ATLAS MAP SUPPLEMENT: MEXICO AND CENTRAL AMERICA

VOL. 120, NO. 4 OCTOBER, 1961

NATIONAL GEOGRAPHIC

$8.00 A YEAR $1.00 A COPY

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

NATIONAL GEOGRAPHIC Society

16th & M Streets N.W. Washington 6, D. C.

National Geographic Magazine

ORGANIZED IN 1888 "FOR THE INCREASE AND DIFFUSION OF GEOGRAPHIC KNOWLEDGE"

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COVER: *Welcome to Chiapas! beams a señorita in Mexico's southernmost state (page 517).*

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Were the sculptors from Peru? The growing mass of evidence tends to confirm the older theory—that they came from Polynesian islands to the west. Gradually the riddle is being solved: why the monoliths were carved; how they were moved.

A National Geographic writer photographer team visited this South Pacific island recently. Above, author Howard La Fay (left foreground) and photographer Tom Abercrombie prepare to leave their camp on the slope of Rano Raraku. Soon you will explore the mysteries of Easter Island through your Geographic.

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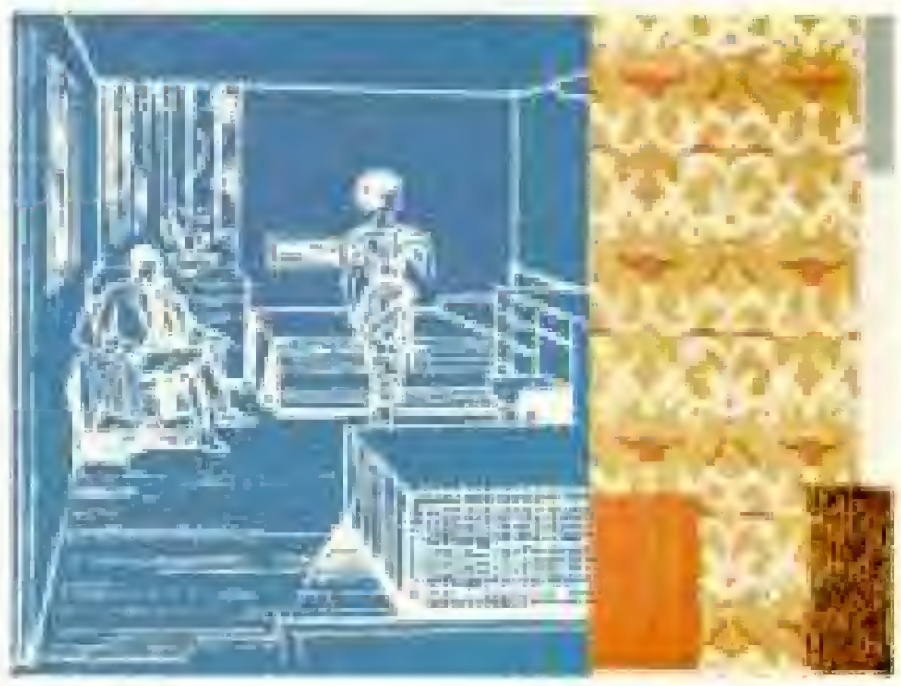
Main Lounge

A quiet room for casual conversation. There are deep cushioned sofas and chairs. Cool blues and greens accented by white drapes and yellow paneling strike a tranquil note.



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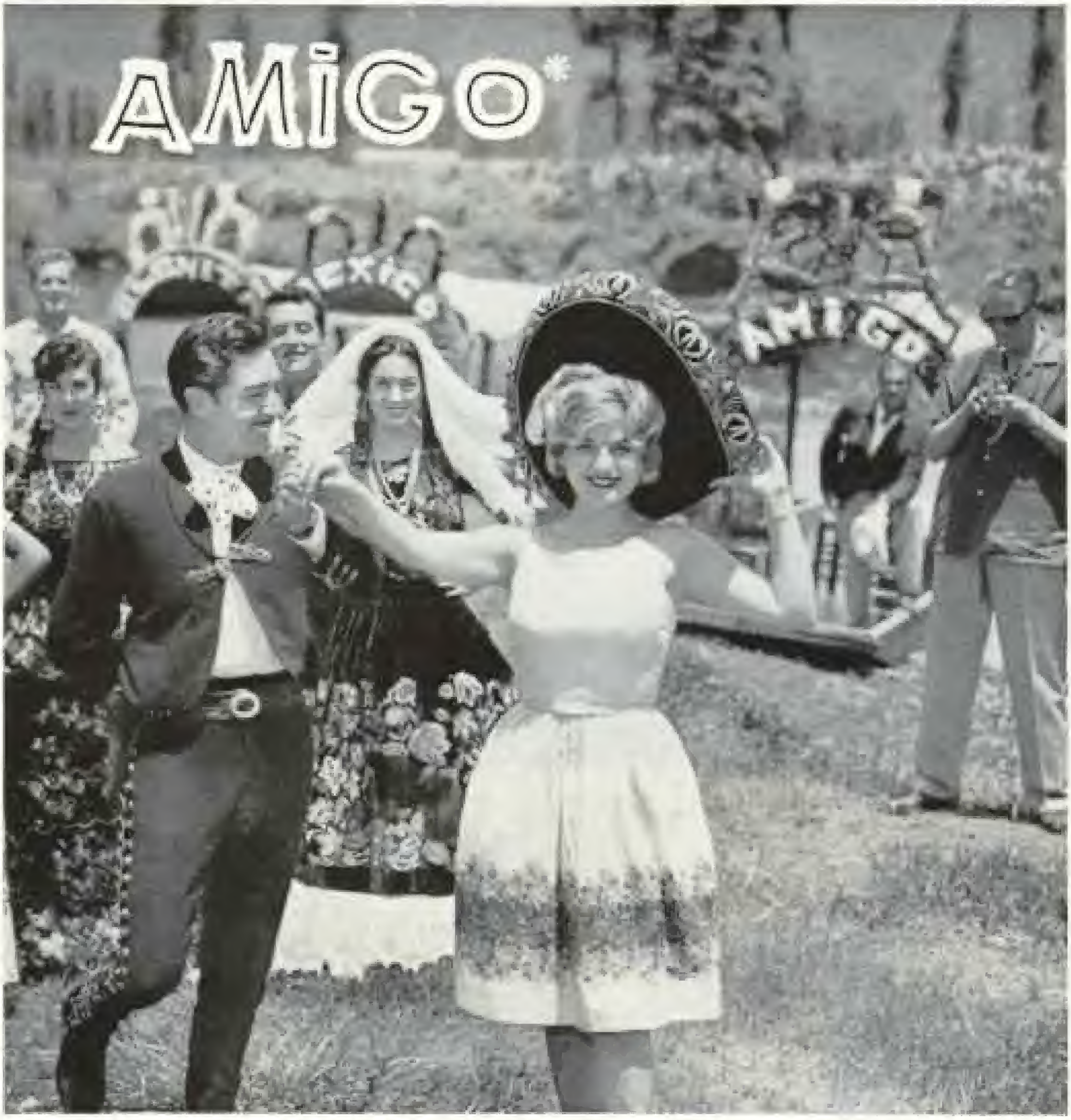
General Francis Marion, the "Swamp Fox", shares his frugal rations with a British negotiator for prisoner exchange, Georgetown, S.C., 1780. Painting by F. C. Yohn.

"A man in earnest finds means
...or if he cannot find, creates them."

W. E. Channing

When the hearts and minds of men burned with a love of freedom, each man gave the best he had—and then gave a little more. Deep within himself he discovered the resourcefulness to help in attaining that cherished goal. Thus it was with the famed "Swamp Fox" and his men. In hostile territory each found or created the means to survive—and so breathe life into an infant nation.

Today it is the same. If we are truly in earnest in our determination to wipe out poverty, ignorance, indolence—the misuse of power and mediocrity in our standards—each of us will unfailingly find deep within himself a way to help in eradicating these evils besetting our way of life.



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Walt Whitman

"SPECIMEN DAYS"

ATLANTA

Where you stand inside a painting and see the face of courage

The beautiful city of Atlanta, Georgia, proudly calls herself "Gate City to the South." But in 1864, when Union General William Tecumseh Sherman's troops stormed up to that gate, she slammed it shut and kept it barred for five desperate, besieged weeks.

All the heroism of that defense has been captured forever in the world's largest painting and diorama, the Atlanta Cyclorama in Grant Park. Stand within its 400-foot circumference and the battle surrounds you as the armies surrounded Atlanta at 3:30 P.M., July 22, 1864. Your view point is from the Georgia Railroad's Moreland Avenue crossing; looking south, you see Confederate General Ben Cheatham's men charging the Federal XVII Corps. To the north, General John A. Logan gallops up to restore the broken Union line. Northeast, flying above the battle smoke from Decatur, "Old Abe," the eagle mascot of the 8th Wisconsin, screams defiance, and looming in the distance, there's Stone Mountain, 18 miles away.

This mountain is one of the earth's largest blocks of exposed granite. On its face is being carved the most majestic statue of the Civil War. You see Robert E. Lee, "Stonewall" Jackson and Jeff Davis in proportions that match their places in history.

The statue is not yet finished. *Neither is the task so nobly advanced by the men and boys,* North and South, whose devotion to duty was so courageously proved on Civil War battlefields. That task is the never-ending defense and preservation of America's freedoms. *It is a task to which this generation, as did theirs, must give mind and hand and heart, without stint and without fear.*

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FALL

What a time of year to enjoy the West's travel hospitality! The peak summer crowds have come and gone. Accommodations are more readily available everywhere. Many resort areas offer reduced "off season" rates.

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JAL

JAL Hostess Miss Sachiko Hyakumura

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Does even a picture postcard from Europe leave you quivering with envy? Then hide. Because this fall and winter, the countries of Europe are gleefully plotting a new attraction. As if the regular attractions weren't enough! They're adding "Open House," a Meet the People program in their homes, studios, businesses. And then to add more temptation, SAS is slashing fares up to $136 for 17 day jet economy round trips, transatlantic or transpolar.

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A gift she'll treasure beyond all others

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Kellogg's Concentrate

Looks and eats like a cereal, but contains more essential nutrients—protein, vitamins and minerals—than any other single all-purpose food: 40% high-quality protein, yet 99% free of the fat found in many other high-protein foods.

Let's face it. We've all got to grow older. But that's no reason to resign ourselves to a rocking chair ahead of time.

That's where Kellogg's Concentrate comes in. One ounce of it gives you, for instance, more protein than an egg and 2 strips of bacon; as much iron as 2 ounces of beef liver; and as much vitamin B, as 3 ounces of ham. (And, one ounce served with skim milk and a tea-spoon of sugar contains only 160 calories.)

Most folks eat Kellogg's Concentrate as a cereal or added to cereals. But you can also enjoy it with casseroles, meats, soups, salads and desserts.

So if you lead an active life and want to keep it that way, an ounce of Kellogg's Concentrate daily may be a big help. Look for it in your grocer's cereal section.

Kellogg's OF BATTLE CREEK

TO BRING YOUR WEIGHT UP-TO-DATE
(bring it down)

If you're still using old tables of "normal" weights, you aren't up-to-date on your weight. Look at your new "desirable" weight, shown below, which is lower than previous standards.

The importance of these tables to you lies, of course, in the fact that "the shorter the belt line, the longer the life line."

Millions of men and women weigh more than is good for them. However, men in their 20's and 30's are especially susceptible to rapid weight gain.

If you are in this age range, don't let your weight creep up. Shedding a few pounds now will be safer and easier than trying to lose many pounds later on.

If the weight tables below show that your pounds are out of bounds, start now—under a physician's supervision—to trim down. He will prescribe a diet that's safe and pleasant, yet effective, in removing excess weight.

To help you carry out a successful pounds-off program, send for the Metropolitan Life booklet, *How to Control Your Weight*. It's full of suggestions on nutrition, and other information to help keep you in trim now and for many years to come. Use the coupon below for your free copy.

Weight in Pounds According to Frame (in Indoor Clothing)

HEIGHT		SMALL FRAME	MEDIUM FRAME	LARGE FRAME
Feet	Inches			
DESIRABLE WEIGHTS FOR MEN of ages 25 and over (with shoes on) 1" heels				
5	2	112-120	118-129	126-141
5	3	115-123	121-133	129-144
5	4	118-126	124-136	132-148
5	5	121-129	127-139	135-152
5	6	124-133	130-143	138-156
5	7	128-137	134-147	142-161
5	8	132-141	138-152	147-166
5	9	136-145	142-156	151-170
5	10	140-150	146-160	155-174
5	11	144-154	150-165	159-179
6	0	148-158	154-170	164-184
6	1	152-162	158-175	168-189
6	2	156-167	162-180	173-194
6	3	160-171	167-185	178-199
6	4	164-175	172-190	182-204
DESIRABLE WEIGHTS FOR WOMEN of ages 25 and over (with shoes on) 2" heels				
4	10	92- 98	96-107	104-119
5	0	94-101	98-110	106-122
5	1	96-104	101-113	109-125
5	2	99-107	104-116	112-128
5	3	102-110	107-119	115-131
5	4	105-113	110-122	118-134
5	5	108-116	113-126	121-138
5	6	111-119	116-130	125-142
5	7	114-123	120-135	129-146
5	8	118-127	124-139	133-150
5	9	122-131	128-143	137-154
5	10	126-135	132-147	141-158
5	11	130-140	136-151	145-163
6	0	134-144	140-155	149-168
		138-148	144-159	153-173

For girls between 18 and 25, subtract 1 pound for each year under 25.

NOTE: Prepared by the Metropolitan Life Insurance Company. Derived primarily from data of the Build and Blood Pressure study, 1959, Society of Actuaries.

Build with the carefree beauty of stainless steel

Handsome appliances and gleaming counter tops that stay bright and are so easy to wipe clean...even the kitchen sink comes a thing of beauty when it is made of shining stainless steel—the useful metal that was developed after years of research.

Whether you're building or remodeling, stainless steel gives a lifetime of value . . . saves many dollars in upkeep. You can now have gutters and downspouts that are almost indestructible because they won't rust or rot. And the strength of stainless makes possible door and window screening so fine you hardly know it's there.

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THE NATIONAL GEOGRAPHIC MAGAZINE

VOL. 120, NO. 4 OCTOBER, 1961

Amid 2,500-year-old traditions and 20th-century progress, a new nation—supported by the West—struggles for its life against Communist guerrillas

South Viet Nam Fights the Red Tide

By PETER T. WHITE

Photographs by W. E. GARRETT

National Geographic Staff

EVERYONE I MET in Saigon, the capital of the Republic of Viet Nam, worked feverishly to be lucky.

Tet was coming, the Vietnamese New Year. If you started the morning of Tet auspiciously, your luck would be good all year. You should wear only new clothes; all your debts should be paid off. Most important, you should arrange to meet an extremely lucky person early in the morning—some of his good fortune would surely rub off on you.

"Your first visitor should be the luckiest man you know," said my friend Dinh.

I asked how one could tell the right man.

"Pick someone very old, very respected, very rich. By rich I mean someone with many sons," he explained. "Arrange to have him come early. People who have had a recent death in the family, or have had any other kind of bad luck, are supposed to stay home, but you never know."

We stood in the middle of a wide boulevard, built long ago by French colonizers nostalgic for Paris. Traffic had been routed away. Now a sea of flowers spread under the scorching February sun—and a sea of buyers, many going home with branches of apricot trees and narcissus.

"If they bloom on the morning of Tet," said Dinh, "it means prosperity."

Could that be arranged too? Dinh grinned.

"Put the branch in water, watch it several days, and keep trimming. The night before Tet, I add a little sugar."

To be lucky, then, one left little to chance.

I wondered about the luck of the republic in the year to come—the Year of the Buffalo, the animal symbolic of patience, fruitful toil, and peaceful contentment. Alas, peace and contentment seemed hardly in prospect, for Viet Nam was trapped in a struggle bigger than itself, bigger than all Southeast Asia.

Barely seven years before, Vietnamese of many political shadings had ousted their French rulers. The fighting had taken eight years and lives by the scores of thousands. In

the end, a Vietnamese coalition of nationalists and Communists defeated the French, and the settlement of Geneva, in 1954, divided the land (map, page 450): a Communist state in the north, calling itself the Democratic Republic of Viet Nam; and the southern part, simply the Republic of Viet Nam, oriented toward the West.

Now the southern republic was threatened by invasion from the north. That wasn't all. Quietly and relentlessly—with the world hardly aware of it yet—the rich country in the south was slipping ever deeper into a calculatedly cruel civil war.

"They do worse than kill," said Dinh. "They'll cut a man's head off. This means that he can never find peace, that his spirit must wander and suffer forever."

"They" were the rebels, the Viet Cong. Their weapons and leadership came from Hanoi in the Communist north, their inspiration from Peking or Moscow. No figures were published of how many people they killed in the villages each night, some sources said 15, some 25. From dusk to dawn, the Viet Cong ruled nearly half of South Viet Nam.

"All this despite our American-equipped army," Dinh went on, "and despite almost two billion dollars in American aid. You'll find we have very special problems. But now, think of Tet."

For children, Tet meant presents and relaxing of discipline. Farmers—four-fifths of the republic's 14 million—celebrated the seasonal renewal of nature. Everywhere it was a time to cast away grief and rancor, to welcome the dead ancestors back for the holidays, and to thwart a whole army of evil spirits—for even demons benefit from Tet, with an eight-day vacation from hell.

Guerrilla-hunting government troops march out of the Hien Nhan Gate of the Imperial City in Hue.

Since 1954 the United States has spent nearly two billion dollars to strengthen South Viet Nam, a target of Communist aggression.

"At New Year's, the first duty is filial piety, veneration at the family shrine as prescribed 2,450 years ago by Confucius," explained F. R. Iredell, formerly a dean at Pomona College in California, where he taught logic and Oriental philosophy.

"People must also please the household spirits who dwell in the kitchens. Just before Tet they ascend to heaven, to report on the family's behavior to the Emperor of Jade. Before they go, they receive offerings — food, incense, a good fish — so that they'll give a good report. That's the influence of Taoism. Like Confucianism, it came from China. The Chinese, you know, ruled Viet Nam a thousand years."

I asked about the national costume that helped the women look so self-assured, so feminine: wispy trousers under a long-sleeved, high-necked dress slit to the hips (page 488). I rarely saw the same pattern twice, but the cut never varied. Ancient Chinese?

"Modern Vietnamese," said the professor. "A modification of the traditional dress by the artist Nguyen Cat Tuong about 25 years ago. A brilliant combination of the alluring and the virtuous."

In Dinh's house I saw the country's culture reflected in a three-tiered altar. First were photographs of ancestors, and brass candlesticks shaped like storks, symbols of longevity, resting on turtles, symbols of hard work. On the next rung, incense burned before a picture of a Chinese hero, a symbol of intellect, courage, devotion to duty. Highest was a picture of the Buddha. I found similar altars in shops, factories, and theaters.

Temples Crowded on Eve of Tet

This year Tet fell on February 15. On the eve of the holiday, I walked through Cho Lon, Saigon's Chinese district. The name means Big Market. I had seen the endless stalls along the streets and riverside piers, lighted past midnight by gasoline lamps. Fish, fruit, and Chinese condiments; hundreds of pairs of shoes, hundreds of combs, hundreds of yards of rope. Who would buy it all?

Now all Cho Lon seemed to be in the Chinese temples — or rather, in the temple where I was. I had never felt more crowded in the New York subway. And everyone carried a lighted candle or incense stick (page 453).

Intricate screens at the entrance shielded us from evil spirits. They travel only in straight lines. But there was no relief from the smoke, intensified by the burning of papers to carry prayers to the beyond. Gongs dominated the continual din. Their rhythm was supposed to rise and fall with the generosity of donors eager to assure a good reception for their prayers. Generosity mounted fiercely.

I was pushed into a woman next to the gongs and offered to help her fight her way out. She said no, she'd stay all night. "I take contributions. It's for the good of the whole world."

Bamboo Sticks Predict the Future

Next morning I visited the Temple of Marshal Le Van Duyet, a Vietnamese military hero contemporary with Napoleon. That day 100,000 Saigonese besought his benevolent spirit for favors and omens (page 452).

Men and women prostrated themselves on carpets, bowing again and again. Rattling noises came from the boxes each was shaking — until one of many bamboo sticks fell out of the box to the carpet. The sticks carried numbers, corresponding to the numbers on colored slips stacked in an adjoining hall. Each stick was a key to the future.

"If you get a number you don't like, put the stick back and try again," said my interpreter, Lt. Nguyen Quoc Hung of the Air Force.

How did one know what number to like? "Didn't you see the fortune teller outside?" Lieutenant Hung asked. I got my box, my stick, and my slip with predictions. I was going to be very lucky.

On the third day of Tet the Vietnamese family bids goodbye to the ancestors. Lieutenant Hung took me to see the ceremony performed by his grandfather. This venerable man prayed before the home altar and burned gold leaf in the yard, so that the departing spirits would have money.

Then he invited me to the holiday feast: meat, fish, and lotus seeds that tasted like chestnuts; a round bowl representing the sky,

Sunday Afternoon Strollers Promenade Tree-shaded Tu Do Street in Saigon

When France governed old Indochina, the boulevard won renown as the Rue Catinat. Exquisite shops and sidewalk cafes made it the Oriental counterpart of the smart boulevards of Paris. French cultural influence remains strong in Saigon. New Year's banners drape the 10-story Caravelle, a new hotel built mainly with French funds.

a square cake the earth; and *nuoc mam* sauce —made from fermented fish, rich in nitrates, sodium chloride, calcium, iodine, and vitamin B. It flavors every Vietnamese meal, strongly. I liked it.

I savored Tet to the end. Firecrackers were now forbidden; they could sound like machine guns, and the Viet Cong might strike in the confusion. But there still were the unicorn dancers, roaming Cho Lon with drums and cymbals. The unicorn brings luck, especially to households that hang money out the window for the unicorn to eat (page 461).

Inside the unicorns were Chinese amateur boxers, cavorting strenuously, while members of the same sports club performed stylized combat with spears and swords.

Boom-boom went the drum. The cymbals clashed faster. In the crowd, the man next to me watched as intently as I. Boom-boom-boom. I felt a tickling in my hip pocket. My neighbor had his hand on my wallet. He grinned at me. I grinned at him, and he took his hand back. Had I spoiled his Tet? At least he hadn't spoiled mine.

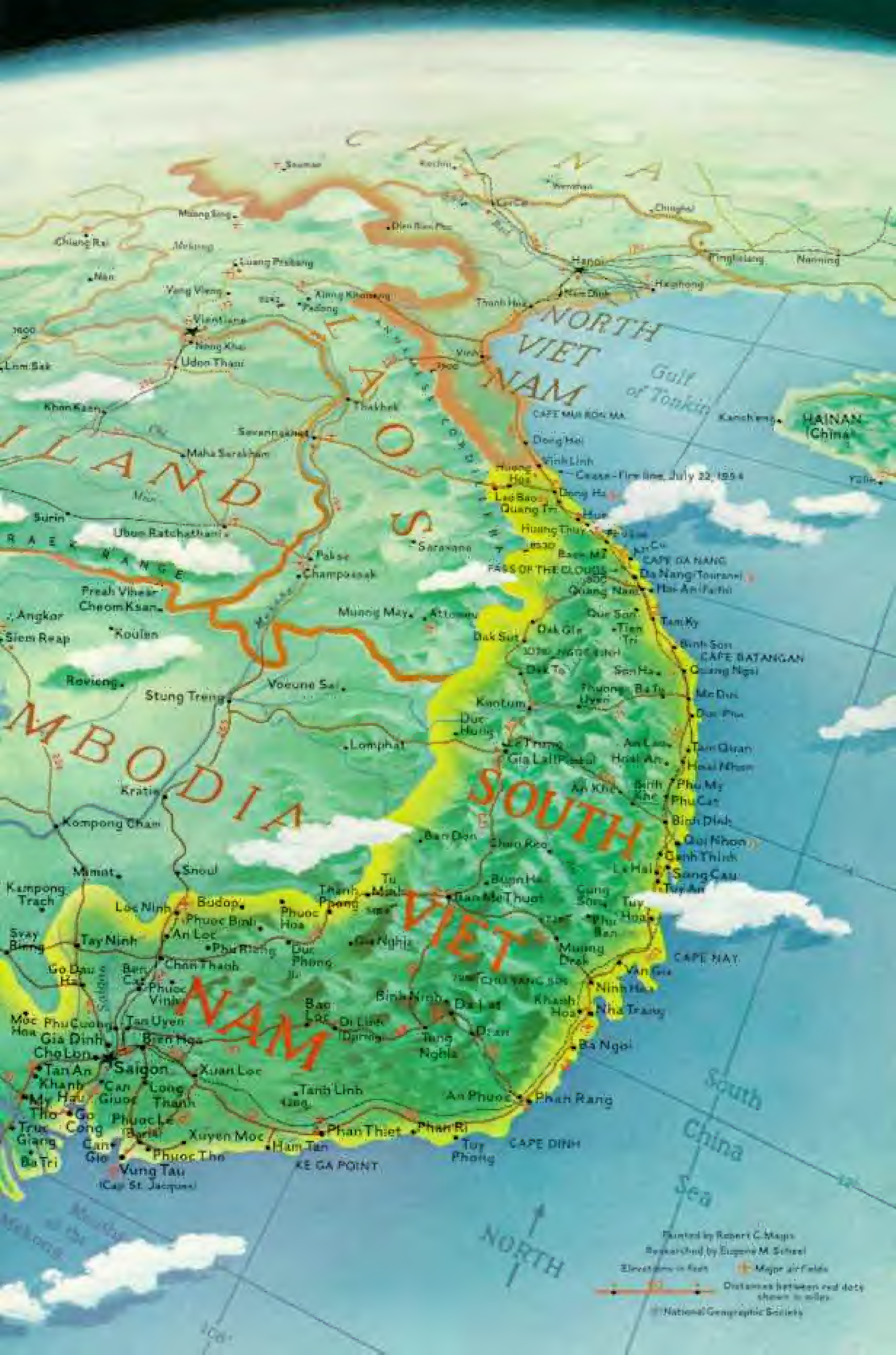
Driving northwest from Saigon, I found the road to Tay Ninh lined with exhortations. "Don't Give Information to the Viet Cong," said the signs, and "The Whole Nation Supports Only President Diem." My interpreter recalled what had happened here, between the Plain of the Rushes and "Zone D," as the Communists call it.

"The French took dogs on their patrols and dug traps for the rebels," he said. "The rebels put cats into the traps. The dogs barked. The

South Viet Nam Stands in the Path of a Communist Drive in Southeast Asia

Vietnamese struggled for a thousand years to shake off Chinese domination. Today they face a new menace. If Communists topple Viet Nam, former President Eisenhower predicted that the rest of Southeast Asia might follow "the falling-domino principle."

Viet Nam, Laos, and Cambodia, all occupied by France in the 19th century, made up the protectorate of Indochina. After World War II, the Viet Minh, then a coalition including nationalists and Communists, challenged French forces and surged to final victory in 1954 at Dien Bien Phu. A cease-fire arranged at Geneva, Switzerland, ended the war against the French, granted full independence to Laos and Cambodia, and partitioned S-shaped Viet Nam along the Ben Hai River, near the 17th parallel. A pro-Western government runs South Viet Nam; Communists rule the north. Each half covers an area roughly equal to Georgia's.



CHINA
Hanoi
Haiphong
Nam Dinh
Thanh Hoa
Vinh
Lao Cai
Dien Bien Phu
Muong Sing
Chiang Rai
Nan
Luang Prabang
Vang Vieng
Xiang Khouang
Padong
Vientiane
Nong Khai
Udon Thani
Lom Sak
Khon Kaen
Thakhek
Savannakhet
Maha Sarakham
NORTH VIET NAM
Gulf of Tonkin
HAINAN China
Kanchiang
Yulin
Tunghsing
Nanning
CAPE MUI RON MA
Dong Hoi
Vinh Linh
Cease-Fire line, July 22, 1954
Huong Hoa
Lao Bao
Quang Tri
Dong Ha
Hue
Huong Thuy
Bach Ma
CAPE DA NANG
PASS OF THE CLOUDS
Da Nang (Tourane)
Hoi An (Faifo)
Quang Nam
LAOS
THAILAND
Surin
Ubon Ratchathani
DANGREK RANGE
Saravane
Pakse
Champassak
Preah Vihear
Cheom Ksan
Angkor
Siem Reap
Koulen
Muong May
Attopeu
Dak Sut
Dak Gle
Duc Son
Tam Ky
Tien Tri
Binh Son
CAPE BATANGAN
Quang Ngai
Dak To
Son Ha
Mo Duc
Duc Pho
Rovieng
Stung Treng
Voeune Sai
Kontum
Duc Hung
Lomphat
Gia Lai (Pleiku)
An Lao
Tam Quan
Hoai An
Hoai Nhon
An Khe
Binh Khe
Phu My
Phu Cat
Binh Dinh
Qui Nhon
CAMBODIA
Kratie
Kompong Cham
Ban Don
Cheo Reo
SOUTH VIET NAM
La Hai
Song Cau
Tuy An
Snoul
Buon Ho
Ban Me Thuot
Tuy Hoa
Phu Bon
Muong Drak
CAPE NAY
Van Gia
Ninh Hoa
Khanh Hoa
Nha Trang
Ba Ngoi
Dalat
Don Duong
Tung Nghia
Loc Ninh
Budop
Phuoc Binh
Phuoc Hoa
An Loc
Phu Rieng
Duc Phong
Tay Ninh
Chon Thanh
Go Dau Ha
Svay Rieng
Kampong Trach
Ben Cat
Phuoc Vinh
Tan Uyen
Bao Loc
Di Linh (Djiring)
Phu Cuong
Moc Hoa
Gia Dinh
Bien Hoa
Cho Lon
Saigon
Xuan Loc
Tan An
Khanh Hau
Can Giuoc
Long Thanh
Tanh Linh
An Phuoc
Phan Rang
My Tho
Go Cong
Phuoc Le (Baria)
Xuyen Moc
Phan Thiet
Phan Ri
Truc Giang
Can Gio
Phuoc Tho
Ham Tan
KE GA POINT
Tuy Phong
CAPE DINH
Ba Tri
Vung Tau (Cap St. Jacques)
Mouths of the Mekong
South China Sea
NORTH
Painted by Robert C. Magis
Researched by Eugene M. Scheel
Elevations in feet
Major air fields
Distances between red dots shown in miles
National Geographic Society

French thought the rebels were trapped and closed in. Then the rebels closed in on the French. Now this area is infested with Viet Cong. At night they hold drills in the villages, and meetings with Communist self-criticism."

