550 river miles, they battled rapids. Then, from the junction of the Colorado and the Dirty Devil Rivers to the meeting of the Paria, the going became smoother. Powell named this idyllic stretch Glen Canyon. His choice was apt.

(Continued on page 49)

Desert varnish, created by iron and manganese seepage, streaks a sandstone wall in Forbidding Canyon, one of the myriad arms of new Lake Powell in southern Utah. Plastic raft sails rising waters backed up by Glen Canyon Dam. When filled to capacity, the reservoir will drown this hanging tapestry, but others equally spectacular survive in once-remote canyons.

Oasis amid parched red cliffs. Davis Gulch tempts sun-soaked hikers to linger in its shadows. Thin, clear stream takes a tortuous course toward the Escalante River, thence into the Colorado. Distant La Gorce Arch at left center honors Dr. John Oliver La Gorce (1879-1959), who served

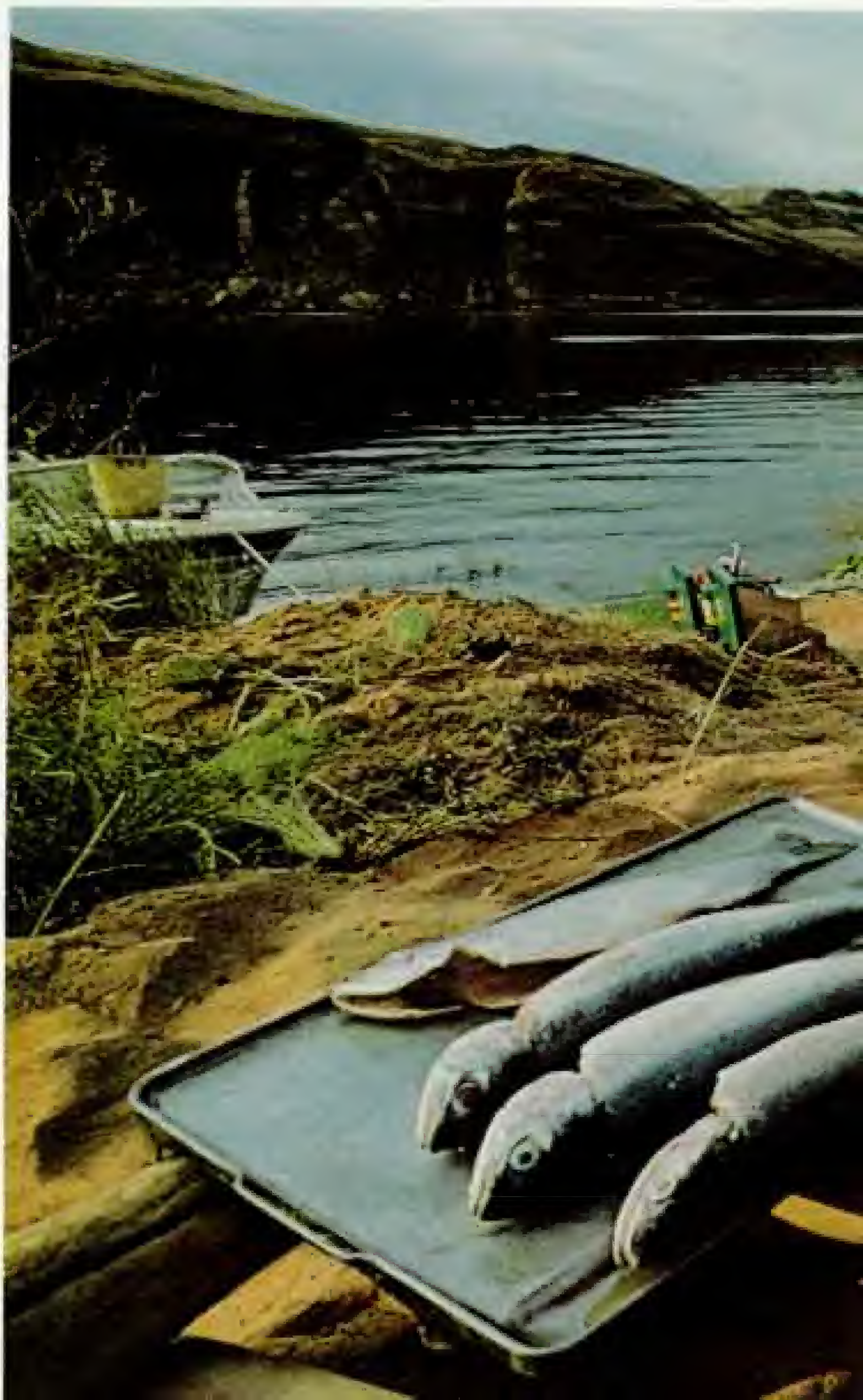
the National Geographic Society for 54 years, including three years as President and Editor. Ultimately Lake Powell will cover the silt bar and the rocky caves in the foreground, but spare the arch. Such beauty epitomizes wonders hidden deep in scores of Glen Canyon's tributaries. 47

Casting into the Colorado from a ledge below Glen Canyon Dam, a fly-fisherman nets a 12-inch rainbow trout. Fishing is good, the author reports, both below and above the 710-foot-high concrete plug and its neighboring span, the world's highest steel-arch bridge. Lake waters abound in trout, largemouth bass, sunfish, and catfish. Air drops periodically restock the lake (pages 68-9).

ENLARGEMENT ABOVE: ANN SIMMONS © N.G.S.

Brazen nibbler, a green sunfish too small for the hook bites at the toes of a wader.

Dawn. Driftwood crackles and fresh trout, dusted with cornmeal, await the frying pan. The aroma proves almost more than hungry campers can bear. The previous night they spread sleeping bags on this wedge of sand beside the lake near Hole in the Rock (page 66). They awakened to a golden glow that routed the last of the stars, and breakfasted as the summer sun climbed above the jagged horizon and enveloped the cove.



Here the river's narrow tributary canyons tempt the explorer into fascinating glens—secret fairylands where walls, tapestry-streaked with desert varnish by iron and manganese seepage (page 45), tower up to thin cerulean crescents far overhead, and titanic chambers glow delicately pink or orange.

When I first drifted through Glen Canyon, many such Edens beckoned. Other wonders, difficult if not impossible to reach, remained unexplored. Four years later, with the lake flooding deep into their twisting passages, they became accessible by boat, and I recruited a party for an exploratory cruise.

To navigate the new lake, we obtained two Buehler Jet boats. Developed by New Zealander William Hamilton to travel his homeland's shallow mountain torrents, they drew less than 6 inches of water at their 28-mile-an-hour cruising speed, and could turn in their own length. Using a water-jet system instead of propellers, they were sisters of the boats that in 1960 climbed the Colorado's formidable rapids in Grand Canyon.* We named them *Green Lady* and *Blue Lady*.

To help man them on our month-long cruise up Lake Powell, I enlisted 22-year-old William (Buzz) Belknap III of Boulder City, Nevada, who at 16 had piloted one of the jet craft in the Grand Canyon adventure. He

*See "Shooting Rapids in Reverse!" by William Belknap, Jr., NATIONAL GEOGRAPHIC, April, 1962.

was joined by his sister Loie and his mother Frances. His father, photographer William Belknap, Jr., a frequent contributor to the GEOGRAPHIC, joined us whenever he could. John Evans, a graduate student at the University of Minnesota in Minneapolis, and Jerry Garrett, undergraduate at the University of Missouri at Kansas City, completed our team. In addition, Dr. J. Parker Van Zandt, of Washington, D. C., a spry septuagenarian, aviation pioneer, and former contributor to the magazine,* accompanied us for part of our journey.

On a scorching June afternoon we started from Wahweap, about five miles behind the 710-foot-high dam and its spectacular bridge, world's highest steel-arch span (page 48). Until work began on the dam in 1956, 45 miles of jeep trails separated the site from paved highway.

After the barrier was finished, the National Park Service, which administers the new Glen Canyon National Recreation Area, built paved roads beside the bay at the mouth of Wahweap Creek, the lake's largest boat-launching area. Now, with a motel, trailer park, and marina, Wahweap bustles with activity.† Lake traffic has grown so fast that a Coast Guard station has been established to assist with an aggressive water-safety program.

"Like Cruising in a Washing Machine"

Between Wahweap and Padre Bay, 25 miles uplake, the river had not yet climbed out of its canyon. In the narrow channel, the wakes of our boats and others bounced back and forth between the cliffs, churning a chaotic storm of crisscrossing echo waves. As Jerry put it, "It's like cruising in a washing machine."

Padre Bay was worth the pounding we took to get there (pages 58-9). The lake's largest expanse of open water, it introduced us to the massive red sandstone cliffs and monuments that would be our companions during most of the trip. Gunsight Butte loomed like a giant saddle to our left. On our right, Dominguez Rock lifted its red monolith from the lake, and many unnamed buttes stood around us like dignified sentinels.

One of the best-known landmarks lies beneath Padre Bay. Here in 1776 two Franciscans, Fathers Dominguez and Escalante, forded the Colorado on their return to New Mexico, after a futile attempt to open a direct route to their order's California missions. The spot came to be known as the Crossing of the Fathers. As Lake Powell formed, the crossing vanished under Padre Bay.

We beached our boats on a strip of golden sand at Padre Point, where the Navajos plan to build a marina, and plunged into the water, clothes and all. The intense dry heat had dehydrated us, and we soon learned that the only way to remain comfortable was to drink gallons of water and wet ourselves down at every opportunity.

Following lunch Buzz and Loie demonstrated their

Drama of change wrought by Lake Powell unfolds in photographs of Gregory Butte made four years apart.

When author Edwards, flying in a companion Cessna, snapped the picture above, in June, 1962, the Colorado snaked between steep-walled banks. Nine months later, the gates of Glen Canyon Dam closed, and the waters began encroaching on the land.

By June of 1966 the lake almost rings Gregory Butte. At capacity, Powell will cover the peninsula behind the butte and turn the stone tower into an island.

*Then in the U. S. Army Air Service, Lieutenant Van Zandt wrote "Looking Down on Europe" for the March, 1923, GEOGRAPHIC and "On the Trail of the Air Mail" in January, 1926. "Looking Down on Europe Again" appeared in the June, 1939, issue.

†Ralph Gray reported on the area's recreational facilities in "From Sun-clad Sea to Shining Mountains," GEOGRAPHIC, April, 1964.

water-skiing expertise. When Britain's Princess Margaret and her husband Lord Snowdon visited the lake the year before, he had indulged his fondness for the sport. The November weather was cool, and he had worn a wet suit, but we needed no such insulation. In midsummer the surface water was 72° F., and the sun blazed relentlessly.

Storm-tossed Family Calls for Help

Heading uplake the next afternoon, we rounded a long S-curve leading into Last Chance Bay, a broad, straight arm that stretched northward, paralleling the multicolored layer cake of the Kaiparowits Plateau for more than ten miles. Suddenly we were caught in one of Lake Powell's many moods —the dangerous one. The weather in the canyon is capricious. Storms can be wild and squally, and boating requires seaworthy craft and competent crewing.

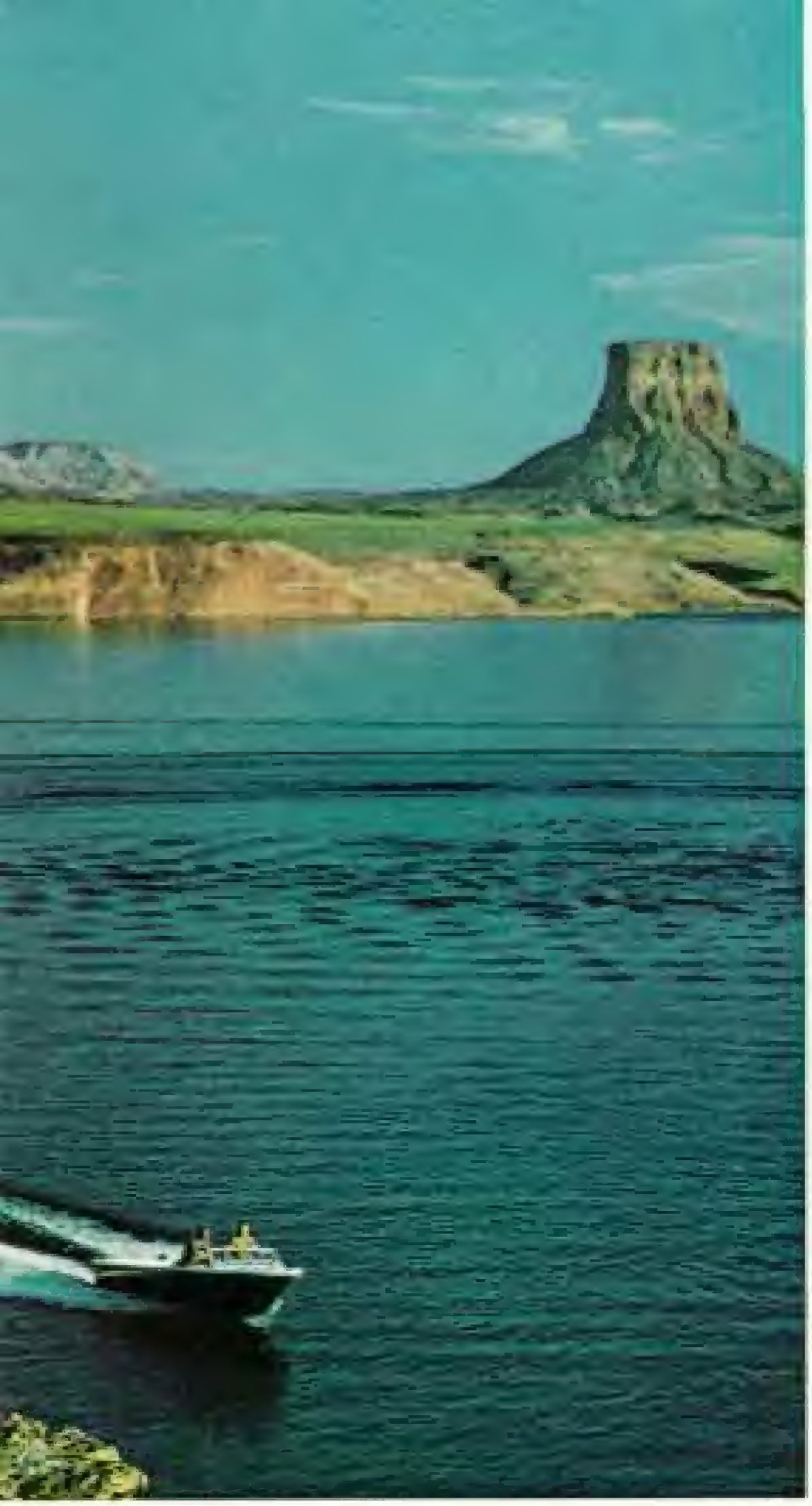
At the mouth of the bay we overtook a family in distress. The wind, whipping white streamers from heavy swells, was toying with a tiny boat and its occupants, a couple and their five youngsters. The drenched little ones were crying.

"Can you take my children?" shouted the desperate father. The waves seemed about to swamp his homemade plywood craft.

"Too dangerous!" shouted John. "Head for shore! Over there!"

We escorted the little boat to a sheltered beach, and soon the family was drying around a fire, wearing assorted spare clothing from our duffel bags (opposite, upper).

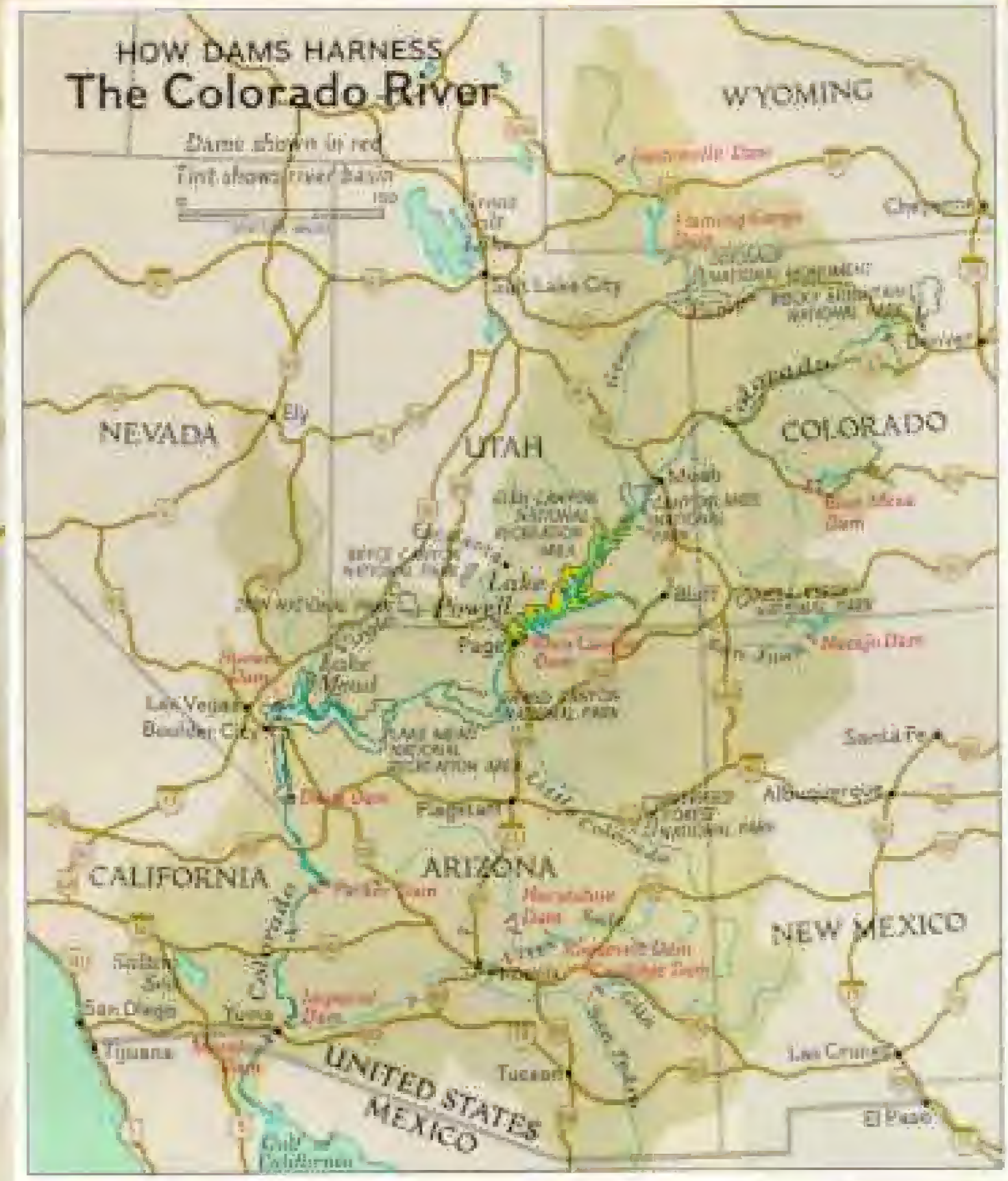
After the storm, we breezed out of Last Chance Bay and headed uplake once more. Between Dungeon Canyon, now lying beneath 250 feet of water, and the mouth of the San Juan River, 22 miles farther up the lake, about twenty tributary canyons drain Kaiparowits Plateau to the north and Cummings Mesa and Navajo Mountain to the south. We had explored many of these on our raft trip four years before, hiking deep into such evocatively named canyons as Dangling Rope, Cascade, Twilight, Little Arch, Mystery,



Southwestern sun copperplates buttes above Padre Bay, where jet boats cut creamy wakes. All but the tip of Padre Point lies within the vast Navajo reservation that borders Lake Powell's eastern shore south of the San Juan River (map, next page). The tribe plans a marina and airstrip here.

Blankets and bonfire warm boaters drenched by a squall that almost capsized them on Last Chance Bay. John Evans, here helping remove a wet shirt, later joined the climbing team that scaled Antarctica's highest peaks (GEOGRAPHIC, June, 1967).

Thrilling to their first boat ride, a Navajo family skims the lake. A sheepman like many of his fellow Indians, Harold Drake farmed a small island near the mouth of Piute Canyon before the rising lake waters engulfed it. Active in tribal affairs, he serves as a member of the Navajo Council and for a time was Chairman of the council's policy-making Advisory Committee.



Rising in the snow-crested peaks of its namesake state, the Colorado zigzags southwestward for 1,450 miles to reach Mexico's Gulf of California. Hernando de Alarcón discovered the mighty stream in 1540, yet for more than three centuries it remained a river of mystery. In 1869, Maj. John Wesley Powell (opposite) led a party down the uncharted Colorado in wooden boats. Today more than 40 dams tame the river and its tributaries; map shows 27 major installations.

COURTESY OF ARIZONA PIONEERS' HISTORICAL SOCIETY

Civil War veteran Powell, who lost a forearm at Shiloh, fought boulder-strewn rapids for most of his daring journey down the Colorado. But in a 170-mile stretch of the river between its junctions with the Dirty Devil and Paria Rivers, Powell and his companions floated on smooth, swift water. Awed by the beauty of the glenlike side canyons, he named the region Glen Canyon.

Here Powell meets Paiute chief Tau-gu on the banks of the Virgin River in Utah during an 1873 expedition. The explorer later became the first Director of the Smithsonian's Bureau of Ethnology, second Director of the U. S. Geological Survey, and a founder of the National Geographic Society.

Hidden Passage, Cathedral, Music Temple.

A few, like Music Temple, a vast, fern-fringed chamber that Powell had found "filled with sweet sounds," now lay more than 100 feet beneath our hulls, but others, like Cathedral and Forbidding Canyons, had surrendered only their outer defenses.

Raft Carries Party up Narrowest Channels

The lake had opened many remote beauties to the eyes of the voyager. Cathedral had been one of my favorites. In 1962 we had penetrated only three of its reputed 30 "rooms"—cavernous bulges sculptured out of the sandstone gorges by millenniums of water-borne sand and gravel. The lake had risen more than 300 feet since then, and this time we cruised for almost two miles in a channel that contracted and expanded as it twisted, until finally it became too narrow for our jet boats.

Here we unshipped our Sport Yak, a hard plastic boat shaped like a life raft, not much larger than a bathtub, unsinkable, and apparently indestructible (page 48). At various times we had paddled it, rowed it, sailed it, or dragged it along the ground loaded with duffel. Inverted, it served Buzz as a bed.

In this tiny craft Buzz ferried us still farther up Cathedral Canyon until the passage became too tight for even its 42-inch beam. From that point, balancing on driftwood logs, or straddling the space between high curving walls, we made our way to higher ground and picked a route over smooth boulders until a high overhang, the lip of a dry waterfall, frustrated further exploration.

Green lawns of Page and blue depths of Powell patch the desert's tawny mantle. Aerial view surveys the lake's southern end on the Arizona-Utah border. A prominent landmark, Lone Rock, looms like a fortress at upper left and appears even more formidable at water level (below).

Page, the town a dam built, sprang out of scrub and sandstone atop Arizona's Manson Mesa, where Navajos grazed their sheep only a dozen years ago. From the outset a planned community, built and administered by the Federal Government, Page swelled to almost 7,000 residents during construction of the dam.

Today the town counts about 1,200 but contemplates a prosperous future as a recreation and retirement center. Homes, schools, office buildings, supermarkets, motels, and a dozen churches line broad paved streets. The name honors the late John C. Page, Commissioner of the Bureau of Reclamation from 1937 to 1943 and a pioneer in development of the Colorado River's resources.

U. S. 89, looping across the new bridge, links Page with Kanab, Utah, to the west and with Flagstaff, Arizona, 134 road miles to the south. Summer temperatures soar by day, but the 4,300-foot elevation and low humidity assure cool nights.

KODACHROMES BY WALTER MEAYERS EDWARDS © N.G.S.

Just six miles from Cathedral Canyon and about 50 miles from Wahweap is one of the area's most famous sights—Rainbow Bridge (pages 64-5). Spanning Bridge Creek, its spectacular rock arch rises 309 feet above the stream's bed, striking testimony to the relentless power of the elements.*

Four years earlier we had hiked for five miles from the river to reach Rainbow Bridge, threading our way up Forbidding Canyon, over flower-decked dunes, through glistening Bridge Creek, past great rocks and occasional low waterfalls. We had stopped often to linger in the cool pools along the canyon floor. It was a tough hike, and broiling hot. I recall one of our party gasping as he flopped below the arch, "I'm all here, but there's nobody inside pushing."

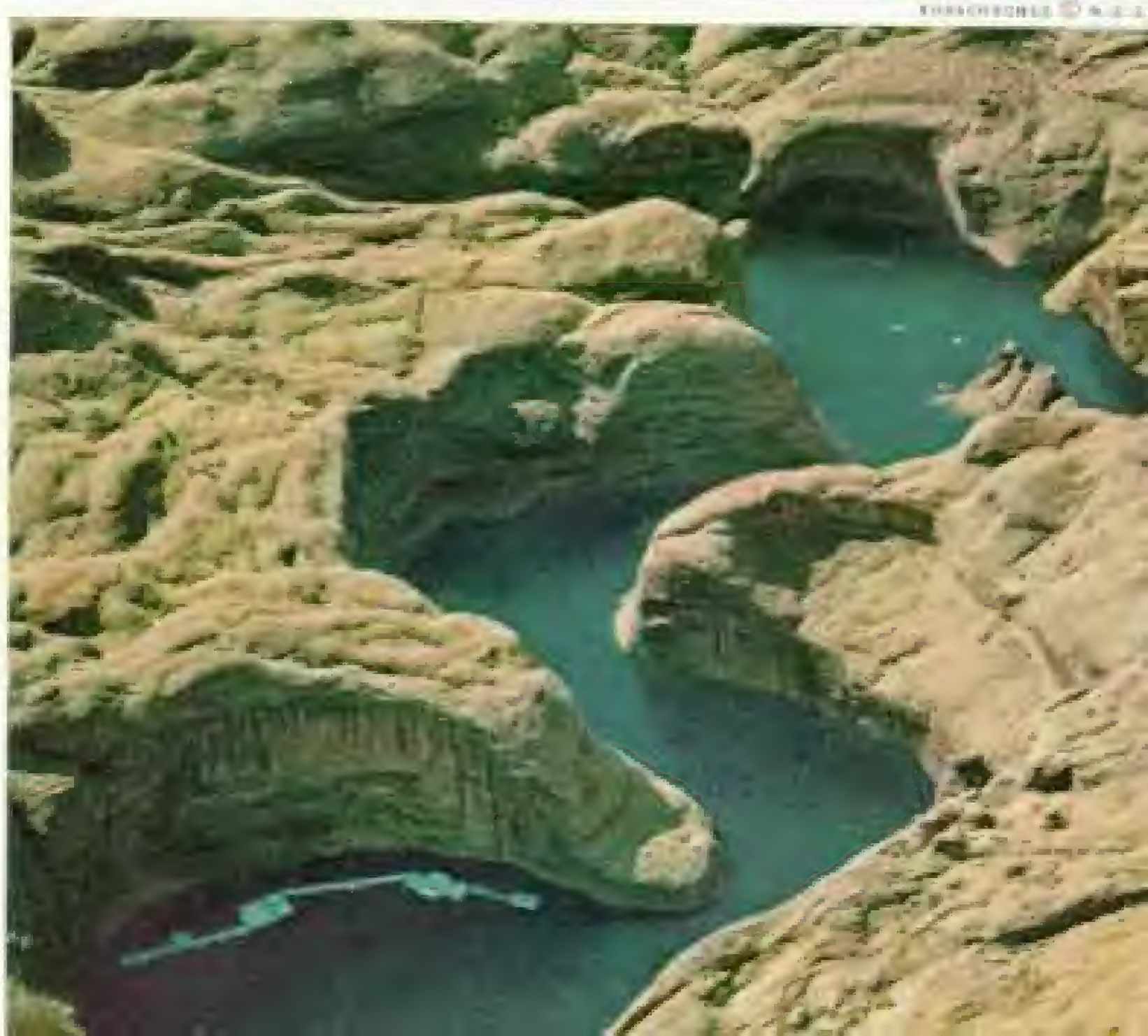
*Ralph Gray wrote of "Three Roads to Rainbow" in the April, 1957, National Geographic.