This was the dry season, and some of the rice fields we passed were idle. Others, watered from wells, sprouted their second crops —corn, tobacco, flowers.

Plantation Payrolls Come by Plane

Trees abounded—cashew, mango, kapok, coconut. Thousands of rubber trees stood in rows as neat as the gardens of Versailles. Rubber is still a major export, and the French plantation managers still have their swimming pools and tennis courts. Payrolls come by plane now.

"I don't land. I drop the money," a pilot told me. "If there's an ambush, at least they don't get the plane."

Tay Ninh, the holy city of the Cao Dai sect, was celebrating its annual Day of the Creator (page 464). An American in Saigon had said: "They'll make saints out of Winston Churchill and Danny Kaye."

Cardinal Truong Van Trang was not amused. "Such things are spread to discredit us. Why don't people come here and ask us?" I lunched, strictly vegetarian, with the cardinal and a lady archbishop. "We call the Creator Cao Dai," he said. "We did not produce a new religion; there are too many already. We took the best of Confucianism, Taoism, and Buddhism. In our temple you will also find a likeness of Jesus.

"We believe that we receive messages from the Creator and from great spirits of the past. Victor Hugo is one. We honor him as an apostle, because he wrote with true compassion for mankind. It matters little how a message comes. What it says matters."

At midnight the acting superior gave a sermon. He spoke of "spiritual cleanliness." He urged people not to be afraid to be poor, and to be kind to each other.

The following day the Viet Cong cut the road near the rubber plantation, just after we

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Joss sticks held aloft, a supplicant marks the New Year by bowing before an incense burner outside the Temple of Marshal Le Van Duyet in Saigon. After reciting her prayers, she will place the smoking wands in the tray.

Spirals of burning incense thread the fragrant gloom of a Chinese pagoda in the Cho Lon section. Each coil smolders for several days. Most Vietnamese observe a potpourri of Confucianism, Taoism, and Buddhism.

had passed en route to Saigon. They held it for three hours. When I went to Tay Ninh again, with two newsmen, the government insisted on an escort: two armored cars, 100 motorized marines.

Lieutenant Hung flew me over the five-mouthed Mekong Delta, where those marines fought frequently, and I imagined that flushing guerrillas down there was like picking needles out of a swamp. We saw French-built forts resembling medieval castles with their crenelated towers and moats.

Saigon Drivers Make Own Rules

What a contrast to the city of Saigon with its modern buildings and streams of racing traffic (pages 458-9): thousands of bicycles, some with motors and two riders; scooters and pedicabs built for two but carrying four; small blue-and-white Renault taxis; big black Chevrolets from MAAG, the American Military Assistance Advisory Group.

There were plenty of traffic lights and regulations, but the overriding rule was unwritten. "Outbluff the other fellow," Dinh explained. "It's bulk versus daring."

It was quite a game, especially in a motor-driven pedicab. The driver sat behind me, protected by my bulk. I sat out front, in the open, with nothing to give even an illusion of protection. I was surprised how often my side won out, with my driver gaining face and me getting scared.

I had two favorite spots in Saigon: the pool of the Cercle Sportif, the affluent sports club, and an alley close to the banks and the American Embassy. Here men gave haircuts out of doors, ladies gossiped, and children watched pet crickets, betting which way they might hop next. I came by daily and became a cricket watcher too.

One day I saw a 10-inch rat cross the alley.

Waterways Form the Veins of Saigon; Ships and Barges Carry Its Commerce

Under the French, Saigon grew from a sleepy fishing village into a metropolis. Now incorporating the predominantly Chinese district called Cho Lon, it has a population of two million, almost a seventh of South Viet Nam's total. Shipyards occupy Thu Thiem on the near bank of the Saigon River. Majestic Hotel, on the far bank at right, overlooks a waterfront drive. Bridges at upper left span Rach Ben Nghe, one of the canals that link Cho Lon with the river.

He headed serenely for a garbage can, disappeared, and emerged with a piece of rice cake. On his way back across the alley he stopped. He looked up at me. The big rice cake in his mouth made him radiate a big smile.

Where There's Rice, There's Progress

By now I knew well enough that Viet Nam's troubles weren't caused by any shortage of rice. In fact, if rice and economic progress were the measure of happiness, the Vietnamese should be among the happiest people on earth.

Along the Cho Lon piers, I had visited the squat motor ships full of rice from the south. The 100-pound stevedores with the 150-pound bags were always running, for on passing the gangplank into the rice mill each received a bamboo splint. "Worth 3 piasters apiece," said the foreman. That was approximately 8 cents at the official rate. "A fast man can manage 130 bags a day."

I followed the stevedores into a dim storage shed. It was 40 feet high and filled to the ceiling—easily 50,000 bags. Five and a half million tons of rice in the past year, reported the government; nearly half a million tons for export.

The ministries poured out other proud statistics. Thirteen airports completed in 1960. New canals putting thousands of acres under cultivation in the south. New roads linking

Umbrellalike *non la* inscribed with poetry shades the face of a girl in Saigon. To read the verses, she holds the hat against the sun.

Sidewalk Cafe Patrons in Saigon Watch the Girls Go By in Three Styles

Passer-by at right wears the trim slit skirt of China. Shoppers at left display the flowing tunics and pantaloons of Viet Nam. Girls at center prefer Western dress.

Shoe-shine boy, sidewalk vendor, and off-duty Americans and Europeans complete the tableau.

market towns across mountainous jungles in the north. New bridges and superhighways fostering industry near Saigon.

There was news of sugar factories and a paper mill. A cement plant here, a glass plant there. Three million bags a year of kenaf, a newly grown substitute for jute, calico by the mile from one of the most modern textile mills in Southeast Asia.

"Some of the capital comes from us," a Chinese businessman told me at a Rotary meeting. "We are called 'new Vietnamese' now." But most of the financial lifeblood by far was pumped in by USOM, the United States Operations Mission. Signs of this were plentiful: little red-white-and-blue shields showing two hands clasped in a handshake. These shields were stuck on goods purchased with American aid.

I saw them on typewriters from Italy and Land-Rovers from England; on Japanese power looms; on a map-copying machine from the Netherlands at work in the land reform office. Importers flourished.

Dollars from USOM paid for improving crops and livestock and the making of lacquer ware and pottery, for an atomic energy research station; for posters teaching *Cach-thuc-Xu-dung Cai Van Vit*, how to use screwdrivers correctly; for a booklet titled *Duc-tinh Nguoi Chi-huy Gioi*, on the "Qualities of a Good Executive."

All Saigon seems

Gown streaming in the breeze, a determined commuter zips through traffic on her motorbike. Tree-lined boulevards whir with wheels and sputter with motors.

Resting tired legs, cyclo drivers stretch out in their cabs for a siesta. Pedicabs, which replaced man-pulled rickshas, are yielding to motor-driven tricycles.

to go cycling

Family scooter passes a pedal-powered *cyclo*, which competes for fares with tiny Renault taxicabs like those in the background.

Indifferent to curves or traffic, a gaily dressed passenger perches sedately behind her escort. A silk scarf secures her conical hat.

Cyclists drive with gusto and pay only casual attention to stop signs. Two plants near Saigon assemble Italian-made Lambretta and Vespa motor scooters.

Sidesaddle rider looks sweet on a motorbike built for two. She grasps a handle to keep from falling off. Motor above the front wheel propels the machine at breakneck speed. Men and women drive scooters and motorbikes as nonchalantly as cowboys ride horses.

"These Vietnamese really take to modern technology," said Kurt Hinterkopf, a German engineer setting up a toothpaste tube factory. "They taught me a lot too. I never saw such individualists."

And he told about ordering a shower installed. "I showed the man exactly where I wanted the faucets. When I came back, the faucets sat much higher. Why? 'Look,' said the man, 'if I'm going to work for you, you must let me make some decisions too.'"

The Vietnamese were at work with a will.

Why were they not at peace?

"Victims of Our Own Success"

Said President Ngo Dinh Diem: "Faced by failure in political action, the Communists have resorted to subversive warfare."

A presidential adviser elaborated: "We are victims of our own success. When the French pulled out and the Communists took over the northern half of Viet Nam, nobody thought we in the south could last long. We had no trained administrators, but we carried on. Nearly a million refugees poured in from the north. We absorbed them.* The economy was exhausted. We revived it.

"President Diem has slapped the Communists in the face, and they're desperate to do something about it."

My friend Dinh said I would find other reasons as well. "Things seem rosy from Saigon. Now go to a village. Don't worry if the people don't look you in the eye. It wouldn't be polite. And they don't shake hands. They think that's barbaric. So those American handclasp stickers don't always make the point intended."

And so I drove south toward the Mekong Delta with Marcel de Clerck, the Belgian chief of a United Nations mission, and he told me about the dragon of Khanh Hau.

This village had the shape of a dragon, he said, which meant prosperity for people born there and assured that their children would become important men. But many years ago the French built a road that disturbed the dragon, tying it down so that it could no longer do its good work.

"That's geomancy, the Taoist influence. A canal is a dragon, bringing luck. A road is a tiger, a menace. It makes sense. Water brings life. Roads bring tax collectors and soldiers.

"In 1956 we wanted to establish an educational center in the vicinity, to train teachers for all Viet Nam," Marcel continued. "The notables of Khanh Hau said it would be useless to start any project unless a canal were built first. For irrigation, I thought. But no. They wanted to release the dragon, you see, to restore his power."

The villagers dug without pay, without coercion. "President Diem asked me how much money the canal had cost. I said none. He couldn't believe it."

Why hadn't the villagers liberated their dragon before? "Because one leaves things as they are, unless high authority orders otherwise. That's also the Taoist influence."

Best Place to Sit on a Dragon

In the house of the village chief of Khanh Hau we met notables in black robes and the associate director of the Fundamental Education Center, Mr. Truong Van Mui.

"You're sitting in the dragon's head," he said. I ventured that this must be the best place. "No," said a village notable. "The best place is the belly."

We visited the sights: the new canal, the tomb and temple of Khanh Hau's most famous son, Marshal Nguyen Huynh Duc; also the Pagoda of the Thousand Happinesses with its Buddhist nuns. The nun I spoke to replied only reluctantly, especially when I asked her name: Hue Hanh—Blessed Virtue. As we left, Marcel said:

"People who don't know Westerners re-

*For a moving eyewitness account of these refugees and their resettlement, see "Passage to Freedom in Viet Nam," by Gertrude Samuels, NATIONAL GEOGRAPHIC, June, 1955.

Masked as a Unicorn, a Celebrant Climbs a Pole for Cash and Cabbage

Joyful Vietnamese mark their lunar New Year with the festival of Tet, a national holiday, family celebration, and religious rite for the dead, all rolled into one. The word itself is short for Tet Nhat, meaning "first day of the return of spring." Frenzy and—until they were banned recently—firecrackers usher out the old year; prayer and thanksgiving welcome in the new. The observance occurs in January or February.

Unicorn dancers are believed to bring good fortune. Luck seekers at this Cho Lon house suspend money and cabbage leaves from the banner. To reach the reward, a costumed merrymaker mounts a two-story bamboo pole held by his friends.

sent direct questions. And you address them by family rank. If a man is third among his brothers, he's *Ong Ba*, Mister Three.

"You see, many people fear that giving their names exposes them to some evil. A pious Vietnamese also has a secret name, known only to himself and his parents."

And his wife? "Hardly," said Marcel. "That would give her power over his life. He wouldn't risk it."

I could see what Dinh had meant. American style salesmanship—the folksy approach of the public relations man—was not likely to succeed in rural Viet Nam. And Viet Nam is 80 percent rural.

Back in Saigon I found new sights. At dawn, Frenchmen sculling on the river; at night, shoe-shine boys with chalk playing ticktacktoe on the sidewalk. The first rains whipped down, and the pedicab drivers put up canvas to keep their passengers dry. With only a tiny slit to peer through, I felt whizzed along in a fast canvas bag.

One night I dined at the air-conditioned Caravelle Hotel (page 449): fair French food, a fairly good American-style band, and a check big enough to meet the cash needs of a family along the Tay Ninh road for half a year.

I walked down Tu Do Street to the piers.

Couples on straw mats ate crabs from charcoal stoves. The show was free: songs and dances, courtesy of the government.

I continued along the waterfront until there were no more ships or shops—only lovers, sitting two by two like starlings on a telephone wire, facing the quiet river with their backs to bicycles. A river island stretched in the moonlight. Over there was Viet Cong territory by night.

A little farther I found a barrier across the street and police with submachine guns. They made me turn back. The Viet Cong were over here, too.

One afternoon I stood in line at the post

PHOTOGRAPH BY [illegible]

Three men in a tub stare in wonder; they behold an American medical team aboard a Chinese junk. The encounter took place near an island off Nha Trang. Mainlanders visit the spot to fish, dry their nets, and collect ingredients for bird's-nest soup. Basket boats somehow make good headway without spinning.

PHOTOGRAPH BY W. E. GARRETT, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Ocean-going Liner Creeps Into Saigon

Some 1,500 vessels, with food, textiles, and manufactures, call at the port each year. They cast off with cargoes of rice and rubber. The city lies 50 miles up the narrow Saigon River from the South China Sea. The largest vessels calling here can turn around only by grounding their stems on the bank and allowing the tidal current to swing them about.

The white *Laos* (background), which sails between Tokyo and Marseille, will tie up in the Khanh Hoi district beyond the canal at right.

Strollers enjoy the promenade along the waterfront. Diners board the floating restaurant at right. A miniature golf course occupies the small plot at left.

Massed at midnight beneath the Eye of God, praying Caodaists at Tay Ninh mark the Day

of the Creator. Dragon pillars flank the nave; hidden singers suggest heavenly voices

Female Worshipers in White Hoods Glorify Cao Dai at Tay Ninh

Caodaism embodies a hierarchy of pope, cardinals, and bishops, reflecting the organization of Roman Catholicism. Founded only 35 years ago, the sect claims two million members. Its guiding spirits include French novelist Victor Hugo, who died in 1885, and Sun Yat-sen, the father of the Chinese republic. Celebrating the Day of the Creator—whom they call Cao Dai—priests hold ceremonial lanterns symbolizing the faiths and traditions on which the creed is based—Buddhism, Taoism, and Confucianism.

office, behind a lady from Florida sending a cable. A cyclist had tossed a hand grenade at her house. Her husband, a USOM expert on airports, had been hit in the eye.

A Jeep was found at a MAAG billet with a foot locker full of explosives. The time clock had missed.

"Relax," said an old Saigon hand. "There's no more danger in this town than on the Pennsylvania Turnpike on Sunday afternoon." Maybe he was right. But here people might hurt you not out of ineptitude but because they really wanted to. Eventually this feeling overshadowed Saigon's sunniest pleasures. Even waterskiing.

George Calfo of the American Trading Company of Southeast Asia Ltd. (roadbuilding machinery, construction equipment) took me out one Sunday in his racy outboard. We shot upriver past a guarded bridge and guarded compound walls. I waved at the soldiers and they waved back.

After skiing, we lunched by the river in the thatched-roof pavilion of the Club Nautique, greeted the Director-General of the Budget and Foreign Aid, dodged children before they could upset their Coca-Colas on us, and appraised the bikinis.

"Home," said George, and we were on the river again, passing sampans that plodded toward Saigon to sell charcoal. Each housed a family. Father did the propelling—lying on his back, grasping a pair of oars with his toes, and pedaling leisurely, as if upside down on a bicycle. We caught up with the yacht of the French Ambassador and stopped our motor to take pictures.

That was a mistake. The motor wouldn't start again, and we drifted toward shore – the other shore. I quoted the sign at the club: "The commander of the local military post requests that you do not station yourselves near the opposite bank."

Enemy Waits Across the River

George said, "We put that up after the Viet Cong shot the French doctor. They wanted to kill his wife and two children too. But they let them go because the children begged so hard. The kids were Vietnamese. The doctor had adopted them."

George kept pulling the starter cord. No result. I found an oar and paddled. Still we drifted shoreward. The club and the yacht were out of sight now. A sampan went by. How fast it seemed! I looked at the greenish mud of the riverbank and the dense green wall behind it: fernlike stalks seven feet high.

Two men in floppy hats stepped out of the green wall. They stared at us. I waved. They didn't wave back. Then the motor started and we scooted off, relieved but sad at the country's plight.

Still, nothing could dim the charm of the Saigon girls, especially of the six I met at the Vietnamese-American Association.

Towered temple at Tay Ninh serves as the spiritual center of Caodaism. Here God speaks to believers through the medium of a moving pencil. Images of Jesus, Confucius, Buddha, and Laotse stand near the altar. Caodaists call the temple site their "holy land."

"We tell about America with lectures, films, and exhibits," said the director, who was none other than Professor Iredell, the Orientalist from California. "Our most popular activity is teaching English. We have 3,000 students—wives of officials from the ministries, cab drivers, a taxi dancer."

He led me to a table where those six young ladies sat with a teacher, Mrs. Dorrit Jacobson, the wife of a colonel in MAAG.

"Fine students, terribly curious about America," said Professor Iredell. "I hope you won't find them too shy."

Shy? I could hardly keep up with their questions.

Where do you live? At the Hotel Majestic. What room? 307. May we come and see you? Yes. Tomorrow at three-thirty? Yes.

And so they came: Tuyet, Linh, Bich Hong, Lam, Ba, and Ly. Their names, they said, meant respectively Snow, Soul, Rose, Forest, Third Sister, and Pear Tree Flower. We took a walk, but the sun bothered my guests, who had no hats and were forever holding their pocketbooks over their pretty heads. We returned to the hotel terrace. Now I did the asking.

Would the young ladies like some ice cream? Yes. What kind? Whatever I would have. Chocolate? All six wanted chocolate. To every question, all responded alike.

Yes, they liked riding sidesaddle on the backs of motor scooters. Yes, the boys drove too fast. No, nothing could be done about that. Certainly, they wanted to wear nothing but the Vietnamese national dress. Absolutely, they all wanted to be housewives.

Girls Tell the Truth on Paper

I asked: "If I give you each a piece of paper, will you write down what you really think? Don't write your name, fold the paper, and I won't know who said what."

That's how I found out that two of the six young ladies very much wanted to wear Western dress, but feared that they weren't built for it. Only three of them wanted to be housewives. One wanted to be a lawyer, and two physicians.

As I drove my sextet home, dropping them off one by one, I was asked into each home to meet father. Thus I had a glimpse of Viet Nam's growing middle class: an office clerk in a small stucco house, a factory manager in a big one, lots of children, always an altar with offerings of fruit.

Linh's father, Maj. Dang Dinh Thuy, was away, but she proudly showed me his photograph, taken at the United States Army's Command and General Staff College in Fort Leavenworth, Kansas. Now he was in the Mekong Delta.

"We don't see him often," said Linh.

Villagers Fear for Their Heads

I met a lady from Chicago stopping in Saigon on her round-the-world trip by jet. She wondered about village life, and I showed her photographs.

She shuddered. "How can people live like that?"

I remembered Khanh Hau—that people *could* be content with a bed of simple boards, and rice and fish and nuoc mam. True, a better diet would be all to the good. So would more teachers and medicines. But these things were not what worried the villagers most. They went to their hard beds fearing for their heads.

"Some elders dare not sleep in their own houses," said a member of a United Nations mission. "They hide in a different house every night, or they go to the nearest town with a garrison."

The Viet Cong problem grew daily. I visited a provincial security chief, a veteran anti-guerrilla fighter whose submachine gun was as close as his field telephone. Behind his desk hung four graphs: extortion, ambush, murder, attacks in force. The line of each graph slanted up.

The government had armed 60,000 civil guards and 40,000 village militia. I saw a militiaman in his fortress tower. He let me inspect his rifle. It was an old French repeater, but it wouldn't repeat. Could it be fixed? Yes, at the ordnance depot. Soon? Yes, soon, in a few weeks.

"To fight the Viet Cong, you must get out of those towers," said Maj. Lewis Millet, a red-haired American. He had won a Medal of Honor in Korea. Now he was training the elite Biet Dong Quan, the Army's Special Missions Force, or Rangers (page 471). "You've got to go on patrol. Get them before they get you. And get the villagers on your side!"

To do that, to prove that they came as the villagers' friends, the Rangers helped build wells, canals, houses. "In their rest periods, of course," said Col. P. D. Thu Lamson, commander of the Rangers. Was that an order?

Photograph by W. E. Garrett, National Geographic Staff © N.G.S.

"Her face as radiant as the moon. . . . Clouds lost their loveliness beside her hair. . . . Flowers envied her brilliance, willows coveted her grace. . . . Beside her, of what value were empires and citadels?" Such a fair Vietnamese as this dancer from Hué may well have inspired these extravagant lines by the poet Nguyen-Du (1765-1820).

Mock Battle With Live Ammunition Lends Realism to Ranger Training

Guerrillas led by North Vietnamese Communists plague South Viet Nam, blowing bridges, blocking roads, and assassinating officials. To subdue the terrorists, the government maintains an army of 150,000 men. The United States equips the troops and gives training advice.

Special drills in guerrilla warfare teach Rangers how to live off the jungle, distinguish innocent farmers from disguised terrorists, and survive an ambush.

This unit maneuvers near Nha Trang. In combat the men would wear steel helmets.

President Ngo Dinh Diem, accompanied by his brother, Archbishop Ngo Dinh Thuc, dedicates an airfield at Vinh Long. South Viet Nam has a million Roman Catholics.

"No," said the colonel. The three silver apricot blossoms flashed on his collar. "The men know that I hope they'll all join in."

Try as they might, neither the government nor its American helpers had managed to remove the daily fear from many villagers' hearts. At times, on the contrary, the authorities multiplied the fear.

Dinh handed me a newspaper. It told of a Mr. Mung, beaten to death by a chief of police who machine-gunned the body as it floated in a river and kept the widow from burying it.

"This police chief is now in jail, or the story could not have been printed," Dinh said. "But what happens to other village tyrants? The Viet Cong come and say, 'Tomorrow after dark we'll kill this imperialist oppressor.' They kill the man, and to the villagers they are the heroes. It doesn't help to explain that Communist oppression would be worse."

Foe Seduces Hill Tribes

Even thornier was the problem of the people of the high plateau up north: the Sedang, the Bahnar, the Jarai, the Rhade—perhaps twenty tribes, traditionally avoided by the Vietnamese, some hardly known even to missionaries and anthropologists.

Now they had strategic importance. From

Laos and Cambodia the Viet Cong infiltrated bands of tribesmen. Enemy leaders married tribeswomen and promised a mountain peoples' state. They set up guerrilla bases in the highland jungles. More and more soldiers fell into traps, onto sharp bamboo sticks.

Hoping to protect the open borders, the government built tribal settlements. These were simplified versions of the "agrovilles" of the lowlands, the collective farming towns with schools, hospitals, plenty of work and plenty of police. Not everybody in the agrovilles had wanted to go there; and the newly settled mountain men were reported pining for their old freedom in the wild.

"A fantastic country," said Joseph Ilou, a Frenchman. "There's a bird up there with a five-foot tail, a kind of pheasant, brown with gold spots. Its tail feathers are the largest known. The scientific name is *Rheinardia ocellata*. Centuries ago such birds were presented to the emperors of China, and so began the legend of the Chinese phoenix.

"And what people! I met a man on the trail with a tattoo on his forehead, like this."

He drew a figure of a man:

"I wondered what this was. Nobody could tell me. Then I found

(Continued on page 477)

Sunset silhouettes a patrol plane carrying the author over rice fields near My Tho. In the distance flows the broad Mekong River, which winds 2,600 miles from the Tibetan highlands before emptying through five mouths into the South China Sea.

Rural mosaic along the coastal strip near Da Nang, formerly Tourane, illustrates the intensive cultivation practiced in South Viet Nam. A proverb says, "Every inch of earth is an inch of gold."

Traffic interchange on the new Saigon-Bien Hoa highway carries few cars. Built with United States aid, the 20-mile-long freeway opens up new land for industrial development, speeds farm crops to market, and serves as a defense artery.

Farms, canals, roads unfold from the air

Converging canals near Phung Hiep suggest the spokes of a wheel. Man-made waterways, the lifeline of agriculture, lace the Mekong Delta south of Saigon. They drain the land during the summer monsoon and irrigate it in dry weather. Fleets

Strawstacks, aftermath of the rice harvest, dot the land near Da Nang. Farmers use the straw for fuel and fodder. Other agricultural products include rubber, corn, copra, sugar, tea, and pepper.

of river craft glide along the channels, bearing crops to market. Tireless dredges clear the ditches of mud and weeds. Silt becomes fertilizer or fill for new roads beside the canals.

Roomful of Onions Tells a Story of Embarrassing Surplus

American agricultural graduates working at Da Lat taught the farmer at right how to grow bigger and better onions. But Vietnamese shoppers, accustomed to smaller bulbs, proved reluctant to buy. When his storage bins filled, the man preserved the excess in his house, sacrificing even his bed cloth. Eventually he sold the crop. His cabinet holds the family altar, where he pays his respects to the spirits of his ancestors.

Young bathers frolic with a water buffalo in a stream near Hue. Beast and master often become firm friends; many farmers view the animals as partners in the field.

(Continued from page 471)

it in a book. It was the sign of the blood eaters. They sacrifice humans and eat the blood. Would you like to see them? It might take a month to prepare such an expedition, to make sure that all goes well."

I didn't have that much time, and the mountain people I did visit were very far from fierce. They called themselves Thuongs and lived near Route 20, the road northeast from Saigon to the highlands. They had had many visitors and expected money for being photographed. They also expected me to be shocked by their poverty. When I said I didn't feel that way, they were first surprised and then amused.

To be sure, when I entered a long log house on stilts, I choked. Two fires were going full blast. One had a bird over it with feathers on. But through the fumes I discerned the well-organized home of six men, eight women, and five children. Brooms, baskets, mats, oil lamps. Looms, traps, fishing poles and nets, paddles for the pirogues on the near-by river. Spears, crossbows, flutes, brass gongs.

The status symbols were eight big clay

Manicured rows of Da Lat lettuce soak up the sun, a farmer fertilizes the plants. Da Lat occupies a temperate plateau where one crop follows another the year round.

Show-place market in Da Lat replaces the usual open-air stalls. For shopping bags, the departing customer uses baskets hung from a shoulder pole.

jugs in a row, with wine to be sipped through bamboo tubes. Grandmother pounded a freshly killed chicken, dropping the pieces into an aluminum pot. A woman suckled a little girl. A boy tickled a caged mouse. Not a bad life.

Maybe ten days a year the men worked for Jean Parrez, a French coffee planter near by. "I wish they'd work more often," he had told me. "I must pay in advance, or they won't even consider it." What would they do with the money? "Buy shoes," said the Thuongs. This was a sign of changing times. A few years ago they would have wanted more jugs.

War of Ambush Plagued the French

I drove on and up toward Da Lat, thinking of the horror that lingered over Viet Nam. While Americans fought in Korea, Frenchmen had died here by the thousands—in a war with few fronts but constant ambush, with wounded left to torture or to death through ants and vultures.* The French had a phrase for those who came back: they looked like "Christ off the Cross."

Vietnamese soldiers also died by the thousands, fighting beside the French or against them. Villagers died by the tens of thousands. Only six years ago Saigon itself was a hell of bullets and mortar shells as the government crushed a well-armed private army for good.

And last November the government's own paratroopers had revolted against President Diem, claiming they could fight the Viet Cong better without him. Their uprising failed, with 400 dead in the capital. Was it surprising that fear grew in the very fiber of the people?

I was riding with Tran Van Nghia, who had done his share of fighting. He didn't want to talk about that. He was a professional hunter now, and he liked to talk about animals.

Elephants, for instance. "I catch some for zoos abroad," he said. "When they're two years old, they are about four feet high and

*See, in the NATIONAL GEOGRAPHIC: "Indochina Faces the Dragon," by George W. Long, September, 1952, and "Strife-torn Indochina," by W. Robert Moore, October, 1950.

Stage star Thanh Nga ranks as first actress of a Saigon theater group.

ACHROMES ABOVE AND LEFT AND OPPOSITE BY K. G. Y.

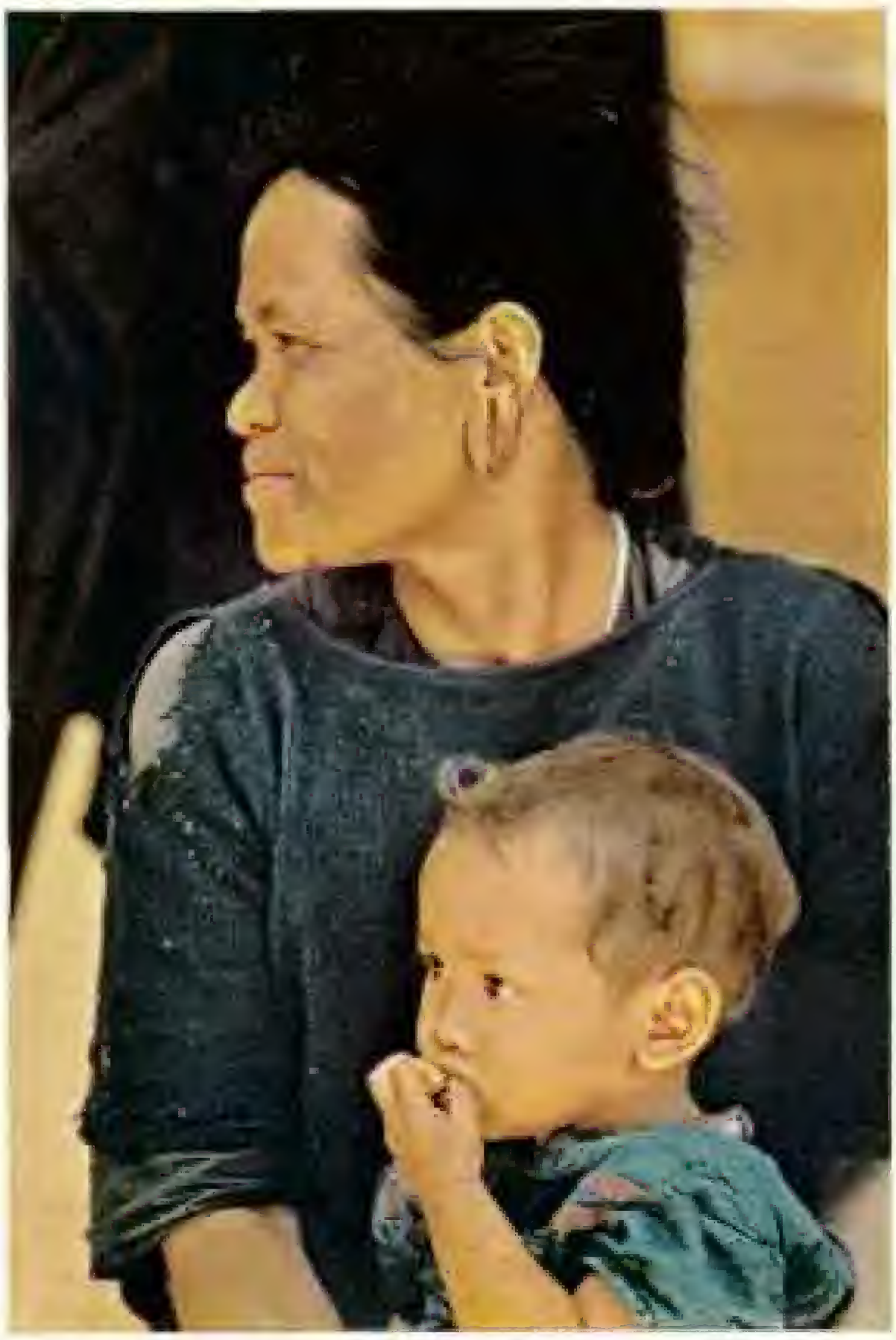
Trumpet fanfare at Hue salutes palace dancers (opposite). Vietnamese musicians use instruments and a pentatonic scale inherited from China.

Death Stalks the Stage: An Assassin's Sword Strikes Down the King

Dazzling costumes and sumptuous settings distinguish *cai luong*—reformed theater. Dating from the 1920's, cai luong combines words and music, tragedy and comedy into a dramatic form that suggests Western operetta. Musical tempos denote sadness, anger, joy, and other emotions. Romantic plots employ realistic characters. Classical *hat boi* offers tragic themes with legendary heroes.

This scene took place during a performance of *The Beautiful Girl of White Flower Village*, at the Nguyen Van Hoa Theater in Saigon.

Symbolic blossoms in hand, the palace troupe performs the Dance of the Flowers. Children dedicated to the ballet receive free schooling.



Yao child peeks over mama's shoulder in Ban Me Thuot. A refugee from the north, mother displays her wealth in silver necklaces and shaves her head except for a patch at back.

Mountain mother and child relax during a visit to Da Lat. Their semi-nomadic tribe burns growth off hillsides, plants rice in the ashes, and moves on when the land becomes exhausted.

Ivory earplugs stretch the lobes of a tribesman encountered near Da Lat.

Pipe smoker of the matrilineal Rhade tribe dwells in a long house near Ban Me Thuot

very friendly. My men run up to them with a pole that has a lasso on the end. Get that sling around one foot, and that's that.

"Did you know that a little wild elephant eats 75 pounds of greenery a day? A big one can eat 1,000 pounds every 24 hours. He hardly sleeps, he's so busy eating. He's one huge digestive system."

At Kilometer 234 we visited Dr. Paul Metz, born in Alsace but famous as a surgeon in Indochina for 40 years. Once, desperately ill and with no doctor for himself, he cut out part of his liver before a mirror. Now his right hand was crippled.

"I had a tiger for a pet," he said. "He thought I gave his food to my cat and so he bit me. I kept him in a cage until he died. That ashtray is his skull."

Dr. Metz's injury finished him as a surgeon, but tigers were still with him. "When they hunt, they give a high-pitched bark, to raise wild boars and stags. They make my windows rattle at night. A tiger came up to my porch in daylight and took my dog. What could I do? I had no gun."

Driving on, Nghia said: "My men killed a buffalo in the forest two days ago. When he has been dead three days, a tiger is sure to come. That's the food a tiger likes best. And we'll be there."

Chunks of Sugar Cane and Pineapple Tempt Travelers Near Vinh Thanh

Roadside peddlers with cheerful faces hawked their sweets when vehicles drew up at a stream in the steaming Mekong lowlands. Gunfire ahead delayed the crossing.

PHOTOGRAPHED BY W. E. GARRETT, NATIONAL GEOGRAPHIC STAFF

Banner in Nha Trang Proclaims a Double Feature: Aladdin and John F. Kennedy

Color films of the U. S. presidential inauguration share the bill with a motion picture based on the *Arabian Nights*. A commentator reports the oath-taking in Vietnamese.

In Da Lat the provincial security chief approved our tiger hunt. Then we called on the governor, a routine courtesy.

The governor said we could not go hunting. I was surprised. What about my letters of recommendation from high officials in Saigon? President Diem himself had ordered that I be given all possible cooperation.

The governor was unimpressed. He said there was no way to communicate with Saigon. I went to a telephone and got Saigon immediately. But when I saw the fear on the faces of the men with me, I dropped the matter. I might clear this bureaucratic roadblock, but they would have to stay for the wrath of the governor. It wasn't worth it.

Siesta Keeps Cadets Alert

I stayed for the pleasures of 5,000-foot-high Da Lat. Dry, sunny days and a golf course. Cool nights. A golden sunrise on a lake amid fir trees, while noisy young swallows sent their parents flying for food.

Here stood the republic's Military Academy, emulating West Point with West Pointers as advisers. Col. Tran Ngoc Huyen, the superintendent, disclosed an innovation: after lunch, a 45-minute siesta for all 450 cadets. "My idea," said the colonel, "Before this they came to classes at 1400 looking sleepy."

The cadets I met – Nguyen Ngoc Khiem, Ho Xuan Quang, and Vinh Quoc – were models of alertness. Each spoke French and English. Khiem's sister had married an American and moved to Denver, Colorado. "My family didn't mind," he said. "They only asked, 'Do you love him?' He's a very civilized man."

On Sunday this trio took me out for a Vietnamese breakfast: Chinese soup with noodles and bits of meat. Then we went to the new market (page 477). Flowers, vegetables, meat, flies, clothes, a counter with film star photographs and records. Audrey Hepburn outsold Marilyn Monroe, said the salesgirl. Musically, "Bat Boom" was on top. Quang said, "She means Pat Boone."

At a camera counter I saw Dutch flash bulbs, French color film, an American movie projector. And a Russian copy of a Leica camera. Five thousand piasters, or $70 at the tourist rate. How did it get there? Somebody had brought it from Laos.

Cockleshell Craft Ride at Anchor off the Fishing Village of An Cu

Coastal waters harbor 300 varieties of edible fish. Eaten fresh, dried, or salted, the catch provides protein for the Vietnamese diet. Much of the haul

becomes *nuoc mam*, a fermented sauce. Seeking to modernize the fleet, the government encourages fishermen to replace oars and sails with motors and heavy hemp nets with nylon. South China Sea washes the feet of this village north of Da Nang. Inland lies Deo Hai Van—the Pass of the Clouds

We talked in a coffee bar full of rock-'n'-roll noise, and at a waterfall. I was deluged with questions. Why are Americans always cheerful? Did they really care about Laos? Why do American newlyweds tie tin cans on their cars? I said it's their friends who tie on the cans, but I couldn't say why. Just one of our strange customs.

Back in Saigon once more, I looked for my friend Dinh. Was that really his name? He had written it down for me, and also his address. But when I went there, nobody knew him. That afternoon he came to my table in a sidewalk cafe and said, "Did you wish to see me?"

"Yes," I said. "Are you a Viet Cong?"

He looked shocked. "No, my friend," he said. "The Viet Cong cut my brother's head off." He paused. "I think that President Diem is honest and experienced and very sure that he knows best. But I am an educated man myself and cannot agree with everything his government does. So it is best to be careful."

He sipped his apéritif. "You've undoubtedly met the Viet Cong, you know. An elevator boy, or a shopkeeper, or a driver for MAAG. They are everywhere. They collect 'taxes,' even in Saigon, by persuasion or by threats. They give a receipt. If a man takes it to the police station, the Viet Cong kills him. Let the police catch him with it, and he might go to a re-education camp."

In Search of a Miracle

I asked, "What will happen to Viet Nam?"

"I hope for a miracle to save us," he said. "Otherwise the Viet Cong will get stronger. Will the Americans go home? Maybe they'll let their own soldiers fight. But how could they do better in the swamps and the jungles than the French?"

And what about my six girls, and the eager cadets?

"Some will die, some will escape. But most people will have to stay and try to get along. One day you may face those boys across a conference table. Or across a battlefield. As our old primers say: Man is born good, but life makes him bad."

I pushed my apéritif away. Did it have to be that way?

After all, nobody could have suffered more from malign fate and man-made disaster than the heroine of the *Kim Van Kieu*, Viet Nam's greatest poem. She was misled, mistreated, and miserable, a victim of unsettled times. The poet asks, "Amid so many upheavals, who among us can restrain his sorrow?"

But in the end she found agreeable peace.

Perhaps, through some miracle, her country will yet find the same.

Beauty on the beach at Nha Trang epitomizes the grace and charm of Vietnamese women. Flowing *ao dai*, with high collar, snug bodice, and skirt split to the waist, swirls around her pajamalike *quan*, or pantaloons. The fashion evolved from traditional dress. Few women outside Saigon dare to face the public in bathing suits.

Skeins of golden light tie a Christmas ribbon around Cuauhtémoc Statue at Mexico City's

MEXICO IN

Beneath the surge of progress, old Mexico's charm and beauty lie undisturbed

By BART McDOWELL. *Photographs by KIP ROSS*

busiest intersection. Domed Monument to the Revolution glows with holiday brilliance

MOTION

National Geographic Staff

AN EVENING SHOWER had glossed the streets of Mexico City. Now, like black mirrors, the wide avenues and narrow side-streets reflected a jumble of vitality: lighted restaurants and elegant girls in Paris fashions . . . noisy vendors offering luck with their lottery tickets . . . homebound shoppers, honking

drivers, old women in shawls . . . shoe-shine boys kneeling before Latin dandies now preening for the night.

Even my cabbie, taking me to a dinner party, felt the magic. "Do you wish a direct route," he asked, "or a more scenic drive?"

A man may forget his Spanish subjunctive but not his precautions. "What's the difference in fare?" I asked.

The driver pursed a luxuriant mustache. "Six pesos—no, *three*. Because the drive is also scenic for me."

Maybe the country hasn't changed, I thought; Mexico is still the land that Mexicans themselves enjoy. Together, we took the scenic route.

We passed two men wearing extra-wide sombreros. Obviously countryfolk in town for the sights, they tilted back their big brims to see the tops of skyscrapers. I knew how they felt. As a boy I had lived on a cattle ranch in northern Mexico. My later visits here had not prepared me for these new buildings—as modern as any in New York. But looking closely, I could see the Mexican difference. Lobbies were splashed with color—bright murals and mosaics. Textures were different; like peppers in a sauce, volcanic stones preserved a touch of hot volcano.

Mexican Hostesses Appreciate Lateness

"You are a guest for dinner?" asked the cabbie. "Then you should take your hostess some flowers. We will stop at the market. Yes, it is open all night, for who knows at what hour he might need flowers?"

We pulled up to a brightly lighted sidewalk market; it resembled a single bouquet half a block long. The saleswirl, a look-alike for actress Dolores del Rio, pushed back her braided hair and held up a full dozen gardenias. We dueled over the price and settled on four pesos—32 U. S. cents.

"You paid too much," chided the cabbie. "But your hostess will appreciate the gardenias. And even more she will appreciate the fact that you are now a few minutes late."

Mexico was still Mexico.

Before my return, I had wondered. Economists had told me of boom and progress. Now I was finding that the concrete mixer had not really drowned out the *mariachi* music. Just the day before, I had talked with television executive Juan M. Durán.

"This is a country without statistics," he said. "Our people don't like to answer personal questions. None of our television programs have ratings after 9 p.m. We simply can't call people that late."

Progress, in other words, is arriving on strictly Mexican terms. But Señor Durán to the contrary, Mexico does have some statistics—dramatic ones. Since 1940 bumper crops of dark-eyed babies have almost doubled the population (to 35,000,000). In the same period the country has tripled its exports. Electric power has quadrupled. Steelmaking has increased eleven-fold. And in the past decade Mexican farmers have made astonishing progress in food production.

Invasions Start at Veracruz

My own progress began a bit self-consciously, in Veracruz on Mexico's Gulf coast. (See the ten-color Atlas Map, **Mexico and Central America**, distributed to members with this issue.) Many a famous foreigner—and many a villain in Mexican history—has entered through this mellow port (page 511).

Spain's daring Hernán Cortés was the first. On Good Friday of 1519 he landed here with "the cavalry, infantry, and artillery, on the sand hills . . ." Promptly, he founded Veracruz and its first government. "A gallows was erected in the square of the town, and another at some distance out of it." Then Cortés turned inland, launching his conquest and modern Mexican history.

The legacy of colonial Spain still haunts the narrow streets and 17th-century churches. On a low island in the harbor bask the ramparts of the fortress of San Juan de Ulúa, notched like a gunstock by time and invasions. U. S. troops under Gen. Winfield Scott captured the city in 1847. British and Spanish fleets soon showed their colors here. Louis Napoleon's French invaders established a beachhead in 1862; later they brought in their puppet, the Emperor Maximilian. And to Veracruz in 1914 President Wilson sent U. S. forces in reprisal for a harbor incident.

With such a history, how could any foreigner expect hospitality? But I was surprised.

I found the French fleet invading Veracruz again, though this time peacefully. Two training ships had just disgorged some 700 French sailors for a good-will visit. Their red-

Aztec Dancer, His Face a Mask, Strums a Lute and Stamps to Drums

Pheasant feathers and ostrich plumes stud the headdress of a professional performer outside the Shrine of Our Lady of Guadalupe during a December fiesta (page 497).

Sunday in Mexico City: frolic in the morning, death in the afternoon

AS DEPICTED FROM HAMILTON WRIGHT

A leisurely air pervades the capital in the forenoon. Smiling señorita with beribboned pet strolls the boulevards. Boys with handkerchief seines dip for minnows at Chapultepec Park. A vendor peddles *antojos*, Mexican fritters, at an outdoor art show.

As afternoon shadows lengthen, excitement mounts. At 4 p.m. trumpets blare in the Plaza Mexico, world's largest bull ring, and a matador nimbly sidesteps a charging bull.

Blind to the bullfight, eyes on the crowd, a hawker offers candy and programs

pompommed hats bobbed all over town—among the crowded shops and along wide beaches with fancy summer homes.

"Is Veracruz always this busy?" I asked a waiter in an arcade cafe.

"This is nothing," he replied. "Wait until *Carnaval*."

I couldn't wait, so I ran a decibel test from the Hotel Diligencias (literally, "diligences," and freely "stagecoaches"). Four floors above the Plaza de Armas, I diligently kept score one night on noises heard between naps.

Two marimba bands played competing tunes; holiday crowds from Mexico City detonated firecrackers; vendors hawked fresh crabs over an accompaniment of streetcars. Throughout the night, caravans of freight trucks shifted gears en route to and from the dock area. Dawn came with a summons from church bells hanging at ear level. Then a new

day was announced by roosters—also at car level, since chickens live on downtown roofs. In the modern land of *mañana*, tomorrow can come too soon.

But the day-and-night pace brings results. Electricity from the Papaloapan River valley energizes new industries; one factory makes seamless pipe for Mexican oilfields and export. Veracruz now has 138,000 people.

Bus Ride Begins With a Blessing

I had some misgivings about the mountain bus trip from Veracruz to the capital. Guidebooks call this drive *scenic*—a word that can sometimes mean hair-raising. I could also recall, with dread, the roads and buses of another generation.

Our driver, a dashing test-pilot sort, inspired little confidence by gunning his diesel for departure. Then the passenger next to me made the sign of the cross.

We quickly left the banana plantations of the coast and climbed, engine smoking, toward Orizaba—the tallest and snowiest mountain in Mexico. Our highway spiraled into a foggy mass of cloud. Once a goat bolted across the road to test our brakes; they passed, and so did we. Taking my eyes off the highway, I saw that my seatmate was reading a breviary. He was a Roman Catholic priest. He had crossed himself in piety, not anxiety. So I relaxed and enjoyed the scenery.

The guidebooks are right: This scenery is mountainous, magnificent, and very Mexican. The traveler who wants to stay awhile in the area has a bafflingly wide choice. One favorite spot is Fortin de las Flores, "the little fort of the flowers." The village bulwarks are under constant siege from orchids, camellias, bougainvillaea, and trumpet vine. Fortin offers a Latin Horatio Alger story: the poor boy, named Antonio Ruiz Galindo, who prospered and brought a luxurious hotel to his small home town. Every thumber of tourist folders knows Ruiz Galindo's master touch: the hotel swimming pool garnished with floating gardenias.

If a gardenia bath isn't

(Continued on page 501)

Tolling a church bell as he voices the *grito*, Mexico's historic cry for independence, President Adolfo López Mateos emulates the patriot priest Father Hidalgo, who in 1810 rallied his countrymen to throw off the Spanish yoke. Each year the ceremony takes place on September 15, the eve of Independence Day. Señor López Mateos speaks from the steps of the same colonial church in Dolores Hidalgo, Guanajuato, where the crusade for liberty began.

"Bless this pet." A priest sprinkles holy water on animals held aloft by owners outside the Church of San Fernando, Mexico City. "I counted hundreds of parrots, parakeets, and canaries," reports photographer Ross, "all kinds and sizes of cats, and almost every possible variety of dog."

The Day of the Animals takes place at churches all over Mexico on January 17, St. Anthony's Day. Villagers adorn their dogs, pigs, and burros with paint, ribbons, and flowers.

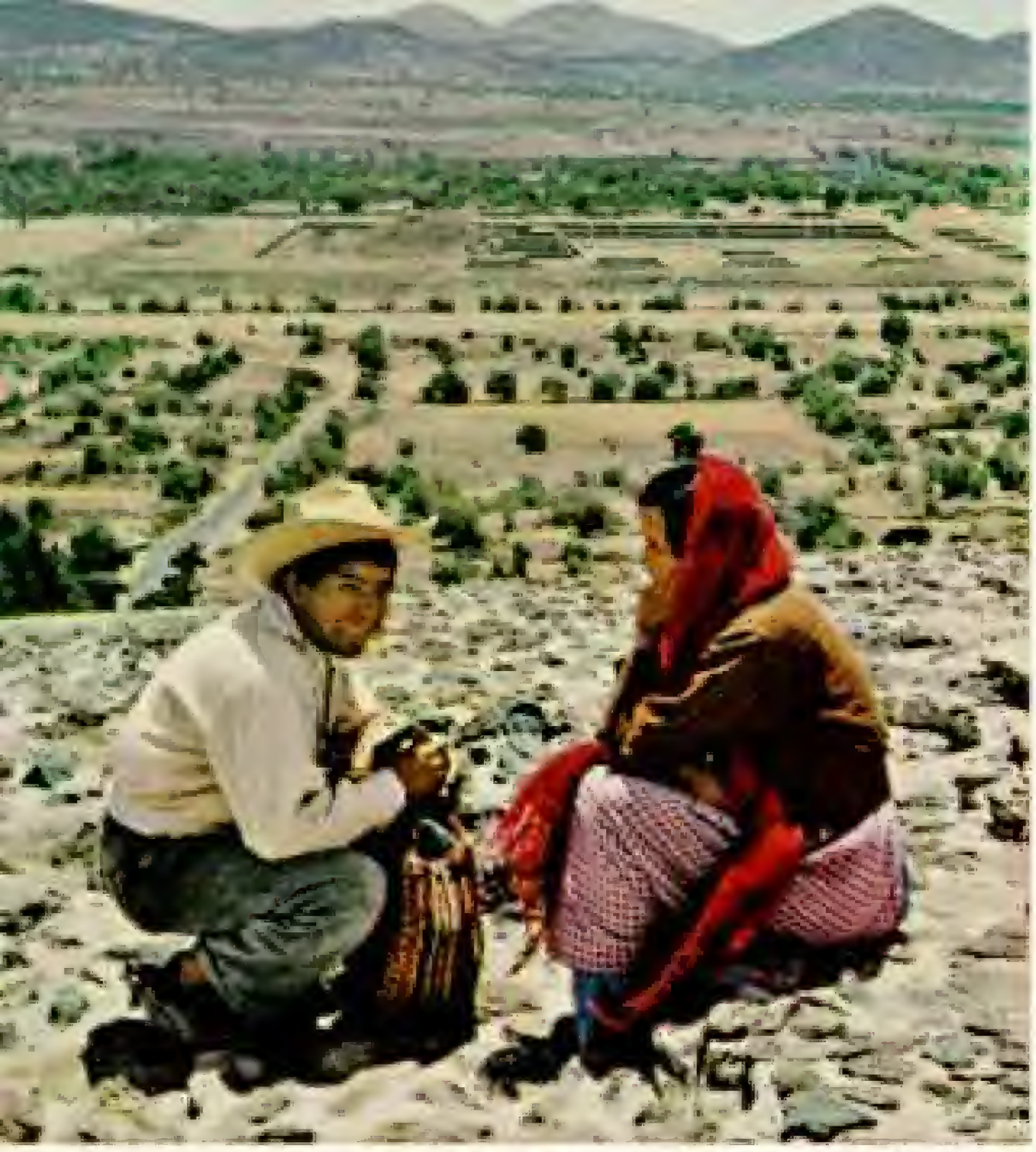
Pilgrims, Walking on Their Knees, Inch to Church in Villa Madero

Often called the Lourdes of Mexico, the Shrine of the Virgin in a suburb of Mexico City attracts thousands of Indians from all parts of the republic. They come to celebrate the miracle of 1531, when, devout Mexicans believe, a dazzling vision of the Virgin Mary appeared to a farmer and bade him build a church on the spot where she stood.

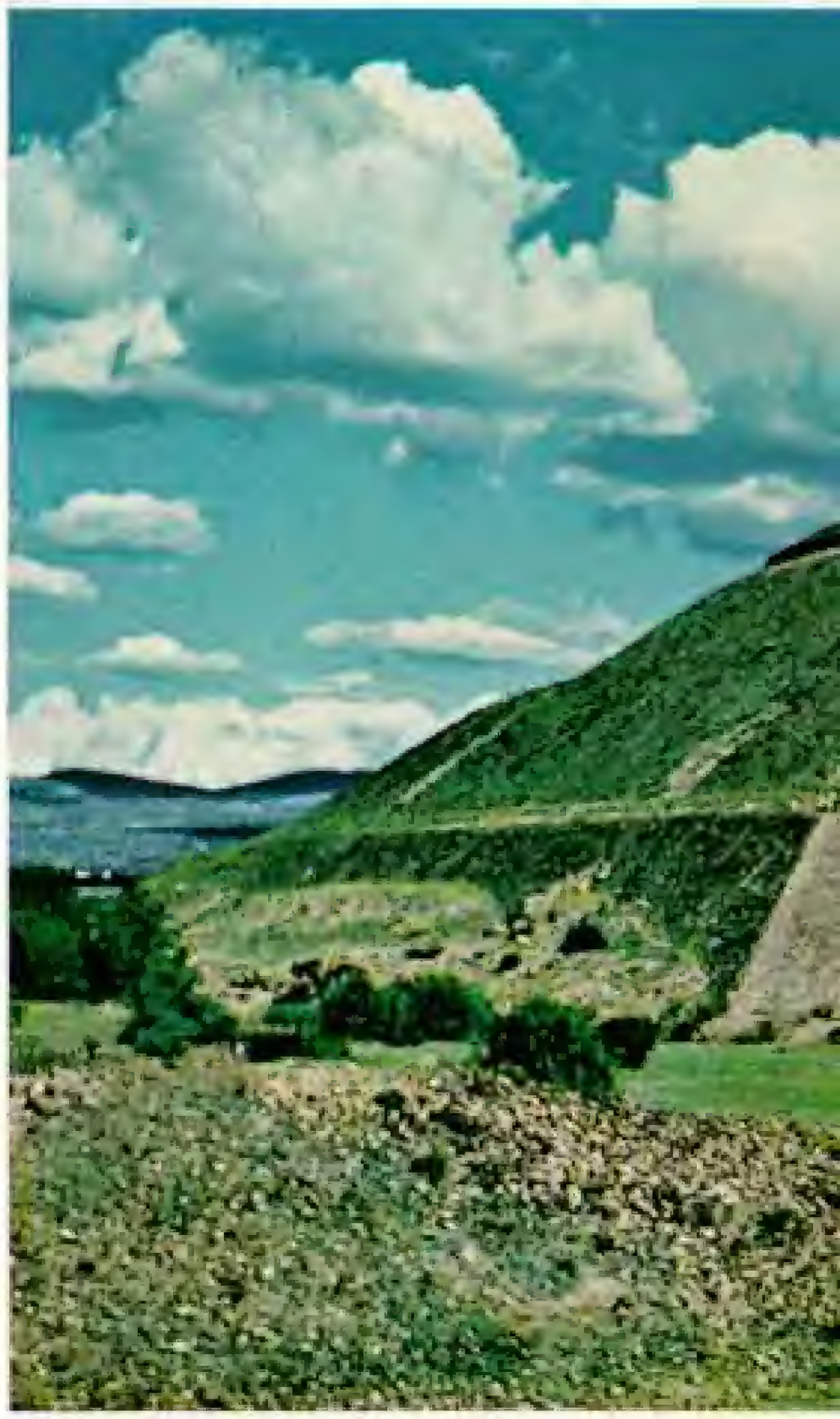
Zócalo, Mexico City's Historic Main Plaza, Awakes to Christmas in a Blaze of Light

Dome and bell towers of the Cathedral suggest a jeweled crown. Largest in Mexico, the four-century-old church houses a bell whose peal can be

heard six miles. Glowing symbol represents a *piñata*, an ornamental clay jar that blindfolded Mexican children break with sticks at Christmas time to gather its shower of gifts. Overhead street lamps lend a greenish glare. Candles of light bathe the face of the Hotel Majestic at left.



Setting up shop atop the Pyramid of the Sun, a couple awaits visitors who conquer the 222 steps. The vendors offer miniature clay heads dug up in the surrounding fields. Courtyard walls wear designs of bygone artists (below).



Rising as high as a 20-story skyscraper above the valley at Teotihuacán in Mexico State, the Pyramid of the Sun once dominated a now-vanished city. The colossal structure served as foundation for a temple. One archeologist has estimated that construction occupied 10,000 laborers for 20 years. In olden times priestly processions ascended the man-made mountain to pay homage to their supreme god, Quetzalcoatl.

NGS PHOTOGRAPH BY THOMAS R. SMITH, NATIONAL GEOGRAPHIC STAFF

lush enough, then you go to Tehuacán to bathe in mineral springs as bubbly as champagne. Volcanic Mexico is dotted with similar mountain spas where hot waters fizz.

In Tehuacán, well away from the baths, water is bottled for sale all over Mexico. And the traveler who lacks a naturalized stomach should learn to pronounce *agua Tehuacán*. Not every visitor gets digestive trouble, but in any land where there are extravagant flora and fauna, the microbes can be exotic.

The lush, subtropical resort towns of Orizaba and hilly Córdoba – famous for pineapple, cigars, and beer – lure their share of visitors. So does the many-churched Cholula. Here the early Spaniards found an Indian religious shrine; missionaries converted the Indian and his places of pagan worship, crowning each site with a church.

Of all the vacation spots in the region, Puebla, Mexico's fourth largest city, is the major temptation. At an altitude of 7,100 feet, Puebla reclines in a hammock-shaped valley under three great snow-capped mountains. Over the centuries, Puebla has loaned out its name as an adjective, a word that modifies some of Mexico's richest traditions: a costume (the full-skirted *china poblana*), a national dish (*mole poblano*, a saucy way to fix turkey); and a lavish architectural style (Puebla baroque, gold scrollwork resembling doodles by King Midas).

My guide, José Morfin, spoke riddles. "Now we are looking forward to an even richer past," he told me. But a tour explained

his point. Though workers have built new shops and 180 textile mills, they also are restoring the city's old theater and colonial arcades.

Next spring citizens will celebrate the 100th anniversary of May 5, 1862. It was then at Puebla that fewer than 4,000 Mexicans met 6,000 invading Frenchmen sent by Napoleon III to make Mexico his satellite. In a wild, hillside victory, the defenders temporarily stopped the invaders and made Cinco de Mayo (the Fifth of May) a street name in towns all across the republic. Next year's fiesta, complete with fairgrounds, should be the largest yet.

The drive from Puebla to the capital is relatively short. You slip through a pass near the very feet of Popocatépetl, as regal a peak as exists in North America. Popo with its snowy crown dominates the panorama.

"Center of Town" Proves Elusive

We passed gangs of workmen widening the highway to four lanes; the road sloped down into the Valley of Mexico. Then the capital spread into view: Mexico City, third largest metropolis in North America, after New York City and Chicago.

I wanted a room at the center of things. But the city has many centers. One is the Zócalo, the paved plaza faced by the National Palace and the huge Cathedral of Mexico

BEDSPREADS BY KIP ROSS, NATIONAL GEOGRAPHIC STAFF © N.G.S.

Barges Jam a Watery Highway in Xochimilco's "Floating" Gardens

Centuries ago a vast lake covered the valley where Mexico City now stands. To create land for crops, Aztec Indians topped wicker mats with soil and tethered the rafts together. Shrubs that grew on them gradually took root in the lake bed and anchored the gardens. Today passenger boats poled by gondoliers drift through a network of canals lined with beds of lilies, carnations, sweet peas, and tuberoses.

Dreamy-eyed *niña* with floral topknot surveys the gardens from her deck chair.

Rising sun sifts through Xochimilco's lacy trees and burns off the mists of night.

PHOTOGRAPHS BY DENIS SMITH

(page 498) Church and state, often far apart in Mexican history, come physically close at the Zócalo. But most hotels don't.

Centers, too, for most visitors, are the public markets. These vast new *mercados* with clean concrete floors offer a gabble of kiosk-keepers and customers. But no rooms.

The university is a special kind of center — a stewpot for student demonstrations and now a vivid inspiration for modern architects (opposite).

I settled at last on the Hotel Prince, because it is near the Alameda, the old mid-city park. Once, when the late Diego Rivera was commissioned to paint the history of Mexico in a single mural, he chose the Alameda as his setting. History has indeed promenaded through the Alameda. Before the Spaniard, this was the Aztec market place. Spanish inquisitors burned dissenters here. At the turn of the last century, when Porfirio Díaz was the lordly dictator, the Alameda was a meeting place of elegance. Today it is a cross section of Mexico.

Between daytime interviews, before breakfast, and late at night, I used the Alameda as a sitting room. It never disappointed me. Here no one is a stranger for very long.