Powell's largest expanse of water, Padre Bay laps at Gunsight Butte, left foreground. Already the lake converts many promontories into islands: a rise of 165 feet more to maximum level will widen the bay to six miles, swallowing the jutting finger of Padre Point at right center, except for Dominguez Rock near

its tip. Waters lick ever higher on Gregory Butte (page 51) near the mouth of fiordlike Last Chance Bay, just beyond Padre. Other landmarks: the tableland of Cummings Mesa, upper right; the 10,388-foot whaleback of Navajo Mountain, beyond; and the sheer ramparts of Kaiparowits Plateau, upper left.

Floating filling station near the mouth of Forbidding Canyon lies anchored in 200 feet of water; sheer canyon walls necessitate the unconventional dock. Here at Rainbow Bridge marina, boaters can buy gasoline barged from Wahweap or shop for camping and fishing supplies. Maintenance personnel and a park ranger live in houses built on the platform.

Through Forbidding Canyon's rock-ribbed maze (right), waterborne visitors will cruise to the boundary of Rainbow Bridge National Monument, within a short walk of the arch (pages 64-5), when the lake has attained capacity. In pre-lake days, hikers had to tramp five miles up the canyon to reach the landmark.



Water backing up in Bridge Creek was now only a mile from Rainbow Bridge, and the lake ultimately will form a reflecting pool 46 feet deep beneath the arch. Some geologists believe the water eventually will topple the spectacular formation. Others disagree. But more visitors have seen Rainbow Bridge in the past two years than in all the previous years since its discovery in 1909.

In that year John Wetherill rode a horse beneath Rainbow Bridge, the first white man known to have done so. Neil M. Judd, who directed Society-sponsored archeological studies of Southwestern Indian ruins four decades ago, was with the party that discovered the bridge and wrote in the GEOGRAPHIC of his awe upon first beholding "this sublime creation of the Master Builder." *

Our old-timer, Parker Van Zandt, had known Wetherill. "In 1927," he told us, "I flew Wetherill around Navajo Mountain on his first plane trip. He wouldn't believe how small Rainbow looked—like half a thin doughnut. Now I'm having a hard time believing it's so big!"

For my part, the sight of a marina floating near the entrance to Forbidding Canyon had been hard to believe. Its white structures nestled incongruously against the brooding cliffs in 200 feet of water (left).

There was something else new, too, and it saddened us. When the lake level is down, retreating water leaves a white "bathtub ring" on the walls of the great gorge. The fact that Lake Powell presents its best face only when rising or remaining constant continues as one argument against such dams as Glen Canyon.

Near Reflection Canyon one morning, Buzz and I met Guy Chambers, a schoolteacher from Tucson, Arizona, and his wife Betty, a nurse, putt-putting along in a ten-man life raft powered by a tiny outboard motor.

"We've known this canyon for years," said Mr. Chambers. "We still love it, though we liked it better the way it used to be."

Later we encountered Don Teetor, a retired industrialist, in his 60-foot houseboat *Connie*. With air conditioning, two-way radiotelephone, and a speedboat as tender, he and his guests were "roughing it" in style.

"This lake's the greatest thing that ever happened!" he exclaimed.

With 1,800 miles of shoreline, Lake Powell never seems crowded. Seldom did we see more than three boats at a time above Wahweap.

Fire Still Warm—But No Navajos

The 25,000-square-mile Navajo Indian Reservation borders nearly a third of the eastern shore of the lake. One afternoon, in the hope of finding Navajos, we cruised for 22 miles up the San Juan and pulled into Piute Canyon, one of several large gorges that drain the north side of Navajo Mountain. We left our boats and hiked up the creek. Bill Belknap forged ahead with a two-way radio.

He called back shortly that he had found a Navajo camp near a spring and a rock corral in a grove of cottonwoods, but no Navajos.

"Looks as if they've been here recently," he said. "Suggest you walk up the wash."

Half an hour later, a tiny white terrier overtook us, gave a few staccato barks, and disappeared ahead. Following a hand-dug irrigation ditch, we came finally to a spring and a rock shelter with a fireplace.

"The coals are warm," announced John. "Whoever was here hasn't been gone long." The terrier reappeared, sniffing and howling.

*See "Beyond the Chaco Hills," March, 1924.

Off to the east, the sides of Piute Mesa, now glowing red in the setting sun, warned us to retreat. We had gone only a short way when a sturdy, broad-faced man in red shirt and blue jeans hailed from high up on a rise:

"Have you seen a little white dog?"

John ran to meet him and returned to report.

"He's a Navajo, all right—name's Harold Drake. He was sure pleased to find his little pooch. He and his family camped here last night. His sheep were down at the lake." John turned to me and added: "When I told him you were from the GEOGRAPHIC, he wanted to know how he could get the magazine. I told him if he'd meet us tomorrow at the mouth of Piute, you'd arrange it for him."

Next day, Harold Drake, his wife Stella, and four of his five children enjoyed their first boat ride in *Blue Lady* (page 53).

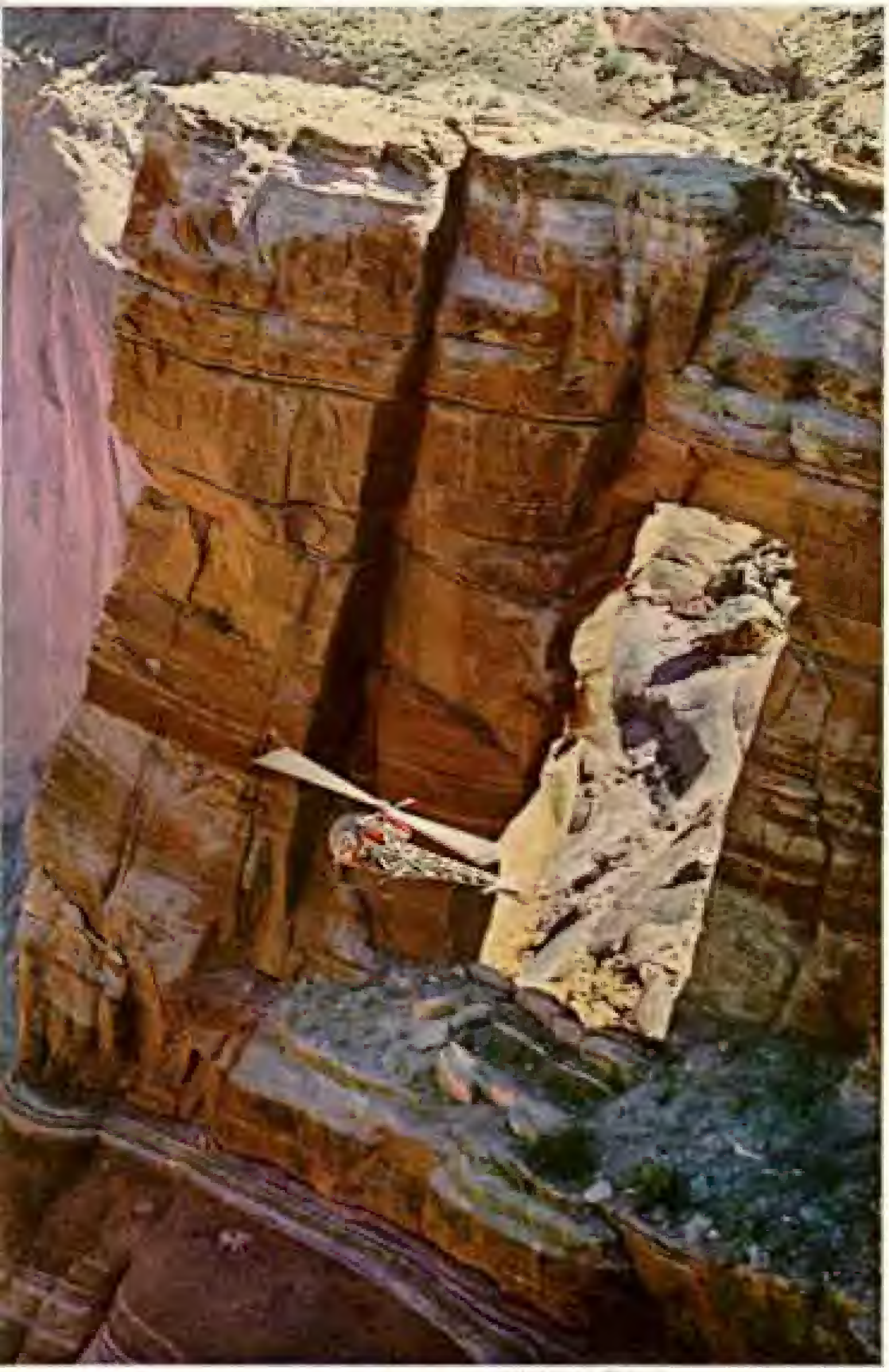
The following afternoon found us at a historic spot. Lois, John, Jerry, and I perched precariously on a cliff about five miles uplake from the mouth of the San Juan. Our feet rested on a narrow ledge 800 feet above the water. Directly below us, *Blue Lady* floated at the apex of a pointed inlet. From there a steep trail led almost straight up a cleft in the canyon wall to a narrow notch at the top, 300 yards to our right, known as Hole in the Rock (map, page 54).

Here in the winter of 1879-80, a band of Mormon pioneers—some 250 men, women, and children, with some 80 wagons, horses, and more than 1,000 head of cattle—halted on their way from Escalante, Utah, to settle on the San Juan. Misled by over-optimism and hazy geography, they found themselves committed to trekking across almost impassable desert, crossing the Colorado, and building a 200-mile road through some of the roughest country in the West. This break in the Glen Canyon wall was the only way to cross the river without a long detour.

In six weeks of superhuman toil they opened a route through the "Hole" with blasting powder, built a wagon road three-quarters of a mile down to the water's edge, assembled a raft, and on the opposite shore hewed a road up the face of a 250-foot cliff.

The first third of the way down was a 45-degree grade over rock that became slicker and more treacherous with the passage of every wagon. Incredibly, they *drove* the wagons down! Each wagon's brakes were locked, and its rear wheels wrapped with chains. A dozen men and boys hung on behind to keep it from careening into the rocks below.

Joseph Stanford Smith and his wife found



Six-story building would fit into the keyhole arch overlooking Wetherill Canyon. With its altimeter, the helicopter measures the vertical opening as about 70 feet high. The rock window—work of rain, wind, and frost—stands safely above Lake Powell.

themselves stranded at the top. A grandson, Raymond Smith Jones, retold the story a few years ago:

"If we only had a few men to hold the wagon back," Joseph angrily exclaimed to his wife Arabella.

"I'll do the holding back," said Belle, "on old Nig's lines. Isn't that what he's tied back there for?"

Stanford braced his legs against the dashboard and they started down. Old Nig was thrown to his haunches, rolled to his side, and gave a shrill neigh of terror.

"His dead weight will be as good as a live one," thought Belle.

Just then her foot caught between two rocks. She kicked it free but lost her balance and went sprawling after old Nig. She was blinded by the sand. She gritted her teeth and hung on to the lines. A jagged rock tore her flesh and hot pain ran up her leg from heel to hip. The wagon struck a huge boulder. The impact jerked her to her feet and flung her against the side of the cliff.

"All the Help a Fellow Needs"

The wagon stopped with the team wedged under the tongue, and Stanford leaped to the ground and turned to Arabella.

In a shaky voice he asked his wife, "How did you make it, Belle? Belle, you're hurt! Is your leg broken?"

Kicking his shin with fury, she fairly screamed, "Does that feel like it's broken?"

Later, Stanford met five men coming up to give him a hand with chains and ropes.

"We came back to help you," one of them began, but Stanford cut him short. "How's the ferry, boys? Any of it left for us?"

Stanford hadn't gotten over the bitterness he felt when his family and wagon were left stranded above the Hole in the Rock. He glanced at Arabella. She was pale. He remembered her gallant conduct, and was ashamed of his own ill temper.

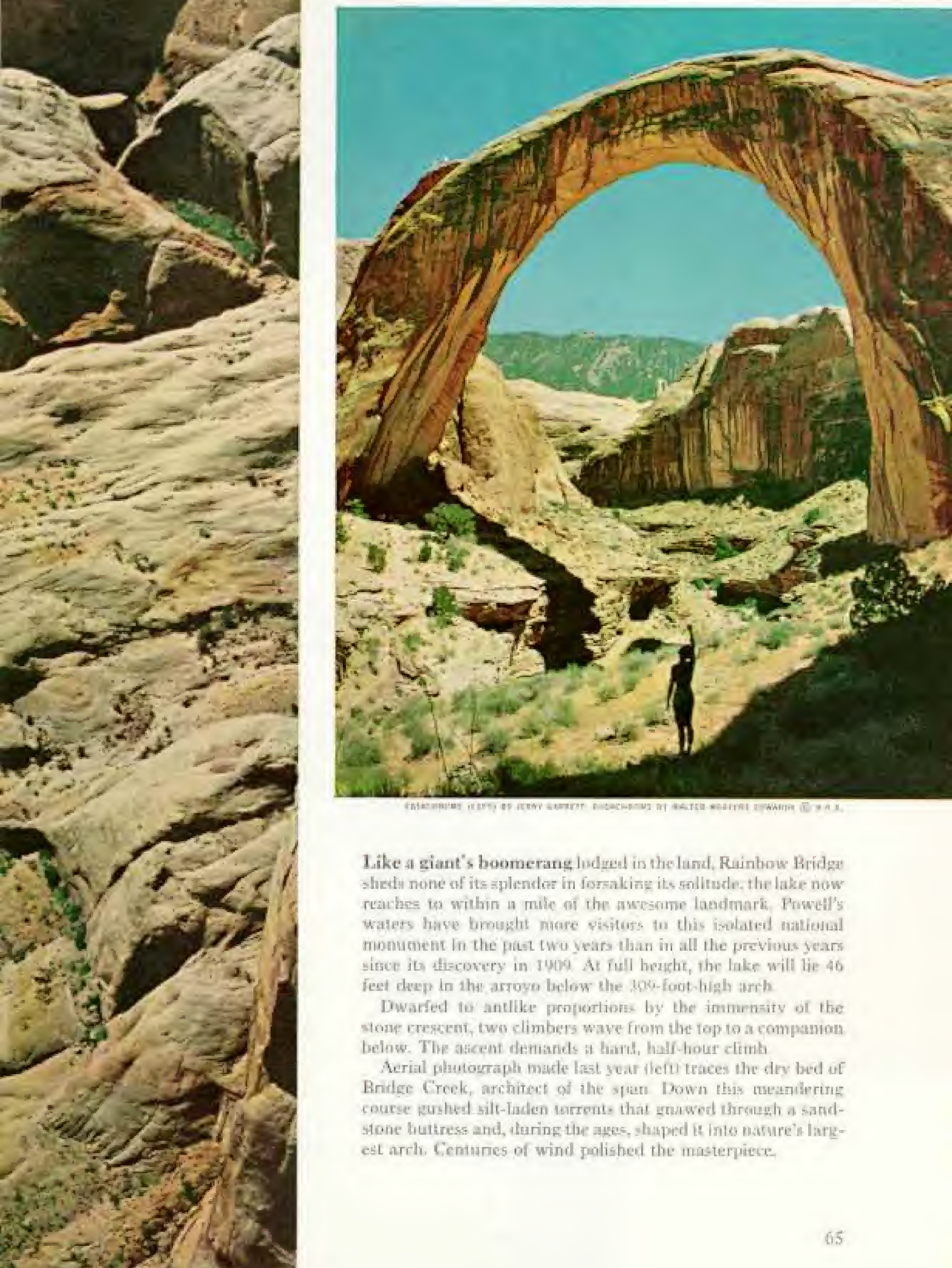
"Forget it fellows. We managed fine. My wife here is all the help a fellow needs." *

*Adapted from *Deseret Magazine*, June, 1951.

Somehow, every wagon made the perilous descent safely (page 66).

Once across, the pioneer band faced further laborious road building through mile after mile of tilted, twisted, and eroded rock. After ten weeks of travel, they halted and founded the settlement of Bluff, Utah. There had been no casualties, and three babies were born en route, but the trek, originally estimated at six weeks, had taken them almost six months.

Tracery of reflections from a limpid pool dances on a rust-red wall in Cathedral Canyon. Lois Belknap and John Evans weave the Sport Yak around corkscrew bends between cliffs that rise hundreds of feet, but stand less than ten feet apart on the canyon floor.



PHOTOGRAPHS (LEFT) BY JERRY GARRETT. PHOTOGRAPHS BY WALTER ALBERTIN EDWARDS © N.G.S.

Like a giant's boomerang lodged in the land, Rainbow Bridge sheds none of its splendor in forsaking its solitude; the lake now reaches to within a mile of the awesome landmark. Powell's waters have brought more visitors to this isolated national monument in the past two years than in all the previous years since its discovery in 1909. At full height, the lake will lie 46 feet deep in the arroyo below the 309-foot-high arch.

Dwarfed to antlike proportions by the immensity of the stone crescent, two climbers wave from the top to a companion below. The ascent demands a hard, half-hour climb.

Aerial photograph made last year (left) traces the dry bed of Bridge Creek, architect of the span. Down this meandering course gushed silt-laden torrents that gnawed through a sandstone buttress and, during the ages, shaped it into nature's largest arch. Centuries of wind polished the masterpiece.

Perilous defile. Hole in the Rock witnessed heroic deeds in the winter of 1879-80.

To this place came a band of Mormon pioneers—about 250 men, women, and children in 80 covered wagons—on a journey from Escalante, Utah, to the San Juan River, where they hoped to plant a colony.

Here they faced a terrible obstacle—the deep, swift Colorado River in its seemingly impassable gorge. But they found one cleft that offered hope of reaching the river. Blasting an opening through the "Hole," they carved a road down the 45-degree slope. At the river they built a raft, and on the opposite side hacked another road up the face of the 250-foot cliffs. Then they actually drove the wagons down the precipitous rock chute seen at right, from which erosion has long since swept away most of the road's surface. Teams of oxen, horses, or mules helped slow the wagons, and men and boys hung on as human brakes. Incredibly, the Mormons lost not a wagon.

Across the Colorado the trail led between huge flat-sided boulders on which the

pioneers scratched their initials and names. Their autographs survive on Register Rocks (above), a reminder to Powell visitors today of the indomitable frontier spirit.

Weathering had obscured much of the evidence of the heroic passage. In one stretch, to traverse a 50-foot cliff, the Mormons attached a road to the sheer rock wall. We saw grooves they had cut to hold the inside wagon wheels, and holes they had drilled for poles to support a roadway for the outside wheels.

Waters Almost Swallow Huge Arch

Just north of Hole in the Rock, the lake is fed by the muddy Escalante River. Before Lake Powell provided easy access over the quicksand at its mouth, few but plateau-roaming cattlemen knew the upper reaches of the Escalante. From the air, I had been intrigued by its deep tributaries: Fiftymile Creek, Davis Gulch, and Clear Creek on the west, and Stevens, Cow, and Explorer Canyons draining the Waterpocket Fold on the east.*

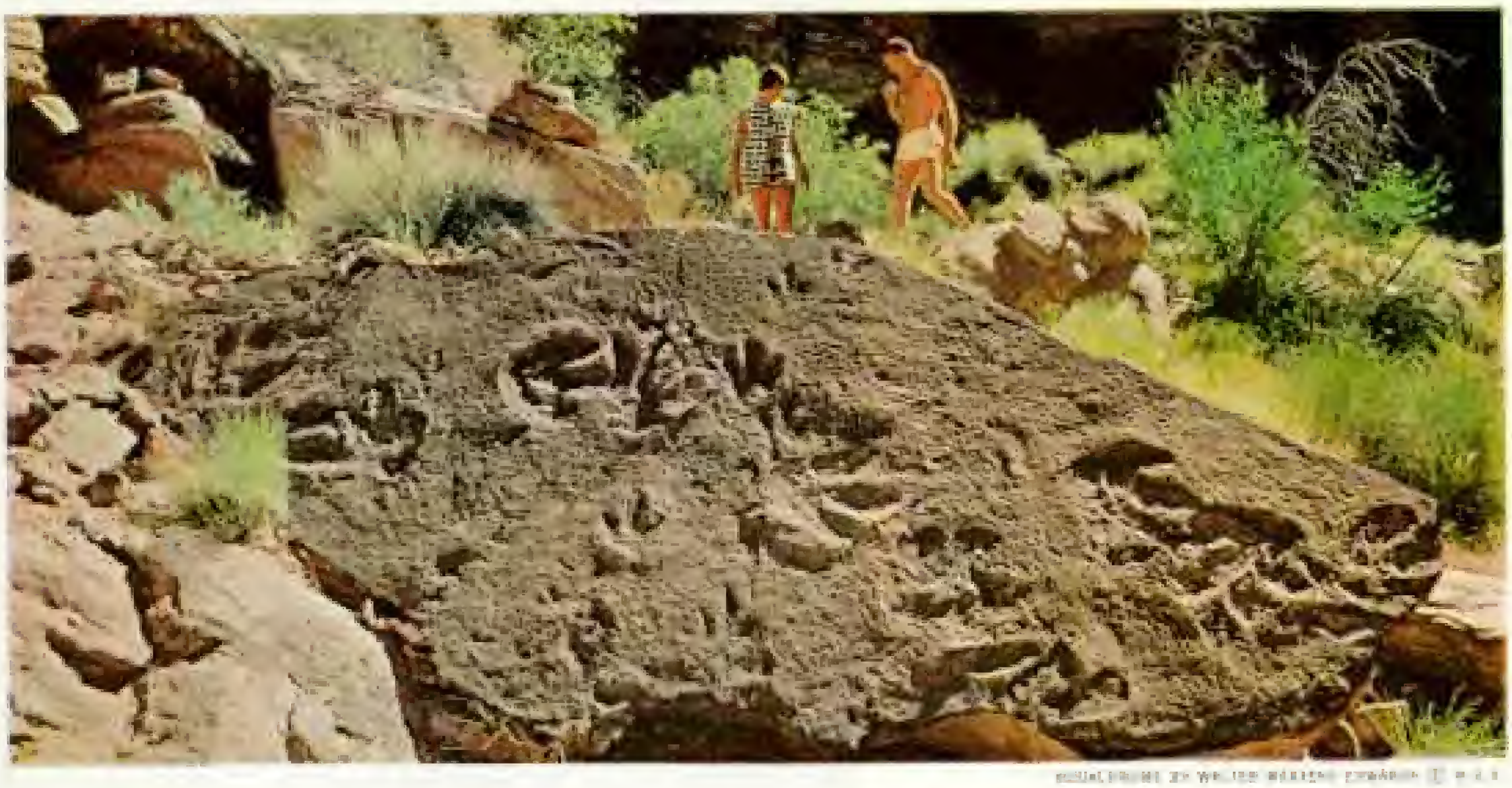
Now, boating up Fiftymile Creek, we just squeezed under Gregory Natural Bridge, which once soared 180 feet. In Davis Gulch, however, the triangular window of La Gorce Arch (page 46), named for the late John Oliver La Gorce, President and Editor of the National Geographic Society from 1954 to 1957, seemed high enough to survive. So did a 100-foot panel of Indian pictographs, believed to be a thousand years old.

In Clear Creek the lake lay eight feet deep in the Cathedral in the Desert, a glen that closely resembled Music Temple. I had hiked in to see it the previous year in all its tapestried, vaulted glory. This time we entered in the boats. Though it was still magnificent, I missed the green pool, the tiny crystal stream, and the delicate moss and maidenhair fern on the red sand floor. Its years, too, are numbered by the rising waters.

Explorer Canyon's scenery confirmed the impression I had gained from the air. We hiked to the far end, splashing through crystal pools, pausing to examine some aquatic creature or drink from a cool, sweet spring. Here 500-foot-high walls merged in a gigantic alcove. Water trickled down into an inviting pool. Vines entwined a chaos of rocks under the overhang. The great alcove acted like an orchestra shell, reflecting the chirps of swooping violet-green swallows and the sweet descending notes of canyon wrens. We left the miniature Shangri-La reluctantly.

There is much to be learned of man's prehistoric past in these canyonlands. Archeologists from the University of Utah and the Museum of Northern Arizona, under contract with the Park Service, in 1957 began an urgent survey of the lake-bed area to discover

*See "Escalante: Utah's River of Arches," by W. Robert Moore, NATIONAL GEOGRAPHIC, September, 1955.



Dinosaur junction: Frozen in stone, tracks discovered by the author's party in Explorer Canyon trace the criss-crossing paths of reptiles living 170 million years ago. Prints more than a foot wide leading across the rock were made by a carnosaur, or flesh-eating dinosaur, striding on hind feet. Paleontologists suspect it may have been the big Kayenta dinosaur, *Megalosaurus wetherilli*, skeletal remains of which have been uncovered on the Navajo reservation. A smaller dinosaur left the seven-inch tracks going up the slab.

all they could before it was submerged.

Five years later my wife and I had watched a University of Utah field party excavate a cliff dwelling in a high alcove in Slick Rock Canyon—about 16 miles upriver from the mouth of the Escalante—measuring and mapping, picking and brushing in storage cists, ceremonial kivas, and living rooms, and dropping their finds into numbered bags.

"The Indians who lived here about A.D. 1250 are called the Anasazi—Navajo for the 'Ancient Ones,'" said Floyd Sharrock, the field director. "Remnants of alluvial terraces show that the stream level was higher at that time, and the valley was probably covered with fields of corn, beans, and squash."