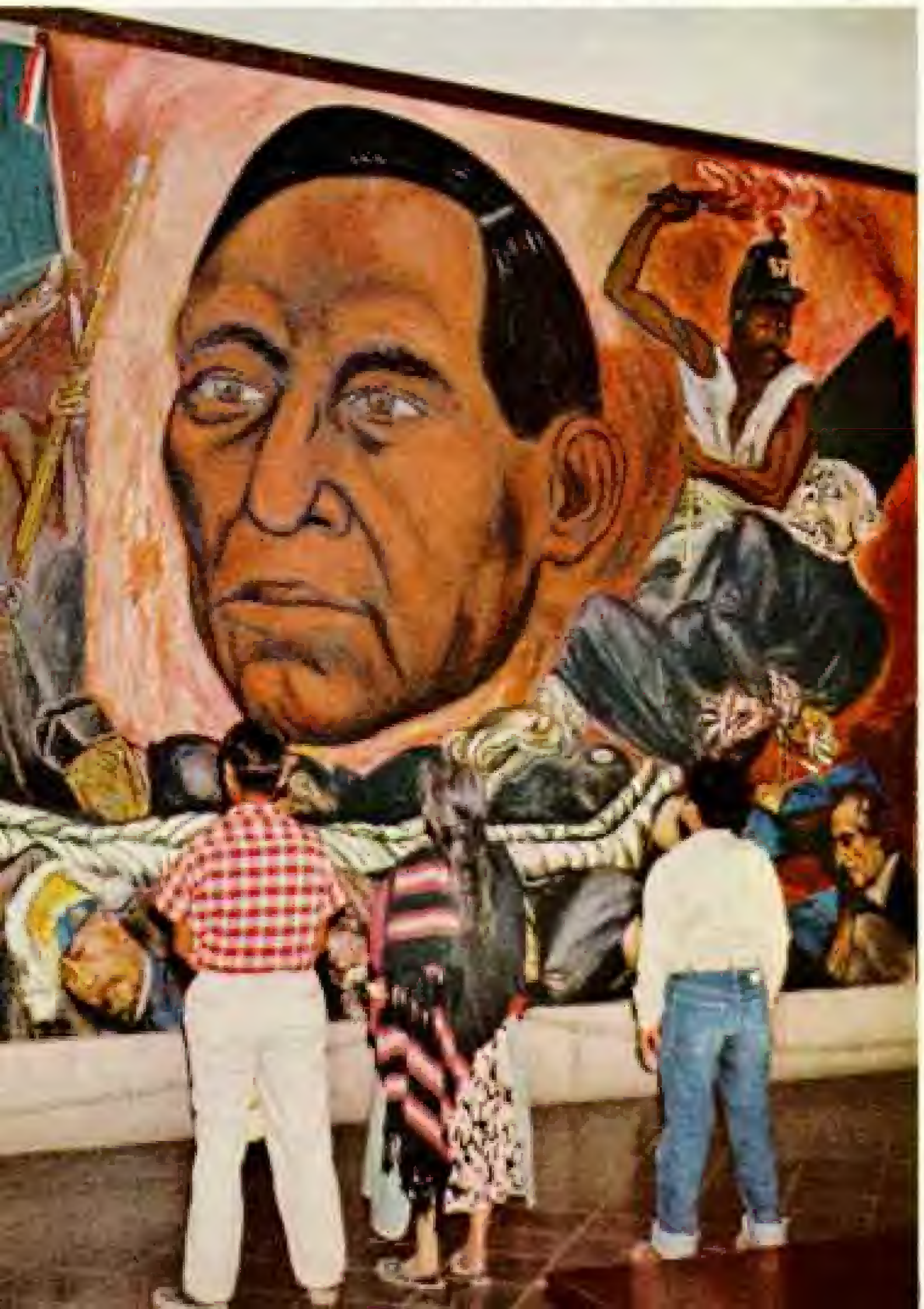
"I am a student, how do you do, and I need to practice the English," a young man announced to me one evening. He then recited the whole of Joyce Kilmer's "Trees" in a single breath, thanked me for my time, and went away.

Lovers are more reticent. They stroll through the Alameda hand in hand, stare soulfully into the fountain, and sometimes visit the park-side church, San Juan de Dios, to light a candle for San Antonio de Padua, the patron saint of the loveborn. Years later, the same couples may return for a family picnic, to loll possessively upon the grass.

Wise United States tourists know the right therapy for museum feet; in the Alameda they stroll less than they sit. And here a good eavesdropper can compile his own Baedeker. "Yes," says the winded man, gasping in the altitude, "the pyramid at Cholula is larger than the Great Pyramid of Egypt" (page 513). He pants a moment. "Those human sacrifices — when the Aztecs offered a heart to the sun god! By the time I climbed to the top, I figured I was next."

One morning President Adolfo López Mateos came to the Alameda to lay a wreath on a monument. Another day I listened to a band concert performed with splendid punctilio. At night I watched people form lines in front of the theaters across the Avenida Juárez. While they waited, organ-grinders and sellers

Revered Mexican patriot Benito Juárez, a Zapotec Indian who spearheaded social reforms more than a century ago, is honored here in Chapultepec Castle in Mexico City. Once the palace of Maximilian, the emperor executed by order of Juárez, the building is now a museum. José Clemente Orozco painted the portrait.



Wrap-around mural ten stories high blankets the almost windowless walls of the main library of the National University of Mexico. Juan O'Gorman's mosaic in natural stone dramatizes Mexico's history, culture, and aspirations.

Heroic figures in sculptured concrete portray Mexico at work. David Alfaro Siqueiros's creations adorn one of the 80-odd modern buildings that dot the parklike campus of the New World's oldest university. Enrollment stands at 50,000.

of hot chestnuts helped them pass the time.

I got to know the other regulars of the Alameda. When his business was slack, the old park photographer would wipe hypo off his hands and join me on a bench. And when a sharp-faced stranger offered me some "genuine stolen costume jewelry," the photographer set me straight.

"He is dishonest," warned my friend. "His jewels are not really stolen."

Humble Mexicans Enjoy a Royal View

On Sundays Mexico City celebrates. In addition to church and family dinners, there are bulls to cheer in the world's largest ring, open-air art exhibits, folk-dance fiestas at the Palace of Fine Arts, and family excursions to the zoo and museum in Chapultepec Park.

In the castle atop Chapultepec Hill every modern Mexican can enjoy a royal and heroic view. This was the summer home of Spanish viceroys in the 18th century; later it became Mexico's national military school. In 1847, its young cadets became *Los Niños Héroes*, the children-heroes, defending this hill with their lives against U. S. troops.

Then came the Emperor Maximilian and his glamorous, neurotic Empress Carlota. They turned Chapultepec Castle into a voluptuous Tuscan palace, and Carlota herself ordered a wide roadway carved into the center of the capital.

Eventually the royal couple took their separate, tragic roads, he to the town of Querétaro, northwest of Mexico City, and a firing squad, she to beg help in Europe before she went mad. Yet Carlota's view remains: from the terrace of her luxurious bedroom, humble Mexicans look down the Empress's roadway, now the great urban boulevard called Paseo de la Reforma.

Weekday, workaday Mexico City has developed enormously.* A metropolitan population of 3.3 million grows nearly 7 percent a year. Factories ring the northwest part of the city with smokestacks. Businessmen, who still prefer to go home for lunch, honk their way through four rush hours a day. Citizens perversely boast that "our smog is worse than in Los Angeles." It isn't, and when a shower has laundered the air and refreshed the year-round flowers, Mexico City remains one of the world's most beautiful spots.

"Our building design is better since the 1957 earthquake," explained my friend Héctor Hinojosa Zozaya, a young architect. He remembers the disaster well. At 2:44 one July morning, Héctor was awakened by the rumble of a strong quake. In the next few minutes whole apartment buildings collapsed; more than 50 people died.

Before evening, Héctor was planning to prevent similar disasters. Well-designed buildings had easily withstood the quake. For example, the National Lottery Building—which "floats" on a saucerlike foundation—had ridden through unscathed.

"We got copies of building codes used in Tokyo and other earthquake cities," Héctor told me. "We tightened qualifications for construction designers. We talked to men in the government."

In six months a new code was in force. Now, with the rubble cleared and better designers at work, new buildings are not only stronger but also handsomer.

Big office buildings, of course, need tenants. And a large and prosperous number of them make up the international community: Japanese cotton buyers, French automobile salesmen, German chemists. The Anglo-American telephone directory—a list of British and United States residents of Mexico City—alone lists 5,300 families.

Internationalism reaches some sort of peak at the Mauna Loa restaurant. There, cosmopolites order Polynesian foods in varied accents: Mexican waiters relay the word to Cantonese cooks via a full-time translator.

Education Dooms *Evangelistas*

Adding greatly to Mexico's new wealth is a capital asset often missed by economists: mass literacy. Few changes are as dramatic as this one.

In the capital I tried, for example, to find an *evangelista*, the black-suited public scribe who—for a fee—used to write letters for the illiterate. I could remember when they worked in almost every Mexican plaza.

"Try the plaza near the Church of Santo Domingo," a barber suggested. "Maybe a few evangelistas still work there."

In the plaza, near the site of the first print-

*See "Mexico's Booming Capital," by Mason Sutherland, NATIONAL GEOGRAPHIC, December, 1951.

Street and Balcony Serve as Stage When Guanajuato Enacts a Spanish Farce

Classical plays performed in the alleyways and plazas of this storied Mexican mining city bring 16th-century Spain to life. Residents make up cast and production crew. Playgoers watch from plank seats that block traffic at street's end.

ing press in the New World, stationers' stalls crowd arcades. Their wares mark life's big events: bright-colored birth announcements, cards for saints' days and fiestas, wedding invitations, and notepaper edged in black. Most of all, printers here turn out calling cards — universally used in Mexico as a kind of printed handshake.

On the sidewalk I introduced myself to Feliciano Félix Portillo, public secretary. "Evangelistas? No, none here for years," he said. "Colorful, weren't they? My business is mostly tax forms and English letters for exporters." And how often did he see a true illiterate? "I saw one two days ago—but it may be a month before I meet another."

The one man who has done the most to put evangelistas out of business is Dr. Jaime Torres Bodet, the nation's dynamic Secretary of Public Education. Dr. Torres Bodet has a firm, abrupt handshake and quick gestures. The pace has served him well as novelist, poet, diplomat, Director-General of UNESCO, and as the educator who launched Mexico's "each-one-teach-one" campaign in 1944. Now his Education Ministry spends 20 percent of the total national budget.

With enthusiasm, Dr. Torres Bodet told

ENTACHROME FROM HAMILTON WRIGHT © NATIONAL GEOGRAPHIC SOCIETY

Iztaccihuatl, the "Sleeping Woman," Overhangs Mexico's Central Plateau

Mountains divide Mexico into a checkerboard of valleys. Many people in these basins live in isolated communities, each with distinctive customs little changed for centuries. Some 60 miles southeast of Mexico City, east and west ranges merge into a jumble of peaks dominated by 17,343-foot Iztaccihuatl, pronounced ees-tak-see-watl, and neighboring Popocatépetl, the "Mountain That Smokes" (not shown).

Aztecs regarded the two volcanoes as lovers who always kept within sight of each other. Izta is extinct; Popo steams. Bananas, oranges, and mangoes grow at the foot of Izta, whose elongated, snow-mantled summit suggests a reclining woman.

history could be truly objective. The text surprised me. Texas rebels were described as "people with traditions different from our own." They "lacked close contact with the rest of the country . . . felt disunited from Mexico." The historian saved his sharp words for the Mexican President whom the Texans had opposed: "The government of Santa Anna was a despotic dictatorship." Objectivity, indeed.

During the next few days, NATIONAL GEOGRAPHIC photographer Kip Ross and I visited some of the 33 factories making prefabricated school buildings for rural areas. The government is installing 2,000 of these prefabs this year.

Each steel-frame building contains a large classroom and a five-room teachers' residence; yet it costs the Education Ministry less than $3,000. The price includes all furnishings—mahogany desks, bed linens, even a phonograph record of the national anthem. Details are practical. "Our teachers cook in pottery vessels; so to prevent breakage, we used a soft plastic faucet in the sink," the architect explained.

Windows interested me most. Schools need abundant light, but instead of glass—an invitation to pranks—architect Pedro Ramírez Vázquez uses plastic. To brighten them and to provide visual aids, artists put colored designs on each of the 32 windows: maps, planetariums, anatomy charts. I agreed with the current Director-General of UNESCO, Dr. Vittorino Veronese of Italy: "These windows provide simultaneously the light of nature and the light of knowledge."

Packed into trucks, a prefab school can be assembled by local villagers, who furnish labor and land (page 515).

me about his Eleven Year Plan, begun in 1959: "Just look at the problem! We need room for 7.2 million children by 1970." He described new normal schools for training teachers, correspondence and radio courses to improve the quality of instruction, and the 20,000,000 free textbooks the government is now distributing.

"Here," he said, "take a set of these books with you. Examine them. They are truly objective."

That night I did my homework with a fourth-grade history text. As a onetime pupil of Texas schools, I wondered how Mexican

Swinging like a pendulum, a clam bucket shifts sulphur from train to ship on the docks of Coatzacoalcos, Veracruz. Salt domes at near-by Jáltipan cap some of the world's richest deposits of the mineral. Super-heated steam piped into the earth melts the sulphur; compressed air blows it to the surface. Drying and crushing prepare the powder for export.

Mask and glasses protect a worker's nose, throat, and eyes from acrid sulphur dust.

Webbed with steel, the towers of an oil refinery pierce the sky at Minatitlán, Veracruz State. Petróleos Mexicanos, or Pemex, whose name appears on the tank truck, directs the nationalized oil industry.

Mexicans everywhere revere education. For example, villagers in the Territory of Quintana Roo wanted a school so desperately that they built one for themselves, complete with desks, then begged the surprised school authorities for a teacher.

And consider the experience of Dr. Agustín Arroyo-Damián, an eminent eye surgeon in the capital. A few years ago, he founded Mexico's first eye bank when a dying woman from the United States bequeathed her eyes for corneal transplants. One cornea went to a charity patient in Celaya, Guanajuato, a blind little Indian girl with the naïve name of Tránsito, a word meaning automobile traffic.

"The child was so grateful for the gift of sight that she wanted to reward the whole community," says Dr. Arroyo-Damián. "Tránsito learned to read, and then—even though she is painfully shy—she organized a little school near Celaya. Now still in her twenties, she teaches other Indian children to read."

Mexico is heir to two flamboyant cultures, Spanish and Indian. The nation revels in both. This mixed—*mestizo*—nature of Mexican life is aptly illustrated by two kinds of theater groups.

The first is found near the center of the republic in the city of Guanajuato. The Spaniards built colonial Guanajuato in a steep trough of a valley because the region had more silver ore than arable land. Old Spanish traditions survive, particularly the coffeehouse as a meeting place of the arts.

Amateurs Play to Standing Room Only

One day seven years ago, a coffeehouse group began discussing the golden age of Spanish drama and how it had originated in the very streets of towns. The citizens took a new look at their own Spanish town, at its closely squeezed homes and tiny plazas. Guanajuato, they decided, resembled the stage set for a Cervantes drama. So they turned Guanajuato into just that.

Tailors, engineers, doctors, students formed the cast and production crew. They mounted

Spanish steamship glides into historic Veracruz harbor, where Spanish galleons put Hernán Cortés and his army ashore in 1519. From the seaside promenade at left, sightseers board ferries for the fortress of San Juan de Ulúa across the bay, last stronghold of the Spaniards. Lighthouse atop Customs Building guides traffic in the port.

Swinging by their feet. Totonac rain dancers take 13 turns around a 90-foot pole. Fifth *voladór*, or flyer, beats a small drum and plays a flute atop the platform before the 1,400-year-old Tajín Temple near Papantla, Veracruz.

Puebla Youths Tap the Heart of a Maguey Plant for Its "Honey Water"

Fermentation of the sweetish liquid makes pulque, sacred drink of the Aztecs, who used it to communicate with their gods. For centuries the mild alcoholic beverage ranked as Mexico's national drink. In recent years beer has replaced pulque in popular favor.

At right, the ruins of Cholula, the world's largest man-made pyramid, appear as a tree-clad hill. Today the Church of Our Lady of the Remedies caps the mound.

spotlights atop the roofs around Plazuela de San Roque, brought in seats for 200 people, and rehearsed roles in the stylized Cervantes dramas (page 507). During the first season, thousands came to the Open Air Theater, and each year the numbers have increased.

"Yes, we have re-created the 16th-century situation," one of the actors, Federal Judge Armando Olivares Carrillo, told me over coffee. "If the drama calls for a lamplighter, we use the plaza's real lamps. We play love scenes on the balconies of private homes. During one performance, I recall, there was sickness in a neighboring house. Before the doctor made his professional call, we insisted that he put on a period costume.

"Amateur actors save us money—the annual budget is only $2,000 for costumes and such. We also rent burros and horses; only human actors come free.

"But the results! Every Guanajuato grade-school child knows his classic theater. And now the idea is spreading to other cities. Our scrapbook has clippings from all over the world!"

Those who think that modern Mexico has ripped up its Spanish roots should try to get a hotel room in Guanajuato during the theater season.

Mexico's Indians Speak Many Tongues

A completely different kind of theater appeals to the Indians. It began a few years ago when puppet masters from Mexico City produced a play for the National Indian Institute. Anthropologists took note of the audience reaction. Why, they wondered, couldn't puppets be used as a tool to teach the Indians to live a better life?

The idea was ambitious. But so is the Na-

Musicians entertain a crowd, including a pint-sized boy, as citizens of Santa Bárbara, near Texmelucan in Tlaxcala, erect a school, one of 2,000 going up in Mexico this year. Volunteer builders give their time after chores in the fields.

While the school takes shape, teacher reads to his class despite the clatter of hammers and timbers.

tional Indian Institute. For years this agency has worked with a problem embracing one-fifth of the Mexican population—and some 50 to 100 languages. The institute chose to try out this puppet idea in the State of Chiapas.

Chiapas is the southernmost state of Mexico. Its choppy mountains are green and steep, a delight for coffee raisers and a despair for highway engineers.

Each valley neatly seals off its own special Indian culture. Chamula Indian men wear white sombreros and fringed tunics, Huitecos wear a kind of knee-length diaper resembling Gandhi's, Zinacantecos dress in flat hats rakishly decked with red ribbons, pinkish tunics above brown bare legs, and high-backed sandals (pages 520-21)

Spend ten minutes in the market place of San Cristóbal de Las Casas, where these and other tribes come to barter, and you can grasp the size of the problem: A tremendous number of Chiapas folk speak various Indian tongues, and little or no Spanish.

Road Show Dramatizes the Good Life

Soon a puppet master from the Institute of Fine Arts and anthropologists from the National Indian Institute were making puppet clothes in the colorful Chiapas styles. Four Mexicans, bilingual in Spanish and the local Tzotzil language, learned how to handle the little dolls. Simple dramas were worked out with characters bearing names like "Señor DDT," "Flea," and "Soap." Always the hero

favored cleanliness, schools, and the good life.

A strange road show opened on November 10, 1954, in the village of Belisario Domínguez. The audience cheered the hero, jeered the villains. Seven years later Puppet Theater's three companies still play to crowds with standing room only (pages 518-19).

Has it worked? "Just a few years ago," one anthropologist told me, "a school was built in an Indian village and mysteriously burned. Now we never build a school until the people really want it. The puppets encourage them to want it."

In a dusty institute Jeep, I accompanied anthropologist Armando Aguirre on his rounds, dropping in on several Chiapas villages to look at the results of puppet shows and their follow-up. We saw new schools, cooperative stores, clinics, and community bathhouses. Thus the Indian Institute works to bring citizens into the mainstream of Mexico.

The Mexican mainstream has a swift current, as I learned in the booming southeast. On the map (see the supplement Atlas Map), the nation's curving coast along the Gulf of Mexico looks like the Texas coast. Geologists and investors are finding other parallels.

Oil has long been the industrial staple on the coastal plain; now offshore deposits are being exploited. New pipelines carry natural gas to Mexico's industrial heart. Yellow mountains of sulphur are scoured from the earth for export around the world (page 510).

Classic face of Yucatán comes to life in a girl whose delicate chin and full lips reflect Maya heritage.

Pig-tailed maiden wears the embroidered blouse popular in Chiapas. She carries a painted bowl made from a gourd, brimming with pinks and calla lilies.

Oil, of course, is inflammable—especially in diplomacy. When the Government of Mexico nationalized the foreign oil holdings in 1938, world politics grew hot. But patient men prevailed. Unlike other restless lands, Mexico paid for all the oil properties—mostly U.S. and British. Then Mexicans began to run their government-owned monopoly, Petróleos Mexicanos, or Pemex—a big business stretching from oil exploration to the filling station.

"How long since you lived in Mexico?" asked Pemex economist Antonio Vargas MacDonald. "Thirty years? You'll find plenty of changes. Our business has tripled since the oil fields were taken over. Our annual gross is close to the size of the national budget!"

Trained personnel? "Not a foreigner on our payroll. Our engineers are good—and *young*. Their average age is 35," he added.

Two members of Mexico's new industrial generation met my plane at the refinery town of Minatitlán, Veracruz: Ramiro Hernández and Guillermo de la Mora are both Pemex engineer-executives.

"We'll start with Coatzacoalcos," said Guillermo as we climbed into his car. "It's our port." It is also a raw boom town. We drove by an untidy riverside market and past the railroad station; a train was waiting to cross North America—slimmed here at the Isthmus of Tehuantepec to only 135 miles.

For a glimpse of the future, I went to the windy, skyscraping top of the Minatitlán refinery (page 510). On the flat horizon, tankers approached on the Coatzacoalcos River, bound for the fresh-water docks below us. Multicolored storage tanks brightened the panorama.

"What's the color code?" I asked Ramiro.

"Code?" he asked. "No code. They just look prettier that way."

The hillside below us was a jumble of pits, beams, and construction shacks. "There," said Ramiro, "is our future: petrochemicals."

The new factory will make ingredients for plastics, synthetic rubber, detergents, fertilizers, and a multitude of other products.

Next day we flew east in a Pemex-owned Beechcraft. The day was clear and a swampy landscape oozed as far as the mountains on our right and the Gulf on our left. Over the sound of the engine, my escorts shouted a commentary.

"State of Veracruz," yelled Ramiro. "It ends here."

He pointed down to the imaginary line that separates the sprawling Gulf coast state from its compact eastern neighbor, Tabasco. Now we were flying over a country both wet

and hot: in order to divert a deluge of some 100 inches a year, the roofs were as sharp as church steeples. Drainage canals crosshatched the flat lands, separating the pastures of zebu cattle from prim plots of banana.

"Cacao," yelled Ramiro, again pointing. I looked down at a bushy but disciplined grove of cacao trees carefully planted in rows. This combed forest was a reminder that Indians here gathered cacao beans and drank chocolate long before the Spaniards came. It's still an important cash crop.

Flying back over coastal swamps, the engineers pointed out a new and narrow ribbon of road—"next to our own work, the most important project down here. Before that road was built, farmers sold milk locally for three cents a quart. Now they ship it away for twelve cents."

New Highway Opens Yucatán

A few days later I followed parts of this new Gulf Circuit Highway, a road that rims the Gulf of Mexico from Veracruz all the way to Yucatán and opens a fascinating new area to the tourist.

My road threaded through Villahermosa, cow-town capital of Tabasco, past the lagoon-side town of Ciudad del Carmen, then north to the port of Campeche. Until lately, Campeche could be reached only by boat; it is still almost unknown to the tourist—but not for long. As romantic as any town in the republic, Campeche is a clean, bleached antique with a whiff of salty swashbuckle.

To cut down pirate raids in the 1600's, Spaniards ringed the port with a fortified

Harps and guitars serenade a carnival crowd in Bohom near Tuxtla Gutiérrez, Chiapas. Chamula tribesmen wear fringed wool tunics over white cotton pantaloons. Marchers with flags sport monkey fur hats; costumes copy 16th-century Spanish military uniforms. Fire-walking rites climax the five-day February fiesta in this valley, whose thatched huts lend a South Pacific look.

Finger puppets dramatize health habits for Chiapas Indians. Here a clay doll symbolizing water preaches cleanliness to an Indian puppet. Farmers at Bohom grin approval. Since these Indians understand little Spanish, puppeteers use Maya (page 514).

PHOTOGRAPHED BY AIR FORCE, NATIONAL GEOGRAPHIC STAFF © N. G. S.

wall. The road and a new hotel help modern visitors breach these ramparts.

Half a day's drive from Campeche lies Mérida, capital of Yucatán. This is Maya country, wealthy in lore and ruins.* Its one cash crop is blond sisal—or henequen—fiber used in making rope.

Politically, Yucatán is a state; but spiritually, it is quite independent. Several times Yucatecans have tried to secede from Mexico.

"I am still a separatist!" roared a young man named Miguel, almost meaning what he said. "This new highway brings us too many *huaches*." *Huach* is the local word for Mexican!

East of Mérida a good paved road now reaches all the way to Mexico's Caribbean coast. This trip, by second-class bus, offers reasonably high adventure, for the bus is filled with armed hunters market-bound to sell slabs of venison. Once I counted 14 rifles; only two were pointed at me.

But the ride was well worth a game of Yucatán roulette. The route slices through high bush—not lush jungle, but a tangle of dry trunk and branch. Jaguars sleep in the trees by day.

Abruptly, the road ends in sand and the bus collides with a seascape of blue Caribbean. This is the Territory of Quintana Roo, Mexico's easternmost possession. Off the mainland lie two of the country's newest vacation attractions, the little Isla Mujeres, or Isle of Women, and the larger Isla de Cozumel to the south.

The Isle of Women got its name from the first Spanish explorers, who heard tales here of Maya temples decorated with idols of women. It is a quiet place, cadenced by tides and surrounded by crystalline waters. You can easily rent a launch, an Aqua-Lung, or a snorkel; the submerged scenery here is a shimmering dream of coral and fish.

Quiet Island Invites Discovery

You can now reach Cozumel by plane from Mérida in just under an hour; as a result, more travelers are discovering it every year.

The island has always invited discovery. Cortés stopped here en route to his conquest—and found two shipwrecked Spaniards there ahead of him. Only a dozen years ago hardy international travelers began to talk about white, palm-shaded beaches and the low prices.

Now—a few hotels and many plane fares later—some of those discoverers complain about the progress. And there's no doubt about it: Living standards are higher for both the visitor and his host.

Yet the dazzlingly white San Francisco Beach remains nearly vacant. Divers still spear their own fish for a lunch broiled on the shore; lazier folk with snorkels can watch their guide pull rock lobsters from the depths.

On Cozumel I was surrounded by honeymooners, among them the newly wedded Robert E. Kramers, of Bartlesville, Oklahoma. Bob is an architect, and every time I saw him he was muttering about the Maya ruins of Tulum on the mainland 38 miles away.

Finally his blonde bride, Margaret Louise, suggested hiring a 24-foot launch. Then she invited several of us to come along and share the cost.

We left Cozumel at midnight and by 6 a.m. pulled up at the dock of a coconut plantation. There we got a Jeep to drive through palm groves and tangled bush to one of the few fortress-cities the Maya left for modern man.

Tulum stands on sheer rock cliffs above ocean spume. Its towering stone temples, largely cleared, seem to grow naturally from the lonely escarpment. Except for a new gov-

*An account of recent archeological work at a great Maya site, Chichén Itzá, begins on page 540.

Bare-legged Zinacanteco Indian weaves a straw hat at a market in San Cristóbal de Las Casas, Chiapas. His thick-soled sandals have heel protectors reaching well above the ankles.

PHOTOGRAPHED BY JOE ROSE, NATIONAL GEOGRAPHIC STAFF © N.G.S.

KODACHROME BY VIRGIL LOVE © NATIONAL GEOGRAPHIC SOCIETY

Hawk-nosed like their Maya ancestors, Zinacantecos wear shallow, saucerlike hats with fluttering ribbons. Short trousers, pink-striped wool serapes, and scarves tipped with red tassels complete their dress. Zinacantecos are taller than most Indians of Chiapas.

Dwarf wheat grown at an experimental station near Ciudad Obregón, Sonora, withstands irrigation waters, which cause taller species to topple. A recent field day attracted the farmers above, who watched intently as agronomists demonstrated new crops and techniques.

Future farmer of Sonora stands smile-high in rippling grain at the agricultural station.

Sonora's desert blooms. Irrigation canals stitch a patchwork quilt of wheat fields

ernment caretaker busily thatching a house to live in, we had the ghostly city to ourselves all morning.

As we left for a sun-baked voyage back to the island, Bob and Margaret Louise were deep in a conversation about Maya architecture. The bride, already a skilled husbandkeeper, listened with deep attention.

From the green and blue island of Cozumel, I moved inland to the Bajio, the fertile mountain-ringed range lands and fields of central Mexico. This region is called "the center of Mexicanity," for the Bajio has cradled many of the nation's historic events. In the little Bajio town of Dolores Hidalgo, Father Hidalgo rang his church bell in 1810, summoning peasants to revolt against the Spanish rule.

Within a year the priest's head was hanging upon a spike 37 miles away in the town

Sunset Turns Lake Pátzcuaro to Gold; Tarascan Indians Fish With Butterfly Nets

In the fashion of their ancestors, boatmen seine for small white fish, but as frequently dredge up *axoloti*, a form of salamander. To supplement the

lake's dwindling supply of fish, United Nations technicians train the Indians to raise chickens. Crowning the island of Janitzio, a hollow concrete statue of José Morelos, a martyr in the cause of independence, thrusts an arm into the sky. Murals line the giant's interior.

of Guanajuato—but the cause continued. On a hill near the Bajío town of Querétaro, independence was reaffirmed in 1867 when the Lincolnesque Indian Benito Juárez sent Maximilian to the firing squad. And years later, in the same town, delegates wrote that most nationalistic of documents, the Constitution of 1917.

Today the Bajío revolution is in agriculture. A fertile land of capricious rain, it offers a harsh challenge to the farmer. Here, as elsewhere in Mexico, he races against a population increase of more than 3 percent a year.

In the fall of 1958, unusually heavy rains fell on this parched earth. The Lerma River swelled, broke its banks, and a flood began.

In the warehouse of the agricultural experiment station at La Cal Grande, worried men studied the muddy currents, then began to move sacks of seed to higher shelves. Ironically, some of the seed represented new drought-resistant varieties of corn, developed during five years of study.

More than four feet of water soon engulfed the test fields. Two station employees were drowned. But the seeds were saved; on the spot, agronomists built a raft and floated their seed corn to safety. Today, those new varieties of corn are growing in Bajío fields.

Hybrids Increase Corn Yield

Corn has a long history in these parts. When excavators dug the foundation for Mexico City's 44-story Latin American Tower, they uncovered the fossilized pollen of wild corn 80,000 years old. Many an archaic variety is still grown by farmers in Mexico—but even old native types are suddenly yielding more grain.

"Since hybrids were introduced here," one corn specialist told me, "wind has blown pollen onto native fields, gradually improving

Eating a roasted mackerel like an ear of corn, a boy from Puerto Vallarta smiles, "*Bueno.*"

Like Lollipops Stuck in the Sand, Skewered Fish Bake Over Coals

Fresh from the sea, the mackerel sell for 2 pesos, or 10 cents, at Puerto Vallarta, Jalisco, on the mountain-girt Pacific coast.

Virtually unknown to vacationers a decade ago, the village promises to become one of Mexico's most popular resorts. Pelicans patrol the palm-fringed beach; jaguar and deer lure hunters to wooded hills; offshore waters teem with game fish.

"Houses and hotels are popping up everywhere," reports photographer Ross. "Land values have risen enormously in the last few years."

local varieties. In the State of Jalisco, for example, native Indian corn yields about 20 percent more than it did in 1944."

Cornfields cover most of the arable land of Mexico and provide the basic food for two-thirds of the population. Now new varieties, plus fertilizer, have suddenly made the country self-sufficient in corn production, except in years of severe drought.

Near Ciudad Obregón, in Sonora, Mexico is raising another kind of crop—a bumper harvest of young agronomists (page 523). In the wheat field of an experiment station, I phrased some Spanish questions for several young Mexicans. Then one sunburned chap stopped me cold.

"Sorry," he said in English. "I don't understand. I come from Afghanistan."

He and dozens of other specialists from all over the world had been sent here by the United Nations Food and Agricultural Organization to learn new farming techniques.

Mexican scientists are also speeding up wheat research for their northern neighbors. Each fall, experimental seed harvested in the United States and Canada is flown to the station near Ciudad Obregón. There a new crop is raised and harvested in time for spring planting in the north again. Thus a dozen years' work can be done in six.

International cooperation marks another food project in the State of Michoacán. There, beside Lake Pátzcuaro (page 524), a United Nations group called CREFAL trains teachers, farm experts, and public health workers in community development. Tarascan Indian villages provide the laboratory.

Pátzcuaro fishermen's butterfly nets are older than the conquest, but recently the fish population has declined. To help the Tarascans find new sources of income, CREFAL workers in 1956 got a small bank

credit. Then they persuaded 30 Tarascan families to borrow money and raise chickens. Experts showed the Indians how to build concrete-floored henhouses and how to mix feed for white Leghorns.

While husbands fished, wives tended the chicks. As they earned money from eggs, women ceased to occupy an inferior place in the family. They began to demand houses "as good as those the chickens have." Every family showed a profit; they paid off their first loan, then borrowed more to expand their businesses. Now some are adding bee culture to their projects. Villagers in lakeside Tzintzuntzan, long famous for their pottery, now make earthen jars for the honey.

Sooner or later, any discussion of Mexican food production turns to "the Revolution." Early in this century—seven years before the Russian Revolution, as Mexicans proudly tell you—peasants carved up the old estates into small plots and even communal farms. Now, after two generations of political stability, most Mexicans talk less of dividing land than of multiplying it. Some 5 million acres of desert are now watered by great new dams, particularly in the northwest. More and bigger projects are a-building.

(Continued on page 532)

Flaming poinsettias the size of sunflowers entice a shopper in the Friday market at Toluca, in Mexico State. Indians from the Lerma River valley trek into the city each Friday to sell produce, livestock, and handicrafts.

Flower of Christmas, the poinsettia is named for Joel Poinsett, first U. S. Minister to Mexico (1825-29).

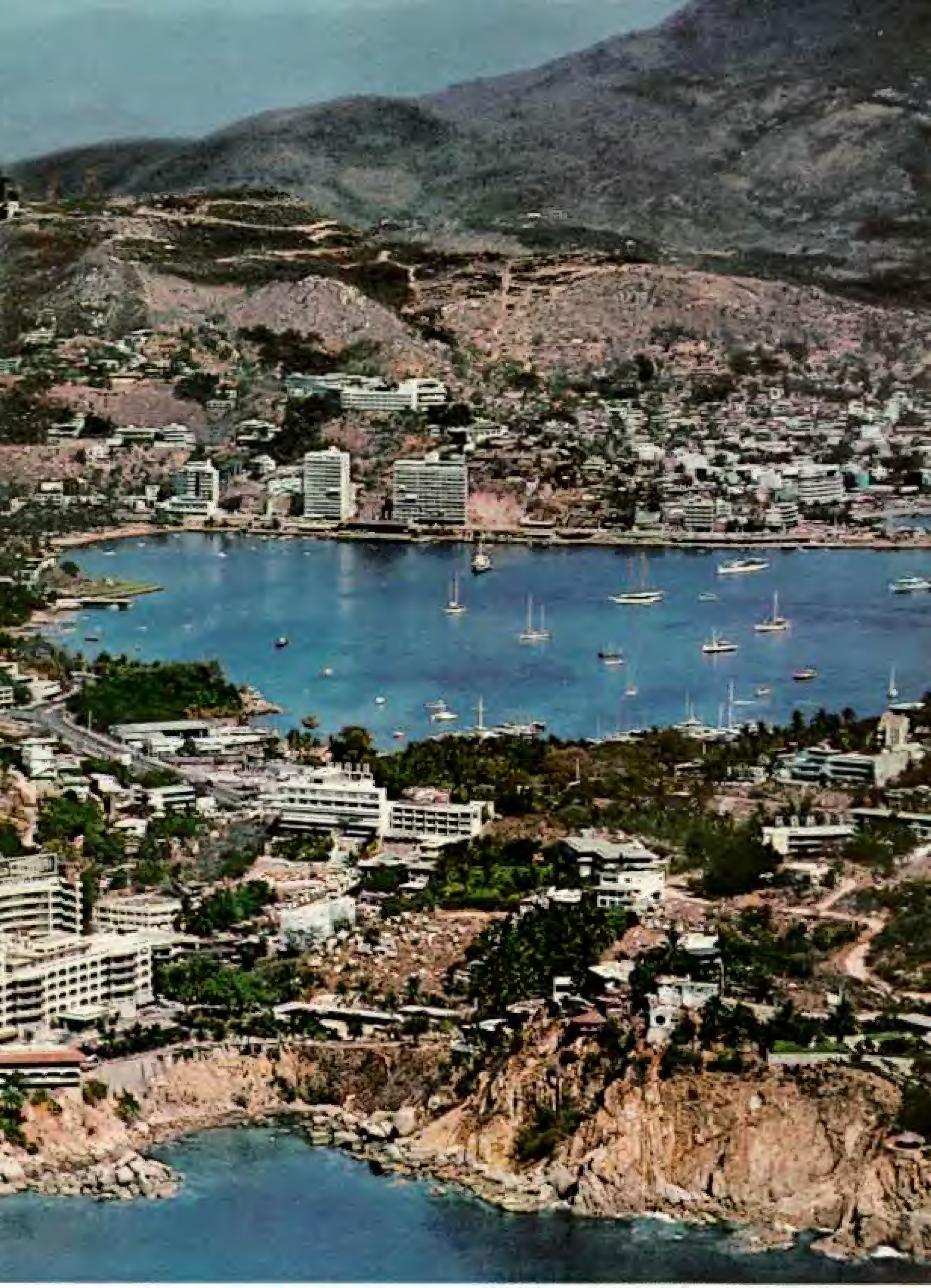
Gleaming jewelry and household objects shaped like fishes, flowers, and butterflies dazzle customers in Los Castillos, one of the 300-odd silver shops in Taxco, Guerrero.

William Spratling, an American living in Taxco, revived Mexico's almost-forgotten silver craft in the 1920's.

PHOTOGRAPHS BY MICHAEL NICHOLS © NATIONAL GEOGRAPHIC SOCIETY

Glowing in the sun, towers of the Church of Santa Prisca and San Sebastian rise above Taxco's red-tiled roofs and cobbled streets. Mexico has proclaimed the town a national monument; no venerable building may be razed, no modern structure erected.

Muscled with mountains, Acapulco crooks a protective arm around a yacht-studded bay.



Beaches glitter white. Balconied hotels overlook a glamorous, expensive setting

Sapphire pools adjoin private bungalows at Las Brisas Hilton, high above Acapulco Bay. Distant headland and Isla La Roqueta shield the placid cove from the restless Pacific.

Sails dot the waters between an Acapulco yacht club and the mainland. Teen-age boaters head out to join the fleet. At pier's end a skipper strikes his canvas.

Even so, at least a million Mexicans still wait for the day when they may own land. Some of them are becoming homesteaders under a new land colonization plan. Accompanied by the Director-General of the project, Francisco López Serrano, Kip Ross and I visited a homestead colony near Tampico.

"This land has never before been farmed," explained our host. "It's part of our national domain."

López Serrano knew most of the people by name. Among them was Ricardo Moreno, whose home we visited: a simple thatched house with two rooms, a porch, and outdoor privy. The whole place cost only $80.

"But it's decent, it's an improvement," said López Serrano. "Look at their garden. They treat their house like a sweetheart!"

In 10 years—or even less, if crops are good—Señor Moreno will have paid for his home and 60 acres of farmland. This year, 6,000 families will become landowners through this same project.

Acapulco Defies "Destruction"

With all the nation's new industries, both public and private, the No. 1 source of United States dollars remains that most pleasurable business to sample: tourism. Naturally, I made some careful firsthand studies of tourism on Caleta Beach in Acapulco.

Basting my shoulders with suntan lotion, I pondered such facts as these: Mexico now ranks beside Canada as the favorite foreign country for U. S. vacationers. . . Roughly 600,000 U. S. tourists visit the land each

Fundamentals of the Book, National Geographic Staff © N.G.S.

Water sprite on Acapulco's Caleta Beach captures the sea in a pail.

Fiberglas launch speeds a passenger ashore at La Concha, where guests dine and sun beside a tidewater pool.

year . . . Mexico tourism more than doubled during the 1950's.

"We've tried to ruin Acapulco," said a Mexican airline pilot basking on a reed mat next to mine, "but we've failed. How could anyone ruin such natural beauty?"

Beyond a Bikini-clad distraction, cliffs dived into warm blue waters—one of the world's most magnificent watering places (page 530). As many as 80,000 visitors happily flock to Acapulco's hotels and beaches on a single weekend.

"Of course, these Acapulco beaches aren't Mexican," said the pilot. "I can prove it." He promptly shouted a paragraph of rich, raw Spanish oaths. I winced.

But no one else did. The only comment came from a gentle, gray-haired lady with a Midwestern accent:

"My! He's certainly having fun."

Other Pacific ports now vie with Acapulco for tourist dollars: Manzanillo, Mazatlán, Guaymas. Quiet Puerto Vallarta now owns a supermarket. And the mountain tourist towns continue in popularity.

"What's your favorite place in Mexico?" an Iowan once asked me. I could not answer him. The truth is, I have too many favorite places. I like the Lake Pátzcuaro area where a steep, peaked island leaps out of the water like a trout. But I'm also partial to the brown northern hills, a landscape as wrinkled as an old Indian. The mountains near Puebla awe me; so do the shadow-striped deserts at sundown. For fishing, there's the whole Pacific coast; for diving, Cozumel. I like the bargains of Oaxacan markets and the ribbon-decked costumes around San Cristóbal de Las Casas. I've already told about Mexico City.

Favorite places every one—but *the* favorite? Once I overheard an argument between two veteran travelers of Mexico. One was a partisan of San Miguel de Allende, Guanajuato; the other favored Taxco, Guerrero.

The argument started gently enough. The San Miguel man made a good – even a lyric –

Steaming Rice, Beans, Fish, Spaghetti, and Tortillas Tempt Merchants in the New Guadalajara Market

Capital of Jalisco and Mexico's second largest city, Guadalajara enjoys a balmy climate the year round. Roses, cannas, gardenias, and flowering trees brighten its parks and avenues. Residents spend much of their time out of doors.

Double-decked shopping center, the modern Mercado Libertad (left, above), replaces an old open-air market in midtown Guadalajara.

Hatmaker weaves designs in gold and silver thread on black felt sombreros. His creations sell in the mercado for $40 and up.

case. He praised the climate, the light, dry air of the central plateau, and sunshine so clear that it leaves indigo shadows. ("Why else did the Indians become sun worshipers?") He boasted about the artists' colony and the candy-pink church of San Miguel.

But the Taxco supporter met him point for romantic point. "The oldest mining town in North America," he called it, and nobody can prove otherwise. He glamorized the silver wealth of the miner who left the town the lavish little Santa Prisca and San Sebastian Church (page 529). He praised the view from the hillside hotels, and the silver craftsmen who fill Taxco shops with glittering bargains.

Then the argument got hot and reckless. "It's too crowded," said one. "It's self-conscious," said the other. Both men were missing the point. Beautiful spots grow crowded because great beauty attracts people.

But if you should think the charm self-conscious, then visit any place in Mexico during Holy Week and watch the faithful make their painful penance. Some women wear masks, some mortify the flesh with shirts of hair. In the face of such fervor, a visitor's camera might as well be clicking in another world. The rich and unaffected variety of Mexico is as real as the Mexican people.

El Soldado Makes His Farewell

Whatever his destination, the traveler usually takes in a bullfight, a national sport as important in Mexico as baseball games in the U.S. In Guadalajara, the nation's second largest city, I saw garish posters announcing an all-star *corrida*: the last appearance of a famous but old matador called El Soldado.

A sentimental crowd cheered the old veteran before his first bull. But El Soldado—his body thickened by long success—was eager to survive his final fight. His capework was now skittish, his feet nervous; he finished the bull with clumsy impatience.

The next bull belonged to an angular young matador named Capetillo. Stylish, and utterly without fear, he won the crowd's ovations.

El Soldado returned for his second and last bull. His reactions were slower than before. As the old man left the ring, the crowd jeered openly. Then, suddenly, the fans fell silent; everyone realized that El Soldado's career was ended. They began to applaud, then rose to cheer El Soldado's past bravery.

Young Capetillo dramatically dedicated his next bull to the retired matador. To cheers, he led the animal through close and dangerous movements—and then it happened. The bull's right horn ripped into the young bullfighter's thigh. The crowd gasped, and Capetillo was carried off to the surgeon. Who would finish this dangerous bull?

El Soldado marched out to face an animal already dedicated to himself. A novelist might finish the story with a return of youthful bravado or even glorious death. Truth wrote a different tale. El Soldado—still thick in the middle and nervous of foot—again finished his bull impatiently. But the ending was not unhappy. Withal, he had survived to retire.

Modern Mexico: Changed and Changeless

Preparing to leave the country, I wanted to take one final subjective measure of Mexican progress: to visit the Rancho Teniente, near the Rio Grande, where my family raised cattle when I was a boy. So I left the border town of Ciudad Acuña for my first visit since 1934.

I followed the road out of town over the rolling, brushy pastureland, past fields of wild verbena and the Spanish dagger's waxen shakos. When we entered the ranch gate, I saw a dead coyote hanging on the barbed wire as a warning to his kind. Folkways had not changed. Then the car pulled up to a vaguely familiar cluster of houses and an old windmill. To the ranch foreman, Luis Vela, I explained my visit. "A boy here?" he said. "Please consider it still your home."

The main house had been enlarged. I pointed out the room where my mother had sometimes written letters for our workmen: Out of perhaps 50 cowboys and goatherds, only one had been literate.

"How many people on the Teniente can read now?" I asked.

Luis Vela smiled. "We have only one person who is unlettered—a baby of three months."

White Leghorns now lived in a handsome brick chicken house; the old swimming hole—our duck pond—had gone completely dry. "Still no electricity?" I asked.

"Not yet," said Luis Vela. "But when Amistad Dam is complete. . . ." Amistad, or Friendship, Dam was launched jointly last year by Presidents Eisenhower and López Mateos. Waters from the Rio Grande and Devil's River will generate power for both sides of the border.

"Yes," Luis Vela was saying, "Amistad Dam will make a 20-mile lake." A duck pond is lost, a big lake is gained.

That one unlettered baby on the Rancho Teniente will enjoy quite a swimming hole in his changing land.

PAINTING BY JOHN MATTESON © NATIONAL GEOGRAPHIC SOCIETY

Battle of the corral pits six *vaqueros* against an unbroken horse. Action takes place on the San Miguel Ranch near Ciudad Acuña, across the Rio Grande from Del Rio, Texas.

Ranch Hands Gentle a Lassoed Colt

Soon a cowboy will spread a blanket across the horse's back and, later, a saddle. Then he will mount a hurricane of flying hoofs.

Among the most skillful of cowboys, the Mexican vaquero taught his counterpart north of the border many tricks of his trade. The United States rancher appropriated some of his vocabulary as well; corral, bronco, lasso, rodeo, coyote, desperado, and calaboose are a few of the words that crossed the border

New Atlas Map Focuses on Fast-growing Mexico and Central America

EACH MORNING near Minatitlán, a Mexican boom town, overalled Indians bid their bare-breasted wives *maj nioj* —goodbye in their ancient Aztec tongue— and set off to build one of the world's most modern chemical plants.

This is Mexico's double life, a bizarre blend of the past and future typical of Latin America today.

Keeping pace with this fast-changing scene, the National Geographic Society's latest Atlas Map, **Mexico and Central America,** brings with this issue a timely portrait of seven Latin American republics—Mexico, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, and Panama.*

Giant of the seven, Mexico matches in population many countries of greater area. Mexico's 35,000,000 outnumber Canadians almost two to one. Since the Society published its last map of Mexico and Central America in 1953, Mexico has increased its population by 7½ million, built thousands of miles of highways and rail lines, and added 12 major airports.

Paradox follows the rush for modernization. Mexico's brand-new Chihuahua-to-the-Pacific railroad passes within a hundred feet of the rim of Barranca de Cobre, a bleak canyon whose only contacts with the world for centuries have been narrow trails and rivers to the sea. Here live Indians so primitive that they still catch game by running it down on foot and strangling it.

Progress on the Inter-American Highway moves that future lifeline of the Americas toward completion. The red line on the map that traces the 3,159-mile highway south from Nuevo Laredo to Panama City shows only one remaining gap—a 153-mile stretch in Costa Rica.

Motorists following the new highway south from Mexico City will travel through the lands of yesterday's great Maya civilization. A detour to the Yucatán Peninsula leads to Chichén Itzá, famed ruined city of the Maya, where an expedition supported by the Society and the Mexican Government recently explored a treasure-laden *cenote* (next page).

Change reshapes old boundaries elsewhere. In November, 1960, the International Court of Justice reaffirmed an award made by the King of Spain in 1906, by which Honduras received an area the size of New Jersey north of the Rio Coco—an area long disputed by Nicaragua. The controversy had been so bitter that even NATIONAL GEOGRAPHIC maps showing both claims impartially were banned by one of the countries involved. The northern border of Nicaragua now begins at Cabo Gracias a Dios—"Cape Thanks Be to God" —named by Columbus in 1502 when he found refuge there from a storm at sea.

Southward in Panama the United States and Panamanian flags fly side by side above the Canal Zone, granted in perpetuity by Panama to its friend and neighbor to the north. An inset on the map shows the Canal Zone in detail.

Throughout the new map, Spanish place names reflect a common tongue, an eloquent heritage from the 16th-century conquistadors. But in the small Crown Colony of British Honduras the names change to English: Middlesex, Orange Walk, Jonathan Point.

To the Society's 2,700,000 member-families, the new map brings an accurate and up-to-the-minute portrait of a vital area—the crossroads of the New World, junction of two great continents and two vast oceans.

*Mexico and Central America, twenty-sixth in the series of uniform-sized maps issued as magazine supplements in the past three years, becomes Plate 22 in the National Geographic Society's Atlas Series. To bind their maps, a quarter-million members have ordered the convenient Atlas Folio, at $4.85. Single maps of the series, at 50 cents each, or a packet of the 21 maps issued in 1958-60, at $8.25, may be ordered from the National Geographic Society, Dept. 85, Washington 6, D. C. A combination of the 21 maps and folio is available at $12.50.

Mexico's Pittsburgh, Thriving Monterrey Wears the New Look in Architecture

Proximity to the border—144 miles to Laredo, Texas—makes Monterrey a familiar overnight stop for U.S. motorists bound for Mexico City. Soaring fountain, a fantasy in cement, rises near the honeycomb of a modern bank building.

Return to the Sacred Cenote

By DR. EUSEBIO DÁVALOS HURTADO
Director, National Institute of
Anthropology and History of Mexico

SUNBURNED MISSIONARIES first described this place of death and treasure. Consider these words, written by Spanish Bishop Diego de Landa four centuries ago:

"Into this well they have had . . . the custom of throwing men alive as a sacrifice to the gods, in times of drought. . . . They also threw into it a great many other things, like precious stones. . . ."

The bishop's words have long tantalized archeologists and treasure hunters. De Landa was describing not some vague mysterious site, but a precisely known location: the Well of

Air-lift dredge explores the sacred well's turbid waters in the dense bush country of Yucatán.

Bearded deity, embossed on a gold-flecked copper medallion, emerged from the depths of the sinkhole.

PHOTOGRAPHS BY NATIONAL GEOGRAPHIC
PHOTOGRAPHER KAREN KASMAUSKI © N.G.S.

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To Appease the Gods, Maya Priests Fling a Girl Into the Well of Death

Drought parches the cornfields, maize withers on the stalk, and famine threatens the Itzá people. The rain gods are angry; human sacrifices must be made, the priests decree.

Artist Herget's dramatic painting re-creates the dawn rites. As onlookers chant a dirge to muted drums, blue vapor floats up from incense burners. Two priests seize the terrified maiden and hurl her off the brink. Hair streaming, she plunges toward the dark water 80 feet below.

Spectators shower the pool with their most precious possessions: bells, pottery, weapons, carved bones, jade jewelry. Then they disperse homeward to feast and prepare for the rain that will surely come.

Miniature geyser spurts from an air pump dredging the sacred *cenote*. This year the Mexican National Institute of Anthropology and History, in cooperation with the National Geographic Society and the Exploration and Water Sports Club of Mexico, recovered more than 4,000 artifacts from the well.

Sacrifice—the sacred *cenote*—at the Maya city of Chichén Itzá in Yucatán, Mexico. For centuries only the difficult local topography stood between the adventurer and his loot.

And what topography! I can still recall my own first glimpse of Chichén Itzá 27 years ago. It was an awesome experience.

First let us picture the surroundings. Dense, towering Yucatán bush is interrupted in this region by *milpas*, or cornfields.

Quite suddenly the visitor comes upon a large clearing, where rise the temples of the ruined city itself. During some eight centuries, Chichén Itzá served as a market for traders and a seat for sages and priests. But above all, this was a holy city, held by pilgrims "in the same veneration as we have for . . . Jerusalem or Rome," according to de Landa.

Past rich wall carvings, still intact, the visitor follows a path some 325 yards long. At its end, he reaches the sacred cenote.

This is no ordinary well. It is really a circular sinkhole some 180 feet across; sheer limestone cliffs fall away abruptly.

The visitor approaches warily, picking his way past the ruins of a small temple standing on the very brink. Some 80 feet below, a surface of green scum covers the waters that have closed over countless human sacrifices.

"What if a man should fall over this cliff?" the visitor wonders. "How could he get out?"

Yet it is a fact that men have entered this ominous pool—and returned with treasures. Near the turn of the 20th century there occurred here an incident that still stirs both excitement and controversy. The whole site—including the ruined city—was bought by

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The Author: Dr. Eusebio Dávalos Hurtado turned from the practice of medicine to "a broader study of man" when he became the first alumnus of the University of Mexico School of Anthropology. Since 1956 he has headed the National Institute of Anthropology and History, embracing 34 museums and 11,000 archeological sites.

the United States Consul in Mérida, Edward H. Thompson. Between 1904 and 1907, Thompson worked the cenote by dredge. He scooped up a vast quantity of art objects in pottery, jade, copper, even in gold. These Maya treasures were given to the Peabody Museum of Harvard University. Archeologists around the world look back on the discovery as an event easily comparable to the opening of Tutankhamun's tomb.

Mexicans were less jubilant. But no Mexican laws were broken at that time; so ruled the Supreme Court of México in the mid-forties. And last year Peabody officials presented 94 of Thompson's discoveries to our Mexican National Institute of Anthropology and History. Even so, Mexican scholars still lacked a large collection of cenote artifacts for their own study in their own country.

One way around the problem—provided the sacred cenote still contained undiscovered treasures—was to explore it again.

Air Lift Offers New Key to Old Problem

"We can give our country its own collection," suggested Pablo Bush Romero, President of the Exploration and Water Sports Club of Mexico—or CEDAM, as we call it. Don Pablo keeps in close touch with new techniques of underwater exploration. Though his associates are not archeologists—they are chemists, photographers, engineers, busi-

Long Before Columbus, Maya Indians Created a Spectacular Civilization

While Europe languished in the Dark Ages, the Maya culture flourished from Yucatán to western Honduras. Indian merchants roamed south to Panama and west into Mexico, exchanging salt and cloth for gold, jade, amber, and cacao. Conquering Spaniards in the 16th century found most of the Maya's templed cities abandoned for reasons not yet fully agreed upon. Today much of the land lies uninhabited, but forest-clad ruins whisper its intriguing story.

Crosshatching on the map at left designates lands ruled by the Maya. Pyramid symbols denote principal cities. Fishing scenes copy murals on temple walls in Chichén Itzá, whose shrines and cenote attracted worshipers from all Middle America.

SACRED CITY OF CHICHÉN ITZÁ

nessmen—they bring a wide spectrum of skills to their hobby of diving.

CEDAM had been successfully exploring old ships in the Caribbean for the past two years, with the National Institute of Anthropology and History.

Chichén Itzá, however, presented an entirely different kind of problem. Don Pablo and his associates knew that a few years earlier an expedition sponsored by the National Geographic Society had successfully used free-diving equipment to explore another cenote at Dzibilchaltun, not far away.* Moreover, six years before, the Frogmen of Mexico, of which Bush was a director, had organized with our consent an expedition to the sacred well. But he had come to the conclusion that diving by itself could not succeed because of the murkiness of the water.

Then suddenly things began to take shape. George M. Clark, head of the Yucatán Exploring Society, who had helped CEDAM in its Caribbean work, talked with Edwin Link, the undersea explorer. Mr. Link, in studying the drowned city of Port Royal in Jamaica, had used a device he called an "air lift."† Mr. Clark suggested that it might be adapted to explore the cenote.

The lift runs by compressed air; it raises water, silt, and small objects through a pipe ten inches in diameter.

Since Mr. Link was then exploring Caesarea in the Mediterranean, he referred Mr. Clark to Norman Scott, who was using an air lift at Port Royal. Mr. Scott became interested at once—but there was the matter of finances. Inquiries were made of the Committee for Research and Exploration of the National Geographic Society. Characteristically the Society offered the skills of its staff and supporting funds to our endeavor in the cause of scholarship and international good will.

*See "Dzibilchaltun, Lost City of the Maya," by E. Wyllys Andrews, and "Up from the Well of Time," by Luis Marden, both in the January, 1959, NATIONAL GEOGRAPHIC.

†See "Exploring the Drowned City of Port Royal," by Marion Clayton Link, NATIONAL GEOGRAPHIC, February, 1960.

Mr. Bush flew to Washington, D.C., and attended a meeting of all parties, including Dr. Mendel Peterson, Head Curator of the Armed Forces History Department of the Smithsonian Institution and a diver himself. Returning to Mexico, Mr. Bush conferred with me and advisers of the National Institute of Anthropology and History.

After much discussion, all of us agreed that the air-lift method, in conjunction with CEDAM and Mexican Navy divers, should be given a test, and the organization of an expedition to the cenote was approved. CEDAM, in charge of the diving operation, was supported by the National Geographic Society. Ponciano Salazar, head of southeastern operations for the institute, headed the expedition.

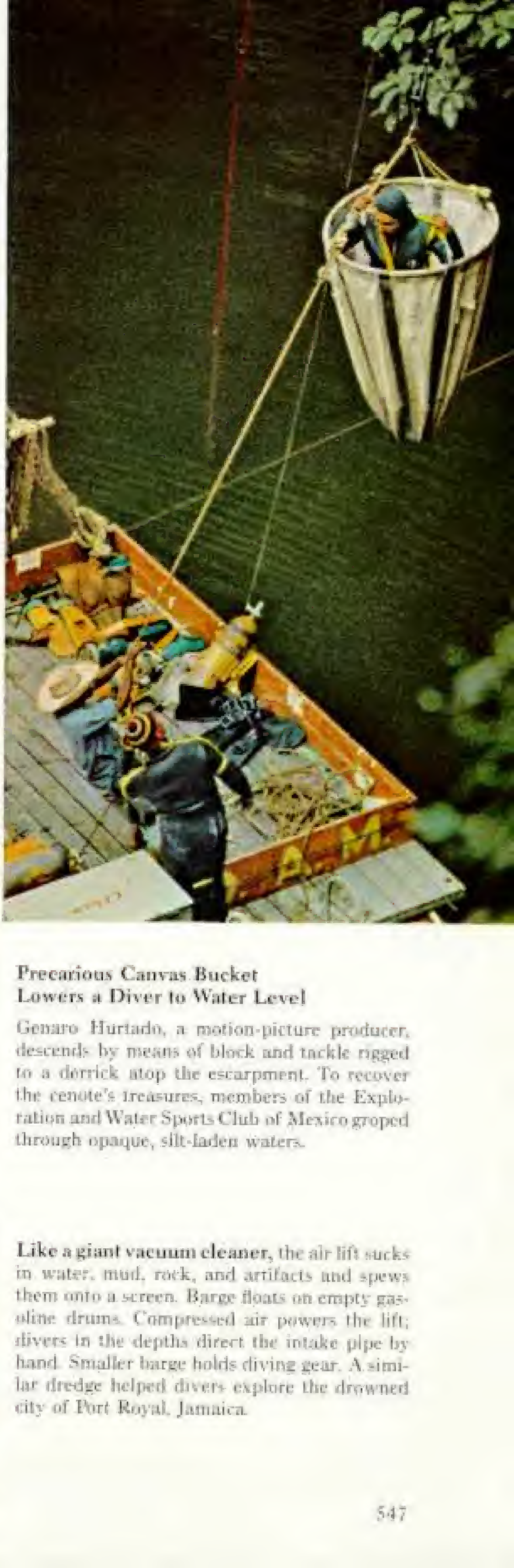
Divers Map Well's Murky Floor

After four months of hard and well-coordinated work, thousands of objects were recovered. The first map of the bottom of the cenote was made. We had reason to hope that the major part of the treasure was still there. Work was temporarily stopped because we feared that fragile objects might be damaged

by the air-lift procedure, and we would not get a stratigraphical record of the recoveries.