We passed the evening in a tent with bronzed young archeologists, singing and swapping yarns, while Floyd sorted the day's discoveries.

Among them were arrowheads, a chalcedony drill attached to a reed shaft, a piece of soft cotton cloth, string made of human hair and yucca fiber, tiny corncobs, part of a turkey-feather garment, and a size-13 sandal that made me wonder if the huge hands and feet I had seen in petroglyphs on a canyon wall were really exaggerations after all.

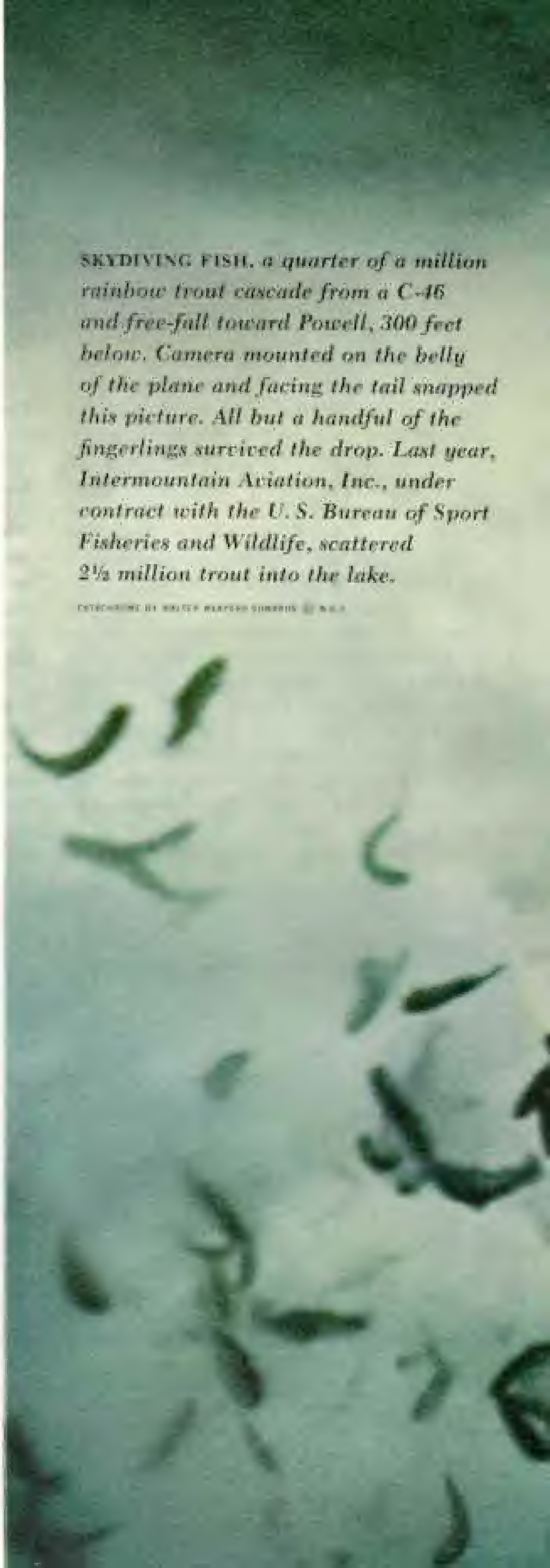
Boat Docks at Once-lofty Retreat

Farther upriver, Lake, Moqui, and Forgotten Canyons were especially rich in prehistoric dwellings. In the first five miles of Lake Canyon, there are more than three dozen. The March, 1924, NATIONAL GEOGRAPHIC contained a picture of an Anasazi site 200 feet above the stream in Moqui Canyon. We stepped right onto the same spot, from the deck of *Blue Lady*.

Dr. Jesse Jennings of the University of Utah, the project director, had told me about the exciting discovery of a 20-room Anasazi pueblo in a Forgotten Canyon alcove (pages 72-3).

"Impassable falls above and below had sealed it off," he said. "We chanced on an ancient hand-and-toe trail pecked into the rock, bypassing the lower falls.

"Most of the roofs were still in place, and we found whole pottery vessels. Two perfect red bowls still had scraps of food in them. We named the place Defiance House, because on the cliffs above there are pictographs of three men brandishing weapons and shields. This place had



SKYDIVING FISH. *a quarter of a million rainbow trout cascade from a C-46 and free-fall toward Powell, 300 feet below. Camera mounted on the belly of the plane and facing the tail snapped this picture. All but a handful of the fingerlings survived the drop. Last year, Intermountain Aviation, Inc., under contract with the U. S. Bureau of Sport Fisheries and Wildlife, scattered 2½ million trout into the lake.*

PHOTOGRAPHED BY BRUCE MARTIN DUMAS © N.G.S.

not been disturbed for some seven centuries."

As our jet boats cruised along a mile below Halls Crossing, about 95 miles from Wahweap near the mouth of a short side canyon called Lost Eden, I found that water had covered a rookery where I had once seen scores of great blue herons. Now, a lone bird took off, its huge wings beating in dignified retreat.

Just as the herons of Halls Crossing are gone, so are the largest of the rapids in Glen Canyon. A placid lakescape appeared where I had watched kayakers ride white water near Bullfrog Creek.

Another landmark I missed was what was left of Robert B. Stanton's giant dredge, abandoned in midstream after the failure of the engineer's gold mining scheme in 1901. Several hundred prospectors had once worked in Glen Canyon. The gold, however, proved too difficult to obtain, and the men drifted away.

Millions of Fish Planted by Airdrop

The big attraction these days is fishing. Frank Wright, who has a marina and ferry at Halls Crossing (map, page 55), told me that 80 percent of those who launch their boats between there and Hite, 45 miles upstream, come mainly to wet a line.

Age-old adversaries, land and water, wage a mute but mammoth battle in Glen Canyon. Assisted by man, the liquid realm triumphs. Four years ago kayaks slipped past sandy shores fretted with tamarisk (right). High above the river-runners loomed a huge triangular cave, upstream from Hidden Passage and Music Temple. Today Powell blots out the verdant bars and the winding river, and ripples to the very lip of the once lofty cave (above). When the lake rises another 75 feet, the cavern too will vanish.

The roads are much too rough for casual sightseers, but the angling is excellent. In fact, the States of Utah and Arizona consider Lake Powell a major fishery and maintain a biological station at Page to manage it.

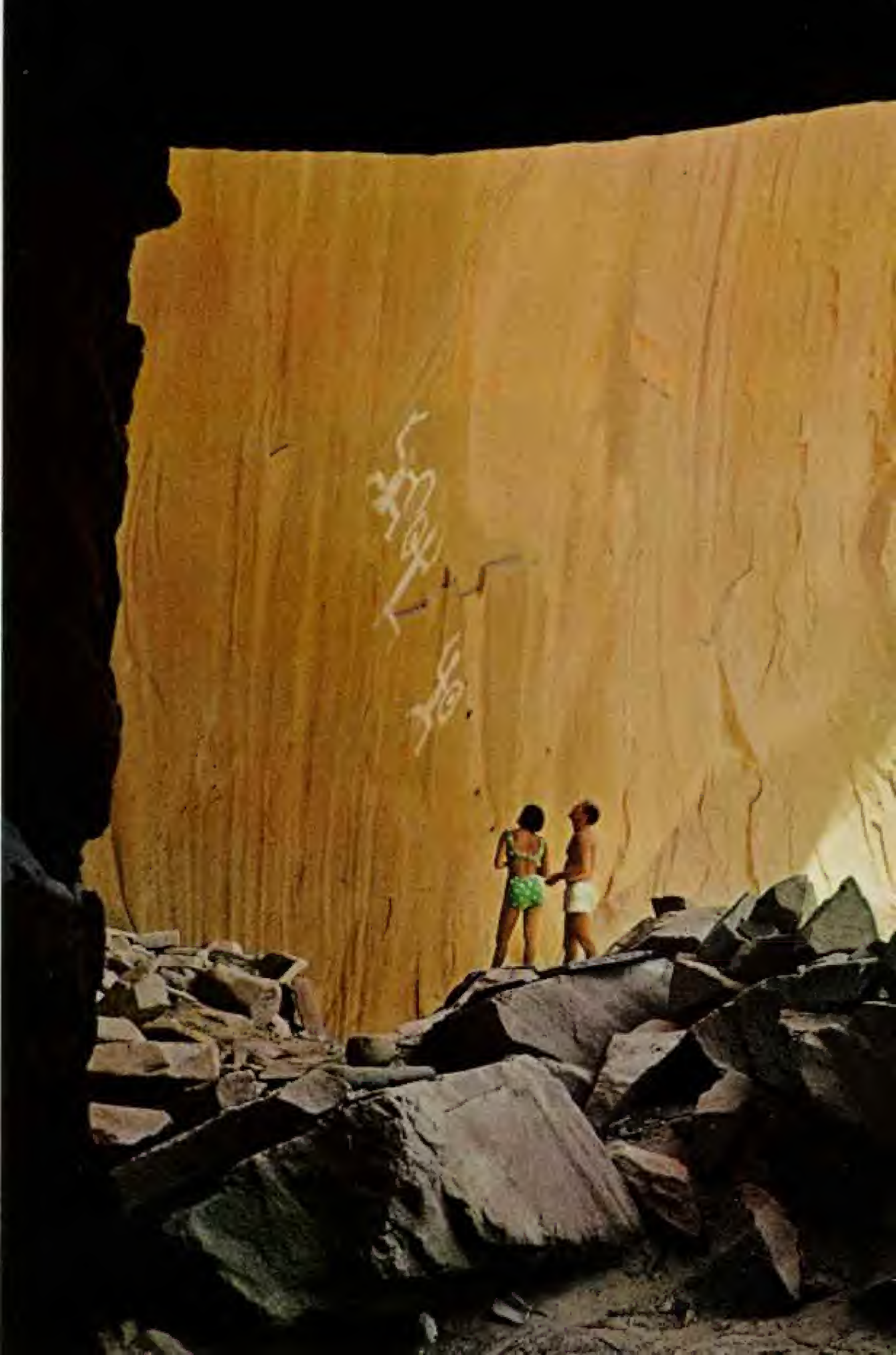
Every spring since the dam closed, the lake has been stocked with trout and largemouth bass. Because of the distance from hatcheries and the great length of the lake, they are dropped from an airplane fitted with four 500-gallon tanks. I saw several such operations.

Each time, the low-flying C-46 made a wide circle and released its load through a chute in the aircraft's belly. In 18 seconds 250,000 fingerling rainbow trout streamed 300 feet down into the lake (pages 68-9). In four days 2½ million trout were released. To my astonishment, few died.

Roderick Stone of the Utah Department of Fish and Game told me later: "We scouted the drop areas to pick up the dead ones, but we got only a quart bottleful altogether."

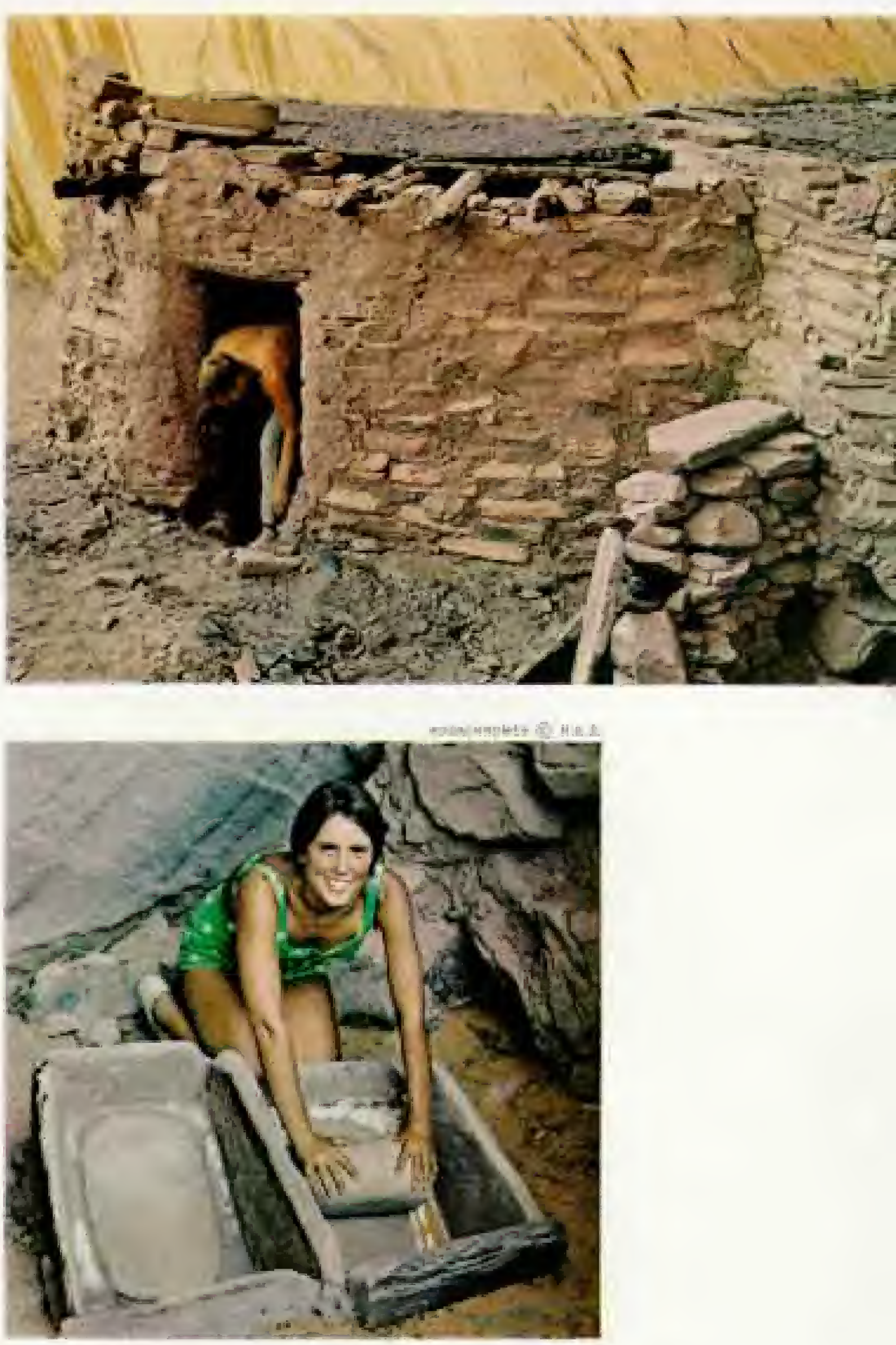
"How fast do they grow?" I asked.

"That depends on many things—available food, competition from other species, water temperature. At this age of the lake, we are uncertain. Probably about eight inches a year." We did some fish research ourselves. Jerry



Pre-Columbian pictographs of three men with weapons and shields inspired the name of Defiance House, a 20-room Anasazi village in Forgotten Canyon. Abandoned for 700 years, the cliffside dwellings lay undisturbed until University of Utah archeologists discovered them eight years ago. Most roofs remained intact; pottery vessels still held food. Scientists speculate that severe drought in the late 13th century forced the Anasazi—Navajo for the "Ancient Ones"—to flee southward.

Waters of Lake Powell, rising into Forgotten Canyon, will not flood Defiance House, but will bring boaters within easy walking distance. Low and narrow doorways that require stooping (below) may have been a device used by the Pueblo people to discourage invaders.



Rubbing dry corn between handstone and slanted slab, or metate, Lois Belknap demonstrates how Defiance House women made meal.

can state, for instance, that green sunfish eat shaving cream. They also find people tempting. As I washed in the shallows each morning, they nibbled at my toes (page 48).

From Halls Crossing upstream to Hite, named after Cass Hite, the prospector who started a Glen Canyon gold rush in 1883, the gorge walls are lower and less spectacular, although some side canyon scenery is superb.

Hite wasn't where I had last seen it. Not only had it sought higher ground, but it had moved seven miles upstream. This wasn't difficult, since it consisted of only a few shacks and a river-gauging station. Even its new location near the mouth of the Dirty Devil River (named by the Powell expedition for its high silt content) is temporary. When silt fills the area, Hite will move again, becoming a full-fledged marina miles downstream.

Hungry Cook Seeks Pie in the Sky

We gassed the boats at Hite and soon roared under the new bridge, just above the Dirty Devil (map, page 55). It is the only highway span across the Colorado between Moab, Utah, and the dam, 155 air miles apart.

Here the gorge changes its name from Glen Canyon to Narrow Canyon, and seven miles farther up, to Cataract Canyon. Powell negotiated this turbulent 40-mile stretch with difficulty. Even before entering Cataract Canyon, he ran short of food. One day he found Billy Hawkins, the cook, pretending to use a sextant. Billy said he wanted to find the latitude and longitude of the nearest pie.

The water by now was turbid. We would soon reach the end of the lake and meet rapids ourselves, and I wondered how far we could get up Cataract. Between high rugged cliffs, millions of years older than those of Glen, we rounded Mille Crag Bend, named by Powell for its "vast numbers of crags, and pinnacles, and tower-shaped rocks. . . ." Then we passed Sheep Canyon and Freddies Cistern, and nosed into the mouth of Dark Canyon.

The sedimentary rock that made up its tremendous walls varied from slate blue to pink (opposite). With its clean stream and potable water, its inviting "bathtubs" and waterfalls, it came as a delightful surprise.

Our map showed Dark Canyon zigzagging 30-odd miles eastward into uranium and vanadium country. Branching from it were side canyons by the dozen: Lean-To, Black Steer, Horse Pasture, Woodenshoe. We could have spent a month exploring them.

Back on Lake Powell, not far beyond Dark Canyon, little whirlpools betrayed the presence of submerged rocks. The water was flowing. The lake had met the river.

Buzz, with an assurance born of experience in reading the river, wove an exhilarating, almost rhythmic course between shores gay with tamarisk and willow and sparkling white beaches. Then around a bend, opposite Bowdie Canyon, we saw rapids. A broad sand bar squeezed the leaping, boiling river against the mighty west wall.

After making camp, we donned life jackets and devoted our full attention to the joy of running the rapids in the Sport Yak. Portaging upstream, we abandoned ourselves to the downstream torrent as we battled to hold a safe course between lurking rocks. When the river won and overturned us, we reveled in the struggle to keep our heads above water.

Finally, after several hours, we flopped exhausted on the beach. The surging power of the river and the majesty of the cliffs above us suggested our insignificance, but filled us with the satisfaction that springs from such intimacy with the beauty of nature.

Young Eyes See New Riches for Old

Silt must inevitably fill Lake Powell, though not in our time. The glens Powell knew are already gone. But thousands of square miles of desert wonderland, hitherto accessible to only a few, have suddenly become available to all.

I have talked to men who knew the river before the dam was built, men who made their living by guiding visitors on boat trips through Glen Canyon. One, who fought the dam, had changed his mind and spoke enthusiastically about Lake Powell. Another, his fortune invested in a new marina, readily admitted, "I'd willingly lose it all if Glen Canyon could be put back the way it was."

But my young companions, who had never seen Glen Canyon before, viewed it through the fresh, enthusiastic eyes of youth.

"Maybe the dam shouldn't have been built," remarked Buzz Belknap, "but it's mighty hard to mourn Glen Canyon now that I've seen Lake Powell." THE END

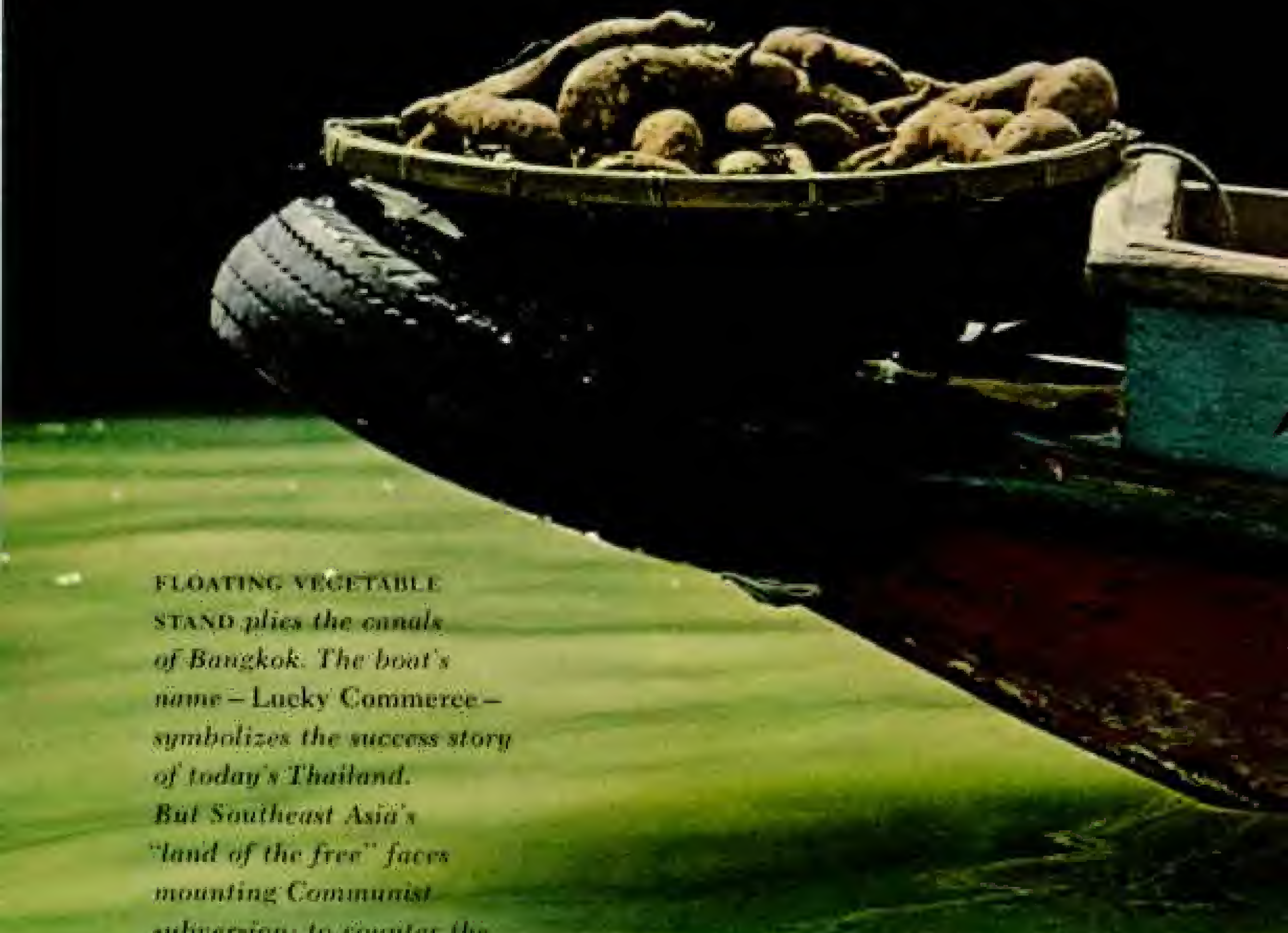
Enticing walkers to explore yet another bend, a shallow stream twists past ancient sedimentary rocks in Dark Canyon. The gorge penetrates unspoiled country; using Lake Powell's upper reaches as access, more and more visitors will discover its haunting beauty. NGS PHOTOGRAPHIC STAFF

Hopes and Fears in Booming Thailand

By PETER T. WHITE

Illustrations by DEAN CONGER

Both National Geographic Staff



FLOATING VEGETABLE STAND *plies the canals of Bangkok. The boat's name – Lucky Commerce – symbolizes the success story of today's Thailand. But Southeast Asia's "land of the free" faces mounting Communist subversion; to counter the threat, the United States increases its economic and military aid.*

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FROM A CHAIN around her neck hung a tiny clay image of the Lord Buddha, encased in reddish gold, and her smile was infinitely sweet, bewitching. Yet for all I knew she was hiding a submachine gun, or a batch of hand grenades.

We shared a slim pirogue from Laos across the mile-wide Mekong River to Thailand. Between us nestled baskets the lady said she would take to market in the Thai town of That Phanom. Cucumbers. Cabbages. Arm-long fish called *plachon*.

I remembered eating fried plachon. Delicious. I also remembered what a Thai police major had told me: That the rising insurgency up here, in Thailand's Northeast, was fed with guns and explosives brought across the Mekong in boats such as this, often by just such gentle ladies.

U. S.-Thai Aid Works Two Ways

"For 550 miles the river forms our border with Laos," said the major, "and unfortunately much of Laos is controlled by Communists. Every day those boats go back and forth by the hundreds. Who can inspect them all?

"They bring in not only weapons but radios, propaganda leaflets, and instructions for the terrorists. And they ferry the agents who direct the insurrection—Thai men and women, first enticed to Hanoi and Peking, trained there, and then sent back to make trouble. It is good that Americans are here to help."

Thailand, in turn, was helping the United States by providing bases for American warplanes that daily flew missions over embattled Viet Nam. In announcing this officially, on March 9, the Foreign Ministry in Bangkok said that this was a Thai contribution toward bringing the trouble in Viet Nam to an end as soon as possible.

So far the trouble in Thailand had followed the Communist prescription for a "war of liberation," Southeast Asia style: Build up stores of food and arms in the jungle. Establish training camps for guerrillas. Ambush police and army patrols. Coerce villagers to come to propaganda meetings. If a village leader won't play along, maim him or kill him, preferably right before the eyes of his people. In 12 months nearly 200 Thai officials, teachers, doctors, and policemen had been assassinated—four times as many as the year before. Ten police posts had been attacked in a single week.

In the face of this threat to Thailand—the traditionally independent kingdom at the hub of Southeast Asia (map, page 82)—the United States increasingly supplied its own anti-guerrilla medicine: some 40 million dollars a year in economic aid, technicians and Peace Corps volunteers, more and more military men to train the Thai armed forces.

In Bangkok, the Thai capital, a high official told me that soldiers, after surprising a guerrilla encampment where the ashes of the cooking fires were still warm, had discovered the bones of dogs among the garbage. He said that this was significant.

Why?

"Well, we Thai do not eat dogs. But the Vietnamese do."