We are now studying the best method of drying the sacred well so that future work will net us the utmost in objects and historical information. I am convinced that the sacred well still holds many more surprises.

On the following pages Bates Littlehales of the NATIONAL GEOGRAPHIC staff takes you to the depths of this cenote at Chichén Itzá. His narrative and color illustrations graphically describe the work and exciting finds of the expedition.



Precarious Canvas Bucket Lowers a Diver to Water Level

Genaro Hurtado, a motion-picture producer, descends by means of block and tackle rigged to a derrick atop the escarpment. To recover the cenote's treasures, members of the Exploration and Water Sports Club of Mexico groped through opaque, silt-laden waters.

Like a giant vacuum cleaner, the air lift sucks in water, mud, rock, and artifacts and spews them onto a screen. Barge floats on empty gasoline drums. Compressed air powers the lift; divers in the depths direct the intake pipe by hand. Smaller barge holds diving gear. A similar dredge helped divers explore the drowned city of Port Royal, Jamaica.

JADE NECKLACE combines beads of varying color and quality. Bells at upper right dangle from a copper turtle, one of a set on a necklace from the Oaxaca region.

Treasures From the Sacred Well

POLISHED BEADS of jade, amber, and crystal came in trade to Yucatán, where they do not exist in nature. Jade amulet in profile shows skill of artists who, lacking metal tools, used abrasive fragments of quartz or other stones.

LUSTROUS BEAD, richly colored and handsomely carved, emerged from the lift pump. The Maya regarded gem jade as the most precious of stones.

FOUR-INCH RUBBER EFFIGY with grotesque features and dancer's pose survived five hundred years' immersion in good condition. Though its exact use remains obscure, it is one of the oldest rubber objects ever found.

ANOTHER EFFIGY plucked from the cenote comes up to the barge. Diver Alfonso Arnold made the discovery.

Gold-washed copper rings, obviously mates, rode up together through the air lift. Scientists believe a single donor tossed these gifts into the sacrificial pool.

Divers hoist part of a column onto the air-lift barge. Collapsing ruins of the pool-side temple may have buried Chichén Itzá's untold treasures beneath tons of rock.

Countless bells, the most popular metal offering, littered the floor of the well. Made of copper and gold, many represent the heads of deities or animals.

INTO THE WELL OF SACRIFICE—II

Treasure

THE AIR LIFT WAS READY. One end of the pipe lay on the bottom of the sacred *cenote*, under 30 feet of murky water. The other end stood before us on the raft, poised to spout Maya treasure.

Above us, leaning over the limestone cliff, dozens of bystanders watched as the divers disappeared into the depths. Soon the air lift began to pump, and a frothy geyser spewed from the pipe into a sieve (page 546).

Archeologists and photographers on the platform watched intently. Gradually the color of our fountain changed from white to tan, proof that the divers must now be work-

Hunt in the Deep Past

Article and photographs by BATES LITTLEHALES, National Geographic Staff

ing on the silty bottom. Bits of rock and wood gushed onto the wire screen. Then I heard someone shout: "Copal!"

This first discovery was an irregularly shaped chunk of pale resin, obtained by the Maya from the *pom* tree and used as incense in religious ceremonies.

More copal washed onto the screen mesh, then potsherds. A few minutes later divers uncovered a ceramic bowl. And presently an object of odd shape slid into view. Norman Scott, our air-lift specialist, crouched to pick it up—then danced with excitement.

"An idol!" he shouted to the spectators

rimming the cenote. "We've found an idol!"

While our visitors applauded, Scott held aloft a foot-long figurine made of a rubbery substance. Weeks of planning and hard work were now bringing a reward.

History was repeating itself in this deep natural well. Decades earlier an American consul, Edward H. Thompson, had come here to Chichén Itzá for a similar purpose. Folklore and early chronicles clearly indicated that this sacred cenote held vast treasure.

The practical Thompson studied the cenote and the techniques available in the year 1904. "Draining, dredging, or diving—it must be one of these three," he said. He finally settled on dredging with a derrick, a hand windlass, and a steel scoop.

Getting his equipment overland through difficult terrain to Chichén Itzá took "months of the hardest work I have ever done." Even

Wielding a two-foot machete like a paring knife, Avelino Canul peels an orange for a thirsty diver aboard the barge. A Maya who served as general foreman for the dredging project, Avelino learned to use an Aqua-Lung and proved a superb diver.

Bone knife yielded by the cenote wears a wrapping of gold foil. Glyphs include numbers, possibly a date.

when Thompson got his rig installed, he met deep discouragement. For long days "absolutely nothing was brought up but mud and leaves, leaves and mud. ... My high hopes dwindled to nothing. . ."

Then, said Thompson, "when things seemed darkest . . the dredge brought up what first appeared to be two ostrich eggs, cream-colored and oval against the black mud in which they rested. These proved to be balls of copal incense, and they revived at once my waning hopes. . . . Surely they were thrown into the sacred well as an offering to the rain god in those long-past centuries when Chi-chen Itza was a great and holy city, the Mecca of the Maya!"

During the next four years Thompson used his dredge and diving equipment to recover startling treasures: jade, ceramics, gold masks and breastplates, bells, bracelets, figurines,

Stylized portrait in jade, part of an ancient necklace, depicts the aquiline nose, prominent cheekbones, and drooping lower lip common among the Maya of yesterday and today.

Twentieth-century Maya, young José Burgos, shows the jaw line, high cheekbone, and black hair characteristic of his people.

At Chichén Itzá, José assisted photographer Littlehales; in off-duty hours he swapped Maya lessons for English. When not employed by archeologists, he labors on road gangs or in the fields.

Thompson himself descended into the cenote's muck. But even after all that, he always believed that he had tapped only a fraction of the treasures.

As our own expedition gathered at Chichén Itzá, all of us hoped that Thompson's estimate was right. We had brought more sophisticated equipment: Aqua-Lungs and air lift. Moreover, our plan was more complex. We wanted to provide a representative collection of artifacts for the Mexican Government, but we also wanted to explore the cenote and to plan future investigations. With such expert divers as Norman Scott and Raul Echeverria, we went confidently to work.

Divers Play a Wishing Game

On our first night at the well, the same question was put to each man: "What would you most like to find in the sacred cenote?"

"A sacrificial knife," answered three of the divers. Maya priests, we knew, sometimes cut out the hearts of sacrificial victims.

Assistant archeologist William Folan had a scholar's preference. "Some complete Maya codices," he said, "the hieroglyphic records that disappeared during the Spanish conquest."

We photographers preferred photogenic finds. Laverne Pederson, making motion pictures for American Broadcasting Company

Headdress, ear plugs, and downcast eyes of a wooden figurine may represent the rain god Chac. Master carvers, the Maya prized their idols and passed them on as heirlooms.

television, hoped for "a complete skeleton wearing jewelry."

I wanted to see—and photograph—a full set of Spanish armor. And why not? During the conquest, Chichén Itzá was the scene of a battle; one of the Spaniards could have fallen into the cenote.

But the most modest and sensible wish came from our expedition director, Ponciano Salazar: "I would like merely to find something Thompson did not find."

But first we had to install a derrick on the brink of the cliff to operate an "elevator" for men and equipment. This done, we lowered the divers' barge, a compact platform about 8 feet by 12. Somehow a crew inched the bulky object down to water level 80 feet below, where it floated serenely.

"Our first sacrifice to Chac the rain god!" shouted diver Genaro Hurtado. And sure enough, that night an unseasonable rainstorm blew up.

Divers as well as equipment rode the elevator down to the water, for the walls of the well were hopelessly sheer—some sacrificial victims must have drowned simply for lack of a way to climb out.

Soon we were preparing for our first dive from the barge. The most colorfully clad diver was Genaro Hurtado (page 547). Genaro, a distinguished motion-picture producer, had once made a film titled *Monster of the Deep*. He wore a leftover costume, a black diving suit with hood and painted scales; so we promptly dubbed him "Monster."

At last it was my turn to dive. The whole setting was eerie: The water seemed to have turned to ink.

Eagle warrior, a popular motif in Toltec art, adorned a jar. Though this clay head lay in the cenote hundreds of years, it still wears paint.

Gleaming beads were the only objects of solid gold found in the well.

Stylized ceramic mask may represent a deity, perhaps a fire god.

Wavy-bladed wooden object presents a mystery; its purpose and use remain unknown. Conceivably, it might have been used in weaving.

Reclining figure of a Chac Mool, or "red jaguar," cradles a disk, perhaps for the hearts of sacrificial victims. Knees drawn up, head turned, he guards the portal to the Temple of the Warriors at Chichén Itzá. Twin columns honor the city's patron deity, Kukulcan, the Feathered Serpent. Colossal heads with fangs exposed lie on the ground; limestone bodies stand upright, and feathered tails project forward like those of scorpions about to sting.

With my underwater flashlight, I couldn't see beyond my arm. Hearing only my own breathing, I moved hand over hand, following a line down 40 feet to the rock anchor. By touch, I established the shapes of fallen boulders and twisted, waterlogged trees. As mud churned up from the bottom, my light became useless.

Our exploratory dives familiarized us with the underwater contour of the cenote and the location of some of Thompson's dredging sites. It was time for the air lift.

All hands lowered a larger raft into the cenote. Floated on steel drums, it had a hole in the center for the lift's large pipe. Around the base of the pipe we stretched our sieve—a conical framework of screen wire to strain artifacts from the fountain of water that would soon emerge from the tube.

Old News Is Good News

During off-duty moments, Genaro talked with the visitors. One was an old man with strong Maya features. He wore typical rope sandals and knee breeches.

"I worked here when Señor Thompson dredged," he said nervously in Maya. He had walked 12 miles just to see us. "Thompson put his machine right there." He pointed near the temple.

This news particularly pleased Norman Scott, for it confirmed that we were working in an area where Thompson had not dredged.

Our archeologists began to study the air-lifted treasures. The rubber effigy, kept temporarily in a tub of water, especially interested them. Its limbs were twisted in the style of a leaping dancer, and it wore sandals and headdress. Chemists later identified the material as true latex.

Soon more divers arrived: Professor Fernando Euán, a veteran from the Dzibilchaltun expedition; Hernán Gutiérrez; engineer Carlo Durand; and Alfonso Arnold.

Murkiness plagued us all. Time and again I tried to take underwater photographs of the explorations, but the muddy water obscured everything. All attempts failed.

Nevertheless, discoveries continued as the air lift struck new, rich layers of mud. Every day, dozens of artifacts spewed onto our conical screen: beads of all sorts and styles, pieces of polished jade, potsherds, and copal (pages 548-9 and 560). Sometimes the copal was still pressed into ceramic incense burners.

Our first wooden figure—probably Toltec—emerged after the first month (page 554).

Roofless colonnade adjoins the Temple of the Warriors, named for the magnificent figures of combatants adorning its pillars. Carnegie Institution archeologists in the 1920's found the pyramid-sanctuary covered with rubble and overgrown with trees. They worked four years excavating and restoring it.

"But what a price for an idol!" said Euán, who lost his Rolex wristwatch the same day.

We collected numbers of metal bells, most of them copper, some washed with gold. Curiously, few had clappers (page 550).

"Death bells," explained archeologist Román Piña Chan, the institute's Director of Pre-Spanish Monuments. "The Maya usually 'killed' a sacrifice before throwing it into the cenote; bells were silenced by ripping out their tongues."

Of our more modern finds—contemporary coins from Mexico, the United States, and countries of Central America—Piña Chan observed, "This wishing well has always had its imports."

The Maya were great traders. Bishop de Landa, for instance, had written that "the occupation to which they had the greatest inclination was trade." Caravans of merchants traveled from Yucatán to Tabasco, on to the Aztec Empire, and even south to Honduras and Panama over a large network of roads (map, page 544).

To their distant markets the Maya took salt, cloth, fish, honey, feathers—and human slaves. In return, they received cacao, jade, pottery, and objects of copper and gold. Yucatán had, and still has, no known ore deposits. Our artifacts from the cenote could be identified as "Zapotec breastplate" or "Mixtec ring"—all imported.*

Among our discoveries was a human skull. To Dr. Dávalos Hurtado's skilled eye, even a casual examination could tell a great deal about a victim.

This was the skull of a woman with a small, delicate face. From the state of the wisdom teeth, her age might have been 18 or 19. As an infant, she had undergone a Maya beauty treatment: boards strapped to her head to flatten the rear and front. She may have known suffering. Where spine joined skull, Dr. Dávalos Hurtado detected a pathological condition, perhaps arthritis.

*For a comprehensive account of Maya history, see "Yucatán, Home of the Gifted Maya," by Sylvanus Griswold Morley, NATIONAL GEOGRAPHIC, November, 1946.

Moonlight bathes El Castillo, largest of Chichén Itzá's seven structures. Ninety-one precipitous

"It is rare to find such a well-preserved skull," he said. The chill mud of the sacred cenote had proved a protective tomb.

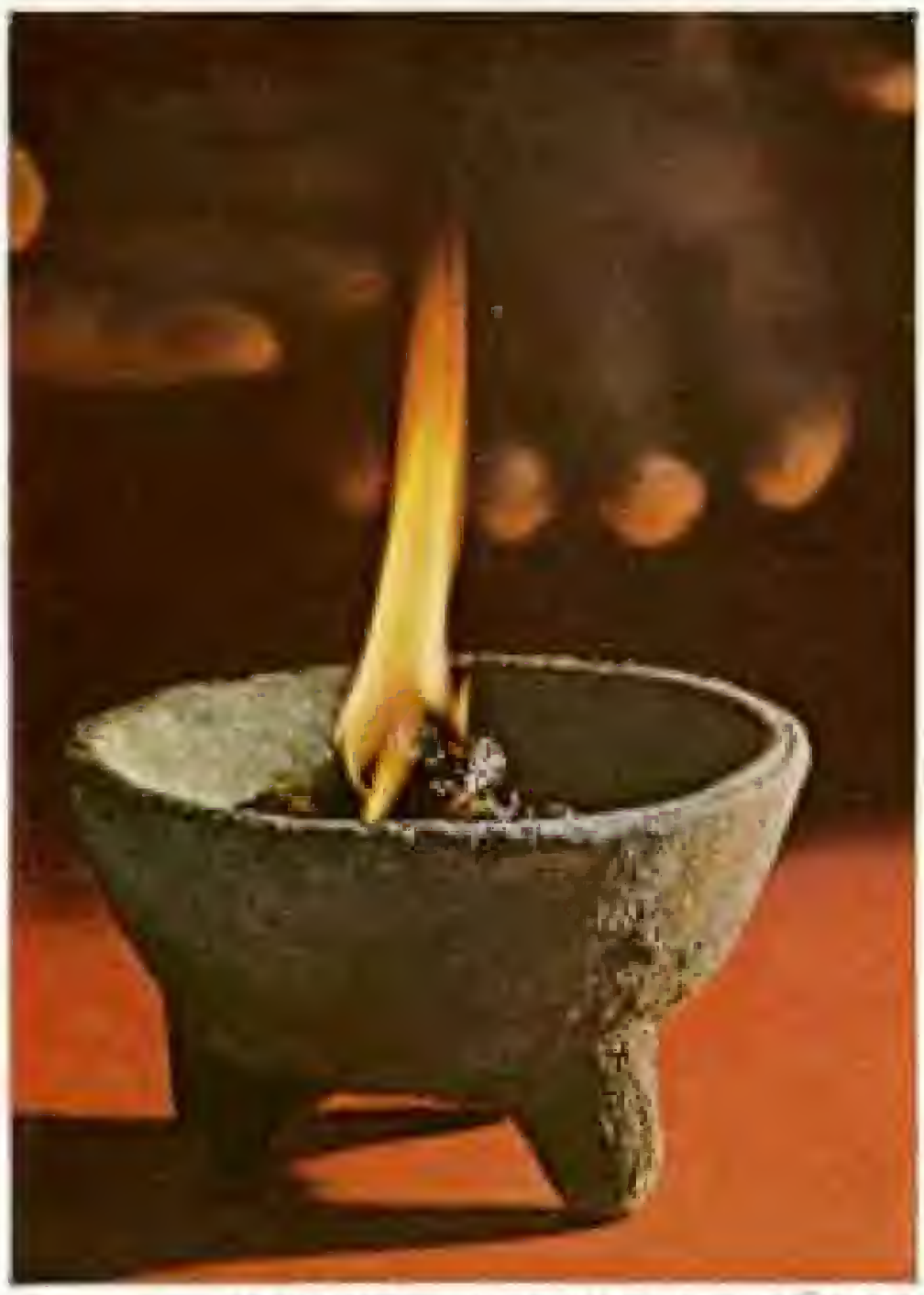
From 16th-century Spanish records, we know that many persons were sacrificed in this sacred cenote in the final Maya era. The rituals probably began here about 1,000 years ago, with two purposes: to implore the gods for rain, and to foretell the future.

Sometimes victims volunteered. But the chronicler López Medel writes that "those who were sacrificed by their own free will

steps climb to the temple. "Don't look down," guides warn visitors beginning the dizzy descent

were few." Orphans and children kidnaped from enemies were also killed. Some devout parents gave their sons.

The Maya priest fixed the fateful date. When the day arrived, the victim was anointed with blue paint—the color of sacrifice. Blindfolded, he was led forward by elaborately costumed priests. From the bas-reliefs of Chichén Itzá, we can picture the pageantry of the procession: musicians, singers, dancers. *Balché*, the holy intoxicant, added to the revels.



Incense Immersed for Centuries Burns Brightly in a Bowl

Copal, resin of the *pom* tree, provided the Maya with a sacred perfume to pay homage to the gods. Priests' assistants molded it into small cakes decorated with crosshatching and painted a bright turquoise. Sometimes they fashioned imitation hearts.

Incense smoldered in clay pots like this bowl recovered from the cenote. Its smoke, the Maya believed, wafted their prayers to heaven. Because copal was sacred, people of Chichén Itzá often embedded their gifts in the resin before tossing them into the well.

Modern pilgrim, a Maya girl of Valladolid, presents her offering of lighted tapers during the Fiesta de la Candelaria.

In some ceremonies the living victim's heart was cut out with a sacrificial knife and offered to the gods.

De Landa reports that priests hurled other victims into the cenote while still alive, "believing . . . they would come out on the third day, although they never appeared again."

Victims were to intercede with the gods, and the priests instructed them concerning the requests. They were to ask for rain, good crops, knowledge of the future, and, on occasion, for relief from hurricanes. But at least one candidate refused to obey orders. When López visited Chichén Itzá in 1557, he heard of a preconquest incident:

"Holding a virgin for the sacrifice in the said way and the priest telling her . . . to ask their gods . . . to send them good times, she replied that she would not say any such thing . . . since they were going to kill her. And the boldness and assurance of that virgin in her speech had so great an effect that they left her and sacrificed another in her place."

In addition to humans, the Maya offered animals to their gods (we found more bones of animals than of men). Jaguars, pumas, alligators, deer, game birds—all were deemed worthy of Chac.

Often our work was slow and disappointing. The air lift sucked up a large stone, a part of the fallen temple; the plugged pipe collapsed, and repairs were tedious.

Witch Lurks in Depths of Well

During such delays, I enjoyed talking with Avelino Canul, an extraordinary person (page 552). Though his native tongue is Maya, his self-taught Spanish is good. He is sophisticated about Maya superstitions, but well versed in Yucatán folklore.

"People here do not swim in the sacred cenote," he told me. "But I am not afraid. When I was a boy 7 years old, I climbed down this cliff on vines. I swam here—and no evil came to me."

And what do the local Maya fear in this well of sacrifice? Some believe in Hechicera, a monstrous witch. "Hechicera was a princess who could not marry the man she loved," Avelino explained. "If people come too close to the cenote, Hechicera is supposed to take them into her cave and turn them into *alux*."

Aluxob are the little people, comparable to Ireland's leprechauns. I had noticed small huts built in the cornfields, where the season's first ears of corn are left to feed the alux. "For such favors," Avelino said, "the alux will rock your hammock and push up your corn plants."

We could have used some alux ourselves. For exhausting days the divers worked on the underwater rock pile, the ruins of the fallen temple. Moving heavy stones in the murk, they often narrowly missed injury.

When time and funds permit, these building blocks may be raised into a restored temple. Our diagrams should be useful.

Studies Point to Future Treasures

Taking stock of the expedition, we could write a long list of achievement. The air lift and divers had, in less than four months, helped provide the Government of Mexico with more than 4,000 artifacts. Scholars will study these specimens for years to come. Furthermore, we had tested new techniques of archeology. We had completed some basic studies of the cenote itself. Hydraulic engineers may now find a way to pump this sinkhole dry—all of it, or part of it. We are certain that in the future—perhaps quite soon—the sacred cenote will yield an even more dazzling array of treasures.

In the closing days the men made some of the most exciting finds: a wooden doll wrapped in bits of fragile cloth—extremely rare for Mexico; small rubber figurines; wooden spools with black mosaic decorations (probably jewelry for the ears); two beards of solid gold (page 555).

In the last week the men brought up a fine bone-blade knife; its handle, elaborately inscribed with glyphs, was covered with gold foil (page 552). Some day we may determine the meaning of all the glyphs.

If we still lacked a set of Spanish armor, a skeleton, or complete Maya codices, we at least had Salazar's "something that Thompson did not find."

As a final feat, we divers taught the faithful Avelino how to use an Aqua-Lung. He took superbly to diving. On the last day of our operations, he made a solo dive—carefully picking his spot in the cenote. When he surfaced a few moments later, he proudly carried a trophy: the same Rolex watch that Fernando Euán had lost early in the expedition! So, after long years of watching outsiders seek and find Maya handiwork, he treated us to the spectacle of a modern Maya discovering a 20th-century treasure.

Two Favorites Again Available

YOUR SOCIETY takes pleasure in announcing that two of its most beautiful and sought-after books are again in stock—one of them after a long absence.

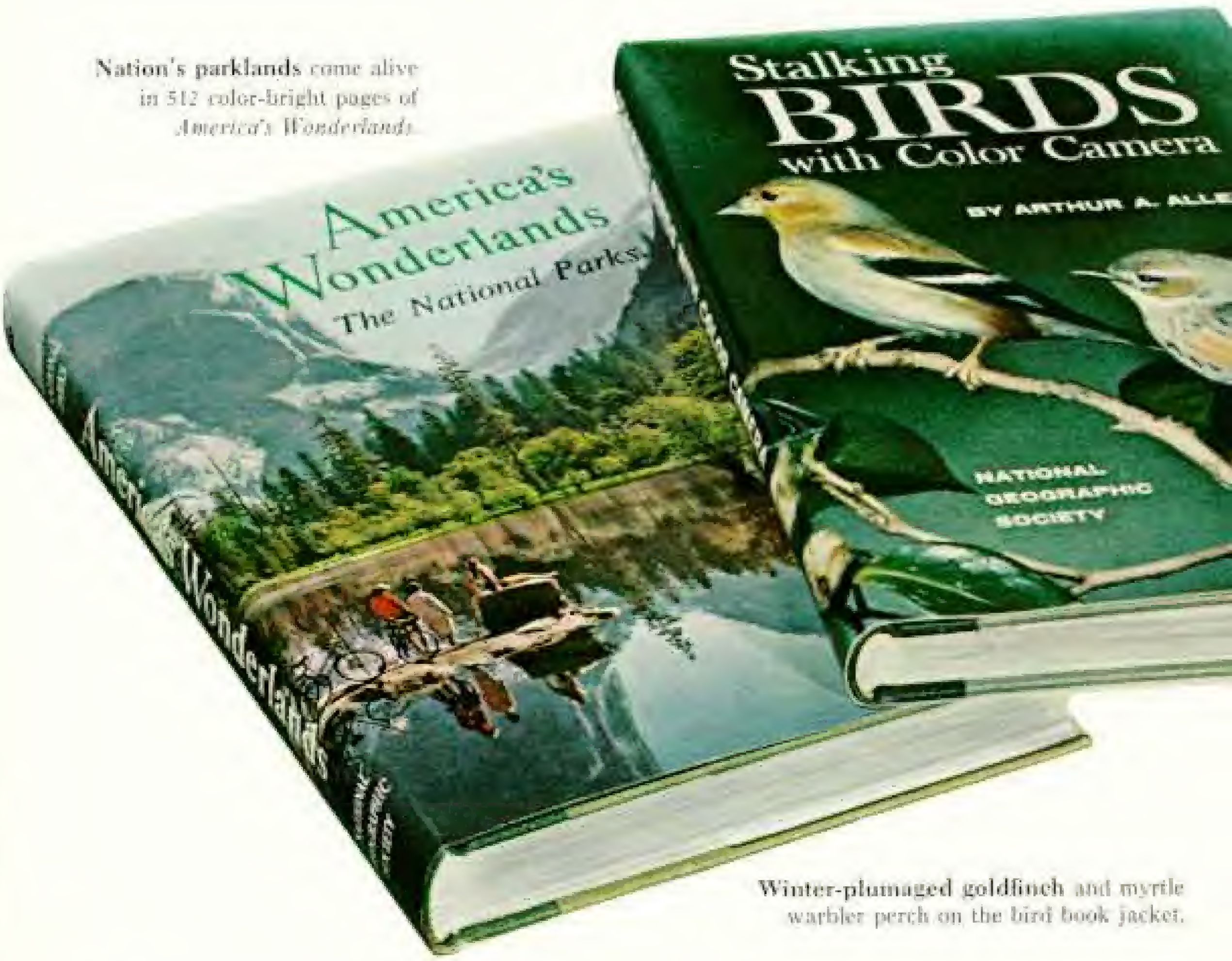
First published in 1951, *Stalking Birds with Color Camera* proved so popular that the initial limited printing was soon exhausted, and the book became a treasured collector's item. *America's Wonderlands, The National Parks* was published just two years ago. But the unprecedented demand for it quickly depleted two huge printings—300,000 copies!

So many requests for both of these volumes continue to pour in that we have ordered big new printings of each.

Stalking Birds with Color Camera is still unrivaled for its superb photographs of North American birds—331 of them in natural color. In all, 266 species are shown in action: courting, building nests, feeding their young. Here a male cardinal attacks his own image in a mirror. A ruffed grouse, tail spread like a fan, drums ardently. Head thrust skyward, a startled bittern freezes among the cattails. Hosts of snow geese take off, black-tipped wings beating furiously.

In his engrossing text, Dr. Arthur A. Allen of Cornell University takes you along with him as he probes the mysteries of bird life and behavior during a lifetime of research and exploration, much of it backed by the National Geographic Society. An additional feature is a chapter by Dr. Harold E. Edgerton and two other scientists on "Freezing the

Nation's parklands come alive in 512 color-bright pages of *America's Wonderlands*



Winter-plumaged goldfinch and myrtle warbler perch on the bird book jacket.

Flight of Hummingbirds"—those amazing jeweled wonders of the bird world. This is a book the whole family will use and enjoy.

Another is *America's Wonderlands*. A magnificent picture album, its 512 pages and more than 450 illustrations—390 in color—bring to life all the variety and beauty of 82 of America's scenic national parks and monuments. A detailed and authoritative text makes this an indispensable reference work as well as a valuable vacation guide to our parklands.

Regional maps help you plan a weekend jaunt or a summer of travel. Concise summaries tell how to get to each large park, where to stay, what to see and do. A detailed ten-color map of all the areas is tucked into an inside pocket. Here's the perfect book for planning new trips, reliving old ones.

The demand for these books—ideal as gifts—is sure to be heavy; members are advised to reserve their copies now. Requests will be filled in the order received. *Stalking Birds with Color Camera* sells for only $7.50; *America's Wonderlands* for $9.95. A bill will accompany your order when delivered. New printings are also available of *The Book of Fishes* ($7.00), and *Everyday Life in Ancient Times* ($6.00). Write to the National Geographic Society, Dept. 81, Washington, D. C.

Sheer, awesome cliff, Toroweap Overlook looms above the Colorado River in Grand Canyon National Monument.

Wings frozen in flight, father brings an earthworm to fledgling eastern robins.

BY L. S. B. LEAKEY

Exploring 1,750,000

A NOTED BRITISH ARCHEOLOGIST TELLS

ABOVE THE CRACKLE of the wireless, I could hear my wife calling faintly. "Olduvai to Langata. Olduvai to Langata. Can you hear me? Over."

I pressed the switch to "Transmit."

"Olduvai, this is Langata. Yes, I can hear you, but only barely. Try tuning a bit. Over."

Mary's voice came again, this time clearer.

"Olduvai to Langata. How is it now, any better? Over."

"Yes, much clearer," I said. "I can hear you now. Over."

"Good, then listen. Yesterday at Site N.N. we found a foot. Yes, I said a foot—we may have another discovery as exciting as *Zinjanthropus*. Over."

"Wonderful news! How much have you got?" In my excitement I forgot to add "Over."

"Quite a large part," Mary replied. "The heel and ankle bones and a number of others. When are you coming to see them? Over."

"Langata to Olduvai. I'm on my way. Over and out."

Mary came back at once. "Olduvai to Langata. Not so fast. As long as you're coming down, there's a whole list of things for you to bring with you. Have you a pencil and paper ready? Now first. . . ."

And that is how I learned of the discovery

Skilled Family Team at Olduvai Gorge Unlocks Priceless Stone Age Secrets

Dr. and Mrs. Louis S. B. Leakey and their son Philip examine a living floor, or campsite, of the world's oldest known manlike creature. Its fossil remains, unearthed by the Leakeys in 1960, predate those of *Zinjanthropus*, their earlier find, a tool-making man that scientists believe lived 1,750,000 years ago (letter, page 568). Olduvai Gorge in Tanganyika, East Africa, contains one of the richest deposits of fossils ever discovered. A beach umbrella wards off the searing sun. Two of the Leakeys' five Dalmatians and Trixie, a fox terrier, guard against snakes and wild beasts.

Years Into Man's Past

OF DRAMATIC DISCOVERIES AT OLDUVAI GORGE

Illustrations by National Geographic photographer Robert F. Sisson

of some of the fossils belonging to the world's oldest known hominid, a member of the scientific family that includes both man and his cousins, the near-men, or australopithecines, of the prehistoric past.

NATIONAL GEOGRAPHIC readers will recall that last year Mary and I reported our discovery of the skull of the world's earliest man, Zinjanthropus, who lived during prehistoric times in what is today Tanganyika, East Africa. Until recently, pending exhaustive dating tests, we could only say that Zinjanthropus lived "more than 600,000 years ago," though Mary and I both believed that

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Discoveries of startling significance in the study of prehistoric man have been made during the past two years in Tanganyika, East Africa, by an expedition led by Dr. and Mrs. Louis S. B. Leakey and sponsored by the National Geographic Society's Committee for Research and Exploration. Of these finds, perhaps the most important has been the fossil remains of a juvenile manlike creature located in a deposit even older than that of Zinjanthropus, the tool-maker described by Dr. Leakey in the September, 1960, NATIONAL GEOGRAPHIC. Tests made this year by the University of California reveal that the fossils date from 1,750,000 years ago.

On these pages Dr. Leakey, Curator of the Coryndon Museum in Nairobi, Kenya, gives his own account of how these exciting discoveries were made. An explanation of the potassium-argon dating process that determined their age appears on pages 590 through 592.—The Editor.

World-traveled Banner Flies Over Olduvai

National Geographic Society research funds support Dr. Leakey's pioneer archeological work at Olduvai Gorge. Land-Rover and trailer haul precious water 34 miles to camp.

Wedge-shaped excavation and an exploratory trench notch the gorge, where the Leakeys have made their discoveries. The National Geographic grant enabled them to explore in one year more than twice as much as in the previous thirty. A worker removes rock in Bed I, lowest and oldest level of the gorge.

PHOTOGRAPHER © NATIONAL GEOGRAPHIC SOCIETY

Skull fragments point to murder. Upper fossil, from an Olduvai child, shows a break and radiating fractures, suggesting a violent death. In comparison, the modern skull (below) split after death.

UNIVERSITY OF CALIFORNIA

DEPARTMENT OF GEOLOGY
BERKELEY 4, CALIFORNIA

May 20, 1961

Dr. Louis S.B. Leakey, Curator,
Coryndon Museum
Nairobi, Kenya,
East Africa

Dear Dr. Leakey:

The potassium-argon dating of the Olduvai fossils is progressing well, and though much remains to be done, the early results are so startling I thought you should know them at once.

Zinjanthropus and the "pre-Zinj" child are much, much older than anyone had suspected, except perhaps you and Mrs. Leakey. The average age of the samples my partner Dr. Jack Evernden and I have dated so far is 1,750,000 years.

Dr. Evernden and I believe that this date is close to the true age of Olduvai's early man, but that if anything it is slightly conservative.

One thing is certain -- Olduvai man is old, old, old!

Sincerely yours,

Garniss H. Curtis

Garniss H. Curtis

Official news of Olduvai man's fantastic age reached Dr. Leakey in a letter from Dr. Garniss H. Curtis of the University of California's Department of Geology. He believes the age given may be conservative.

he eventually would prove to be far older than that. Now, at last, we have the facts—and they are truly staggering. A dating method known as the potassium-argon process places Zinjanthropus not merely hundreds of thousands of years but an almost incredible 1,750,000 years in the past!

We had made that first exciting find in 1959 in Olduvai Gorge, a fabulously rich storehouse of fossilized remains that we have been exploring and sifting since 1931 (map, page 566).

Now Mary was telling me that the gorge had yielded other priceless fossils of a hominid *even older* than Zinjanthropus, though whether a true man or a near-man it was too early to tell.

Foot bones of a juvenile manlike being who lived 1¾ million years ago suggest that a carnivore gnawed the tips. Symbols tell when and where each bone was found. Photograph shows a preliminary grouping.

Calipers gauge a giant bite, the jaw of the prehistoric child. Five of the teeth — all of them permanent — outsgunned six belonging to the modern adult at left. Geologic pressures have distorted the child's jaw.

Within hours I had rounded up what I could of Mary's list and set out by Land-Rover from Langata, the suburb of Nairobi, Kenya, where we live. Olduvai lay 347 miles and, with luck, 13 hours away.

I say with luck, for during the rainy season, from March until June, parts of the road to Olduvai become a nearly impassable mud wallow (page 572). Once it took Mary and me three days to cover just 16 miles! More recently, we spent so much time bogged down, being helped out, and in turn helping other drivers with their stranded cars that my passenger could only keep repeating, "I can't believe it, I can't believe it. . . ."

However, the rainy season means no such deluge for the gorge itself; most of the time it resembles a giant dust bowl. The nearest source of drinking and cooking water lies 34 miles from our camp, over roads so pocked and boulder strewn that our cars, with water trailers hitched behind, can get only four miles to a gallon of petrol.

But in 1960, the National Geographic Society's Committee for Research and Exploration had awarded us a generous grant, and we decided to work right through the year, wet or dry. In a single period of 13 months, with the enlarged staff made possible by the grant, we put in 92,000 man-hours of excavating — more than twice what Mary and I were able to do in the previous 30 years.

And what did we find in those 13 months? We found so much it is hard to know where to begin.

First of all, we found more of our old

Olduvai's treasure trove, the fossilized remains of prehistoric men and beasts, lies in a layer-cake sequence of geological beds. Tedious, endlessly patient digging uncovers relics that tell a fascinating story of the past. Layers of volcanic ash within the beds enable geologists to determine the fossils' immense age. Small illustrations key actual campsites to their occupants, the hunters shown below, whose fossils lie buried as deep as 300 feet beneath the rim of the gorge.

Earliest known hunters, who date back nearly two million years, lived largely on tortoises and catfish they could catch by hand. The Leakeys found no hunting weapons with the fossils.

Wooden clubs may have helped Zinjanthropus, a true man in the tool-making sense, felt larger game, like this prehistoric zebra colt. In lean times Zinj ate rats and mice, as did all Olduvai's dwellers through the ages.

Dawn of the spear, a sharpened stick, possibly occurred among Zinjanthropus's successors, who occasionally stalked large game, such as this sitatunga, a swamp-dwelling antelope.

friend Zinjanthropus, whom Mary and I call "Zinj," or affectionately, "Dear Boy."

In our extended excavations at the Zinj site—which involved removing thousands of tons of overlying rock—we found the two bones of our man's lower leg, the tibia and fibula, and some fragments of a second individual. We had hoped, among other things, to find the lower jaw of the 1959 skull, for with that we might be able to tell whether Zinjanthropus had the power of speech—a vital clue to his stage of development.

In this we have been disappointed thus far, but even without the jaw we have learned a lot more about our man of thousands of centuries past.

Readers of the earlier article will recall that we found the skull on an ancient living floor, an old campsite sealed between two geological layers. On that floor in 1960 we found more crude stone tools used for skinning and cutting up carcasses, as well as bones of animals and the hammer stones used for cracking the bones to get at the marrow.

These cracked bones confirmed our earlier belief that Zinjanthropus and his contemporaries lived largely by killing young animals—most of the bones are from immature specimens. Interestingly enough, we found that later dwellers in Olduvai did not break open nearly so many bones, suggesting that they were not so short of food as Zinjanthropus was.

Radio Links Campsite and Nairobi

Much of this time I was forced to travel back and forth between the gorge and Nairobi, where I continued my duties as Curator of the Coryndon Museum. That is how I happened to learn of our exciting pre-Zinjanthropus find by wireless, for Mary and I kept in daily contact by radiotelephone. She and our 20-year-old son, Jonathan—who is curator of the snake park at the museum—ably directed the work in my absence.

So much for Zinjanthropus. What about the new creature, the one we believe to be older than Zinj himself? I still find it hard

Desert wasteland replaced lake waters, according to geological evidence at the top of Bed I. Additional clues to the climatic change lie in the discovery of the fossils of many desert-loving rodents.

Mired *Dinotherium*, an elephant-like monster, attracts Chellean Stage I hunters, who possessed cutting tools but still lacked the weapons to bring down such a huge beast. In this period swamps succeeded deserts.

Fallen giant, a prehistoric ram (page 584), lies victim of a Chellean bola (painting, pages 578-9). With this new weapon, Chellean man at last could tackle most big game.

Mud wallows left by rainblock the road from Nairobi to Olduvai. Here, at Ngorongoro Crater, Dr. Leakey plans an amphibious assault on the trail.

Well-fed neighbors of the Leakeys, two lionesses pause during a meal on a wildebeest carcass. This pair prowl Kenya's Amboseli National Reserve on the road to the gorge.

Ponderous rhinos bask at Amboseli. Wallowing in the dust, the animals wear away old hide and expose patches of pink new skin.

to tell about that discovery without the thrill of excitement it produced in all of us.

When I reached the gorge, everyone was talking about Mary's discovery of the precious foot bones. She had found them at a site about 250 yards from where we had discovered Zinjanthropus, but at a lower level in the gorge, proving that our new hominid had lived before Zinj. This, we now know, places the creature — undoubtedly a child — at least 1,750,000 years in the past.

The story of the find, like that of so many of our Olduvai discoveries, is one of pure accident. Weeks before, on the slope of Bed I, the lowest and therefore earliest stratum of the gorge, Jonathan had picked up the fossil jawbone of a saber-toothed tiger. He didn't recognize it at first, and little wonder. Nothing of the kind had ever been seen among the tens of thousands of fossils the gorge had yielded up to that time. Jonathan's prize, in fact, was the first saber-toothed tiger ever discovered in East Africa.

Tiger Leads to Greater Treasure

Following up Jonathan's discovery, we combed the slope for more sabertooth. We found a tooth, all right, but it had never belonged to a tiger. Mary's practiced eye needed only a glance:

"Primate!" she exclaimed, and with that we dug a trial trench to explore beneath the surface.

More primate followed: a complete collarbone, some tiny bits of skull, and then several finger bones. I was in Nairobi when Mary added the precious foot bones to our growing collection, and it was that discovery that brought me racing to the gorge (page 569).

Eagerly we began piecing together the clues to this entirely new creature. Further digging produced more of the skull, and at last a large section of lower jaw. That jaw, with its number of beautifully preserved teeth, is a story in itself. A vital story, by the way, for — just as with the teeth of Zinjanthropus the year before — this jaw may speak volumes about its owner.

Fossil Teeth Reveal Owner's Age

The jaw was Jonathan's work. He had predicted all along, ever since the first bits of skull and collarbone turned up, that we would find it. He was so sure that we were all inclined to smile a bit, for Olduvai has a perverse way of doing just what one expects least.

But one morning Jonathan's assistant came rushing over to Mary and said breathlessly, "Jonny's got it. Come quick!"

Mary didn't need to ask what "it" was, and when she reached the pre-Zinj site, she found Jonathan uncovering a magnificent jaw with 13 teeth — precisely where he had predicted he would.

At first Jonathan was disappointed, for the jaw was fractured, distorted, and incomplete. But today he realizes how important it is, and he is very proud.

How, you will ask, do we know the jaw belonged to a child? For one thing, the teeth tell us.

Every mother in the world knows how her child's teeth develop. First there are the so-called milk teeth, which begin to appear in the first year or two of the child's life. Then come the first molars, permanent teeth that develop at the age of five and a half to six and a half years. Following these come the second molars, at about age ten and a half to twelve.

Fossil that it is, our pre-Zinj child was like every living child in the world when it came to tooth development, and in its jaw the first molars are already worn down with use, whereas the second molars have emerged but show little wear. The third molars, which generally appear about the age of sixteen or later, have not even begun to push through the jawbone (page 569).

Clues Found to Oldest Murder Mystery

Unquestionably then, our new find died when it was about eleven or twelve years old. How did it die? That is not an easy question, for we are working, you must remember, with clues more than a million and a half years old!

It would seem, however, that our child died by violence rather than by disease. In our excavating we found the parietals, the bones that form the dome of the skull. The child's left parietal shows clear signs of having received a blow. There is an obvious point of impact, a break in the skull that reaches even to the inner wall, and fractures that radiate from the break (page 568).

The child could not have fallen on a rock, for the simple reason that there were no rocks at all on the mud flats where it lived, except for the small stone tools we found, and a fall on one of those could never have caused the massive fracture.

I think it is reasonable to say that the child received—and probably died from—what in modern police parlance is known as "a blow from a blunt instrument."

But let us turn for a moment from our Sherlock Holmesian deductions and see what this new discovery means in terms of man's development. That, after all, is the vital question.

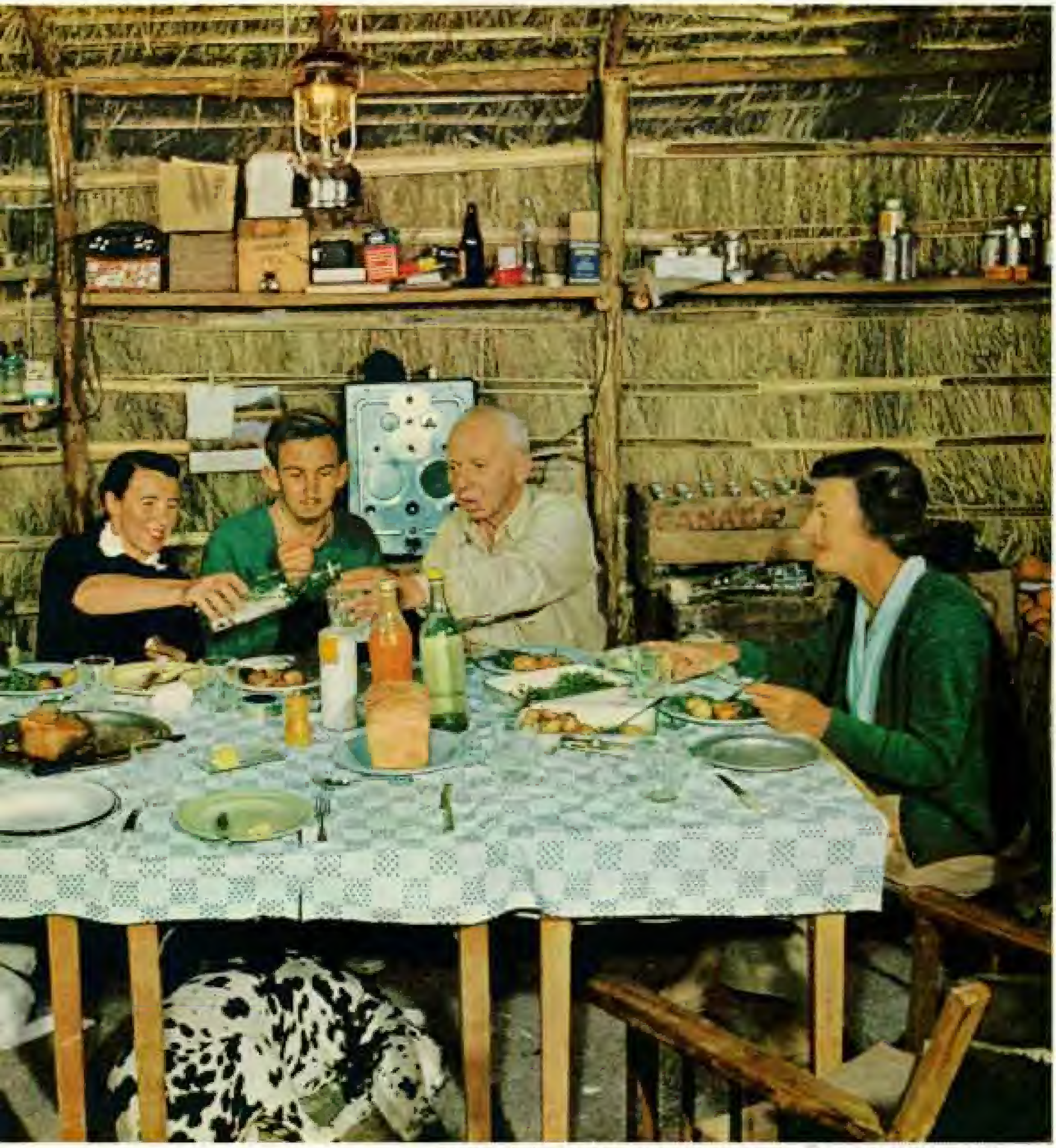
Where does our newcomer fit into Olduvai's immense fossil jigsaw puzzle? Is it a true man, and if so, when did it live and what was it like? Does it replace Zinjanthropus as the world's earliest known man?

Some of these questions we can answer now, and some will simply have to wait.

To begin with, when I say "child" in referring to the new jaw, skull parts, foot and finger bones, I do not imply that the child's father was necessarily a man in the strict scientific sense. As readers of the earlier article will remember, scientists generally agree on the technical definition of man as one who made tools in a regular, set pattern.

Fossil Hunters at Olduvai Take a Dinner Break

This open-air shed serves as bedroom and camp dining room. Sitting between the author and his wife are Mrs. Shirley Coryndon, Dr. Leakey's assistant; Jonathan, one of the Leakeys' sons; and Dr. Matthew W. Stirling, a member of the Society's Committee for Research and Exploration. Maxie and Trixie share the dirt floor.



Unbidden guest, a venomous boomslang, appeared one mealtime in the rafters above Dr. Stirling's head. Jonathan, the family snake expert, casually deported the tree snake by its tail. "Matt never even budged," Dr. Leakey reports.

Visiting chameleon strolls boldly across a fossil skull as Dr. Leakey cleans the prize. "We get used to such visitors," says the author. "After all, sometimes it's *their* ancestors we're working on."

Time-worn Skull Solves a Stone Age Mystery

For more than a century, prehistorians searched in vain for Chellean man. Then, in 1960, the Leakeys found this skull in an Olduvai ravine (opposite). Prior to the find, scientists could only guess at Chellean man's appearance, though his tools were reported in Europe as early as 1846 and later uncovered in many parts of Africa and Asia.

Assembled from 15 fragments, the skull reveals the most massive brow of any early man known. Plaster-of-Paris sections represent missing pieces.

L. S. B. Leakey

Fragments of the Chellean skull lie in the ravine as they were found by Dr. Leakey.

as distinct from the haphazard use of sharp sticks, stones, or random implements. The "regular, set pattern" is the basis on which Zinjanthropus qualifies as a man.

Can we say that this new pre-Zinjanthropus find was, in effect, a man? My answer is frankly no, we cannot. We do not yet know enough about it, and guessing, of course, is a dangerous business. We can, however, say what we have found and what those findings suggest.

First of all, we found stone tools of a very simple though regular design on this new living floor, and one bone tool that showed signs of having been used to work some substance, perhaps leather.

The stone tools were certainly made by a "man," according to our scientific definition involving a regular, set pattern. There is no reason, moreover, to believe that the child's family did *not* make these tools. But absolute proof is what we need, and I can say nothing more definite until we have it.

I said before that Zinjanthropus seemed to be the world's oldest established man, since we see no reason to doubt that he made the tools at the site where we found him. Yet Zinjanthropus is closely related structurally to the near-men, the australopithecines of South Africa.

The new child seems to be distinct from those near-men. I suspect it represents a different type of hominid—I do not say man—with a slightly larger brain and with teeth which, though large, are not like those of the near-men.

The possibility exists, therefore, that there were two types of hominids developing side by side at Olduvai in Bed I times—that is, according to our new dating results, about 1,750,000 years ago. One of them, the evidence suggests, was the Zinjanthropus type, a near-man at least in bodily structure; the other a creature who was very, very primitive, but in whose bones and teeth we can see certain manlike characteristics dawning.

Thus, all I can say now is that the child's father was probably a man in the tool-making sense. There is much more to learn. Until we uncover more fossil bones, we cannot even say whether the child was a boy or a girl.

One morning as Mary dug at the child's living floor, she exclaimed, "Another tortoise! Altogether too many beastly tortoises and catfish. You'd think they would have grown tired of them."

"Yes," I agreed. But I found it interesting all the same. It suggests that at this very early time, our pre-Zinj being was such a poor hunter that he found slow-moving tortoises and shallow-water catfish a better prospect to catch and kill than other animals.

Antelope Diet Replaces Catfish

Indeed, this is one of the great differences between the living floors of the child and of Zinjanthropus. The child's contemporaries left behind great quantities of the remains of tortoises, catfish, and the relatively easily caught aquatic birds. Zinjanthropus seems to have advanced to killing the juveniles of such animals as horses and antelopes.

But the subject of hunting brings up a new discovery at Olduvai, one that puts both Zinj and his tortoise-eating predecessor to shame. In some respects, perhaps, it was the most exciting find of all in 1960, for this time there is no question that we are dealing with a true man.

To understand the importance of this next discovery, which you must remember is quite separate from our pre-Zinj child, we must go back more than a hundred years, to 1846, when the existence of a Stone Age culture was first reported. The culture was called Chellean after Chelles, the site in France where it was first found.

The amazing thing about this culture—typified by easily recognized stone tools—is that although evidence of it had been discovered since 1846 over much of Africa, Asia, and

southwestern Europe, no one had ever found the skull of a Chellean man. In other words, though we had his tools and knew a good deal about him, no one could say what he looked like.

From the earliest days of our work at Olduvai, we had unearthed tools of the Chellean culture at different levels in Bed II, the stratum immediately above Bed I, and we knew that this widespread culture had evolved in East Africa.

Moreover, in 1954 I had found two human milk teeth associated with the first of several stages into which Chellean culture is divided. They came to light on a living floor, huge things compared to the teeth of modern man and suggesting that Chellean man, like our later find, Zinjanthropus, must have had massive jaws.

Mystery Man Eludes Searchers

In 1960 we returned to a site, near that of Zinj, where I had once found tools of the Chellean Stage 3. We made a small excavation and found a Chellean living floor with plenty of stone tools and animal bones and teeth. But try as we would, we found not one fossil to tell us what the man had looked like.

After all that work, all we still knew about Chellean man himself—and all that the world knew, for that matter—hinged on those two milk teeth from 1954. For once our luck seemed to have run out on us.

I sometimes think fate plays an endless game with us at Olduvai, for no sooner had we stopped searching for our prehistoric mystery man than he made his appearance.

Chellean Craftsman's Mate Inspects a Secret Weapon of the Stone Age

Hunters of the mid-Chellean period, who lived about 400,000 years ago, took an immense step forward with development of the bola, an ingenious arrangement of three hide-wrapped stones connected by thongs.

Huntsmen hurled the weapon at their quarry's legs, entangling them in the strands. Many bola stones have been found in Olduvai. South American gauchos and some Eskimos still use the ancient device.

In this painting of a camp scene, a woman with suckling child examines a newly fashioned bola. One couple quarrels over the head of a giant swamp antelope. Other members of the tribe cut the antelope carcass and crack the bones for marrow.

PETER V. BIANCHI, NATIONAL GEOGRAPHIC STAFF

It happened when I was touring the gorge with Raymond Pickering, a geologist who was working with us to prepare a detailed map of the gorge. One afternoon Ray and I emerged from a small side gorge about a mile from our camp and climbed a hill to look back at the main excavations.

Something suddenly struck me as odd, and I remarked to Ray that from our knoll I could see an area of exposed Bed II deposits that I had never noticed before.

"That exposure," I told Ray, "can't be more than a hundred yards from the excavation in Bed II where we have the Chellean living floor. It even looks to be on the same level. I've got to go and check it."

It was too late in the day to go exploring, and that night I wondered how we could have missed that little patch while working almost within a stone's throw. The only answer lay in the camouflage of the vegetation and terrain.

Early the next morning I took Ray and my youngest son, Philip, and we hacked our way through the bush to the spot. As we stood at the top of the slope, I had a premonition that something important was about to turn up. The three of us scrambled down the cliff, and I said half laughingly to Ray, "This is the sort of place where we'll find a skull."

I had scarcely finished the sentence when my glance happened to fall on some bone fragments in a little eroded gully. A skull! The thought instantly came to mind, but then doubt set in. No, impossible. These were probably just some bits of fossil tortoise, which we have found look deceptively like human skull.

But as I came nearer the fragments, my doubts vanished. It *was* a skull, a human skull. I could see a fossilized section sticking out of the undergrowth and undisturbed soil (page 577).

I fell on my knees beside the spot, and there was no longer any question. For a moment I could not speak coherently. At last we had found what countless prehistorians had sought for more than a century.

We had a human skull in Bed II, the level of Chellean culture.

Erosion Exposes Fossil Remains

When I had calmed down a bit, I left Philip and Ray to mark the site and drove at top speed to where Mary was working on the pre-Zinj site.

"Mary, quick," I began, "I have Chellean man."

Mary looked up skeptically. "What do you mean, you have Chellean man?"

"A skull, a skull!" I almost shouted. "I've found a Chellean *skull*."

That was enough for Mary, and together we dashed back to where Ray and Philip were marking the find. A little work showed that the skull was being washed free by erosion from approximately the same level of Bed II as the near-by deposits we had been searching so carefully for weeks.

Looking back on it now, I realize what pure accident it was that I walked up that

Profile of a Vanished Giant: Olduvai Yields a Dinotherium

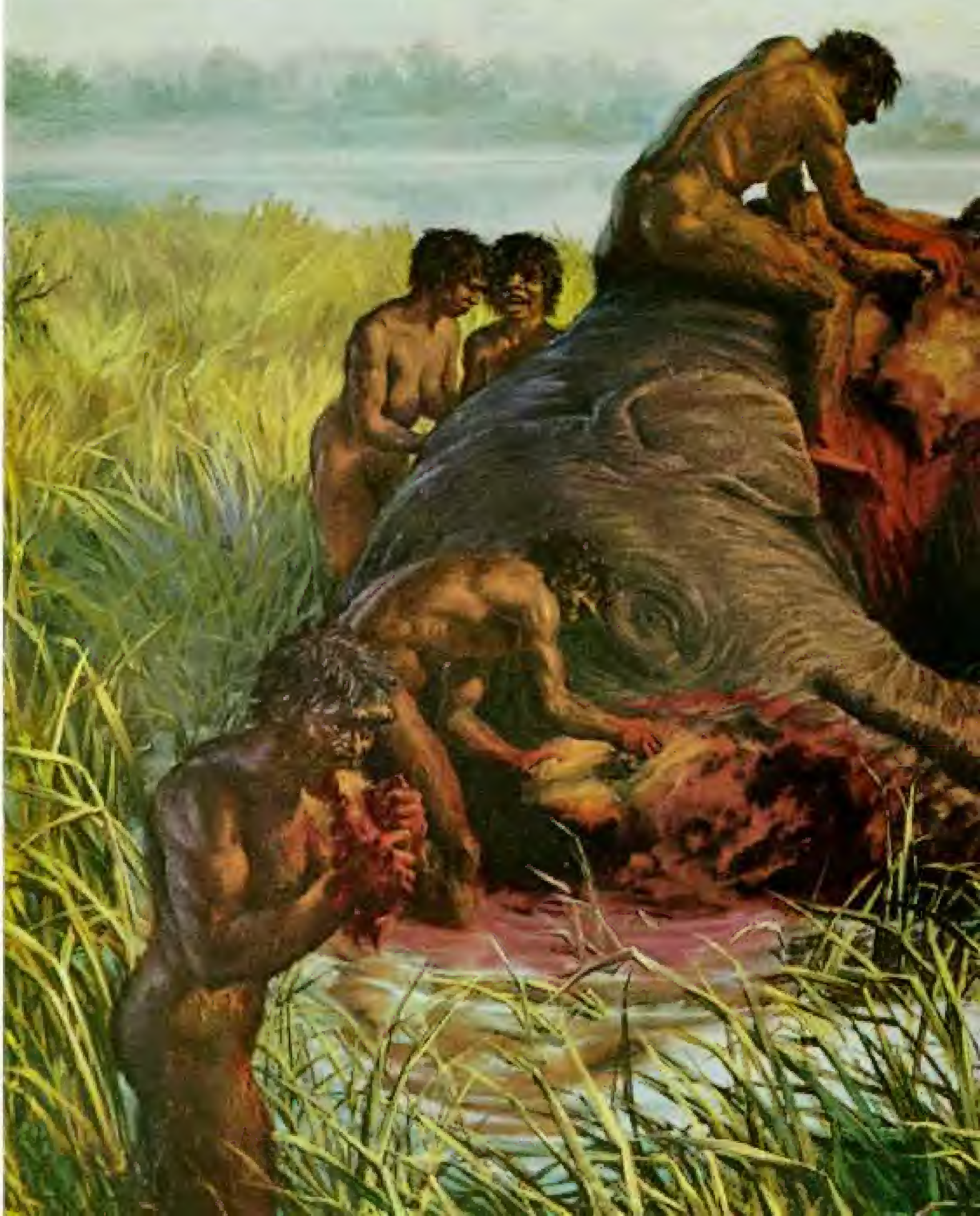
Huge tusks and a bulk measured in tons excluded this nightmare relative of modern elephants from man's list of prey. Uncovered in 1960 together with Chellean stone tools, the beast appears to have bogged down in a swamp, giving hunters a chance to sample its flesh (next two pages). The specimen far surpasses the largest dinotherium previously found. Dr. and Mrs. Leakey (left) and visiting scientists inspect the monster.

Tusks, measuring five feet, grew downward from the lower jaw, unlike those of modern mammals.

particular slope and gazed idly back at that unfamiliar patch of ground. Who knows? Had the light been a little different, perhaps half an hour nearer sunset, I might well have overlooked the site and not stumbled on it for many months more. By then, erosion would probably have washed the skull loose entirely, and it would have been destroyed forever.

Such is the "Leakey luck" with which my colleagues frequently tease Mary and the boys and me whenever we make another important discovery. And I readily admit that luck often plays a part. But then so has 35 years' striving and digging and never giving

Gigantic windfall for Chellean man: Hunters and mates rage and snarl



up. Any scientist will tell you there's no substitute for perseverance.

We already know a great deal about Chellean man's way of life, for as I have said, we have been studying his living floors at Olduvai for years.

It seems certain, for example, that he hunted with the aid of the bola, a weapon made of weights connected by thongs, which is still occasionally used today by the gauchos of South America and by some Eskimos.

We cannot, of course, find a complete Chellean bola, for the leather thongs have long since perished. But we do have many bola

over cuts from a dinotherium fatally mired in an Olduvai swamp

PAINTING BY NATIONAL GEOGRAPHIC PHOTOGRAPHER ROBERT F. SISSON © N.G.S.

stones from the Chellean living floors. We may, I think, be reasonably sure that these stone balls were used as a sort of bola weapon. Certainly without some such weapon, Chellean man would have been hard put to capture and kill the truly giant animals whose bones we find on his living floors. We may guess that Chellean man used the bola as it still is used in South America, hurling it at an animal to entangle the thongs around the beast's legs and hobble it so as to make a kill possible.

Many of the bola stones that Chellean man used are immense in size, suggesting that the hunter must have been a huge and powerful type (painting, page 578). The new-found skull tells the same story, for it is of massive proportions. There is additional evidence in those two Chellean milk teeth we found in 1954, for as I have said, they were enormous compared to those of a modern child.