He paused, toyed with a silver dagger, and went on: "One must not become unduly alarmed. How many trained insurgents are now in the Northeast? About 1,500 of them, operating in bands of 25 or 50. They have thousands of sympathizers, and so, unquestionably, we have a serious problem. But as you will see, we are coming to grips with it. Believe me, Thailand is not going to be another Viet Nam." *

Busy Bangkok Throbs With Traffic

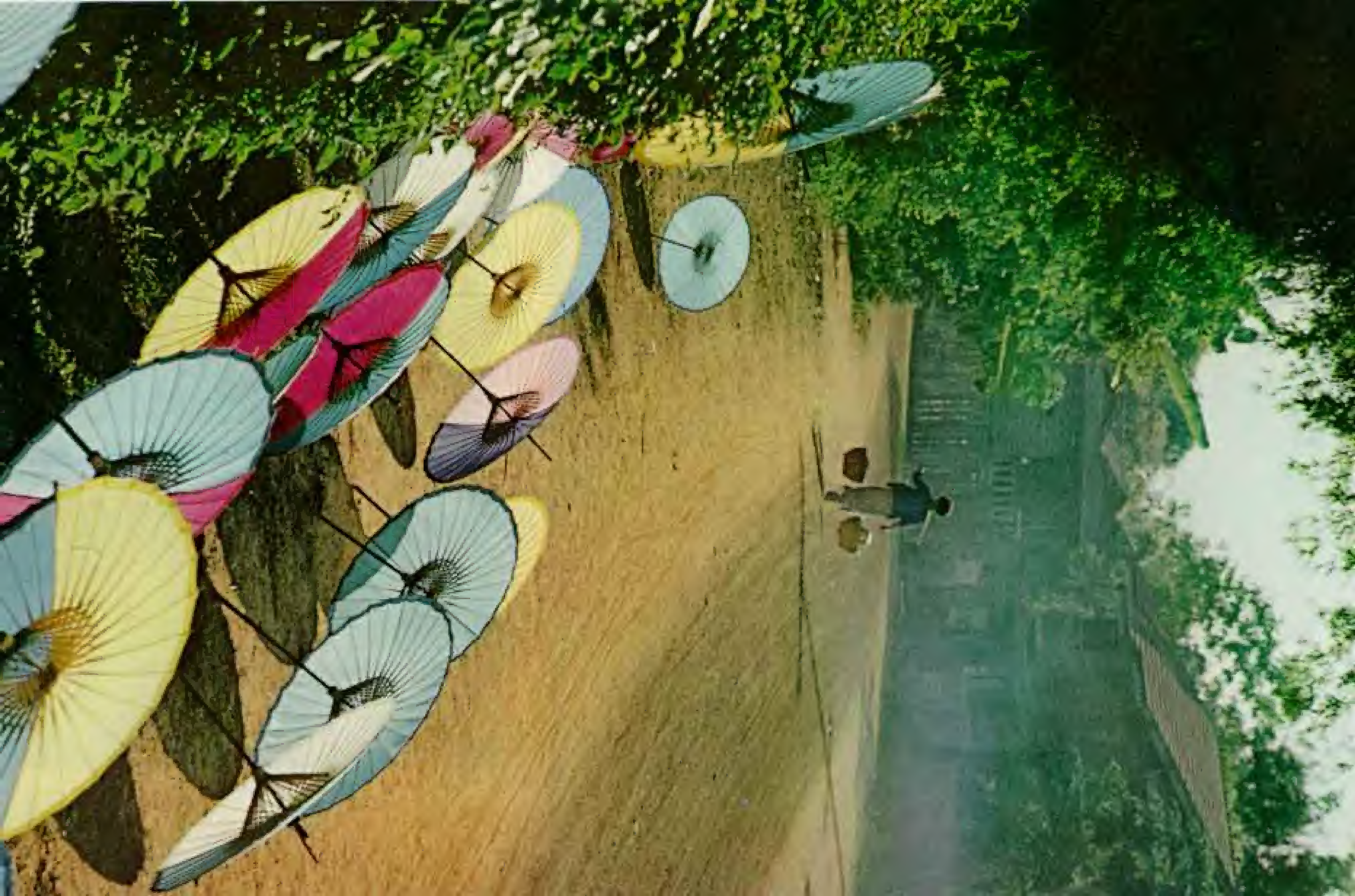
Traveling the length and breadth of Thailand, I would again and again encounter the specter of armed incursion and insurrection in other border areas—in the north next to Burma, in the south next to Malaysia. But walking along the boulevards of bustling Bangkok—and resting in an outdoor cafe, under a shocking-pink umbrella—I found it hard to believe that Thailand had any problems at all, beyond those prompted by rampant prosperity.

Surely the most striking of these was the exuberant motor traffic. At one of the noisiest crossings, along Petchaburi Road, I came close to being flattened by a blue Mercedes. The young lady at the wheel flashed so beguiling a smile that my annoyance evaporated.

"That's exactly what I mean," said my

* For more on this uneasy borderland, see the author's "Report on Laos," NATIONAL GEOGRAPHIC, August, 1961, and "Thailand Bolsters Its Freedom," June, 1961, by W. Robert Moore.

Cheerful as the Thai spirit, freshly painted parasols drying in the afternoon sun splash their colors against the brown earth. In the umbrella-makers' village outside Chiang Mai, 300 families fashion the paper sunshades. Most Thai live in such small settlements, farming rice fields, fishing the waterways, and often practicing handicrafts on the side.



Boat-choked *klong* in Thon Buri, Bangkok's sister city, brings a policeman to control traffic. He signals "stop" from a tour barge, parked while passengers shop. Once the Venice of the East, Bangkok converts many canals into streets for its ever-increasing hordes of automobiles.

Water sprites living on the Chao Phraya River learn to swim as soon as they walk. Front-yard waters invite family-style baths, porch holds freshly washed laundry. Roof-top antenna brings in Bangkok's two television channels.

friend Prasit when I told him about it later. "I mean what's been happening here in Bangkok! Fifteen years ago you never saw a woman driving a car. And that crossing with all the traffic and the new buildings—10 years ago there was nothing there but mango orchards and betel nut trees, and rice fields and buffaloes."

For that matter, where were the *klongs* of yesteryear, all those colorful canals, crisscrossing the city, that had made travel agents abroad burble about Bangkok as the Venice of the East? "We had a hundred of them," said Prasit.

Clogged Canals Give Way to Clogged Streets

Not all the canals were pure delight, to be sure; not everyone could love a clogged klong. But now, when most of them had been filled, to widen roads or to make new ones, didn't everybody complain about the clogged roads?

That very morning the city had opened an arching "flyover" for cars, to take the pressure off Pratunam junction, where an estimated 6,000 vehicles passed during rush hour. Nearby, in the 90-degree heat, workmen poured concrete for two foothridges for pedestrians.

But who could keep up with all the new cars and motorcycles, or with all these people pouring into town from 70 provinces, not to mention all the foreigners? The capital of Thailand, halfway around the world from New York City, was now a favorite stop on globe-circling flights. More than 25 foreign airlines put down at Don Muang Airport, half an hour away by superhighway.

"A year ago Bangkok had 2,500 hotel rooms up to international tourist standards, and by the end of the month we'll have 5,000," said Mr. Dharmnoon Prachuabmoh of the governmental Tourist Organization of Thailand. "Perhaps we have built too many hotels. I've lost count of them all. We don't even try to count the night clubs."

Most numerous among the visitors were the Americans on leave from Viet Nam.

"More than 5,000 a month," said Mr. Dharmnoon. "But those figures, you know, are not available." He smiled. "Top secret!" Thai officials have a cheerful way with things widely known but never, never spelled out officially.

Another such familiar top secret was the extent of the U. S. military effort to help Thailand fight the Red menace. In addition to all those Americans from South Viet Nam, here to enjoy a few days of relaxation, and scores of military advisers, some 8,000 U. S. servicemen were busy with the building of strategic roads and communications networks, and the maintenance of supply depots.

CHINA
Ha Giang
P'ingtengchieh
Nanning
Lang Son
Peihai
BURMA
Red (River)
Dien Bien Phu
NORTH
Hanoi
Hoa Binh
Haiphong
Nam Dinh
Luang Prabang
Thanh Hoa
VIET
Gulf of Tonkin
Wangwushih
Hainan
Xieng Khouang
Vinh
Ha Tinh
Lotung
NAM
Mae Hong Son
Ban Pak Ngao
Chiang Mai
Nan
Lampang
Mae Sot
Phrae
Chiang Khan
Uttaradit
Loei
Nong Khai
Udon Thani
Sawang Daen Din
Phanom Sarakham
Nakhon Phanom
Dong Hoi
Demarcation Line July 22, 1954
Bhumibol Dam
Sukhothai
Tak
Phitsanulok
Nam Phong Dam
Nam Phung Dam
Sakon Nakhon
That Phanom
Quang Tri
Mae Sot
Mesimsin
Huai Hat
Khon Kaen
Hue
Phichit
Kalasin
Roi Et
Nong Phai
Chaiyaphum
Da Nang
Nakhon Sawan
THAILAND
Ye
Ta Khli
Nakhon Ratchasima (Khorat)
Ubon Ratchathani
Pakse
SOUTH
Thong Pha Phum
Lop Buri
Buriram
Surin
Ban Tha Luang
Pak Thong Chai
Dangrek Range
Ayutthaya
Kontum
Tavoy
Nam Tok
Kanchanaburi
Don Muang Airport
Pleiku
An Nhon
Kompong Sralao
Bang Chan
Thon Buri
Bangkok (Krung Thep)
Samut Sakhon
Samut Songkhram
Si Racha
Battambang
Angkor (ruins)
Stung Treng
VIET
Central Highlands
Phat Buri
Ban Phatthaya
CAMBODIA
Sattahip
Chanthaburi
Pursat
Kratie
Ban Me Thuot
Hua Hin
U Taphao
Laem Ngop
Kompong Cham
NAM
Prachuap Khiri Khan
Phnom Penh
Tay Ninh
Bangkok and Thon Buri products
Under Construction
Takeo
Saigon
Phan Thiet
Chumphon
Sihanoukville
Ha Tien
Ham Tan
Mekong River Delta
Vung Tau
Ranong
Rach Gia
Mac Bac
Dai Ngai
MALAY PENINSULA
Gulf of Siam
Surat Thani
Vinh Loi
South China Sea
Hong My
Phangnga
Nakhon Si Thammarat
Phuket Island
Krabi
Thung Song
Phuket
Phatthalung
Trang
Thale Luang
Kantang
Songkhla
Hat Yai
Pattani
Satun
Yala
Narathiwat
Kota Bharu
MALAYSIA
Betong
Elevations in feet
RICE AND BUFFALO AREAS
FOREST AND ELEPHANT AREAS
OTHER AGRICULTURAL AREAS
ROADS
RAILROADS
MAJOR AIRPORTS
U. S. FORCES AT THAI BASES
MINERALS
OIL REFINERIES
WOOD PRODUCTS
POWER PLANTS
TEXTILES AND FIBERS
OTHER INDUSTRIES
FISH
RUBBER
LIVESTOCK AND POULTRY

THAILAND

ROUGHLY three-fourths the size of Texas, this tropical kingdom of forested mountains and plains laced with meandering rivers and canals supports a Buddhist monastery for every 1,500 inhabitants. New industries hum in Bangkok, the growing capital, but four out of five Thai are farmers; for fun, they watch cock fights and fish fights, and visit each other.

Unique in Southeast Asia, Thailand—once called Siam—was never colonized by Europeans. Friendship with the United States began in 1833, when the two nations signed a trade treaty, the U. S.'s first in the Orient. In 1963 the U. S. Air Force began using Thai bases for operations against targets in Viet Nam.

AREA: 198,456 sq. mi. **POPULATION:** 31,750,000. 90 percent Thai; also Chinese, Malays, Vietnamese. **LANGUAGE:** Thai; Chinese and English widely used. **RELIGION:** Hinayana Buddhism. Minorities of Moslems and Christians. **ECONOMY:** Three-fourths of cultivated area devoted to rice. Rubber, tin, fibers, corn, and teak also exported. **MAJOR CITIES:** Bangkok (pop. 1,608,705), capital; Chiang Mai, teak; Songkhla, rubber.

Hub of Southeast Asia, Thailand braces against incursions from "neutral" neighbors. Communist guerrillas cross her borders with arms for insurgents—especially along the 550-mile Mekong River frontier with Laos. Red China, only 75 miles away, broadcasts inflammatory propaganda.

Besides, some 25,000 U. S. airmen were stationed at the half dozen bases that launched most of the bombing missions against North Viet Nam. Thailand was up to its neck in the deadliest struggle of the sixties.

Most of the harried jet-age tourists in booming Bangkok sensed none of this. They worried that there was so much to see.*

"The Grand Palace, the Temple of Dawn, the Marble Temple, the Temple of the Emerald Buddha—we're all templed out," said a tour leader from Cincinnati. One of his ladies said, "Yes, but we took so many pictures! That's what we've come for, to have something to remember."

Early one morning I joined a boat excursion to the famous floating market across the wide Chao Phraya, the river dividing Bangkok from her sister city, Thon Buri. The river was calm. The boat passed into a Thon Buri klong, past scenery that until recently had been typical of Bangkok too—wooden houses on stilts, landings of slippery clay, big-leafed greenery everywhere.

In slim boats, women vendors brought the daily shopping to the door of the klong-side housewife—vegetables, fruit, ice, charcoal (pages 76-7). There was gossip and spitting of red streaks of betel juice—and here were we, churning the water with our motor. Our wake jostled a woman and her floating notion shop; her razor blades nearly went overboard.

I asked that we stop, and I apologized. The woman said, "It is very hard to stay clear."

Cigarettes Cost Three Hours' Pay

We clattered into a narrower klong, past a general store on stilts. A little girl was painting geometric designs on a coffin in a coffin shop. We poked around still another corner, into bedlam: a wider klong, but so congested with boats that a policeman had to direct traffic from a barge (page 80). Here the tourist boats tied up at an enormous bazaar, offering under one roof all the knickknackery I had seen scattered along New Road, over in Bangkok—moonstones, blued and engraved silver called niello ware, teak elephants, flatware in gold-colored Thai bronze.

I was pinned against a display of shimmering Thai silk. A lady said, "How expensive!" She was from Malaysia. "What a bargain," said another lady. "Home in Kansas City it would be four times as much. Imagine, all woven by hand."

That, of course, was precisely why it was a bargain. Labor was not expensive here; machinery was. The average wage was 2 baht an hour, or 10 cents; a pack of Falling Rain cigarettes, made on imported machines by the Thailand Tobacco Monopoly, cost 6 baht, three hours' work. But the boom was stirring the labor market.

"That's all I have now, *one* maid," said an American businessman back across the river, at the Royal Bangkok Sports Club.

"The domestics go into the big factories,

Guardian in the sky, an American-made Northrop F-5 jet of the Royal Thai Air Force sweeps over Bangkok. White walls enclose the Grand Palace, built in 1782 by Rama I as the heart of the city he founded. Oval Phra Mane Ground overflows on holidays with shoppers, open-air stalls, soccer players, and kite flyers. Spired Temple of Dawn, foreground, surveys the city from Thon Buri.

PHOTOGRAPHS BY BEAN GOSSIN © N.G.S.

*See "Scintillating Siam," by W. Robert Moore, NATIONAL GEOGRAPHIC, February, 1947.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MONEY CHANGER

Firestone tires, Ray-O-Vac flashlight batteries. Foremost ice cream, you name it. My gardener was with me seven years; now he earns three times as much, driving a truck. The truck driver became a crane operator, the crane operator went into a garage as a mechanic, and the mechanic is becoming an engineer. I tell you, this country is on the move."

His business was the promoting of new outlets for American products—chemical rat killers, laboratory equipment, electric slicing knives. "Last year," he said, "Thai imports from the United States went up 116 percent. The opportunities are outstanding."

Thai Superlatives: Rice and Beauty

Thailand—some still call it Siam—is an outstanding country: three-fourths the size of Texas, and the biggest exporter of rice in the world. Queen Sirikit, ever radiant when I watched her during receptions, balls, and visits to students, is widely regarded as the most beautiful queen on earth; and in 1965 Miss Apasra Hongsakul was crowned Miss Universe. My friend Prasit said Bangkok had the fiercest mothers-in-law anywhere.

To me, a symbol of Thailand on the move was the gigantic planning room of Mr. Pote Sarasin, the Minister of National Development. Around a 30-foot table stood 11 microphones, for meetings of planners; illuminated maps on the walls traced the progress of work on roads and dams—on what the planners call the economic infrastructure.

"For that, and for education, we'll spend $2,600,000,000 in the next five years," said the minister. "Some of this money will come from loans—from the World Bank and the United Nations, and from the U. S., Italy, and Japan. But 75 percent will come from our own taxes, our own national income."

Then the minister turned to a photograph of the Bhumibol Dam, 260 miles north of Bangkok (page 105), which began operating three years ago. "Our biggest public investment. This dam supplies electricity for the capital, in fact to the air-conditioners for this room. Most important, in the dry season it enables us to irrigate another million acres. Remember, 10 years ago we had 23,450,000 people. Now it's more than 31,750,000.

"Thailand needs industrial growth," the minister added, "but we intend to stay primarily an agricultural country. We want no sudden changes. We want to change gradually, retaining our traditions and customs, but keeping up with the quick-moving world. The important word is *change*. Go see for yourself."

I said I would. Sure enough, within the hour I ran head-on into an old Thai custom, in a barber shop. "You should have your ears cleaned," said the barber. "If it isn't done at least twice a month, the dirt in the air could make one go deaf." I said go ahead.

He pulled over a gooseneck lamp and went to work with delicate long-stemmed tools. Just seeing them gave me an eerie sensation. Spoon, chisel, pincers, cotton brush with

Streamers of swallows, silhouetted against the bright lights of Bangkok, perch above busy Yawaraj Road. Around them flash messages in Chinese, Thai, and English. More than half a million Chinese live in the Thai capital, where they dominate trade.

Native temptations dazzle the eye in a Bangkok shop. While sipping free refreshments, customers bargain for rings set with Thai sapphires and rubies.

hydrogen peroxide. Whoosh, crackle, tickle, ouch! I thought my eardrum had been shredded. Then the spoon crashed into the other ear.

"Don't you feel better now?" asked the barber. It was a joyous feeling, to have both my ears back. No wonder the Ministry of Health was asking for a new law—that public ear cleaning be done by doctors only.

Another tradition, one that seemed here to stay unchanged, was explained to me by Prasit as we entered a salesroom for spirit houses.

"Every plot of ground has a spirit," he said. "When you build a house, you mustn't drive the spirit away, or you'll meet misfortune. So you give the spirit a house to live in, out of doors, in the east corner."

I saw a score of miniature stone buildings on pedestals, each a foot or two long and styled exactly like most of the temples in town: white columns all around; several steeply gabled roofs, one atop another, tiled in green and red and gold. The spirit house vendor said business was better than ever.

Prasit said: "You don't need one as beautiful as these. The spirit will stay in any little house, as long as you invite him properly. You put in dolls, as servants, and you offer food and incense. Some people do this once a day. It's a way of assuring protection."

Aside from this, of course, one must seek ways of making merit. To make merit is the most deeply honored tradition of all. How much merit one manages to accumulate determines how one fares in this life, and in whatever existence might come after that.

Merit Earned by Freeing a Bird

One makes merit by doing something that is good. By releasing a caged bird, for example. I often saw people buy birds for a baht or two, so they could set them free.

Merit at its highest is made by showing devotion to the Three Jewels—to the Lord Buddha; to his teaching, the *Dhamma;* and to the *Sangha*, the Brotherhood of Monks. This is done in uncounted ways in Thailand, where 90 percent of the people avow eagerness to live up to the Dhamma. They go to the 23,000 *wats*, or monasteries—tourists usually call them temples—to bring flowers and incense and candles, and to put gold leaf on a hundred thousand images of the Lord Buddha.

Men become *bhikkhus*, or monks, by the tens of thousands; you see their saffron robes everywhere. A man can easily leave the Sangha, but the enormous merit he has made by having been a monk will stay with him. A

Gossamer silk filaments screen a craftsman aligning the warp for a bolt of famous Thai silk. Throughout bustling Bangkok, home mills clatter as artisans spin raw silk, then dye it, and weave spectacular patterns, often agleam with gold and silver. The craft burgeoned after World War II when an American, James Thompson, organized the industry and introduced durable dyes and improved shuttles.

Since the 1500's, Thailand has welcomed *farangs*, as Westerners are called. Engineers have come from the Netherlands, lawyers from France and Belgium, bankers and educators from Britain, and doctors and agronomists from the United States.

Best-known farang to Westerners was Mrs. Anna Leonowens, a British governess whose romanticized experiences at the 19th-century court of Rama IV inspired Margaret Landon's novel *Anna and the King of Siam* and the musical and motion picture "The King and I."

Masked gunman sprays a Datsun sedan at Siam Motors and Nissan Co., Ltd., in Bangkok, where workmen assemble cars and trucks from components made in Japan. Factories spring up in former rice fields on the outskirts of the capital as the Thai demand more consumer goods.

Painting lacquer bowls, an artisan of Chiang Mai uses her hand as a brush. For their time-honored trade, women first weave bamboo strips into bowls and trays. Then, as on an assembly line, the wares move from house to house, and neighbors cover the frames with a black mixture of clay and lac, a locally harvested resin. Other hands sand and polish the surface. Finally, layers of red paint build a hard, smooth finish.

With feet for a vise, a carver chisels a teak elephant, symbol of Thailand. From the handicraft villages near Chiang Mai also come bronze images of the Lord Buddha, temple bells, cloth dolls, pottery, fabrics, and silverware made from old Burmese coins.

visitor from California said, "Isn't it sad, so many able-bodied men doing nothing." None of my Thai friends echoed this view. Prasit said, "The monk renounces the world and cultivates the spirit. To us, that is the highest type of man."

Doing something good for the monks—paying them respect, supplying them with the things they need—is a merit-making custom at many a ceremony: at a housewarming or at a cremation, at the launching of a ship, at the opening of a new hotel. I saw it at the anointing of a locomotive.

Soon this locomotive, a blue-and-white diesel made in Japan, would pull a newly scheduled express on its first trip from Bangkok to Malaysia, some 500 miles to the south.

Holy Oil for a Diesel Engine

On a dais along the track, nine cushions had been set out for nine monks. A white cotton cord stretched from monk to monk, then to a foot-high brass image of the Lord Buddha, and up to a headlight high on the locomotive.

"The cord transmits a good influence," said a senior official of the State Railway.

For half an hour the monks chanted, expounding the Dhamma and blessing the anointing oil. Another official slid on his knees from monk to monk, refilling their tea cups.

The general manager of the railway mounted a ladder, dipped a finger into the gilded vessel with the blessed oil, and dabbed six spots below the locomotive's headlight.

Then nine railroad executives knelt before the dais. Each handed to a monk a plastic tray with merit-making gifts: a lotus blossom; candles and matches; a toothbrush and tooth paste; a bar of soap and a towel; a box of detergent and a roll of toilet paper.

Finally the senior monk sprinkled blessed water on us all. As we left, one of the executives said, "This was a privilege for me."

And so, on the following morning, when I saw monks walk about for their daily gathering of nourishment—early, before the traffic rush began—I knew that I had been wrong to think that they were begging. People were waiting for them. It was a privilege to put food into their bowls.

To the Thai, food means *kow:* rice. Not so much to the princes, perhaps, or the Westernized, English-speaking elite of Bangkok, or to the aspiring middle classes; but to the vast majority, "to eat" is *kin kow*, "to eat rice." Whatever else one eats—fish or meat or fruit—is *gup kow*, literally "with rice."

The rice is steamed or boiled, and spiced

Land of Lord Buddha: This 5½-ton gold image in Wat Trimitr hid until recently under a coating of plaster, applied centuries ago to fool invaders. In 1955 the stucco cracked, revealing the treasure. Pilgrims venerate both the precious original and its framed photograph. Colossal demons with upturned toes (opposite) guard the Temple of the Emerald Buddha; inside, the Thai cherish another image—of green jasper—of the Indian prince and philosopher whose teachings mold their way of life. A follower pays respects (below) with flowers and incense at one of the country's 23,000 wats, or monasteries.

with fish sauce and chili. Ah, what rice! Listen:

"The rice of Thailand has grains that are long and slender—and hard, so they won't break while being polished in the mill. After cooking they are soft and palatable, sometimes aromatic . . . the best rice in the world. But of course I am a Thai."

The speaker was Dr. Sala Dasananda, Director General of the Department of Rice. He told me that 25 years ago he had studied plant breeding at Cornell, and he gladly acknowledged that his old professor, Dr. Harry H. Love, had come to Thailand to help make Thai rice what it was. The Rockefeller Foundation was helping now. But mainly it was a tradition of careful selection.

"We have always had a rice surplus, and so we've used only the very best for seed, the way we breed our fighting cocks and our fighting fish. And how do you like our rice?"

I ate it with gusto, and in the Thai manner, fork in the left hand, spoon in the right; the fork pushed the rice onto the spoon.

Rice Fields Blessed by "Mother River"

Just as the overwhelming majority of the Thai live on rice, so most of them live by growing it. Rice grows in all the five parts of Thailand, in the north and in the south, in the northeast and the southeast, but most and best of all in the part known as the great central plain. Here water is supplied in plenty by the river Chao Phraya (map, page 82).

The Thai preface the names of their great

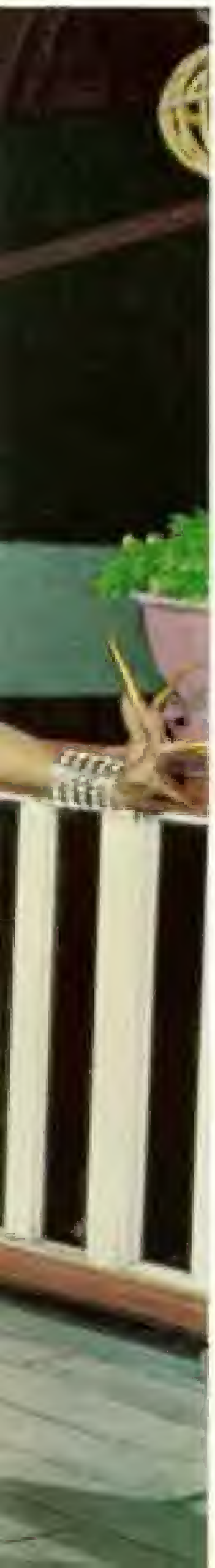
rivers with the word *menam*—"mother of waters," or "mother river." Prasit and I set out by boat for Bang Chan, a village in the realm of Mother River Chao Phraya. Dr. Herbert Phillips, an anthropologist from California, had told me a lot about Bang Chan.

In that village he had heard parents say they didn't like to give their children medicine that offended them; it was better not to hurt their feelings.

He had seen babies only two weeks old gently guided by their mothers to put their tiny palms together and raise them to the forehead, in the traditional Thai gesture of respect. As they grew older they would learn the different degrees: to the forehead for the Lord Buddha and for monks; to the nose for one's superiors, for one's inferiors, to the chest.

Most important, things must be *sanuk*. "That's usually translated as 'fun,'" Dr. Phillips had told me, "but it means a lot more than that." Whatever is emotionally worthwhile is sanuk—going to a wat, harvesting rice in a convivial group, chatting with a nosy stranger from America.

And at all costs one avoided embarrassment, to others and to oneself. That's why one giggled and said *mai pen rai*, never mind, whether one minded or not. That's why, in an election, there's usually only one candidate for village headman. If there were two, the loser might be embarrassed because he had lost. The man who won might be embarrassed too. Didn't the very idea of a competitor



Doing "the jerk" to a frenzied go-go beat, a Thai teen-ager improvises dance steps at a nightclub in Bangkok, where Western tunes and fashions reign. Everywhere they go, the exuberant Thai make their own fun. Here, an American serviceman on leave, right, joins in. Thousands of United States fighting men have found rest-and-recreation leave in Thailand a welcome break from the bloody conflict in Viet Nam.

With intricate gestures and studied grace, students of the *Lakon*, a classical dance-drama, play hero and heroine in the fight between good and evil. Heavily embroidered silk costumes imitate the resplendent dress worn in royal palaces where the Lakon has been performed for centuries. For this show in a Bangkok restaurant, the dancers adopt the long brass fingernails of the folk dancers of northern Thailand.

suggest doubt about a person's competence?

The stilt houses of Bang Chan rose in scattered clusters, along klongs that led into the fields where the green rice stood three feet above the water line.

We stopped far off in a klong six feet wide and turned our outboard motor off. A snow-white egret flopped up lazily.

The silence was total, at first.

Then I heard bees. Fish jumping. Two kinds of birds, arguing. Voices to the right. Voices to the left. Bells. Somebody else's outboard. Dr. Phillips hadn't told me what a noisy place this was.

Prasit pulled up a chunk of weed.

"This is *jaeo*. I ate it when I was a boy. Let's have some."

It was crunchy, slightly bitter, almost nutty. Not bad.

He pulled up a lotus flower and peeled the stem. Not bad either. "We can also eat the reeds," he said, "and the morning glories."

We chugged on to a house amid palms and ducks. A little girl named Sumalee was being soaped by her mother, then rinsed in the greenish-gray water at her doorstep. She wore earrings, a necklace, and two bracelets, all gold, and a belt and anklets of silver.

Her little brother was getting a haircut, from the father. The boy was dressed in a string. It went around his waist.

"He got it when he was sick," said the father. "His body was very hot, so we took him to the wat. The lord abbot put this thread around him and now he is well." Most children got well that way.

Sumalee was having her face powdered by her mother, to make her skin beautiful.

"The lighter the skin, the more beautiful," her mother said. "When we go out into the sun, we put on a hat or a piece of cloth."

I said in America we like to lie in the sun, to get tanned.

"That's very interesting," said the mother. "Why do you do that?"

I said we think it's healthy; it makes us look athletic.

Sumalee's mother said, "Well, I think your skin is very beautiful too."

Teak and Oil Bring Wealth to North

An overnight train ride took me to Chiang Mai—the second-largest city in Thailand, the big town of the north.

Bangkok has 1,600,000 people—Chiang Mai barely 75,000. But then the whole country has only six towns of more than 20,000. Some 30 million Thai citizens live in the villages.

The north has lushly forested mountains, some of them 6,000 feet high, with much teak. This beautiful wood has made the steep-gabled old houses of Chiang Mai famous. The north also has oil, and a new refinery. Good rainfall fosters good tobacco as well as rice.

In the valleys four substantial rivers flow together to form Menam Chao Phraya. Chiang Mai nestles on the Ping River. I arrived

(Continued on page 100)

Anything goes except biting in a Thai boxing match. Feet, elbows, fists, and knees fly as each fighter tries to weary or drop his opponent within five three-minute rounds. Cord around biceps holds good-luck charms. Spectators flock to this televised bout at Rajadamnern Stadium in Bangkok; Thai fans bet heavily on the outcome.

In a calm before the storm (left), combatants at Udorn pay homage to their teachers and invoke the aid of spirits before the clash. The rugged national sport grew out of the unarmed, close-in fighting of medieval wars. At one time contestants studded their hand bindings with broken glass, "if agreeable to both."

Pull-push teamwork moves concrete for a fish-processing plant near Bangkok. Long accustomed to laboring in rice fields, Thai women adapt easily to the construction work that accompanies their nation's spurt toward industrialization.

Raw wound of a new-cut road scars jungle-covered hills northeast of Bangkok. Manning a U.S.-made bulldozer, a Thai driver grades the bed as an American soldier tamps the earth with a sheepsfoot roller. Assisted by the U.S. Army Corps of Engineers, the Thai Government rushes an Accelerated Rural Development program to bind the hinterlands to Bangkok.

Bagful of beverage—water and flavoring mixed with ice—cools a construction worker. Road-building Yank sips a bottled soft drink.

Green-tiled granary of the kingdom, the rice plain north of Bangkok basks in December sunlight. Dike-bordered plots tinted with gold mark early plantings ripening in the dry season. Village houses line the life-giving waterway rather than the arrow-straight road.

In a great national ritual each May, monks bless and distribute seed rice for the annual planting. When families go forth to winter harvest, their moist earth yields a surplus that makes Thailand the world's leading rice exporter.

on the day of *loy krathong*, the festival when people all over Thailand make or buy little floats with candles on them. That night, under the full moon, everybody set his float adrift on whatever water was handy.

As I looked from a bridge at Chiang Mai, thousands of flickering floats made the Ping River a sea of candlelight. A young man told me, "That's how we float away our sins."

Said the lord abbot at Wat Phra Singh, "This is not really a Buddhist festival, and no monks take part. But it does no harm. The intentions are good."

He was the ecclesiastical governor of the north, in charge of 3,442 wats and 28,580 monks. He had just played host to the Eighth Conference of the World Fellowship of Buddhists. He assured me, "Buddhism is as well established here as anywhere."

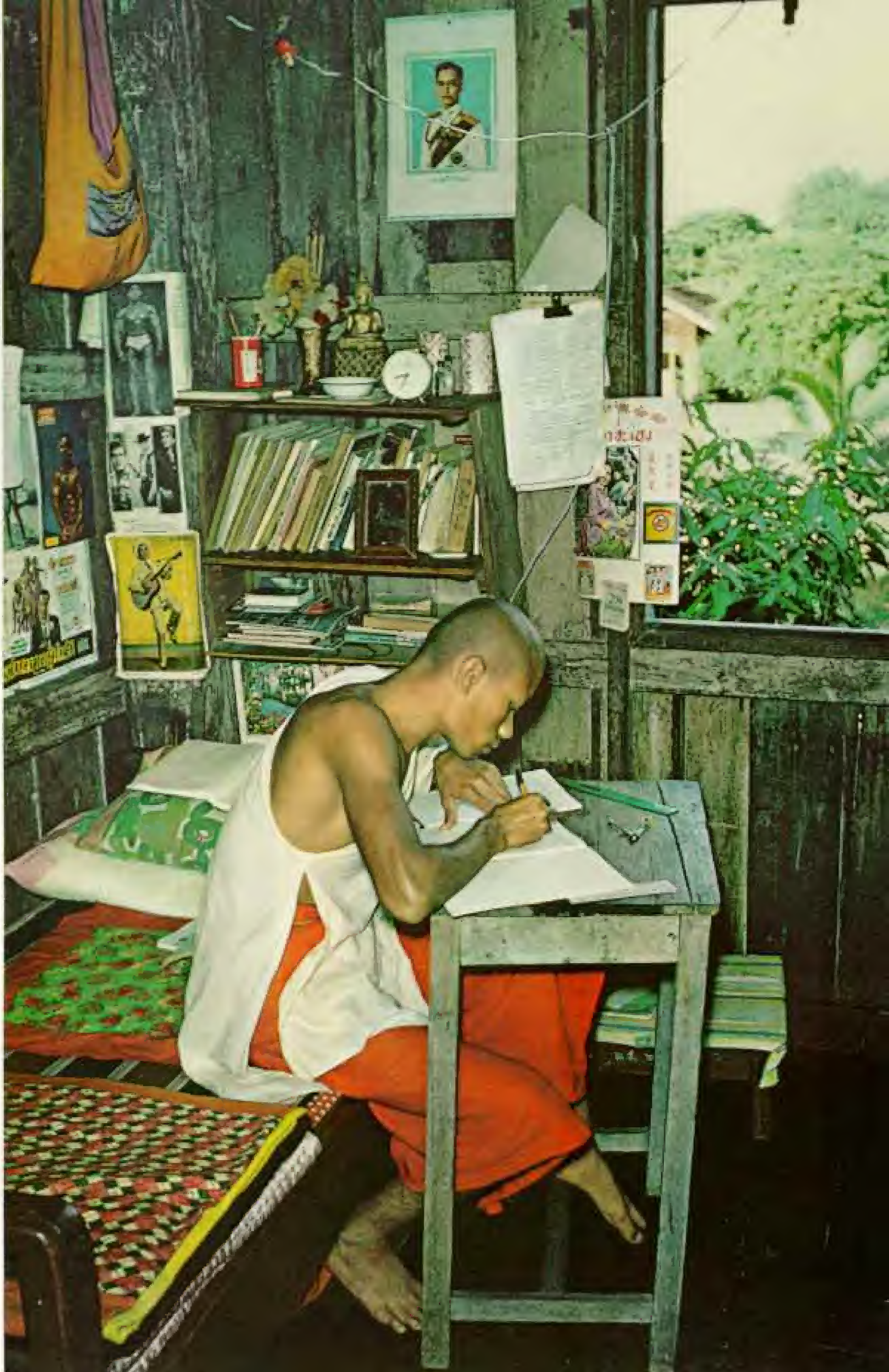
I stayed at the Railway Hotel. Chiang Mai had four other new hotels, because more and more tourists were coming, to visit the craft villages nearby: the silk-weaving village, the silver village, the umbrella-making village (page 79), the wood-carving village, the village that cast bronze bells and images of the Lord Buddha. Businessmen looked forward to a bigger airport, for jet airliners, so that foreigners on around-the-world flights might stop off here, instead of at Bangkok.

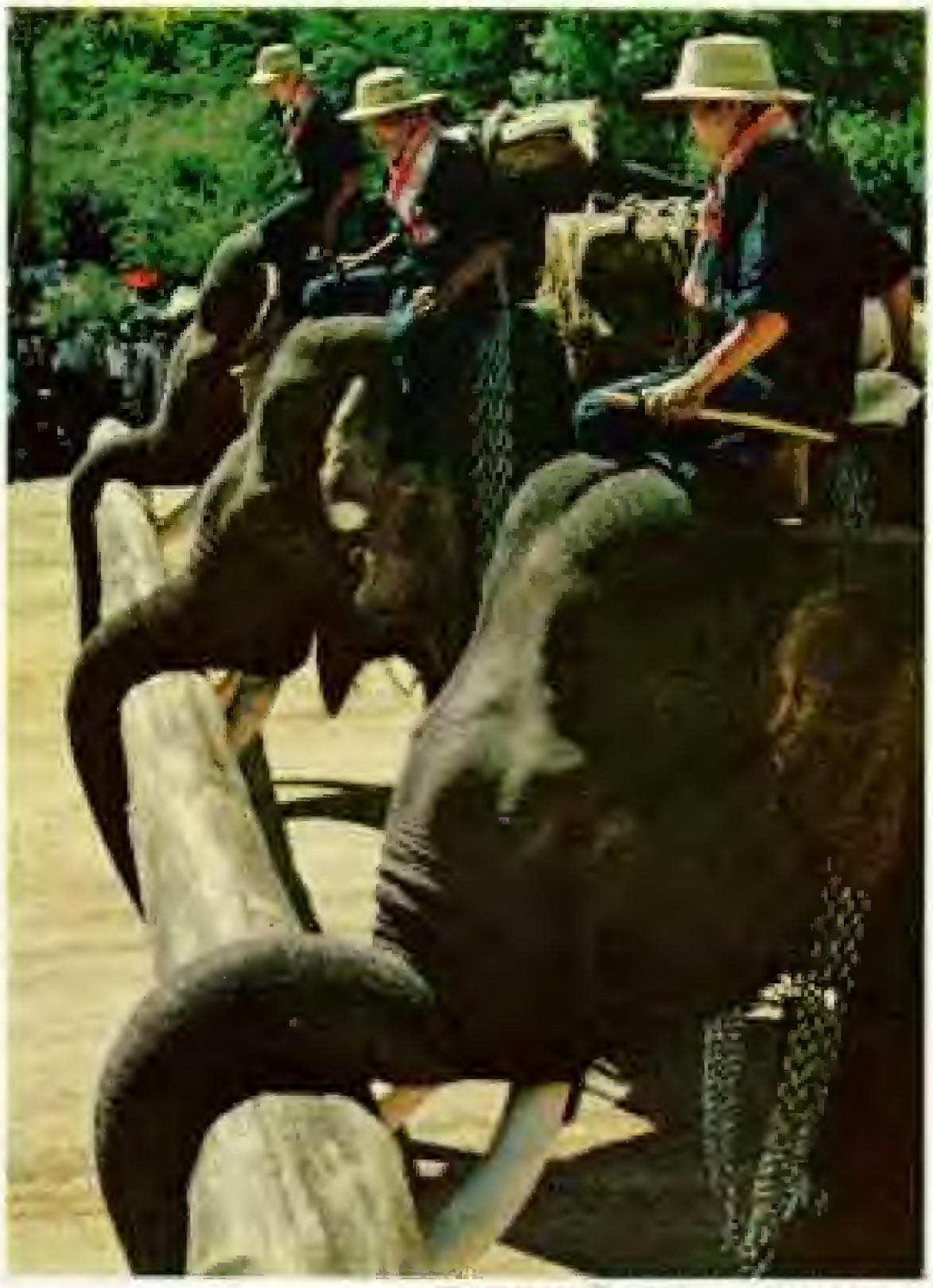
I followed the tourist circuit all the way up to the village of the Meo tribesmen high above Chiang Mai. There was a road, narrow but serviceable, and the view of the valley was glorious.

That day brought a lot of visitors—a French machinery salesman, a Spanish Jesuit, a cattle breeder from Bavaria. All had cameras. They were delighted with the Meos' black costumes and heavy silver neck pieces. A Meo woman grinding corn told her little girl, "Smile for the nice photographer."

Hours of study, days of self-discipline engage a young Buddhist monk in a tiny room at Wat Phra Singh in Chiang Mai. Like all Thai monks, he depends on laymen for food and furnishings. Under no obligation, he may stay a lifetime or leave tomorrow. Most Thai, including the King, whose portrait hangs near the ceiling, earn special merit by living for short periods as Buddhist monks.

De luxe dormitory houses male students at Chiang Mai University, opened in 1964 to serve northern Thailand.





Trudging a river road, an elephant tows a bamboo raft; teak logs too heavy to float ride lashed beneath the rig. The elephant periodically probes the bottom with its trunk to sound the depth ahead. Bound for a sawmill upstream, the party plies the "River Kwai"—the Mae Klong—near Kanchanaburi below the crumpled Bilauktaung Range.

Might bows to majesty: Elephants pay homage to Thailand's King and Queen and the visiting President of Austria, sheltered by a gabled pavilion at Mae Sa Falls Forest Park. Demonstrating the animals' skill, mahouts put them through the paces of forest work: dragging, pushing, and rolling logs. Trunks in triplicate (left) share the weight of a teak log.

The price the Meo charged for allowing themselves to be photographed had just gone from one baht to two. An old Meo told me it was only fair. He had been down to Chiang Mai and seen his picture on a color postcard. He thought everybody photographing him would make money from it, and he wanted his share.

At Border Patrol Police headquarters north of Chiang Mai I was briefed on the problem of the less-visited hill tribes.

There were many of them: Akha, Karen, Yao, Lahu, Lisu, Lua. . . .* They spoke many different languages, and they were very poor.

They had to be helped. They had to be watched. If subverted by Communist agitators, they might become dangerous guerrillas.

Border Patrolmen built schools and taught their children; agricultural experts sought to make them concentrate on crops other than

*See Peter Kunstadter's "Living With Thailand's Gentle Lua," in the July, 1966, NATIONAL GEOGRAPHIC.

Sea-shell arc of Bhumibol Dam (below), named for the King, holds back azure waters of the Ping River; the reservoir will irrigate a million acres for rice farming. Turbines in the 308-foot-high barrier have doubled the nation's electrical output since they began spinning in 1964; eventually they will quadruple it.

Bridge over the River Kwai, grim war relic that inspired a celebrated novel and motion picture, curves dark trusses against a setting sun. Beneath an arch of the 550-foot span, a farmer drifts his cattle homeward.

Seeking a strategic railway link between Thailand and Burma in World War II, the Japanese Army forced Allied prisoners of war and Asian workers to lay more than 250 miles of track through malaria-infested jungle. Tens of thousands died of malnutrition and disease and in Allied bombings that destroyed part of the bridge. Today the rail line carries visitors from Bangkok to Kanchanaburi, near the rebuilt span, where neat ranks of stones (left) mark the graves of about half of the 16,000 prisoners of war who died building the "bridge of death."

opium. American equipment, especially the helicopter, was invaluable, and so were the American advisers, the anthropologists and police experts from the U. S. aid mission.

I drove on north for another 100 miles, through the little town of Fang, to spend the night with a Thai Border Patrol platoon, close to the Burma frontier. The post was blacked out. One never could tell who might be looking for a target.

Next morning, when the jeep could go no farther, I walked along an oxcart trail and up, past a few houses; on up, through a stream, and through a steep forest with leaves glistening as if made of plastic; again up, on a slippery slope and then along a ridge, to a village of the Lahu (page 124).

Dogs growled at me. It must have been my smell. I saw two dozen houses, pigs, stacks of firewood, a corral for dancing. Under some houses were ponies in very small pens. On a bough a hundred yards off sat an eagle.

Opium Growers Don't Tell Lies

A man who knew this tribe well had told me that they lived in a high moral climate. All dressed alike. Everyone took only as much land as he could work. Nobody lied. Everybody would know, because if a man told a lie, or did something seriously wrong, his grandfather's spirit would make him ill or kill him.

A man with a tattoo on his chest said the people were away, in the fields. I didn't want to ask him what they grew. Did he like to go down into the valley? He said he would rather not. It would give him a headache.

Driving back, en route from Fang to Chiang Mai, I saw armed men bring a wounded villager into an improvised clinic. His stomach was a mess of blood.

"Bandits from Burma," I was told. "They ambushed a government payroll, but we foiled that. We killed one of them. Look, here's his weapon." It was a U. S. carbine.

The armed men were Thai, members of the Border Patrol's commando unit. Tapes on their jackets spelled out in English "Special Action Force."

Back in Bangkok I inquired about an interpreter for a trip to the south. Better find someone down there who speaks Malay as well as a couple of Chinese dialects, I was advised. The southernmost provinces had been Malayan territory from the 16th to the late 18th century. They still contain a million so-called Thai Moslems.

Chinese, of course, is useful everywhere in Thailand, especially in Bangkok, where roughly one in three inhabitants is a Thai Chinese. That doesn't include all the people with Chinese mothers or grandfathers. Most of them are loyal citizens, eager to intermarry with the Thai. Many turn their names into Thai, but a Thai can always tell. Teochiu, a Chinese dialect, dominates much of business.

On the map (page 82), Thailand is shaped like an elephant's head, and by flying the 450 miles to Songkhla I moved way down the elephant's trunk. I was also plunging into the rainy season, for in the south the monsoon was in full swing—the monsoon from the northeast, lasting from November through February. Before that it had been the southwest monsoon, from May through September. In those nine months the rains can be phenomenal, producing prodigious floods.

"And marvelous shrimp," said Mr. Panyar Rirks-Urai, District Officer of Songkhla. We rode in the governor's yacht on Thale Luang, a muddy lagoon 40 miles long. He called it "the lake."

"In the dry seasons the water is blue and quite salty. Now the rainwater dilutes the salt—great for shrimp. We freeze them." They thaw in Japan.

Lottery Prize: A Century's Income

Mr. Panyar ranked one step below the governor. He was responsible for 120,000 people —schools, taxes, police, everything. As he put it, it was quite a job: "A lot of responsibility, not much authority, a lot of work, and very little salary."

He pointed out an island famous as a nesting ground of small swifts. Their nests made gelatinous bird's-nest soup, very zesty. "Now let's go back," he said, "so I can show you the new hospital and school for nurses."

Another official told me that within 65 miles of Songkhla some 200 dangerous Communists had been arrested in the past two months. American counter-insurgency advisers had been most helpful to the Thai authorities. Soon after I left, the Border Patrol captured a Communist camp full of uniforms, flags, pamphlets, and booby traps.

In Songkhla I had the pleasure of a visit with Mrs. Soh Bunthong. Nine months earlier she had achieved the great Thai dream—the big prize in the National Lottery. Five hundred thousand baht! That amounted to $25,000. To earn that much, a Thai laborer would have to work for a hundred years.

She had stayed on in the same neighborhood, though the house now was concrete,

not wood. She had bought six pieces of land, and taxis for two sons. But she worked in the kitchen as before, cooking rice in the same old pots.

Her husband, Mr. Mud Buathong, had quit his job as a sprayer for a malaria control program. He told me about the fighting bulls of the south. The bull named Kwanluern was one of the best: he would fight again next Sunday.

How could a bull fight more than once? Didn't the man always kill him?

Mr. Mud said: "You don't understand. The fight is always between two bulls. It lasts until one runs off. Bulls never kill each other here."

My interpreter, Mr. Thanee Thara-vanich, dealt in lumber and loved to talk about it. As we drove past rice fields into the forest, I could hardly keep up with all the trees. *Takian, lumpor, teng, rung* —all durable, heavy, good posts for houses; and *yang*—the cheapest, for the houses of the poor. Also, rubber trees. Rubber was the biggest export from the port of Songkhla: 61,000 tons last year, more now (page 111).

Not far from Songkhla, at the Rubber Research Center near Hat Yai, an attendant said that Mr. Jack Hastings, the Englishman then in charge, had gone to town: "You can't miss him, he is tall and has a yellow Mercedes." I didn't find Mr. Hastings in Hat Yai, but I found half a dozen Mercedes sedans. This was the booming business center of the south. New banks, a motel, two air-conditioned movie houses. A 152-room hotel had opened the week before.

The money of Hat Yai came from rubber, tin mines, and Malaysian tourists. Malaysians loved Hat Yai; it didn't cost much to drive up, and didn't everybody want to see a foreign country once in a while?

Improvements sprouted along the 90 miles of road to Pattani—paving and concrete bridges, to withstand the floods. While the concrete poured, temporary bypass bridges had to serve. Several were under construction, with logs dragged from the forest to the road by elephants. For a while I watched an elephant that had a crooked tusk. His owner said, "His name is Yanuk. He is not beautiful, but he is a good worker."

At the new Central Mosque in Pattani I was told that the imam was Hadji

Hug for hug, a man and his grandson exchange greetings. Parents tied a string around the youngster's wrist to prevent his many souls from straying.

"Sugar cane, please?" calls a pint-size vendor meeting a bus near Kanchanaburi. Road-weary travelers refresh themselves with a skewer of sweets for about a penny.

PHOTOGRAPHS BY JOHN SCOFIELD © N.G.S.

Nik Abdul Rahman. But when I was introduced to the imam, I learned that he was Hadji Abdullah. Had I been misinformed?

Well, no, the Moslems of Pattani had elected two imams. However, the authorities in Bangkok said one man must be in charge. So sometimes it was one, and sometimes the other.

Outside, spotted-necked doves gurgled in decorative cages. People kept them next to their houses, to enjoy their sweet gurgling. They wouldn't gurgle indoors.

Twenty-five miles on, the Governor of Yala, Police Col. Siri Kojhiran, said we had just passed through a hotbed of Chinese terrorists; others lurked ahead. These were experienced troublemakers, having fled into Thailand after their rebellion in Malaya had been suppressed by Malayan forces under British command. He asked us to take along an escort: "If they see a white man, there might be trouble. They might think you are English. They don't mind Americans."

We followed the police jeep through Thailand's most romantic landscape. Glistening trees. Valleys now clear, now misty. Limestone cliffs, some wooded, some craggy, hundreds of feet straight up. I imagined I was riding through a Chinese painting.

Crotto home of bird's-nest soup drips gnarled stalactites on the island of Phi Phi. Scaling a rickety bamboo ladder, a collector plucks a prize.

Darting hordes of swifts converge on the vast limestone caverns that tunnel the Thai panhandle and its islands. Secreting a glue-like substance in their mouths, the birds mold delicate nests (below), sticking them fast to the remotest heights. Collectors harvest a bird's first two nests, leaving the third for raising

young. Fetching about $10 a pound, the nests cook into a gelatinous soup especially prized by the Chinese, who say it lowers the blood pressure.

Those cliffs, full of caves, rose ever closer to the road. I couldn't forget Colonel Siri's remark, "The Chinese terrorists fire down from the mountains. Just about everybody killed there gets a bullet through the top of his head." Would this picturesque wilderness never end?

At long last, at dusk, we sighted Betong—a sizable city. Beyond Betong was Malaysia.

Betong was overwhelmingly Chinese, largely dependent on rubber, and hence not booming. Ten years ago rubber brought six baht a pound. Now, because of competition from synthetics, it went for three or four.

Most rubber of southern Thailand comes from small producers. Some 300,000 people tap their own trees. But near Betong lie a few big rubber estates, and the Chinese terrorists were taxing them. Most of the owners were Chinese and lived in Bangkok or in Singapore, but one lived here. He had two policemen in front of his house.

Heading back north toward Bangkok, I stopped and took a walk into the forest. Big brown butterflies flitted from the shade into the sun and back again. On a rubber tree I noticed a string of Chinese characters, and I asked a nearby rubber tapper what they meant.

He said it was a declaration of love. "A boy and a girl met here. You know."

Another man came by and said those characters meant that the tree was no good. They were a notice not to bother tapping it.

I copied the characters as best I could and showed them to still another man later on. He thought someone had carved them as a tribute to his late father. It was a Chinese custom.

Back in Bangkok I got one more opinion: "It probably was an extortion note, from the Chinese terrorists. The first man you asked probably knew, but didn't want to tell you."

Too bad I'd lost my copy of the characters.

Hotel Grows a While-you-wait Wing

In the rainy south I had often been drenched to the skin, but in 20 minutes I'd be dry again. And I never felt hot, the way I usually did in Bangkok. Years ago, I suppose, people feeling as hot as I did just jumped into the klongs around them. Nowadays numerous klongless Bangkokians jump into their cars and head southeast, to the beach at Ban Phatthaya.

The drive led through the new residential quarter called Bang Kapi, past chemical laboratories and construction offices on Sukhumvit Road, past windmills and fishing nets, past rice fields on the left and salt flats on the right. Prasit said, "The coconuts that grow in the salt water taste especially sweet." The road paralleled the coast of the blue Gulf of Siam.

Ban Phatthaya had a hotel and cottages; a yacht club and beachside restaurant; a recreation center for JUSMAG, the Joint United States Military Advisory Group, and another for the U. S. Army's 9th Logistical Command. Ban Phatthaya was a hotbed of water-skiing and scuba diving.