Primitive Man Appreciated Color

Chellean man thus emerges as a very powerful being with considerable hunting skill, who was no longer restricted to the juvenile animals that Zinjanthropus had had to be content with. On the Chellean living floors we have found countless remains of such huge animals as the giant pig, the giant antlered giraffe, the giant sheep, and several other immense creatures.

One final and fascinating fact we have uncovered: Chellean man liked color. On one floor we found lumps of red ocher that could only have come from a distant source.

Giant of Giants Comes to Light

Last year was indeed a memorable one in the search for fossil man, but the animals have by no means been absent. First there was Jonathan's saber-toothed tiger, which caused great excitement. Then we found a giant species of the African swamp antelope called sitatunga, and a giant form of porcupine. But of all the incredible animals that we unearthed last year, the most surprising was our dinotherium.

Dinotherium is the name scientists give to a strange type of extinct elephant that had its tusks set in the lower jaw, but growing downward like those of a walrus. In modern elephants, of course, the tusks are set in the upper jaw and grow forward and upward.

Science recognizes several stages in dinotherium evolution. In East Africa, for example, we once discovered the remains of a small dinotherium about the size of an ox in Lower Miocene deposits dating from about 25,000,000 years ago.

Mammoth Horns Attest the Size of an Extinct Ram

Pelorovis, a denizen of Olduvai, carried fantastic horns larger than the tusks of most elephants. Dr. Leakey inspects the fossilized cores, which stretch more than six feet from tip to tip and represent less than half the horn mass during life. Modern ram's skull in background has one horn stripped to the core to suggest the missing sections.

Dental picks and paintbrushes help Richard Leakey in the delicate task of removing fossils. He scrapes rock from the leg bone of a horse. Tusk of an extinct hippopotamus lies in left foreground.

Tiny fossils represent remains of a meal for Olduvai's early inhabitants. Largest bone is a lizard's jaw, others the jaws of shrews. Pencil point gives scale.

Central Europe has a larger species, found at a later geological level than that earlier East Africa dinotherium. Because of its great size, the Central European type was named *Dinotherium maximus*. Maximus held the stage for a while until a still larger dinotherium was discovered in Germany. Scientists scratched their heads and labeled that one *Dinotherium gigantissimus*. Its tusks were three feet long.

But I'm afraid science has a real problem now, for our new Olduvai dinotherium puts *gigantissimus* to shame—its tusks alone measure five feet on the curve (page 581).

What to call such a giant? Perhaps Dr. Matthew W. Stirling, a member of the National Geographic Society's Committee for Research and Exploration, has the answer. He suggests *mirabilis*, Latin for "marvelous."

"Mirabilis" turned up in the lowest level of Bed II, where it had apparently died in a swamp and where Chellean man seems to have found it and cut up the carcass with his stone tools (painting, pages 582-3). The tools lay scattered right in with the skeleton.

One of the remarkable features of this weird creature was the immense strength he must have possessed. We all know that when we chew, it is the lower jaw that moves up and down, while the upper remains fixed. The same is true of elephants, whose tusks grow out of the upper jaw and are therefore a fairly stationary burden.

Not so the dinotherium. His five-foot tusks were imbedded in the lower jaw, and the muscular power required to chew with that massive burden must have been staggering.

When it came to excavating and preserving the bones of our new-found giant, we were advised by Dr. J. Desmond Clark, Curator of the Rhodes-Livingstone Museum in Northern Rhodesia, to get a new type of chemical preservative called Bedacryl.

Mary called me on the radiotelephone from the gorge and said, "We have to have the Bedacryl now."

"I'm sorry," I reported, "but there just isn't any in Nairobi. The agents say they'll have to scout around South Africa for some."

"Tell them to fly it to you," said Mary firmly. "Mirabilis can't wait very long."

Fortunately the agents did locate a supply in Port Elizabeth, South Africa, and our dinotherium was saved.

Olduvai's fossils are as varied as they are rich, and if we have giants, we also have dwarfs. This past season we collected the bones of thousands of minute extinct creatures, especially their jawbones and teeth. Some of these animals—they include mice, rats, birds, shrews, and lizards—were so tiny that six of the jawbones would fit on my thumbnail (page 585).

Fossils Record Prehistoric Climate

Getting these delicate miniatures out of the rock is a fantastically ticklish business, but it is worth the trouble, for the tiny fossilized creatures tell us volumes about the climate of the past. Rats, mice, lizards, and other small creatures that live in the desert or in semidesert country are of course entirely different from those in forests, swamps, and meadows.

Fortunately, the fossil jaws, teeth, and bones of even the tiniest animals can be identified as to species. Therefore, when we find the remains of the sorts of creatures that today occupy desert, we can be sure the climate of their period was arid. The reverse, of course, is also true.

It is just this type of detective work, the sorting and interpreting of tiny clues, that makes our job so fascinating. I have often heard archeology referred to as a dry and boring science. Mary and I can tell you that it is nothing of the kind. The cleverest mystery story ever written cannot match our job for sheer excitement and suspense.

Near the top of Bed I we have recently been finding the jawbones of desert or semidesert types of rodents, indicating that the wet climate which we know existed during most of Bed I times had begun to give way to drier conditions. This of course had a vital effect on Olduvai's human life.

The other day we found interesting confirmation of that climatic shift when we discovered a whole layer of mineral structures commonly known as "roses of the desert." These crystalline structures, a form of calcite, are found at varying depths below the surface of the Sahara and other deserts, suggesting that the same type of desert existed for a time at Olduvai. Even today at the gorge, we have the little desert-loving jerboas—similar to kangaroo rats in the United States—scuttling about our camp.

Indeed, I sometimes think the jerboas are the only creatures fit to live in Olduvai, for as I say, the gorge is a true dust bowl almost the year round.

Stone Age Tool Serves the Author as a Butcher Knife

To prove to his African staff that the stone implements they unearth really were used by prehistoric man, Dr. Leakey staged this demonstration at Olduvai with a ram's carcass and a stone chopper of his own making.

A few blows from one rock against another produced the chopper shown at the bottom of the page opposite. With it, the author skinned and disjointed the ram almost as swiftly as with a saw, knife, and cleaver. His time was less than 20 minutes.

"I first began making stone tools some 35 years ago," Dr. Leakey says, "in the belief that I would never fully understand the prehistoric tool-makers until I could handle their implements as effectively as they did."

Occasionally we do get a bonus gift of water when a rainstorm leaves pools on the ground. When such a storm is sighted, someone from the camp often goes out to see if he can collect water. This has led to several adventures, but Jonathan's was no laughing matter.

One evening while I was in Nairobi, he took a Land-Rover and went off in search of pools to tap. When he failed to return by nightfall, Mary became worried and set out

Richard Leakey Chats With Robed and Sandaled Callers at Olduvai

Nomadic Masai herdsmen occasionally visit the camp for water or medicine. Here Dr. Leakey's son converses in fluent Swahili with three tribal elders and a boy. The Masai spokesman (center) carries a spear. Older man at right wears a goat-skin cloak.

in the other station wagon to look for him. This is not as easy as it sounds, for the plains surrounding the gorge are broad and quite barren, and automobile headlights cover very little ground.

Finally Mary found him, still miles from camp, and learned that his Land-Rover had overturned in a hidden gully. He had been forced to start walking in the dark.

Ordinarily this would have been no problem for Jonathan, who knows the area around the gorge as well as he knows the streets of Nairobi. What made it difficult was that he kept running into rhino along the way and had to make a number of detours. He admitted to Mary it was "quite a nuisance."

We often find animals right in the gorge; once when Mary was working, she heard furious barking and looked up just in time to see our Dalmatians pursuing a huge black-maned lion down the gorge. In a group, the dogs can more than hold their own, though singly they are no match for the big cats.

Toots Ambushed by Hungry Leopard

On another occasion, Mary was driving into the gorge with her favorite Dalmatian, Toots, beside her. She stopped the car not far from where we were working and got out on one side while Toots hopped out on the other. There was a flash of black-and-gold fur, and in a second a huge leopard had leaped from

ambush and pounced heavily on the poor dog.

Mary shouted. Toots howled terribly, and the other dogs and I came running for all we were worth. The leopard made off into the brush, but poor Toots was left with nine very nasty wounds.

Matt Stirling can testify to our animal guest list at Olduvai Gorge, though he has reason to remember snakes the best. Last year we built a large banda, or thatched shed, as a bedroom and dining room for the expedition members.

One noon we had just sat down to lunch when I happened to glance at the thatch above Matt's head and saw a black-and-white checked form slithering along the rafters.

"Boomslang," I announced, and to Matt's credit he never stirred, though he must have had a bad moment.

Gentle Nature Masks a Killer

Jonathan, our snake expert, casually took the visitor by the tail and marched it outside into a collecting bag. The boomslang, an innocuous-looking snake (page 575), is perhaps Africa's deadliest reptile after the Gaboon viper. Strangely, the highly lethal quality of the boomslang's venom was not recognized until early in this century, for its poison fangs are lodged at the extreme back of the mouth and only rarely does the snake get an effective hold. Fortunately, too, boomslangs are mild tempered. I can remember playing with them as a boy of ten. I do not play with them any more.

Lunch that day might not have been quite so calm if the visitor had been one of our spitting cobras. They can spray their venom a distance of seven feet on the level, and I have personally been blinded twice, for about a day each time, because I got too close.

I do not mean to give the impression that all our visitors to the camp are wild, for we frequently get visits from the Masai herdsmen who drive their cattle through the gorge on their way from one watering place to another (opposite).* They are always curious about our work, but they do not seem to understand it. One day I was demonstrating to visiting scientists how our Stone Age man cracked animal bones to get at the marrow. We were all squatting in a circle, hammering away with our stone implements.

I was so absorbed in my task that I did not notice the little group of Masai that had gathered near by to watch in awe. They apparently thought we were practicing some mystical religious rite, an impression that was scarcely dispelled when my dignified scientific colleagues picked up the bones and began to suck out the marrow.

I have often tried to make the Masai understand how the stone tools we dig up were once used—that is, as knives and cleavers. They are simply not convinced. Even our own African staff, not the technical assistants but the crews who do the unskilled work, are not easy to persuade.

Last Christmas Eve, therefore, I staged a demonstration. I had ordered a ram to be brought to camp for a special staff feast, and instructed that it be delivered with the hide still on so that I could skin and disjoint the carcass with stone tools. Incidentally, I first began making stone tools some 35 years ago, in the belief that I would never fully understand the prehistoric tool-makers until I could handle their implements as effectively as they did.

When the ram arrived, I gathered the staff around and made a simple Olduvai chopping tool with a few blows of a rock against a piece of stone called chert. The process took less than half a minute.

Then, with this simplest of tools, I proceeded to skin and cut up the ram carcass in about 20 minutes' time. My workmen were astonished, but their surprise was nothing compared to that of Bob Sisson, the NATIONAL GEOGRAPHIC photographer who was recording the event on film (page 587). I only wish I'd had a camera myself to catch the look on Bob's face!

Olduvai Promises New Secrets

By the time you read this, we shall be back at Olduvai again, excavating for our missing clues and going after ones we can only guess at now.

With National Geographic Society assistance once more, we shall be looking for that missing Zinjanthropus jaw, more remains of our pre-Zinj child, and of course more of Chellean man.

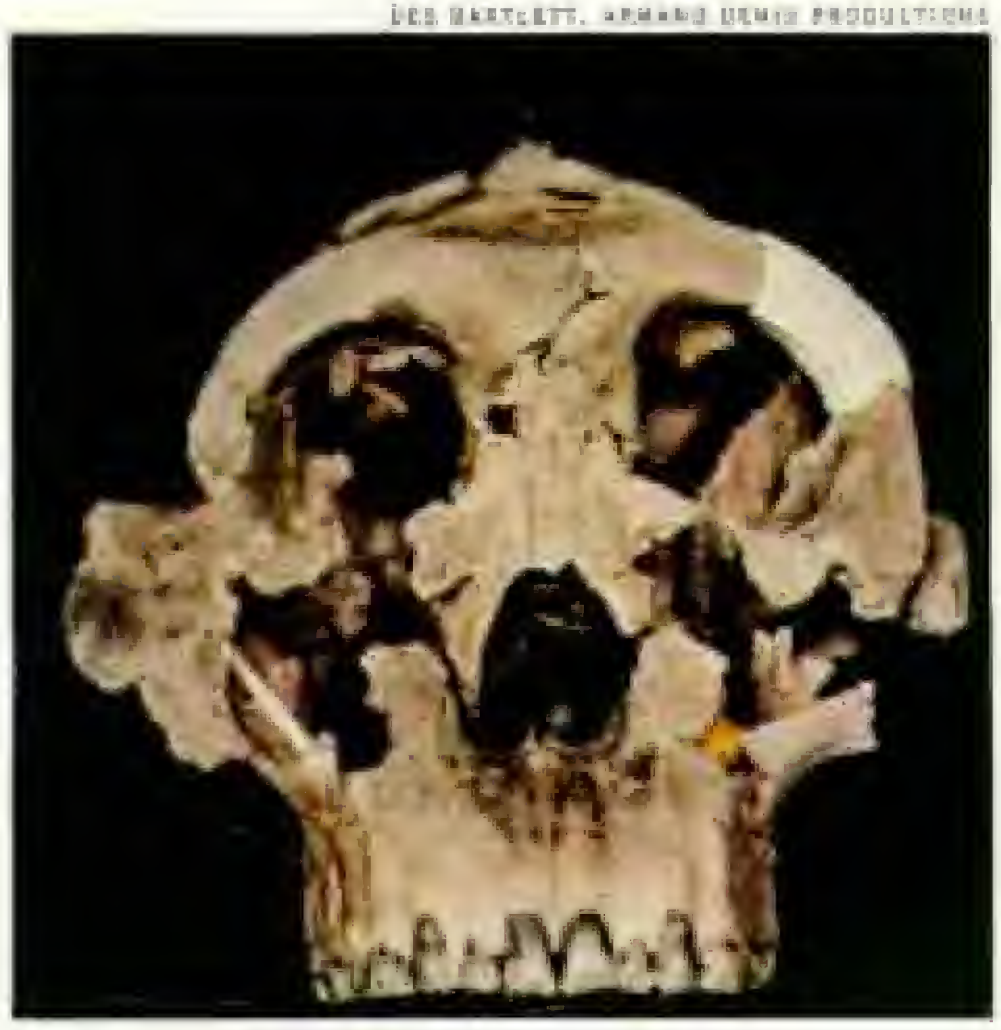
What we shall find, no one can say. But in all the 30 years we have been working at Olduvai, the gorge has always had a surprise or two in store for us each season. I'm sure it won't disappoint us this time.

*A revealing account of the Masai appeared in the NATIONAL GEOGRAPHIC, October, 1954: "Spearing Lions With Africa's Masai," by Edgar Monsanto Queeny.

A Clock for the Ages: Potassium-Argon

By GARNISS H. CURTIS, Ph.D.

Department of Geology, University of California



DEB BARTLETT, ARMAND DENIS PRODUCTIONS

Fossil skull of pioneer tool-maker, *Zinjanthropus*, dates from 1,750,000 years ago. New dating techniques established its astonishing age

AS GEOLOGISTS whose business is exploring the earth's prehistoric past, my partner Dr. Jack F. Evernden and I are used to surprises. Yet nothing ever startled us more than our recent discovery that man the tool-maker is 1,750,000 years old.

Until this year scientists had believed that man developed as a tool-making creature less than a million years ago. But thanks to the potassium-argon process of dating, we need no longer speculate about the age of the earliest known tool-maker.

In the preceding pages, my colleague Dr. Louis S. B. Leakey has told the story of his momentous discoveries at Olduvai Gorge. Coupled with the new potassium-argon dating results, they promise to revise man's basic concept of prehistoric time.

Atomic Change Reveals the Past

What is this new scientific tool that can probe millions of years into the past and unlock the secrets of ages?

Perhaps the simplest way to describe it is to call it a type of atomic clock.

Like the now-famous carbon-14 process, the potassium-argon dating method utilizes a slow but constant atomic change in certain types of matter.*

The potassium-argon "clock," however, runs far longer than that of carbon 14. It is ideal for dating events millions of years in the past, whereas carbon 14 operates accurately only from about 50,000 years ago.

To watchmakers, the mechanism of a clock is known as the movement. The potassium-argon "movement" is the gradual conversion of an unstable element, potassium 40, into the elements calcium 40 and argon 40. Scientists call the original element—in this case, potassium 40—the "parent," while the newly formed elements—the calcium 40 and argon 40—are called "daughters."

I have said our clock was long-running. The actual change of a potassium 40 atom into a daughter atom takes place in a fraction of a second, but it occurs only rarely. For example, if you were to imprison 18 potassium 40 atoms in an airtight test tube for one and three-tenths billion years, you would find at the end that only nine had changed into daughter atoms. The rate of change, then, is enormously slow, but it is constant. We have only to measure the amount of that change, or, as scientists call it, decay, to know how long the process has been going on.

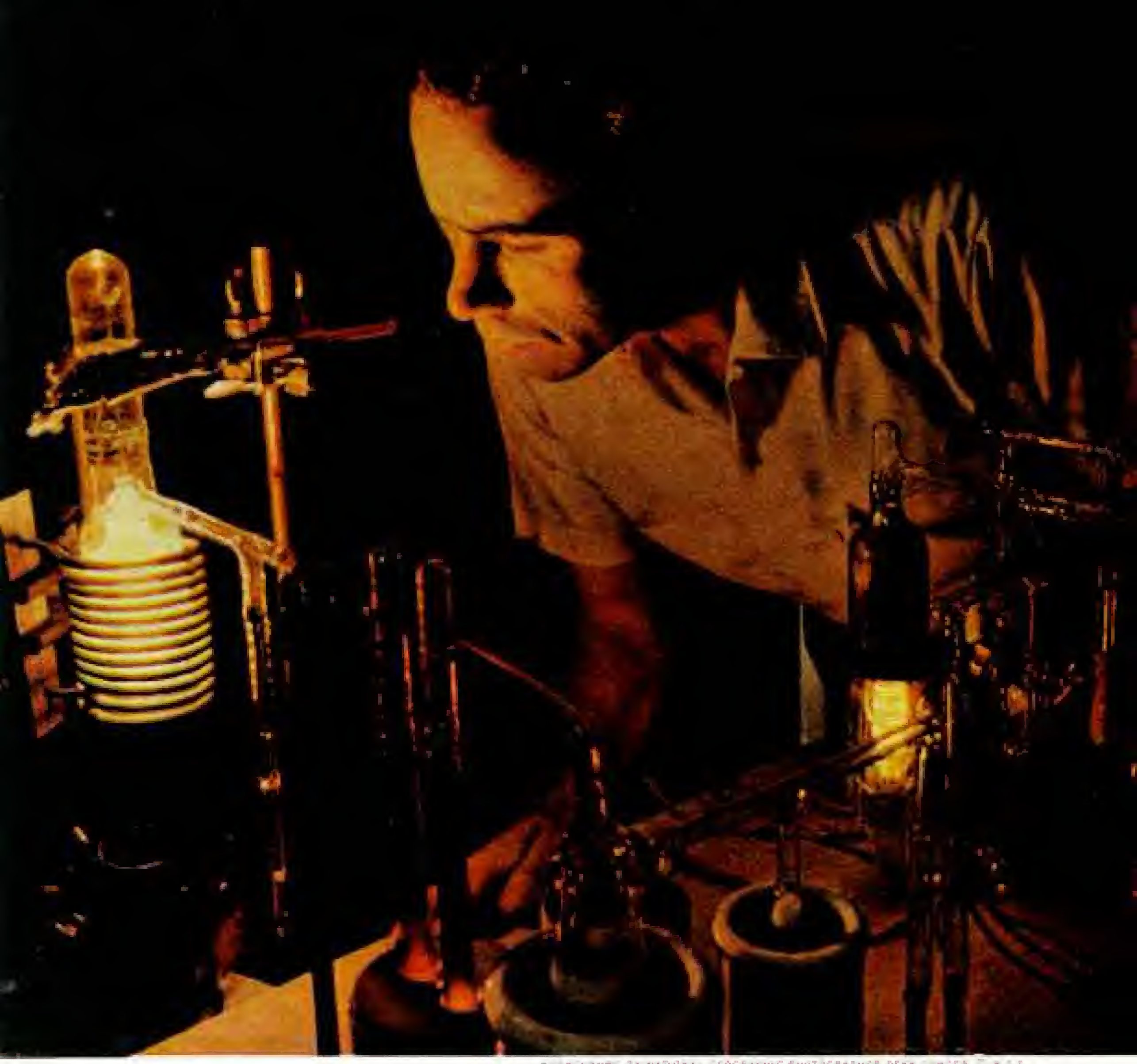
I should explain that the calcium 40 daughter atoms are useless for our purposes, since they are virtually impossible to distinguish from other calcium 40 atoms not related to the movement of our clock.

In determining the ages of rock samples, we depend upon the argon 40 daughter atoms, which can be distinguished from other types of argon atoms.

To learn the birth date of a rock, then, we need only find the number of parent atoms and daughter atoms in one of the potassium-bearing minerals contained in the rock sample. But not every rock will do.

In Olduvai Gorge, if we picked up just any rock sample, it would tell us little or nothing about the age of prehistoric man there. What

* For an account of carbon-14 dating, see "How Old Is It?" by Lyman J. Briggs and Kenneth F. Weaver, in the August, 1958, NATIONAL GEOGRAPHIC.



Electronic furnace, powered by radio-frequency waves, heats an Olduvai mineral sample at the University of California, Berkeley. Coils around the sample jar send waves through a crucible holding the specimen and excite the crucible's atoms to a white-heat dance at 2,200° F. Geologist Douglas B. Nash inspects tools of the potassium-argon process, which has dated meteorites more than four billion years old.

we need is a rock that was actually formed about the time our fossil creatures lived—that is, a rock in which argon 40 has been collecting ever since *Zinjanthropus*, let's say, walked his simple campsite or killed and ate a catfish.

Fortunately, such a type of rock exists in the gorge. We call it volcanic tuff, or ash, and it contains the very potassium-bearing mineral we need—a substance called anorthoclase. In molten lava beneath the earth, the anorthoclase collected no argon 40—the gaseous element simply boiled off. Once erupted and cooled, however, the anorthoclase imprisoned nearly every argon 40 daughter atom as it was generated.

Fortunately, too, the volcanic eruptions occurred both before and after Olduvai's prehistoric inhabitants lived, so that the layers of volcanic tuff sandwich the sites where the fossils lie.

Here, then, are rocks that were born within a few thousand years of our fossil man's time. Find their age, and you have the dawn of man the tool-maker.

At this point, the word "clock" becomes misleading, for no ordinary mechanical clock—not even the finest Swiss watch—can match our laboratory instruments for precision. To measure the argon 40 in a sample, we deal with amounts in the ten-billionths of an ounce! For this we use a mass spectrometer (next page), an instrument so sensitive that it

End of a mystery: Author Curtis (right) and partner Dr. Jack F. Evernden read the startling age of African fossils from a graph.

The scientists tested several samples of the rock sandwiching the beds in which Olduvai's earliest known toolmakers were found, getting age readings that ranged from 1,570,000 to 1,890,000 years, for an average of 1,750,000.

Mass spectrometer, an instrument for sorting atoms by weight, appears in background.

A National Science Foundation grant supports the project.

can, by means of a magnet, separate electrically charged particles according to their atomic weights. In other words, the mass spectrometer can separate argon 40 atoms from other argon atoms by their atomic weights.

Every sample, however, that comes into our laboratory is contaminated in an unfortunate way. If you have ever spilled a jar of sugar on a pantry shelf, you will understand the problem. The sugar—many million grains of it—simply goes everywhere, lodging in cracks and crevices so that you can never sweep up the last grain.

Heat Releases Captive Atoms

The same is true of our samples: Particles of argon 40 from the air—which we call simply "air" argon—have lodged, just like grains of sugar, in every cranny of the rock. Since we want only the argon 40 daughter atoms produced within the rock itself, we must remove these other unwanted particles.

To do this we put the sample in an electronic furnace surrounded by a vacuum (page 591). Then we bake the sample for 12 to 48 hours at about 750° F., driving off most of the air argon 40 but leaving the precious argon 40 daughter atoms within the rock.

Finally we heat the sample again in our crucible to about 2,200° F. At this point the anorthoclase melts, and the long-imprisoned argon 40 daughter atoms are released. In the form of gas, they go into a tube with porous charcoal, which, when cooled to a temperature of 480° below zero Fahrenheit, absorbs the argon 40.

Now we are ready for the mass spectrometer. There each argon 40 daughter atom is ionized—that is, given an electric charge by knocking off one of its electrons. The charged atoms are then shot past a carefully adjusted electromagnet. The magnet pulls the argon atoms out of line and aims them at an electronic target, while letting lighter or heavier atoms go wide.

As the daughter atoms strike the target, they register on a graph, giving us the amount of argon 40 and, with it, the age of our sample. And so we learn the age of this fossil man—1,750,000 years—a giant step toward the solution of one of earth's mysteries.

And yet we have only begun. The recent discoveries at Olduvai Gorge, made possible with National Geographic Society support and dated by the potassium-argon process, shed a vast new light not only on man but on the history of his planet. As man explores the frontiers of space and the realms beneath the sea, he stands at still another frontier—the fascinating frontier of time.

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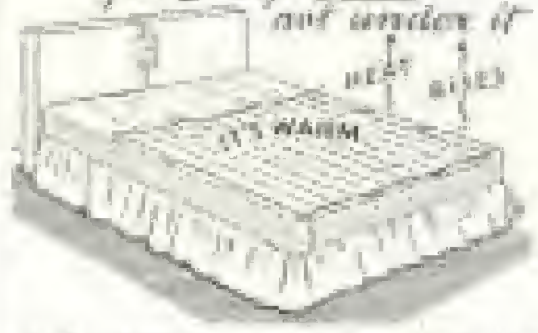

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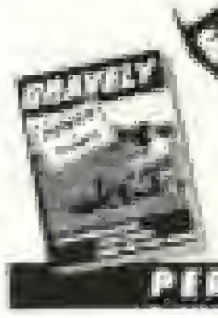

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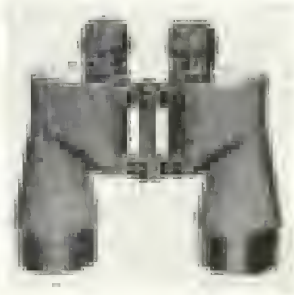

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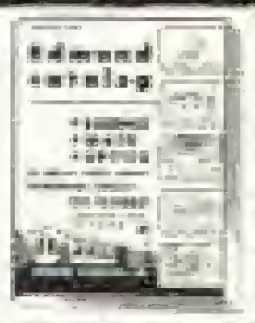

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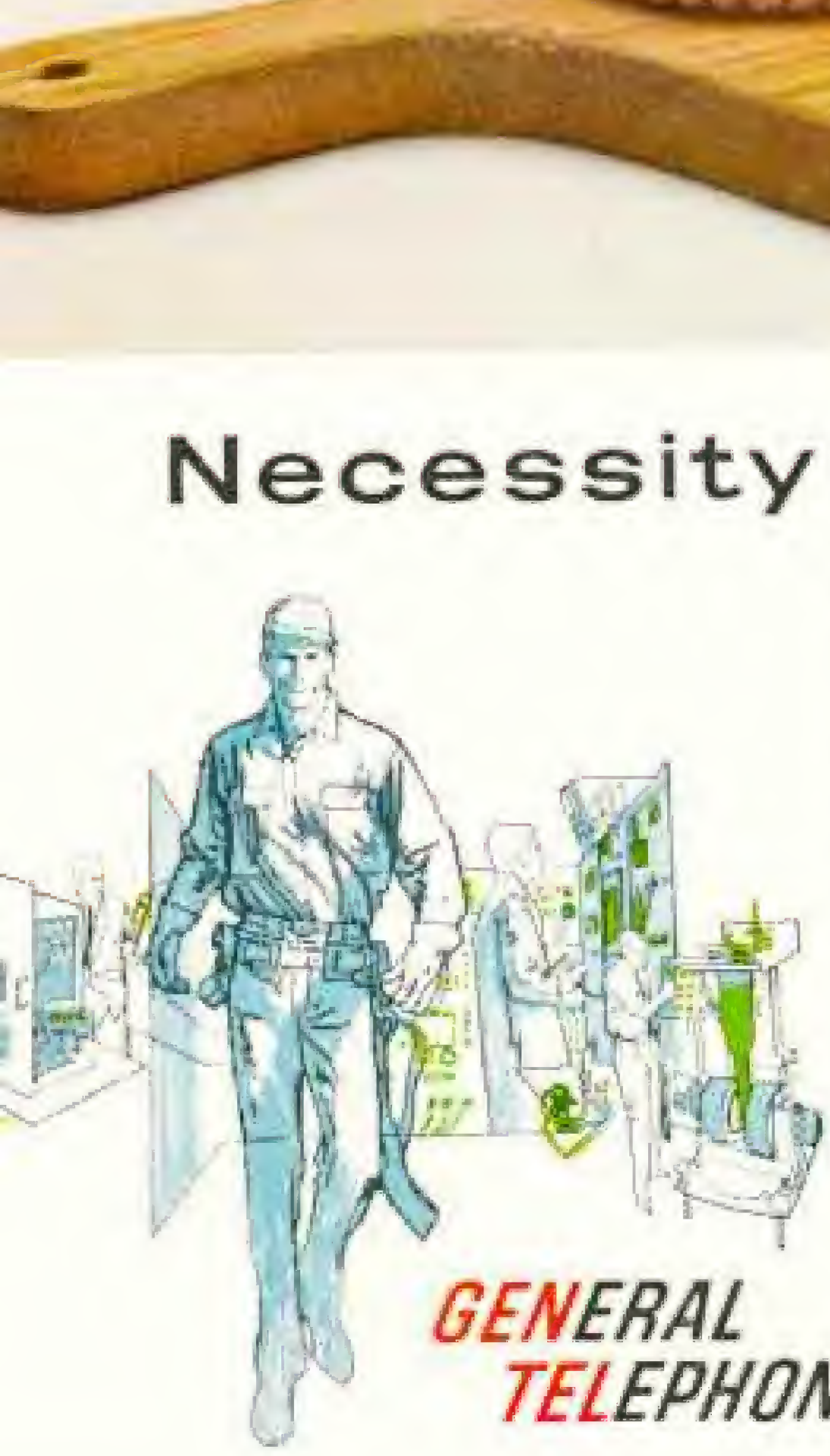

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