We pulled up at the Nipa Lodge at noon. "We're full," said the clerk. "But at five o'clock we'll finish a new wing with 36 rooms."

We came back at eight, glad we had reservations. The other new rooms were full of tourists from Switzerland.

During our roomless afternoon we had driven farther into the southeast—past pineapple and sugar cane and the sweet smell of cassava mills—to the harbor of Sattahip, long a Thai naval base. Now there stretched nearby, at U Taphao, the longest airstrip in Southeast Asia—11,500 feet, plus 2,000 feet of overrun. Parking ramps and taxiways appeared at astonishing speed: every day 4,000 feet of concrete, 18 inches thick and 25 feet wide.

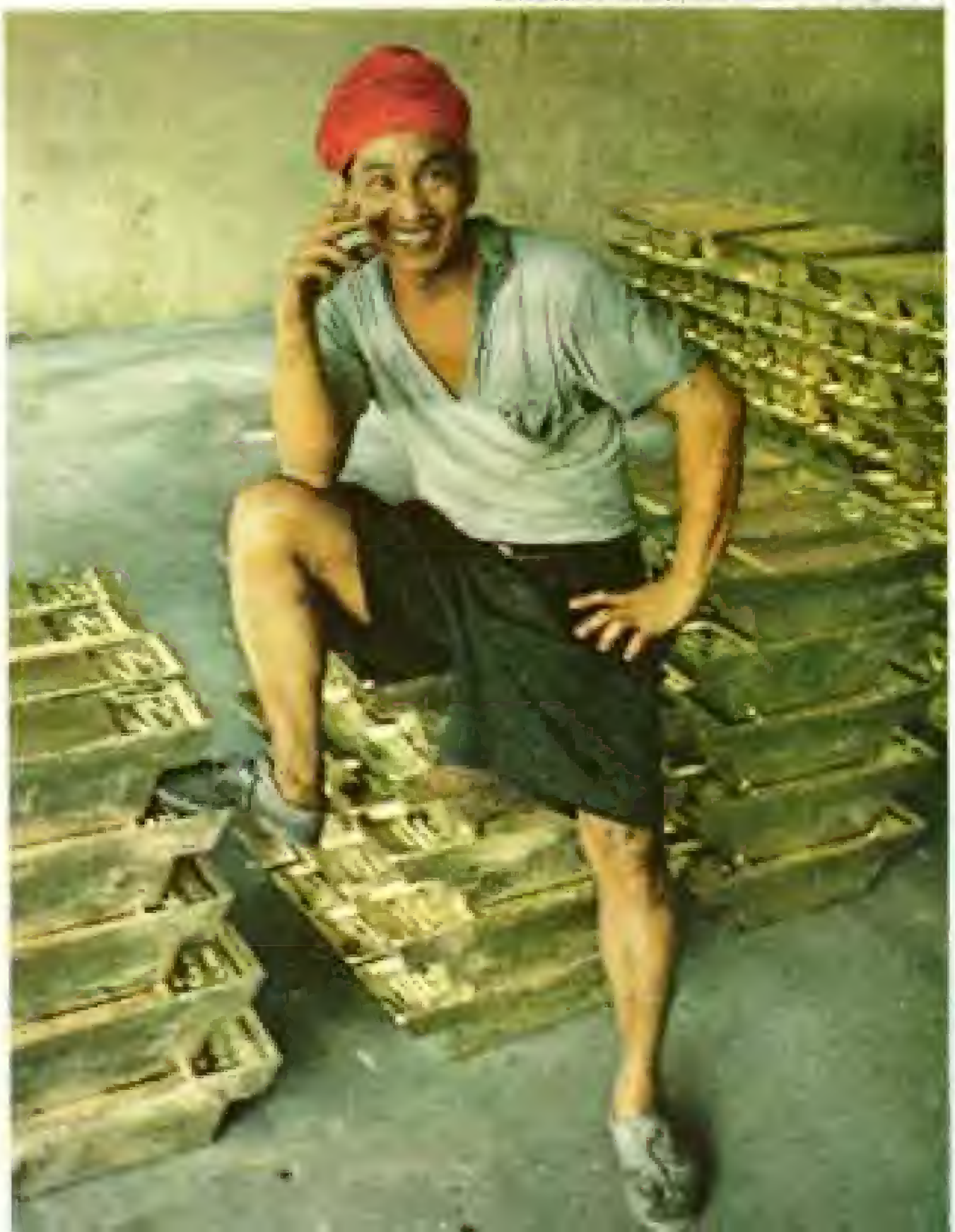
Tank trucks hauled jet fuel from the newly deepened and expanded port to the airbase. There would be pipelines soon. I saw a mountain half green, half brownish-red and dusty. Bulldozers chewed at it. A foreman said this was laterite, a low-grade iron ore, good for making roads and filling land.

Bent under 250 pounds, a stevedore carries baled rubber sheets at a Chinese-run warehouse in Songkhla, a major southern port. He passes a stick to the foreman to tally the cargo as it goes aboard a lighter. Second to rice among Thai exports, the rubber goes primarily to Japan for processing.

Tumpline pressing the worker's brow marks him as a Malay; the Thai regard the head as sacred and would not put it to such use.

Turban and tennis shoes garb a Malay coolie stacking 100-pound tin ingots—products of Thailand's new smelter on the large southerly island of Phuket.

With surf as their sluice, sea gypsies pan tin on Phuket. Menfolk of this wandering coastal people swim out with inner tubes to dive for ore-rich silt, then float it to shallows for the women to sift. Farther offshore, modern dredges bring up massive bites of tin concentrate—deposits washed down from nearby mountains.



In a wonder world of giant plants, boys near Betong foil a drizzle with alocasia-leaf umbrellas.

Monsoon! Rain vying with sunshine gives an impressionistic blur to a roadside restaurant near Betong, southernmost city of the kingdom. Diners wait for the torrent to slacken; sarong-clad cook watches for customers. Near the bunched bananas, a sign written in Thai advertises Ovaltine.

Inexorable as the ebb and flow of the tides, the northeast monsoon brings storm clouds in dark waves across the Thai panhandle from November through February, loosing downpours that trigger devastating floods. Then the winds swing, and from May through September the southwest monsoon pelts the tangled forests. Often drenched on his travels, the author discovered that in 20 minutes the tropical sun would completely dry him.

On the airbase I saw a bronze plaque, with two enameled flags. At left were the red, white, and blue stripes of Thailand (page 83). At right, the Stars and Stripes.

The inscription said that on August 10, 1966, the Prime Minister, Field Marshal Thanom Kittikachorn, acting in his capacity as Minister of Defense, had dedicated U Taphao airfield "as a symbol of cooperation for peace and mutual security."

Thailand and the U. S. were partners in SEATO, the Southeast Asia Treaty Organization. The base was Thai. So were the guards at the gate. Inside, most of the planes and men were American. The Thai were hosts, the Americans guests. On that understanding, six large bases operated in Thailand, and several smaller ones. U Taphao was host to jet tankers. Boeing B-52 bombers would come soon.*

Gift From Crown Prince: Good Grades

In Bangkok, the sun rose brilliantly on the 39th birthday of King Bhumibol Adulyadej, also known as King Rama IX. I hurried to the ceremonial parade of the Royal Guards on the Royal Plaza.

His Majesty carried a golden baton—

*The first B-52 jets arrived on April 10, 1967.

presented by the armed forces—and I heard that he considered as his nicest birthday gift the news that the Crown Prince, then in school in England, was first in his class in mathematics.

I was dazzled by the massed bands and by the generals in their gold-braided tunics of scarlet and dove gray and electric blue, their plumes of white and pink and black, and their sashes in all these colors.

Thailand, I knew, had generals by the dozens. They held many of the highest positions, in and out of the government, and among them all Gen. Prapas Charusathira was a very special general (page 124). He was a Deputy Prime Minister and, with the King's approval, he appointed every governor and district officer, for he was also Minister of the Interior. He headed a dozen kinds of police; and as Commander in Chief of the Army he controlled the troops that controlled Bangkok.

He certainly was a friendly man. I ventured that Thai officers wore the most beautiful uniforms of any modern army in the world. "Thank you," said General Prapas. "You know, when we began to modernize our army, our first foreign advisers came from Russia. Tsarist Russia, of course."

And off he went to a microphone before

the reviewing stand, to make the ceremonial address to the King. He pledged the army's loyalty; referred to the "unprecedented infiltration and subversion of the Communists", and reported that all Thai were uniting against this threat. General Prapas also headed the Communist Suppression Command.

That night, in His Majesty's honor, public buildings—and many others, and even trees—were festooned with lights. It seemed as if some god had sprinkled Bangkok with thousands of rubies and tens of thousands of pearls. Only in one spot were the lights not electric, at the 18th-century fort left over from the dismantled city walls. Here flickered hundreds of little oil lamps, casting a spell of gold.

There I sat along a leftover klong, in an open-air restaurant beneath the old cannons, and watched men scaling the battlements on ladders, to relight oil lamps blown out by the wind. I could imagine them to be warriors, on the attack. It was an image that has haunted Thailand's history.

Thailand's Past Remains a Puzzle

As cities go, Bangkok is not old, not much older than Washington, D. C. It was founded in 1782, after the Burmese had sacked the old capital, beautiful Ayutthaya, 45 miles to the north (page 116). Previous Thai kingdoms centered still farther north, in Sukhothai, in Chiang Mai, and probably elsewhere. Where? Archeologists—Thai, French, Danish, Dutch, and American—think that what they have found lately will change Thai history books.

"The widespread notion that the Thai came from southern China, to get away from Kublai Khan, rests on insufficient evidence. We're just not sure where they came from."

So declared Mr. J. J. Boeles, the scholarly Dutchman directing the Siam Society's Research Center. And Prince Subhadradis Diskul, Dean of Archeology at Silpakorn University, told me:

"We *have* found a new historical period in Thailand. Sites not far from Bangkok extend into the time of the empire of Funan, namely the first to the sixth centuries A.D. Until recently, Funan was thought to have centered on what is now South Viet Nam, or on Cambodia. Now it appears that its capital may well have been here."

Archeology was booming, added the Prince. But so was the illicit export of valuable images of the Lord Buddha unearthed lately. "We would like to get them to museums, before they are all stolen and sold to foreigners. I am afraid this is now quite a problem."

The time had come for me to take a close look at the thorniest problem in Thailand: the Northeast.

Imagine a hard land, a poorly drained plateau about the size of New England, waterlogged under the monsoon but generally arid and dusty. The rice fields are hard to irrigate, and yield poorly.

Imagine 9,000,000 farming people, two out of every seven Thai, hardened by the land. Many are forced to go south and seek work in Bangkok, where they are looked down upon as yokels. In language, dress, and customs they are closer to the farmers across the Mekong, the ethnic Thai who are the people of Laos. Imagine the officials sent from faraway Bangkok, pining for comforts and advancements they left behind, eager to get back. Northeasterners feared them.

In Bangkok, during my visit, it was agreed that this is how things had been in the Northeast for decades, at least until recently. Now the air was full of hopes and plans for great changes, quick: better farming, more roads, more police with helicopters.

Otherwise wouldn't the terrorists, based in the jungles and calling themselves the Thailand Patriotic Front, step up their murderous operations even more?

In a way, that war wasn't so very distant. Maj. Somboon Intraprasart, 35, a father of five and the highest-ranking officer yet killed in the Northeast, had just been cremated in Bangkok. Before the ceremony, Field Marshal Thanom awarded him a posthumous promotion to colonel and the Order of the White Elephant, Third Grade. Colonel Somboon had fallen in a skirmish on his 12th wedding anniversary.

Wild West Lives On in Booming Udorn

After a 300-mile flight to Udorn, the capital of the northeastern province of the same name, my first impressions were of resounding changes indeed.

"You're on the newest street in town," said the taxi driver. "Paved last week. Here's our first traffic light, two months old."

At the race track I put my money on Somboon Chai, or Perfect Victory, who was nosed out by Ratana Thevan, or Divine Jewel—while Yord Ming Mano, or My Soul, came in last. But that didn't disturb me half as much as the thundering of the jet fighter-bombers—the Republic F-105's, or Thunderchiefs, of the U. S. Air Force, landing on the big airstrip right near the track. Didn't the planes disturb the horses?

Humpbacked bullocks pull a cart with a log slung beneath it near Sakon Nakhon, a provincial capital in the terrorist-infested Northeast. The Thai call this hard abundant timber *mai dang* —"red wood." The distinctive cart carries a bumperlike outrigger to fend off underbrush. The more a cart squeaks the better: The driver hopes it will scare off wild animals and evil spirits.

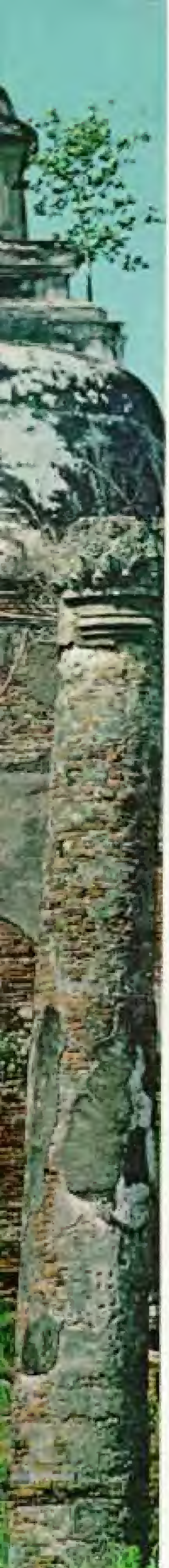
Logging provides a livelihood for many a villager on the 500-foot-high northeastern plateau.

Pride of its owner, a glistening log truck parades pictures and pennants; a sign on the baggage rack proclaims its name, "Bright Light." Made in Japan, the truck has no doors—a common touch in balmy Thailand.

Striding the road to Sakon Nakhon, sandaled lad bears a melon and a tray of sticky northeastern rice, cooked in bamboo tubes for marketing.

Riding to work, a bull elephant and hulking calf fill a truck en route to a forest near Samut Sakhon. Mahouts stay mounted to keep the beasts quiet during the journey. Though mechanization spreads rapidly in Thailand, no machine excels the elephant at bucking trees from forest to river or truck.

Just as English serves as a second language of Thailand, another British influence prevails along the highways, where drivers keep to the left side.



Ghosts of a glorious past, *chedis* of a royal temple spike the ruins of Ayutthaya, Siam's capital for four centuries. Ashes of royalty rest within the spired domes, whose peeling stucco walls reveal red-brick cores. A walled town surrounded by waters of the Chao Phraya, Ayutthaya in the 1600's became one of the largest cities south of China. A Dutch trader in 1636 described it as "frequented by all Nations; and . . . impregnable." But Burmese armies pierced its defenses in 1767. Today only these crumbling monuments are left to haunt the imagination. To preserve them, the government plans a national historical park.

Mask of evil identifies Thosakanth (right), most heinous villain of the *Ramakien*, Thai version of the Indian epic *Ramayana*. While actors pantomime, a chorus tells of monkey generals, beautiful ladies, and powerful heroes.

Magical giant with blazing eyes rescues the army of the hero Rama. Pursuing an ally of the evil Thosakanth, Rama's soldiers reach a seashore. The stage grows dark. Calling on supernatural powers, a general enlarges his body and lays himself across the water as a bridge. Here, carrying their leaders under a ceremonial umbrella, the army dances to battle. Thailand's Department of Fine Arts in Bangkok trained the actors and produced this episode from the *Ramakien* for the first time last year, to honor visiting President and Mrs. Lyndon B. Johnson.

"The horses were afraid," said a groom. "Now they are used to it."

I bought a plastic bag with sugared green vegetable juice, and while I sipped it through a plastic straw, a reconnaissance jet came in, a McDonnell F-4C Phantom; then a big USAF cargo carrier, a Fairchild C-123 Provider. Hanoi was 325 miles away, across Laos —half an hour as the Thunderchiefs normally go. They went that way often.

The Hotel Udorn was crowded with USAF officers. No room at the base. "This is a roaring town," a major said. "Like Dodge City 80 years ago." I hardly slept because of the noise from the annual fair with its Ferris wheel, Chinese opera, and strip-tease shows. The rock-'n'-roll rocked until 5 a.m. Then the roosters started in. The first jets roared at 6.

The Governor of Udorn proposed new ways to help the farmers. For example, teaching them to grow sorghums. "New to this part of the world, but marvelous. Rice here pays 100 baht an acre, after 210 days. Sorghums pay 200 baht, after just 90 days. Then you leave the field alone, and in another 90 days, right on the same stalks will be another crop, another 200 baht! Japan has promised to buy all we can grow to feed its livestock."

Anti-Red Medicine—a Better Life

The governor had studied at the London School of Economics. "My job," he said, "is to give the people a richer, better life. Then they won't listen to the Communists."

On the road to Sakon Nakhon, the next provincial capital, I was struck by the dust

Pig in a rattan poke shares a motorbike in Chiang Mai. Farmers sell hogs by age and size instead of weight, and usually to Chinese, since Buddhist teaching discourages the taking of life.

Sharing their swimming hole, boys splash amid placid water buffaloes near Fang, a town hard by the Burmese border. When all finish their dip, the youths will mount the beasts and sway toward home. Throughout Thailand, the indispensable buffalo plows the rice fields and pulls an occasional cart. With fences unknown, an owner tethers his animal in a small pasture and posts a son to watch over it.

billowing from the road—very fine and golden red. It had so coated the vegetation that I wondered how the plants could breathe.

Because it was hot, we had the car windows open. We were three—GEOGRAPHIC photographer Dean Conger; our interpreter, Mr. Chawin Saragum, a Northeasterner; and I. When a vehicle came the other way, we would quickly roll up the windows.

We had to keep the windows up so much of the time that the car became a hothouse. Finally we just left the windows down, and stopped from time to time, to hear what people had to say.

A shopkeeper: "We clean house many times a day, but still the dust gets into everything. Even into water jars, despite the covers. Will they ever get the road paved?"

A highway engineer: "Here are many, many Communists. It's not safe at night, sometimes not even by day. They keep especially after the army officers. They haven't hit any foreigners yet, but they are trying. They don't want soldiers and officers and foreigners to come here and bring progress."

A third man: "They tell the teachers, 'Teach Communism, or go.' Many go. Sometimes a policeman comes to teach. Some villages have schools but no teachers. Last week the Communists fought with police right here. Three policemen were wounded. Nobody was caught."

In Sawang Daen Din, I talked to a soldier who carried an American rifle, a bandolier, and hand grenades. "The police aren't enough," he said. "Now they need us too."

Farther on, in Phanna Nikhom, we saw more soldiers and many people with conical hats. These were Vietnamese. There were 40,000 in the Northeast—refugees who had left during the war against the French. In a roadside restaurant hung a picture of North Vietnamese President Ho Chi Minh, with offerings of incense sticks before it.

I asked a Thai official about that picture.

He said, "Well, they all have one. He is their hero. As you see, it's a kind of religious worship, and how can we object to that? Everyone is free to worship as he likes."

At the end of this sobering ride we entered the great planning room of Mr. Bodueng Chantasen, Governor of Sakon Nakhon. The setting reminded me of the Ministry of National Development back in Bangkok. Around a large conference table were men representing the government's effort to do something about the Communists. I asked what they did.

The military MDU, or Mobile Development Unit, built roads, dug wells, helped farmers improve crops, and ministered to the sick. ARD, or Accelerated Rural Development, was a civilian program, doing much the same. Both were advised and also partly financed by American aid officials, and protected by a CPM, or Civilian-Police-Military unit. The latter included an infantry battalion, advised by a U. S. Army captain.

"Tomorrow," said the governor, "you can see us on the job."

Next morning we drove from the main road to a so-called security road, then to a just-finished MDU road, which led into an ARD road still under construction. And so, two dusty hours from Sakon Nakhon, we watched American bulldozers and graders dustily at work, expertly handled by Thai (page 96).

The Thai official accompanying us said: "With good American equipment like this, we can make a good road to every village in this province. Then the people will be happy and not think about Communism. But if we should have problems with Communists, we could send in troops in a few minutes and suppress them."

The road had nearly reached a village of some 40 houses, and we walked there to buy

Giving heart to a village menaced by Communists, a medic examines an expectant mother in Huai Hat. He belongs to a People's Assistance Team, a government unit that bolsters sensitive areas with such services as medical aid, livestock vaccination, and gifts of high-yield seeds.

Provincial leader urges villagers of Huai Hat to stand firm against the Communists.

Grim comic books tell a story of Communist terror; members of a People's Assistance Team scan the material they will distribute. The pamphlets relate how the Communists lure young men to North Viet Nam, indoctrinate them, then send them back to subvert their fellow Thai. Meeting resistance, the Reds resort to terror.

PAT members train in the south but serve only in their native Northeast to ensure acceptance by the villagers.

Grimy clothes vanish and new ones appear as a teacher shows off his class in Huai Hat. A People's Assistance Team distributed the outfits—which the children pulled on right over their old clothes. Thai Governments in the past had little contact with the Northeast, and, as a result, the borderland felt few ties with Bangkok. Now the kingdom rushes programs to build roads and schools, establish police and army protection, dig wells and irrigation ditches, and alert the people to Communist tactics.

"In the water there are fish, in the fields there is rice." This description of abundance from a Thai king of seven centuries ago holds true today. A girl near the mighty Mekong River lifts a net full of fish. Clumps of rice seedlings behind her await transplanting.

watermelons. This was the season, but it was hard to get them to market over the oxcart trail. The road would help. But what the villagers desired far more was a well.

The official said: "It is very hard to dig wells here, and we have no equipment now. Perhaps we can build a reservoir later on. We must make a survey. Right now the program for water is not as important as the road."

I heard much scientific talk about how to get more out of the soil. A hundred pounds of fertilizer could mean an increase of 440 pounds of rice per acre. An experimental growing station had demonstrated this. Now the task was to convince the farmers.

Same Field Yields Rice and Fish

The Director General of the Department of Fisheries in Bangkok, Mr. Prida Karnasut, had come to Sakon Nakhon. He gave me this prescription:

"Ten days after the rice seedlings are planted in the water, dig a ditch a foot deep on one side of the field, and we'll give you some carp and gouramis. By day, when the shallow water gets too warm for the fish, they'll stay in the ditch, and by night they'll swim all over. The result will be about 100 pounds of fish per acre—plus 400 additional pounds of rice."

Had that been demonstrated too?

"Certainly. The fish eat weeds. And they fertilize the soil."

Governor Bodaeng invited us to see a PAT, a People's Assistance Team, the latest thing in counter-insurgency. A helicopter carried us into the hills called Phu Phan, meaning "forested mountains." They were one of the main Communist hideouts in the Northeast.

Our flight to a small village took seven minutes. The day before, when the PAT needed a replacement bulb for their movie projector, it had taken a villager four hours on horseback to get to the nearest road, to pick up the new bulb requested by radio.

The PAT men wore blue denim and kept their weapons close. They had been terribly busy, repairing houses and putting up posters, giving haircuts to men, thread to the women, clothes and shots to everybody. They had built a little earth dam and suggested that the villagers add stones later, so the dam wouldn't be washed away when it rained again.

I met the village spirit doctor. He led us into the forest, to a tiny house roofed with corrugated iron. We were in the presence of the *phee poota*, the protective spirit of the village.

The spirit doctor lit a candle and prostrated himself. He told the spirit that we had come from another place; would the spirit mind if we stayed a while and took pictures? Would he let us be happy, and protect us?

Later, the spirit doctor took us to his own house. He said that if strangers failed to pay respect to the spirit, something would go wrong. Two nights ago, when the PAT people set up their movie equipment, the bulbs exploded. They had not been able to show any films that night.

The spirit doctor said that unfortunately he had been away when the PAT arrived, or he would gladly have informed the spirit. Last night everybody had enjoyed the films.

The helicopters lifted us over a ridge into another village. No high official had been there before. The governor planned to stay overnight, to show that the Communists couldn't scare him. Armed Communists were known to be two miles to the southwest.

Our helicopter shuttled back and forth, and load by load, all 70 members of the PAT came in and got down to work, obtaining information from the villagers and digging foxholes.

The PAT captain reported to the governor: The Communists had held a meeting here two nights before, to announce our coming.

Mohlam Teaches a Lesson in Politics

The governor made a speech. The Communists said the government oppressed the people, he declared, but the government was helping the people. The Communists said the country had been betrayed to the Americans, but in fact Thailand was free, as it had always been. The Americans were here to help, not to enslave. The real enslavers were the Communists—the Red Vietnamese, the Red Chinese. . . . Any questions? None.

The governor said, "Pass out the clothes."

A woman in the front row said, "Good."

That evening, in the clearing in front of the schoolhouse, the PAT set up a movie screen. The movies drew a good crowd. One film was in color: a *mohlam*, a traditional sing-song play, showing how Communists came with friendly words, then terrorized with guns.

The captain gave the governor another report: Five villagers were known to be armed. One man had mysteriously left the village.

The audience walked home, carrying torches, and we bedded down in the schoolhouse. More news: 17 buffaloes had disappeared.

Rustling was common, but not 17 at a time. Was this a Red ploy to embarrass the governor? Or to draw away some of our men?

In the dark the captain fiddled with the radio. Peking; Hanoi; the Communist "Voice of the People of Thailand," spouting propaganda from Red China. "Warmonger Lyndon Johnson." "Traitor Prapas." "War criminal Dean Rusk."

It was a disconcerting night, but with a happy end. The buffaloes returned at dawn. Our helicopter had scared them away.

I traveled on through the Northeast, along the high banks of the Mother River Mekong. I visited many wats and I saw many armed men in brown berets and red berets. Some wore black berets and were advised by Americans in green berets.

At last I came to the booming town of Ubon Ratchathani, near the troublesome frontier with Cambodia. A border dispute had been formally settled, but infiltrators, I was told, were still seeping through. I drove past the big airbase to the rail terminal and boarded the evening train to Bangkok.

At midnight the train pulled into Khorat. Here the paved Friendship Highway bridged the tracks, stretching north all the way to Laos. Nearby bustled a big airbase, and the U. S. Army's 9th Logistical Command had stockpiled equipment for an entire infantry division, just in case.

As the train jogged into dawn, my memories kept me awake.

Memories of the island of Phuket, down south, where Mr. Ralph McNair from Ashtabula, Ohio, was in charge of the new tin smelter. He had said:

"Two cast iron kettles were shipped in, ten tons apiece. At home, we'd use a 50-ton crane to unload them. Here, no crane. They told me, don't worry, we'll get them to the smelter sooner or later. A week later they did. I'll never know how they got them on those two

Chestful of medals adorns Deputy Prime Minister Prapas Charusathira on the King's birthday. He also serves as Minister of the Interior and Commander in Chief of the Army.

Squatting for a smoke, a Chinese near Fang uses a stick of incense to light his water pipe.

Lahu tribesman of the northern hills hunts with muzzle-loader and teak-sheathed sword.

Bib of silver reflects the wealth of a Lisu, whose tribespeople dwell in ridgetop villages.

Bubble gum replaces betel for a Muslem maid of the monsoon-soaked Malay Peninsula.

Roses in the hair tell that this girl comes from Chiang Mai, renowned for beautiful women.

trucks. They really are an amazing people."

I thought of the 78-year-old princess who cooked so well that she had recently been asked by the royal household to prepare a meal for the visiting King of Denmark. She kept putting more of her *phag boong* on my plate, her morning glories fried in batter. Her Serene Highness kept saying, "You must eat!" Just like my mother.

And how could I forget the little novice who watched as I talked with the lord abbot in That Phanom? I asked him what made his smile so wide.

"You," he said. "You are so big and fat and talkative."

Hadn't he met any big, fat, talkative Thai?

"Not in this town."

Perhaps I hadn't smiled back widely enough, because he added quickly: "Oh yes, some here are fat, and some do talk a lot . . . but none like you!"

Would these capable, kind people fall victim to the political malignancies of our age?

Royal Command Raises the Spirits

At the end of my stay in Thailand I was ushered into Chitralada Palace, the residence of King Bhumibol Adulyadej.

Sitting in a Louis XV drawing room and dressed in a dark-blue business suit, His Majesty talked to me of many things—of roads, of crops, of psychology, of spirits, and of the importance of the family in times of change. What the country needed most, His Majesty said, was good officials. And then His Majesty told me a story.

Near the summer palace at Hua Hin, along the Gulf of Siam, a medical officer saw his work endangered by Communists. He lacked the means to do what he thought necessary, and he was downhearted. Should he simply sit by while things got worse? Or perhaps go to Bangkok and look to his own advancement?

His Majesty heard about this man and went to see him: "I gave him the funds he needed. And I said to him, 'I forbid you to become discouraged!' "

As my plane rose from Don Muang Airport, I saw the sun burning away the haze from the great rice bowl. If only the political haze would lift from all Thailand. That morning I had heard that the Communists had become newly active close to Bangkok, too. Then into my mind came the words of the King: I forbid you to become discouraged!

I was going home to a far-away republic—but I would often think of Thailand in days to come, and I too would gladly heed that royal command. THE END

England's Scillies, the Flowering Isles

By ALAN VILLIERS

Illustrations by National Geographic photographer BATES LITTLEHALES

Like a Pied Piper, a farmer cutting a loamy wake lures herring gulls to a flower field on the island of St. Mary's. Hugh Town, the hamlet-size capital of the Isles of Scilly, tiers the hill beyond. Warmed by Gulf Stream waters, Britain's Scillies bloom like a garden all winter and draw a host of sun-and-sea lovers in summer.

"EACH YEAR they book the same hotel, same room for the next year—same bed, too, if they can get it," said Capt. Waldron Phillips, harbor master of the Scilly Isles, looking proudly at the pint-size bustling harbor of Hugh Town, St. Mary's.

Long queues of sun-tanned visitors were lined up at the top of the stone steps leading to the husky open motor launches that serve the islands. Pretty women in beach attire or the shortest of shorts hurried along the stone quay, shepherding their children, while the menfolk carried picnic baskets jam-packed with provender for a week. Boatmen with strong faces bushily bewhiskered and wind-weathered to the color of old mahogany smiled as they helped their customers aboard.

For these vacationers the Isles of Scilly (pronounced silly), only 28 miles from the southwestern tip of England, are a dream-world archipelago (map, page 131). The climate is unique in the British Isles; in winter it is often as warm as the Riviera. Brilliant flowers bloom in January, and in such profusion that shipments to the English market are the Scillies' chief export. But above all, the city dwellers are lured by the isolated beaches, the quiet, and the peace. These charms make the Scillies the favorite holiday haunt of 75,000 visitors a year, among them

Influx of vacationers jams Hugh Town's main street on an August afternoon. To reach St. Mary's, they whir in by plane and helicopter or sail from Penzance, in southwestern England, across 42 miles of notoriously rough water. In summer, visitors often outnumber the Scillies' 1,800 residents.

Ruddy stamp of sun, wind, and salt imprints the genial faces of boatmen who operate a ferry and sightseeing service between St. Mary's and the outer islands. Navigating rock-strewn waters, they refute a local proverb: For every man who dies a natural death on the islands, the sea takes nine.

Dried kelp provides a plaything (above, right), but once it earned a living for many Scillonians. Burning the seaweed in stone-lined pits, they shipped the soda-rich ash to British factories that produced alum, soap, and glassware. Today Britain imports its soda or makes it chemically.

Prime Minister Harold Wilson, who has a modest bungalow on a plot near Hugh Town.

As Captain Phillips and I watched, the launches lying five abreast at the harbor steps filled up. Others waited off to take their turns. The sea was calm and the water so clear I could see the sea anemones and the rocks and shells on the white sand as if there had been no water there at all. Ashore no smoke rose anywhere to smudge the clear air, and the hotels and guesthouses backing on the beach gleamed in the bright sun.

Outside the harbor the sea was a deep turquoise, deceptively gentle in appearance. But I knew that dangerous cross tides raced among the myriad rocks and islets. The Scillies include 140 islands, of which only five are inhabited; no one has counted the rocks.

Shades of blue in sky and sea delighted the eye, setting off the hard granite of the islands, and heather purpled the hillsides of St. Mary's. Gulls called to each other noisily in the main street of Hugh Town and, after the morning rush to the harbor and the boats, that was all the noise I heard.

Beaches Aplenty for All Who Seek Them

"You see the crowds on the quay, the filled-up launches," said Captain Phillips, "but there are still plenty of beaches for everybody. Why, if they find two or three people already on a beach, they just walk on to the next.

"But our Scillies are small. We don't want to get too popular. This summer we've even had a few queues. We don't like that."

The Scilly Islands are indeed small. St. Mary's, largest of the inhabited islands, is two and a half miles long by a mile and a half

PAINTING BY BATES LITTLEHALES © N.G.S.

broad. More than 1,400 people live there permanently. The other inhabited islands are all less than half St. Mary's size, with hardly more than 400 residents among the lot. In ancient days men also lived on some of the islands now given up to seals and sea birds, as Bronze Age relics attest.

The Scillies group is part of the Duchy of Cornwall. Since the Duke of Cornwall is also the Prince of Wales, the islands provide some of the royal revenues.

Official policy is to keep the Scillies in their tranquil isolation. Noisy night life and promoted tourism are not wanted. Holiday camps and trailer parks do not exist. The automobile has become a minor problem, however, for the number of motor vehicles has risen sharply in recent years—to more than 350. St. Mary's has nine miles of paved roads, all narrow, winding, hedge-lined, planned strictly for the horse, demanding careful driving. The other islands have virtually no roads. Among the Scillies, the boat is the car and the motor launch the bus.

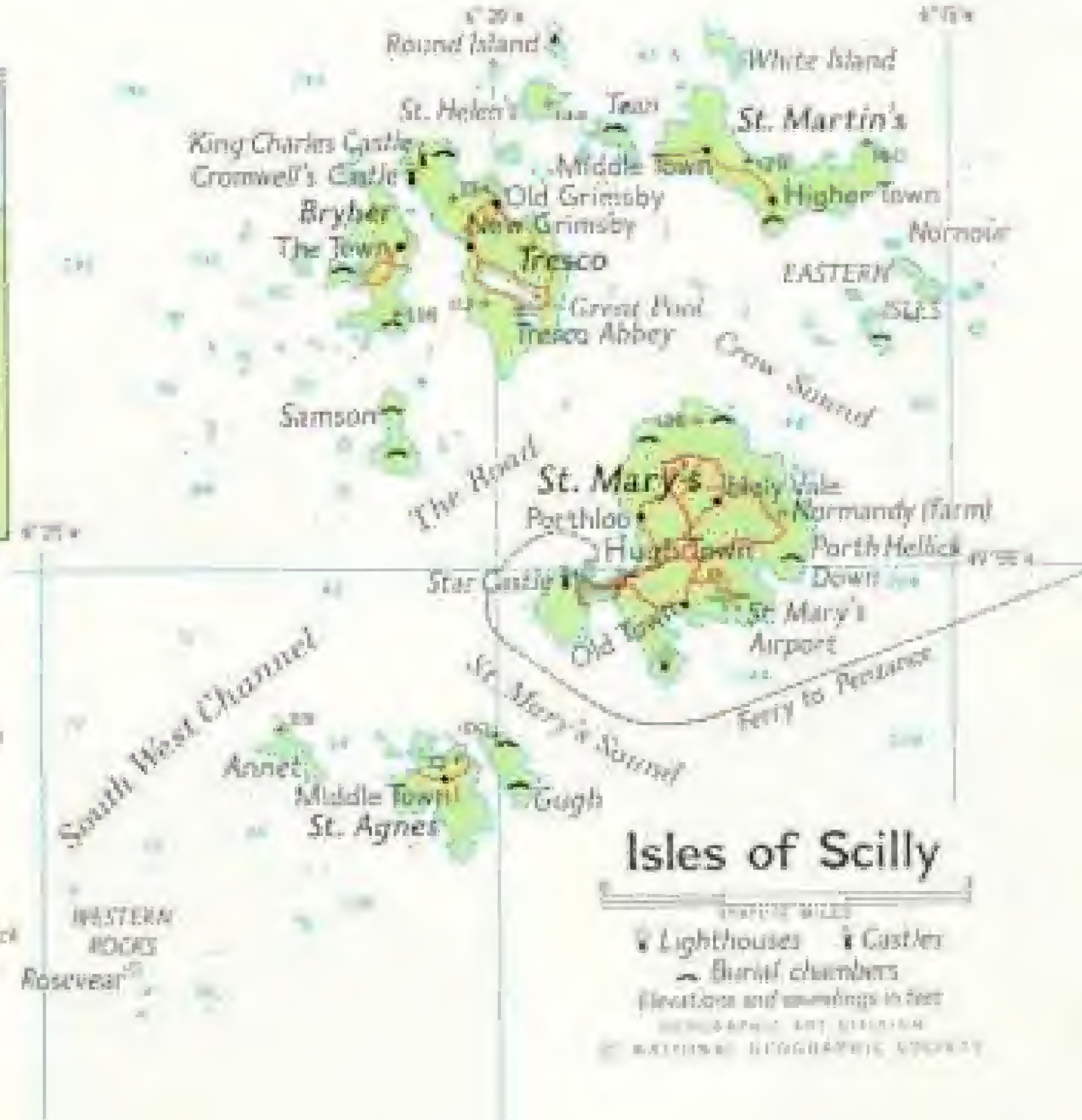
There are three ways to reach the islands. You may come by sea, by 800-ton motor ship from Penzance, some 42 miles away on the coast of Cornwall. You can sail in a small yacht from England, Ireland, or France, if you can accept the

Steppingstone isles: Field-checkered Bryher, Tresco, St. Helen's, and Round Island, with its lighthouse in the distance, lie but 28 miles from England's southwestern tip. Once, goes a legend, a country called Lyonnesse linked the Scillies with England, and on its now-vanished soil King Arthur's knights waged battle against rebellious Sir Modred. Merlin, the wizard, chanted magic words that made Lyonnesse sink, drowning the rebels. The knights found safety on high ground—today's Scillies.

Mysterious maze by St. Mary's shore puzzles even the islanders (left). One theory: Bored British soldiers shaped it about 1800.

March mists shroud Hugh Town as schoolgirls race a tiny dog across tide-brushed sands.

Riviera-like front yard of Britain, the Isles of Scilly lift but six square miles above the indigo Atlantic. No one knows for sure the origin of their name. One theory holds that it derives from *silli*, a Cornish word for conger eel; another favors *sullen*, Cornish for sunken rocks. Of 140 islands, Scillonians inhabit only five: St. Mary's, Tresco, St. Martin's, St. Agnes, and Bryher.



EKTACHROMES BY BATES LITTLEHALES © N.G.S.

Greenhouse magician. Rodney Ward of St. Mary's makes daffodils blossom at his command. After selecting plants in the bud, he regulates their blooming by temperature control. Scilly flower farmers sell about 50 million blooms a year. Three of Mr. Ward's prize-winners appear in close-up (above, from top), White Lion, Foxhunter, and Penberth.

Who introduced daffodils to the islands? Time obscures his identity—a monk, perhaps, or a visiting Dutch sea captain. Islanders say that a single hatbox of Scilly daffodils, sent to market in London about 100 years ago, inspired the flower industry—a mainstay of the economy by the 1880's.

Swishing sea of December daffodils parts beneath the tread of St. Mary's pickers. Surrounded by oceans of bright flowers and blue water, Scillonians learn to steer boats and snip stems with equal skill. Evergreen hedges protect plants from savage winds. Although ordered by the British Government to raise more vegetables and fewer flowers during World War II, islanders still managed to send bootleg blooms to flower-hungry England.

tossing around the Atlantic almost always offers in those waters. Or you can fly—from Penzance, a 20-minute trip by helicopter, or from Newquay by plane.

Flying is the most memorable way to come. The Scillies are all rocks and hills, and none has a really flat field of any size. The one small airfield clings to the brow of a green hill near Hugh Town. A sign says, "St. Mary's Airport: Keep to the Road," which seems sound advice. Nevertheless, to have one's first view of these isles from the air is ideal.

Was This the Fabled Lyonnesse?

As my plane came over them, islands, islets, and rocks of all shapes and sizes seemed afloat in the clear water. I could appreciate how the islands, now carved by subsidence and stormy sea, may formerly have been a single land mass. Legend tells that the fair fields of Lyonnesse once stretched from Cornwall to the Scillies, though scholars aver that any link with England ended long before man's coming. Yet the islands are undoubtedly a continuation of the granite backbone of Cornwall, making a final thrust above the sea before dropping forever into the Atlantic depths.*

"People have lived here since long before the Christian Era," my banker friend Cyril Short of Hugh Town told me as we tramped St. Mary's moors and hills. Mr. Short himself testifies to the attraction of the Scillies, for he came on a tour 29 years ago and stayed.

"Men may have been here for 4,000 years or more," he said. "We've got almost three times as many known ancient burial chambers as in all the rest of Cornwall—45 of them. They've been here at least two and a half thousand years, so the archeologists tell us."

We walked over the gorse and bracken-mantled hills on the springy, sandy earth that covers most of the granite. The purple

*Alan Villiers told of his travels from "Cowes to Cornwall" in the August, 1961, GEOGRAPHIC.

heather lay as thick as in the Highlands of Scotland, and wildflowers smiled all around. A clear artist's light covered the land and sat wonderfully on the unsullied blue sea. Offshore a basking shark lazed by. Razorbills and puffins (page 139), looking like seafaring clowns, flew fearlessly close. ("We've sanctuaries for them; they know it well," said Mr. Short.)

Quest for Immortality Made Soil Sacred

Nobody else was in sight as we strolled over Porth Hellick Down to look at the ancient burial chambers there. In some, which were once used for cremation, remains of 70 or more burial urns have been found. The best-preserved chamber forms a mound 40 feet across and 5 feet high, made with large upright stones that must have taken a lot of manhandling.

"There is a theory that back in the Bronze Age, these islands were a burial place for distinguished dead—the Islands of the Blessed, or the Fortunate Isles," Mr. Short said. "The idea was that dead chiefs and other heroes could find immortality here, in sight of the sea, among scenes of quiet beauty."

I knew of another theory—that the Scillies made an ideal burial place for chiefs because the ancients believed departed spirits could not cross water. Those chiefs were often turbulent characters. One lifetime would be enough of them.

Of all the Scillies' historic monuments, Mr. Short was most enthusiastic about one on the small deserted island of Nornour

"**Enter, then,** if it so please you, and welcome," invites a plaque at Tresco Abbey (right), a home built near the site of a medieval monastery. New Grimsby village clusters beyond Great Pool, a fresh-water lake. A 17th-century tower called Cromwell's Castle guards the harbor. The mansion belongs to Lt. Comdr. T. M. Dorrien Smith, R.N., Ret. (left), the island's fourth lessee, who stands beneath a portrait of his great-great-uncle Augustus Smith.

A Hertfordshire squire, Augustus leased all the Scillies from the Crown in 1834. As Lord Proprietor, he built the great house, set out its famous gardens, and introduced compulsory schooling. He died a bachelor, and the isles passed to his nephew, who established the flower industry.

A new lease signed in 1921 gave the Smith heirs the isle of Tresco for 99 years, though actual control of this and the other inhabited islands rests with an elected council. Another agreement awarded the family custody of the Scillies' uninhabited islands and rocks.

just off St. Martin's, northernmost of the inhabited isles. In 1962, a heavy gale from an unusual quarter caused seas to wash away part of the beach on Normour, exposing a series of upright stones unseen before, obviously put there by man (page 141).

"As soon as the sea subsided, a local family looked carefully at these," Mr. Short told me. "They found two curious brooches and a Roman coin. Excavation revealed a two-room building with hearths and small furnaces. There searchers found more than 70 coins and nearly 300 brooches, all of Roman times. The place was a regular jeweler's store!"

But the archeologists found it was much older than that. The building had originally been a Bronze Age dwelling; Iron Age occupants partitioned it and added the hearths and furnaces.

Roman-era traders, dated by their coins, all of which are from A.D. 69 to 375, came more than a thousand years after the Bronze Age builders arrived, and about 400 years after the Iron Age settlers.

"We have heard for years how these islands may have been the Cassiterides—the tin islands of the ancients—how the Phoenicians may have traded here and the Romans after them. Stories about the Islands of the Blessed, the Sylina Insula where heretics were banished, Lyonnesse, and all the rest have been tossed about for centuries. But the jeweler's store on the beach at Normour is real. Three hundred brooches? They weren't for local consumption. This was an ancient trading place. Such a discovery has never before been made in Britain."

Jeweler's Clientele a Puzzle

I found many of the best brooches in the small museum at Hugh Town. One curious bronze-and-enamel specimen is shaped like a horse, with wings growing from its shoulders and a fish's tail.

The curator showed me a splendid wheel-shaped brooch, inlaid with minute colored stones (page 140). This particular piece was probably made at Anthée, in what is now Belgium, in a workshop which experts know burned down in the middle of the third century.

I wondered where the jeweler of Normour found buyers. Perhaps no one will ever know, for this is one of the many fascinating mysteries with which the Fortunate Isles abound.

Flower Industry Thrives in Winter

Jewelry may have been prominent in Scillonian trade long ago—and, later, highly organized smuggling and the more prosaic seafaring and kelp-burning for soda ash—but for the past 85 years the spring-flower industry has been a mainstay of the islands. About a hundred years ago an enterprising local resident first sent off a choice parcel of daffodils to market in London and got back half a crown. Those first bunches, they say, reached Covent Garden in a battered old hatbox, but when the hatbox was opened, the shining golden flowers inside lit up even the faces of the salesmen. Scillonian daffodils have been bringing light and warmth to wintry English rooms ever since.

"That pioneer really started something. The single hatboxful has increased to 50 million blooms in a season—hundreds of tons of flowers, all grown in the open," Mr. Rodney Ward of Normandy on St. Mary's told me (page 132). Mr. Ward is the grandson of William Barnes, also of Normandy, one of the first to take up the flower trade. Mr. Ward is noted as a developer of new types of narcissi and daffodils, for which his firm, Rodney W. Ward & Son, Ltd., holds many prizes.

"Here climate, soil, and maybe something else not so easily recognizable—perhaps some quality in our sunshine—combine to give us beautiful flowers, especially wonderful narcissi. They bloom early and they travel well.

"Our season begins in November with the beautiful Soleil d'Or narcissus, gives us the Magnificence daffodil in January, and ends in May with iris. It takes 150,000 bulbs to plant one acre, and we have 575 acres in bulbs. So there is a lot of capital in it. And work!"

We were seated comfortably in the parlor at Normandy: Rodney Ward, his wife, his sister-in-law, and a young girl from Holland's bulb industry, over to learn how things are

Uncoiling a five-foot marauder, Matthew Lethbridge tugs a conger eel from one of the 90 lobster pots he hauls daily off Bishop Rock. Like his father before him, the lobsterman is a volunteer coxswain of the St. Mary's lifeboat, which still snatches distressed mariners from the sea's fury. Recently, when the tanker *Torrey Canyon* piled up near the Scillies, Lethbridge and his crew sped to the rescue. His lifeboat wallowed in oily seas for 33 hours while picking up 23 of the vessel's Italian crewmen, nine of whom landed on St. Mary's.

CONTINUED ▷

Puppy-faced seal sunbathes on the rocks of Rosevear. Mother weans the baby at three weeks, about the time slick adult hair replaces white infant fur. Several gray seals caught in the *Torrey Canyon's* clogging oil were plucked from the sea off Cornwall and given a bath by helpful human hands.

Gimlet-eyed kittiwakes, far-ranging gulls, step their nests on the storm-etched profile of St. Helen's. They share the islands' sanctuary with cormorants, petrels, auks, and waders, as well as with many land birds.

done in the Scillies. As for the work, I had seen something of that on various visits—the backbreaking picking; lifting, cleaning, sorting, and grading the bulbs; then a quick dip in boiling water to eradicate the eelworm.

Some of the lifted bulbs are refrigerated for some time, to fool them into believing they have had winter and so cause them to flower earlier. Old underground fortifications, fortified no longer, are used for this purpose.

Trimming the high hedges that protect the flower fields from winds is another facet of the work. These hedges of veronica, escallonia, and pittosporum grow to 15 feet and make a lovely checkerboard of the sheltered sides of the larger islands. Without them, the fragile blooms would stand little chance against the hard Atlantic gales.

While we yarned over tea, we looked through a copy of the GEOGRAPHIC for December, 1938, which had an article on the garden isles of Scilly. Many of the old color illustrations were made in Mr. Ward's fields and packing houses. The Wards recognized the faces of the pretty packers, the sea-booted men working the fields, and St. Mary's lone policeman. (Now there are two policemen, plus a third during the busy summer season.)

We paused sadly over the picture of the old town crier, now dead: he was Hugh Town's newspaper, radio, and bulletin board all rolled into a vociferous bell-ringing one. Radio is common today, and there are many bulletin boards, but a new town crier carries on.

Garden Grew From Seafarers' Gifts

For even more breathtaking proof of the astonishing profusion of flowered beauty in the Fortunate Islands, you must go to the isle called Tresco and visit its fantastic Abbey Gardens. Tresco, all 750 acres of it, lies in full view of the roadstead off St. Mary's. Glorious beaches and lovely little bays, the medieval ruins at Tresco Abbey, a couple of ruined castles, some old coast guard cottages converted into a wonderful hotel—add to these

Clownlike puffin helped pay the rent of the Scillies in the 14th century. Catholic Englishmen prized the bird's meat—and could eat it by dispensation on fast days. King Edward I required an annual payment of 300 birds, or 6 shillings, 8 pence, from Ranulph Blancminster, then captain of Scilly. Despite laws protecting the puffins, their numbers steadily dwindle.

Biggest of the mammals that breed wild in the British Isles, gray seals loll on sea-washed shoals. Adult males grow as long as 9½ feet and weigh as much as 630 pounds.

a marvelous climate and fertile soil, and there is Tresco. You go by boat, and when you get there you walk. And love the walking.

For almost a century, until 1921, the Scillies were controlled by the Smith family, who came from Hertfordshire in England as Lords Proprietor of the isles. Augustus Smith made his home on Tresco in the 1830's and began creating the Abbey Gardens. Island seamen brought him plants, cuttings, and seeds from their voyages. His nephew, T. Algernon Dorrien Smith, established the flower industry.

Geraniums Tower Higher Than Islanders

"Plants and trees grow here which don't grow outdoors anywhere else in Europe. They thrive in our mild and equable climate," said the present representative of the family, Lt. Comdr. T. M. Dorrien Smith, retired from the Royal Navy. He leases Tresco and the uninhabited islands from the Duchy of Cornwall.

As we strolled the luxuriant gardens, I saw plants from all over the world. A hill just over 100 feet high to the westward gives shelter, as far as any hill can in these low Atlantic islands (pages 134-5), where the wind is the enemy and frosts are hardly known.

Near the solid granite house built by Augustus Smith grow gigantic aloes, eucalyptuses, araucarias, bananas, dracaenas, eurybias, geraniums seven feet high, Chinese paper plants, Madeira lily-of-the-valley trees, cinnamon, musk—the list seems endless. Flowers sprout from the rockeries like scintillant water tumbling down a brilliant waterfall, and the hues of mesembryanthemum shine in wildest profusion. It is like a huge botanical garden with neither roof nor walls, set in a man-made subtropical forest—and all this at 50 degrees north latitude, about the same latitude as frigid Newfoundland.

"The Gulf Stream must do it, and the soft, mild airs it sends in—when it isn't blowing a gale," said the commander, like the seaman he is. "But I don't know what the important ingredient is in the soil. Nobody does. It's an

Relics of Roman times: Silvered bronze safety pin and wheel-shaped brooch, bright with enamel and inlaid colored stones, came to light when archeologists sifted the debris on Normour beach (opposite). Diggers uncovered almost 300 brooches. Some had been made in other parts of the Roman Empire, testifying to the flow of trade that touched the Scillies during Roman occupation of England

"**The jewelry shop**": Treasures discovered on this beach suggest that Celtic sailors used Normour as a trading center in the days of Rome. Storm-driven surf in 1962 combed away the sand to reveal ancient hearths, huts, coins, and brooches. Circular stone structure behind amateur archeologist Cyril Short of Hugh Town, a retired banker, was already old when the Romans came; scientists estimate it took shape in the Bronze Age, more than a thousand years before Christ. The British Ministry of Public Building and Works sponsored the excavation.

odd thing. We have thousands of species of plants. They all do well. Bees thrive here, too, producing great quantities of honey."

We passed an arch of the medieval abbey and a hedge, and suddenly there was a most astonishing collection of old sailing ships' figureheads, name boards, and other maritime relics. From a low, open-fronted building, row upon row of stately figureheads stared at the garden as they once had stared at the endless sea from the bows of great Cape Horners and little coastal brigs (page 145).

Waves' Fury Builds a Grim Museum

"The sea brought them here," the commander said. "They are all from local wrecks —we have relics from 40 of them. In the days of sail, these islands could be a death trap."

He pointed out a white-and-gold-painted tonsured monk from the tea clipper *Friar Tuck*, driven ashore in a gale in the winter of 1862. The monk looked as fresh as on the day the 662-ton clipper was launched. A tall, dignified lady clutching a rose to her breast came from the big four-masted bark *Falkland*, smashed on Bishop Rock in 1901. A Welsh girl figurehead is all that remains of the schooner *Jane Owen*, once of Caernarvon, lost on the Scillies deep-laden with a cargo of Welsh slate. Nearby, two brass signaling cannon recall the loss in 1875 of the transatlantic steamship *Schiller* and more than 300 of her passengers and crew. A hundred of them lie in a communal grave in St. Mary's churchyard.

I saw no memento of the worst navigational disaster in the Royal Navy's history, which occurred on the Scillies' Western Rocks in 1707. A fleet returning from the Mediterranean lost its bearings in a fog. Three men-of-war sank and 2,000 seamen drowned.

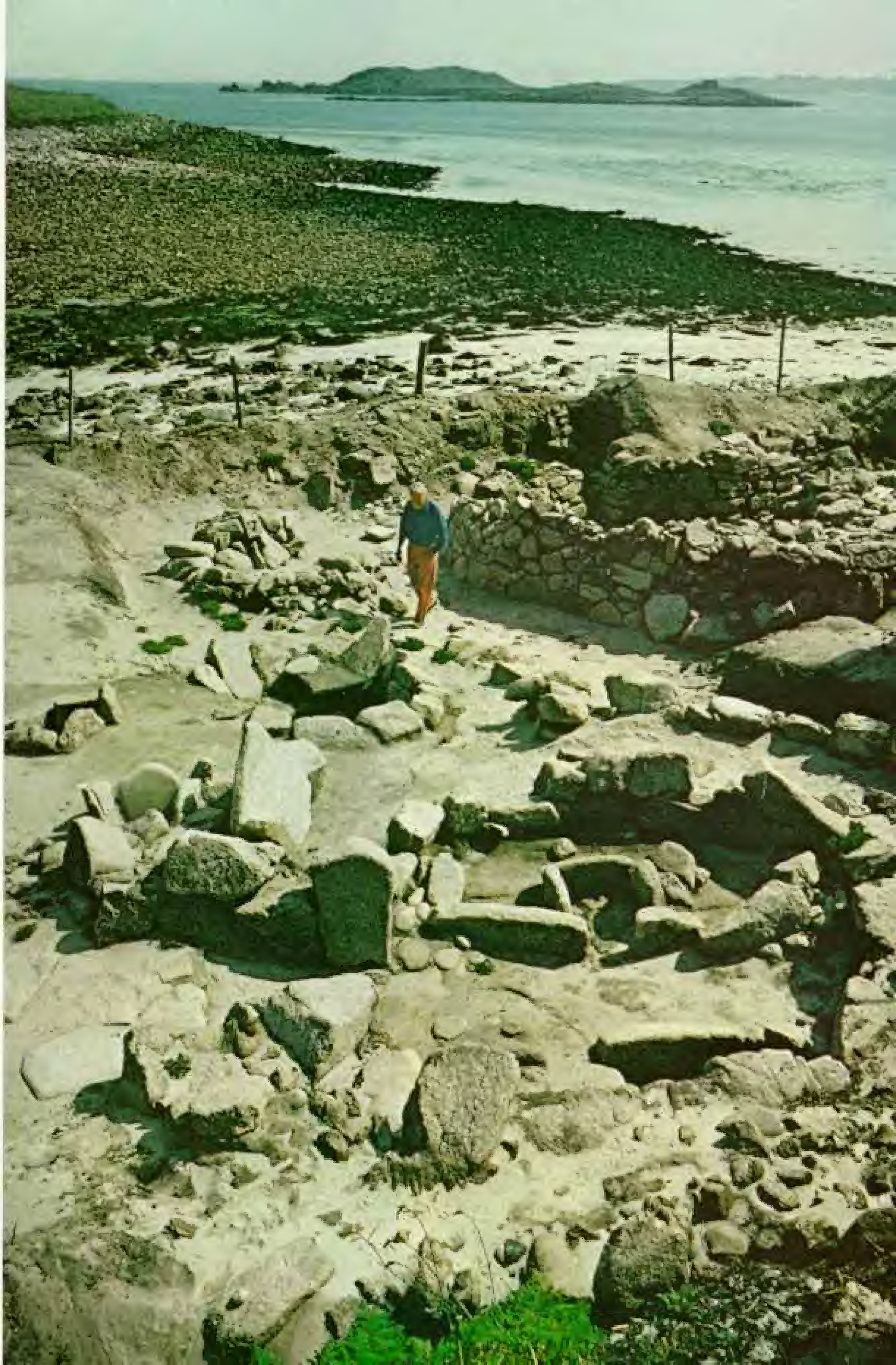
"Augustus Smith named this place Valhalla," the commander said. "You can see why."

There are legends that the islanders were not above profiting from wrecks—perhaps also causing them. I was told of a prayer offered regularly in the St. Mary's parish church in the late 18th century that went:

"We pray Thee, O Lord, not that wrecks should happen, but that if any wrecks should happen, Thou wilt guide them into the Scilly Isles for the benefit of the poor inhabitants."

"The inhabitants benefited by saving things from wrecks," said Commander Dorrien Smith. "It was dangerous and they deserved what they got. But nobody had to pray for wrecks. Around here they happened. And the islanders have a proud record for saving lives."

One day in 1919, he told me, the men of



Bryher were astonished to see a schooner come drifting in, laden with a full cargo of timber but with nobody aboard. She was Canadian, her name *Marion C. Douglas*. The Bryher men went quickly aboard, scarcely believing that a ship could maneuver herself through the complicated tide rips and other dangers. They anchored her just in time to save her from running onto some rocks, and in due course sailed her away to Scotland as salvage.

They learned later that she had sprung a leak in a gale off Ireland and been abandoned. The leak took up, and she wandered along on her own.

The rocks and reefs around the Scillies still take their toll. Just last March the American-owned 61,000-ton tanker *Torrey Canyon*, the biggest ship ever to run aground, broke in three on Seven Stones reef, eight miles northeast of St. Martin's. Its spreading cargo of 35,000,000 gallons of crude oil brought disaster to holiday beaches of southern England and even blackened the sands of Brittany and Normandy, 220 miles away. Royal Air Force and Royal Navy jets dropped explosives to burn away fuel still in the hulk, and troops and civilians used bulldozers, detergents, and sawdust to clean beaches.

Currents and favorable winds spared the Scillies, in spite of the nearness of the wreck. But even now, months later, the extent of damage to England's and France's bird and marine life can only be guessed at.

Bryher: Island of Jenkinses

No wrecks were visible the day I made a launch trip toward Bishop Rock with an old boatman named Horace Nicholas and several fellow passengers.

"Funny thing about names around here," Horace said. "In the old days, Scillonians didn't travel much between islands, so you find only a few family names on each one. Over at Bryher 'most everyone is called Jenkins. A girl seldom has to change her name when she marries."

Astern, the granite houses of Hugh Town shone in the sun. Atop the hill, the Elizabethan fort called Star Castle brusquely fronted the sea, as it had done since Sir Francis Godolphin built it as an outpost against the Spanish a few years after the Armada sailed by. Star Castle, with its unfilled moat and its battlements, is now a pleasant hotel. Musket slits distinguish the dining room, and the dungeons house a bar.

Ahead, out to sea, Bishop Rock Light rose like a pencil thrust from the blue-green water (right).

"Nothing between it and the coast of America," Horace told his passengers. "That's the first light American ships see in Europe. But we don't see so many liners now. And if a sailing

FIRST AND LAST OUTPOST
of southwestern Britain: Bishop Rock Lighthouse clings to a reef, while its light, flashing with the intensity of 720,000 candles, warns mariners of the spiny Scillies. During hurricanes, monstrous seas have hurled spray over the top of the 167-foot tower and jarred lubricating mercury from the lamp. Keeper Graham W. Fearn stoically weathers such storms in his lofty eyrie.

PHOTOGRAPHED BY DAVID LITSCHERLES © N.G.S.

ship passes by, all Hugh Town stops work and comes to look."

The weather was good and the sea calm when we left, for Horace said he could approach Bishop Rock only in the finest weather.

"It looks all right now," he said, "but in a sou'wester the whole Atlantic comes rushing at it. I've seen the great seas breaking almost over it for days on end. The lighthouse keepers have been marooned there for weeks."

Blossoms Hide Annet's Nesting Birds

On uninhabited Annet, a sanctuary for birds, I looked for the puffins and shearwaters that nest there by the thousands, but the granite island was so carpeted with blooms of the pink thrift that I could not see the nesting birds. Black-and-white oystercatchers and ringed plovers walked on the beaches. Great black-backed gulls, as large as geese, wheeled overhead in pairs looking for anything edible, especially young birds. Scillonian shags stood silent and still on the exposed rocks, with their wings held oddly and stiffly out.

"Drying their wings?" I asked Horace, but he didn't know.

"It takes a long time, if that's what they're doing," he said. "They just stand like that for fun, I think. They're always doing it."

Later, I found that they were indeed drying themselves in the warm sunshine—not unlike the sun-worshiping visitors.

The sea began to rise and break on the many rocks, the launch to pitch and roll. Some passengers were seasick. Horace turned back.

"See those rocks?" he asked, pointing to a nasty patch where the tide rushed with surly swells over rocks that seemed to grow as I watched them, for the tide was falling. "I had two cousins drowned there, fishing. Their boat overturned, and they were caught in their own gear. People ashore saw them, but they couldn't get there in time."

Many islanders could tell of personal tragedies such as that. Once most of the residents of one island drowned, coming home by boat

at night from a wedding on St. Mary's.

Back in Hugh Town, the motor vessel *Scillonian* was coming in on her daily trip from Penzance, crowded with passengers by the hundreds. Many were day-trippers but most would stay longer. Overhead a helicopter was descending noisily, carrying 25 more.

Soon the visitors were walking along the little stone quay toward the town, smiling in the soft, balmy air, drinking in the ozone, delighting in the absence of traffic jams—happy to be out of the world for a while in these Fortunate Isles.

"Having a nice time?" asked my friend Captain Phillips, the harbor master.

Indeed I was. I reflected, as I, too, walked slowly along the quay to book, if I could, at the same hotel, in the same room, for the same time the following year. The same bed, too. THE END

Sun-lacquered combers thrash jagged rocks, everywhere a peril to shipping in waters around the Scillies. The nearby Seven Stones reef did incalculable damage when its fangs impaled the supertanker *Torrey Canyon* last March 18. Dumping millions of gallons of Kuwait oil, the wreck spread a 700-square-mile slick that trapped wildlife, smeared resort beaches of southern England and northwestern France, and threatened fisheries on both sides of the Channel. Miraculously, winds and currents diverted the oil from the Scillies, saving island beaches from disaster.

Thrusting through fair seas and foul, figureheads graced the bows of 19th-century vessels, three of them British, wrecked in seas around the Scillies, from left, the steamer *Serica;* the Spanish bark *Prima Donna,* whose sole survivor clung to this figurehead; the bark *River Lune;* and the tea clipper *Friar Tuck.* Like ghosts from the depths, they adorn a nook called Valhalla in Tresco Abbey Gardens, reminders of the fearful toll exacted by the Atlantic's hidden shoals.

In Quest of the World's Largest Frog

Article and photographs by PAUL A. ZAHL, Ph.D.
Senior Natural Scientist, National Geographic Staff

Vanquished king of frogdom hangs nearly half the length of its captor. Moments earlier this *Conraua goliath* crouched in the swirling cascade of a river draining the equatorial rain forest of Rio Muni (left), a Spanish province in western Africa. The giant frog fell prey to Ondó, one of Rio Muni's Fang people, who snagged it with a fishhook dangled from a pole.

HIDDEN ON THE BANK by a curtain of lianas, I scanned the rain-swollen Mbia River as it tumbled over a rocky staircase. The total drop was no more than twenty feet, but the hiss and rumble of plunging water echoed along the gorge, and spray soaked every overhanging branch and vine.

Abruptly my eyes stopped. On a mossy boulder halfway down the cascade I saw a dark form of startling proportions. It had a flat-topped head and crouched on massive haunches. Drenched by mist, the thing was as wet as its rocky perch, and just as motionless.

For minutes I made no move. Then a sudden flicker from what I fancied to be the creature's mouth provided a clue. This could only be *goliath*, the giant frog of the genus *Conraua*, snatching winged insects from the mist-laden air above the waterfall.

Careful to make no hurried movement, I set my camera on a tripod and fitted it with a bazooka-like telescopic lens. But as I focused, something, perhaps a glint of metal, betrayed my presence. In one sailing leap, the great amphibian dived into the current and was gone.

Hope for a Capture Rests With Ondó

Several weeks earlier, in November, I had arrived in Bata, seaside capital of Rio Muni, a tiny Spanish province on Africa's equatorial west coast (map, page 149). Only here, and in neighboring Cameroon to the north, are giant frogs more than a myth. Reports of individuals nearly a yard long from nose to toe, and weighing more than seven pounds, had intrigued me for years. Now I had come to see them with my own eyes, hoping to bring back evidence that the species, though uncommon, is not threatened by extinction.

But my initial feeling there by the river was one of frustration.

Largest of the world's more than 230 true frog species, goliath dwells only in Rio Muni and its northern neighbor, Cameroon. The Fangs call the oversize amphibian Niamon—"mother's son"—because its size and limbs remind them of a small child.

Shy, sharp-eyed, and quick to dive out of sight, the frogs escaped scientific discovery until 60 years ago. The author captured five goliaths to make these first published color photographs of the giants in their remote habitat. He was advised and guided by Spanish naturalist Jorge Sabater Pi, Curator of the Barcelona Zoo's Animal Acclimatization Center at Bata, who has investigated these frogs for ten years and published several papers on the subject.

Creatures of the cascade, goliaths garrison a mossy perch in the Mbia River. When an insect flies into range, a frog snares the prey with a flick of its sticky tongue. The author believes that spray drenching the amphibians provides oxygen that they absorb through the skin, supplementing the supply from the lungs.

In the midst of a raging torrent, how could I collect a creature wary of the slightest movement—even at thirty yards? Frogs frequently are caught at night in the spot of a blinding flashlight. But who could find his way through this jungle in the dark and out into the middle of a waterfall?

A better hope was Ondó, one of the Fang people who work Rio Muni's coffee and cocoa plantations, and one of the few men in Rio Muni with the prowess to take a goliath alive. He had guided me to the riverbank and had watched as the frog disappeared.

"*Mañana,*" he said, cupping his hand to my ear, "that same fellow will be back."

I returned the next day, driving the 25 miles of winding jungle track from Bata to within hiking distance of the Mbia cascades. With me went Señor Jorge Sabater Pi, a skilled naturalist with years of experience in western Africa, who is currently engaged in a National Geographic Society-sponsored study of lowland gorillas.* Along the way we picked up Ondó in the village of San Joaquin.

The low booming of the water grew louder as we twisted our way on foot down a barely defined trail. Stealthier than on our previous visit and careful to stay in the shadows, we

*See "Snowflake," the World's First White Gorilla," by Arthur J. Ropelle, GEOGRAPHIC, March, 1967.

West Virginia-size domain of the giant frogs overlaps steaming Rio Muni and Cameroon. A rich lode for naturalists, Rio Muni recently gave the world "Snowflake," first known white gorilla.

Crouching ponderously, *Conraua goliath* poses on a table for Señor Sabater; then a mighty leap carries the great frog ten feet (above). Away from their invigorating cascades, the amphibians can make but three or four bounds before succumbing to exhaustion.

Fisting themselves on spray-drenched rocks by day, goliaths prowl stream banks at night, snapping up insects, scorpions, and smaller frogs. Captives have been known to reject all fare except white mice. The frogs hear acutely but lack a vocal sac for croaking.

crept just close enough to command a view.

Immediately Ondó nudged me, for there on the same rock, facing downstream just as before, sat a huge frog. We waited as Ondó set to work trimming a pole from a rafia frond. He fastened a cord to the pole's tip and a rusty fishhook to the cord's free end. Then he signaled us to remain where we were—out of sight—and disappeared upstream.

Patience and Timing Bag a Giant

Fifteen, thirty minutes passed. I looked to Sabater for reassurance. No need for concern, he told me. Ondó was seeking upriver shallows that would permit a wading approach to the waterfall's crest. His final maneuver would depend on the fact that goliath, while possessing acute forward and peripheral vision, is not equipped with rearview mirrors.

Now we saw Ondó, up to his thighs in the slashing water, soaked with spray. He was thirty feet from his goal and stooping, to be out of view should the frog turn.

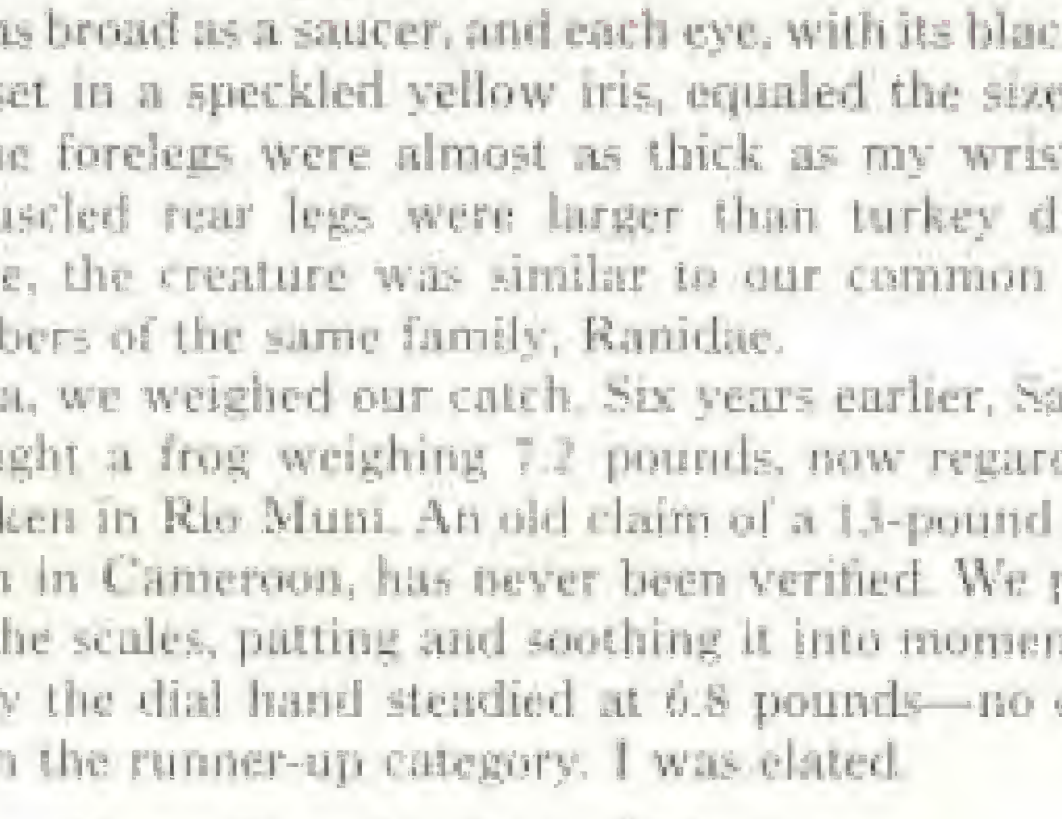
I crossed my fingers as, inch by inch, the huntsman moved down the racing torrent. Finally he eased himself up on a mossy rock only yards behind and above the frog. With steely patience he raised the pole, then slowly lowered the line so that the hook came gently to rest between the frog's torso and one of its haunches. At no point did the frog register the slightest alarm.

Then Ondó gave a lightning jerk on the pole. It arched as the frog, now a fury of unleashed reflexes, flailed in mid-air. Holding steady, Ondó maneuvered the thrashing creature toward him and seized its hind legs.

Fifteen minutes later a grinning Ondó joined us. Quickly we removed the hook from the frog's scarcely injured skin. Then, after

Deceptively tiny as fry, goliath embryos scooped fresh from the Mbia (upper) start life only a little larger than those of the common bullfrog. Shown 1½ times life-size, each feeds on a bulging yolk-sac, but will soon wriggle from its gelatinous envelope to forage on small plant life.

Lower specimens, collected and preserved by Señor Sabater, show stages of metamorphosis from legless polliwog to two-inch froglet, whose tail is shortly absorbed into its body. While bullfrogs stop growing at 15 to 17 inches, head to toe, goliaths strangely double that length.



Huge hindfoot, shown actual size, wears webbing that speeds goliath under water and helps keep the frog on course when leaping. Pads on the sole give traction on slippery rocks.

Ondó had stood for some triumphant photographs (page 147), we examined this extraordinary prize.

The head was broad as a saucer, and each eye, with its black almond-shaped pupil set in a speckled yellow iris, equaled the size of a five-cent piece. The forelegs were almost as thick as my wrist, and the powerfully muscled rear legs were larger than turkey drumsticks. Except for size, the creature was similar to our common American frogs, all members of the same family, Ranidae.

Back in Bata, we weighed our catch. Six years earlier, Sabater and Ondó had caught a frog weighing 7.2 pounds, now regarded as the largest ever taken in Rio Muni. An old claim of a 13-pound specimen, allegedly taken in Cameroon, has never been verified. We placed our contender on the scales, patting and soothing it into momentary tranquility. Finally the dial hand steadied at 6.8 pounds—no champion, but certainly in the runner-up category. I was elated.

Young Show No Hint of Gigantism

Our catch proved a female, but it was not obvious. Externally, goliath sexes are similar. As in many frogs, a slightly swollen first digit on each forelimb (for clasping, during the mating season) identifies the male.

Reproduction occurs mainly during July and August, Rio Muni's dry season, although we found masses of fresh eggs and many newly hatched tadpoles in December and January—the "little dry season." Eggs deposited in the pools by the female are fertilized by milt simultaneously released by the male. Each pea-size egg, slate-gray on one face, yellowish on the other, is protectively suspended in a globe of clear jelly.

Cell division soon produces an embryo; in about two weeks it takes the shape of a tadpole. During these stages a yolk sac on the underside provides nourishment. Finally a free-swimming wriggler emerges from each gelatinous case. A mouth develops, with several rows of tiny sharp teeth for feeding on Podostemaceae, water plants characteristic of the cascade pools.

Within two to three months, the body has sprouted legs and the tail has been absorbed. Now the creature abandons its herbivorous habit, as well as its natal pool; it becomes a carnivore. Analysis of stomach contents reveals the food staples of the adult to be insects, fish fry, crustaceans, and about any other small meaty thing that comes within reach

Hungry stares greet a goliath shown by Señor Sabater to Río Muni's Bayele Pygmies. Encountered as they hunted jungle antelope with spear and giant net, the nomadic forest dwellers jubilantly hailed the great frog as a coveted delicacy.

of the frog's long, sticky, fast-flicking tongue.

Goliath's early growth stages give no hint of impending gigantism. Eggs, tadpoles, and young are not much larger than those of any other of the world's 250 species of true frog (page 151). Only after metamorphosis are the mysterious forces of excessive growth released.

Gift Greeted With Joyous Somersault

It is unfortunate for a species when man finds it good to eat, but luckily, few of Río Muni's Fangs even know of the big frog's existence, let alone its taste.

Not so with the Bayele, a tribe of Pygmies who live a withdrawn, nomadic life in the dark forests of northern Río Muni and Cameroon. These small people subsist on bush elephant, antelope, birds, fish, and buffalo. We encountered a party of Bayele hunters during a trip deep into the jungle and decided to test their familiarity with the frogs by giving them one of our specimens.

Yells and screams of delight rose when we opened our basket and presented the headman with a live giant frog. One man began to turn cartwheels; another climbed a tree and gaily somersaulted down in front of us.

"Do we eat frogs!" roared the headman, as our translator did his best. Words flowed, faces beamed, arms gestured. It added up to the glories of frog meat, to goliath's wariness, to the hazards of stalking in the cascades.

Our jungle friends invited us to their encampment. Two of the men busied themselves with tinder and a whirling stick, and before long the frog was in a pot over a blazing fire.

Because of falling darkness, we could not stay for the feast. Still in high spirits, the little men led us back to our trail. I was convinced that whenever opportunity presents itself, *Conraua goliath* is as much a part of their diet as any other jungle quarry.

I could understand the Pygmies' enthusiasm for the present we brought them, for frog meat is undeniably tasty, and the generous proportions of a goliath drumstick put it in a class by itself. Such appeal could quickly doom these rare animals, were it not for two circumstances: their preference for difficult terrain, and the sparseness of human population to prey upon them. Unless these factors change, their survival seems assured.

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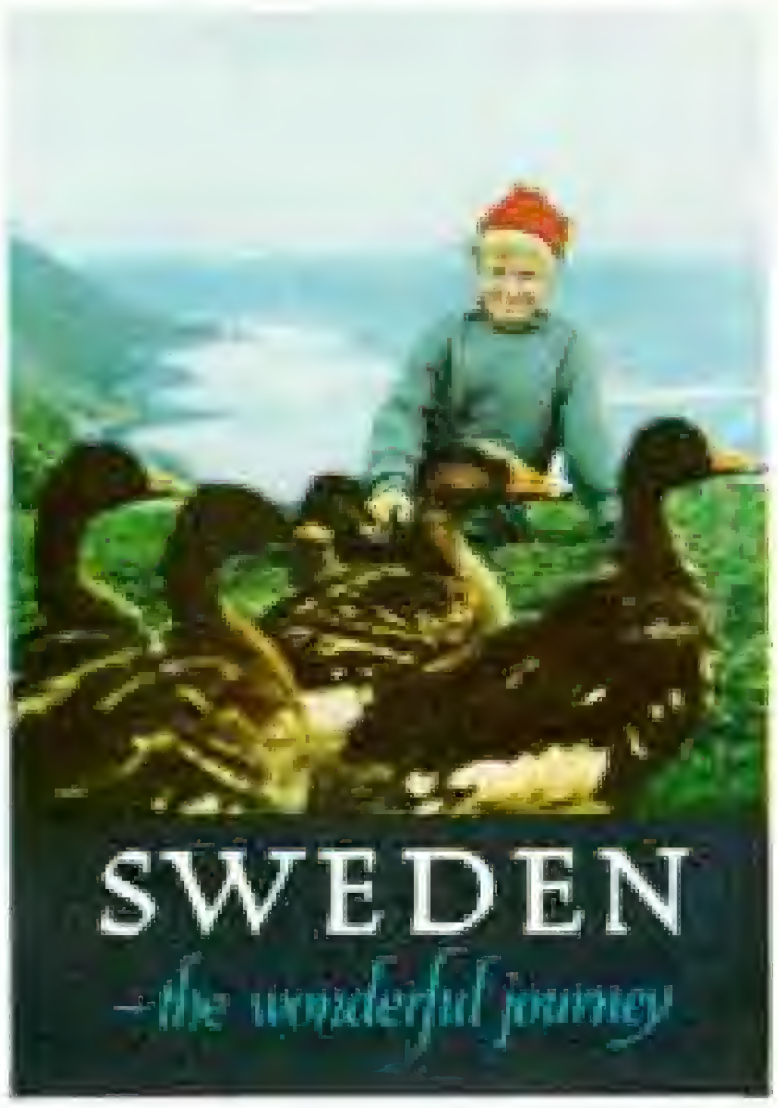

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