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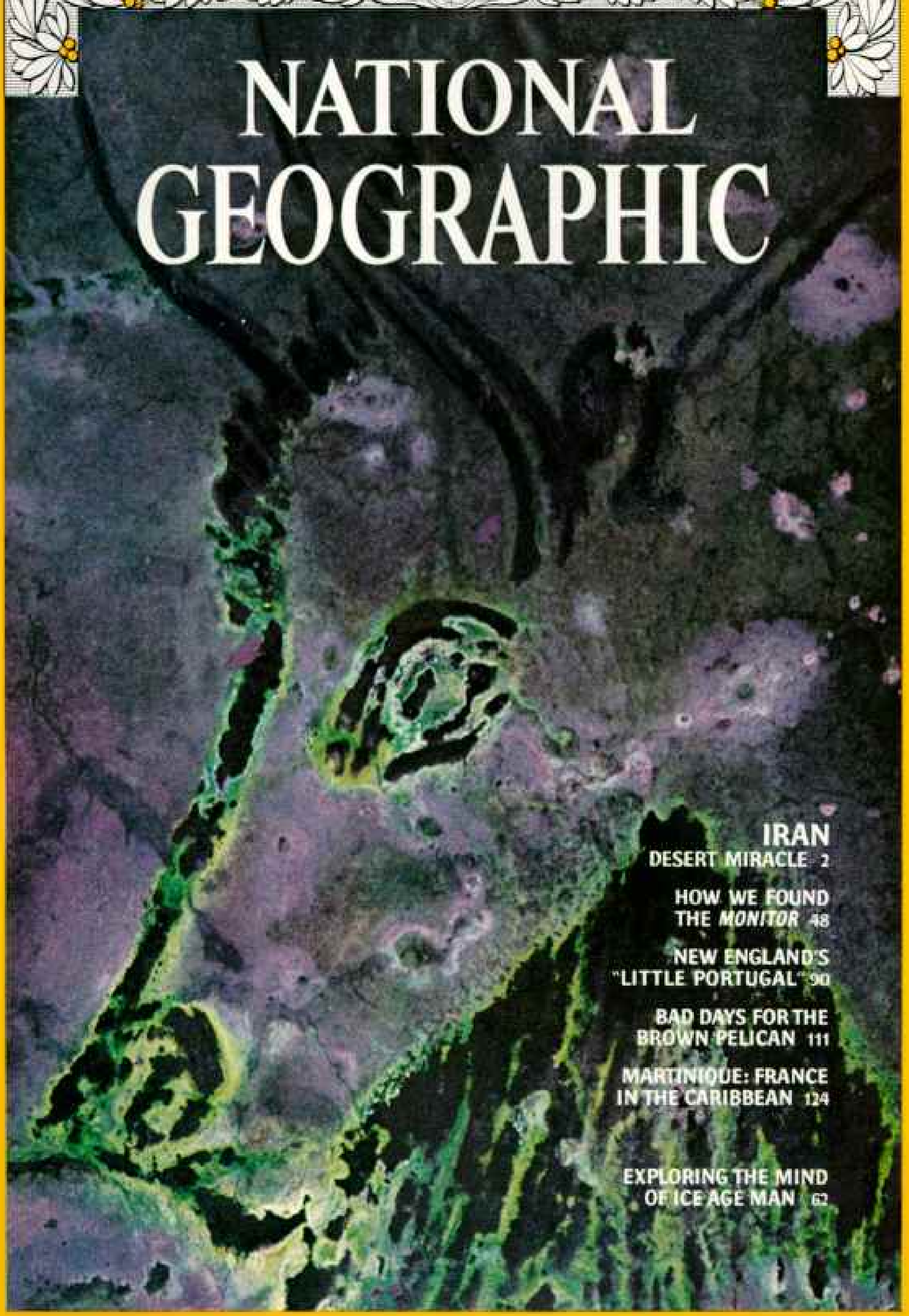

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D. C.

A NEW WORLD ORDER is emerging, dominated by nations that only yesterday were thought of as wastes of windblown sand inhabited by wandering herdsmen. Today almost all other nations—rich and poor alike—must come to terms with these predominantly Moslem lands. For the Arabs particularly, this new power brought by oil must be a heady reminder of that other time, 1,300 years ago, when they swept suddenly out of Arabia and dominated the entire Mediterranean world.

What happens next is anyone's guess, as the industrial nations learn to cope with the high cost of energy, and with the awesome accumulation of wealth that swells Middle Eastern coffers; it may reach $80 billion this year alone.

I find living in these times exciting and challenging—if sometimes nerve-racking—and I think most members of the National Geographic Society do too. They know what to expect of history; their magazine has traditionally documented the fundamental, irreversible changes in the lives of great nations and tiny tribes.

Change can come like a thunderclap, as it did to the Incas; Loren McIntyre brought that period vividly to life in the December 1973 issue. An equally exciting view of Maya civilization is in preparation.

Change can also come as silently as the bloom of a white sail on an ocean horizon—as a forthcoming article on Columbus will show—and as relentlessly as the progress of a road through a jungle. Next month's issue will tell of two Brazilian tribes facing that problem. Later we will visit the Kurds of Iraq, caught in a struggle for autonomy, and view the unprecedented making of a new society in Alaska.

Looking back, I am impressed by the continuity that underlies NATIONAL GEOGRAPHIC's monthly accounting of change. When our staff recently started work on articles about coal resources, geothermal energy, and solar energy, they were acting in an honored tradition: In 1904 we surveyed the "Natural-Gas, Oil, and Coal Supply of the United States"; in 1918 we discussed oil shales; and in 1920 presented "Where the World Gets Its Oil: But Where Will Our Children Get It...?" Two years ago we published "The Search for Tomorrow's Power." And only days after the Arab nations had closed the oil spigot, our staff men were in Saudi Arabia preparing "Oil: The Dwindling Treasure."

This month we visit Iran, one of the nations responsible for, and affected by, the new world order. In 1959 I rode with other journalists into Tehran, accompanying President Eisenhower. Our motorcade rolled over exquisite Persian rugs, but beneath them lay a deeper symbol of the nation's pride and power, Iranian oil-based asphalt.

Assistant Editor William Graves's report introduces us to some of the Iranians making world-shaking decisions, and gives us a vivid picture of the land and its diverse people, faced with a situation unusual in their history—prosperity.

In the long view, I suppose, what happens in the 20th century is only the latest installment in the 37,000-year saga of Cro-Magnon man. We can take comfort in the notion, as Alexander Marshack's article in this issue points out, that even in the most difficult of times, those ancestors of ours managed to make a go of it.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE, VOL. 147, NO. 1

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COVER: *Fluorescing weirdly under ultraviolet light, this bison in a cave at Niaux, France, helps a noted prehistorian toward a new understanding of Ice Age man (pages 76-77). Photograph by Alexander Marshack.*

Iran

DESERT MIRACLE

By WILLIAM GRAVES
Photographs by
JAMES P. BLAIR
BOTH NATIONAL GEOGRAPHIC STAFF

WHEN IT CAME MY TURN, I jumped over the fire, chanting the words young Ali Moradi had taught me: "My troubles and my age I cast into your flames; give me your warmth and brightness in return."

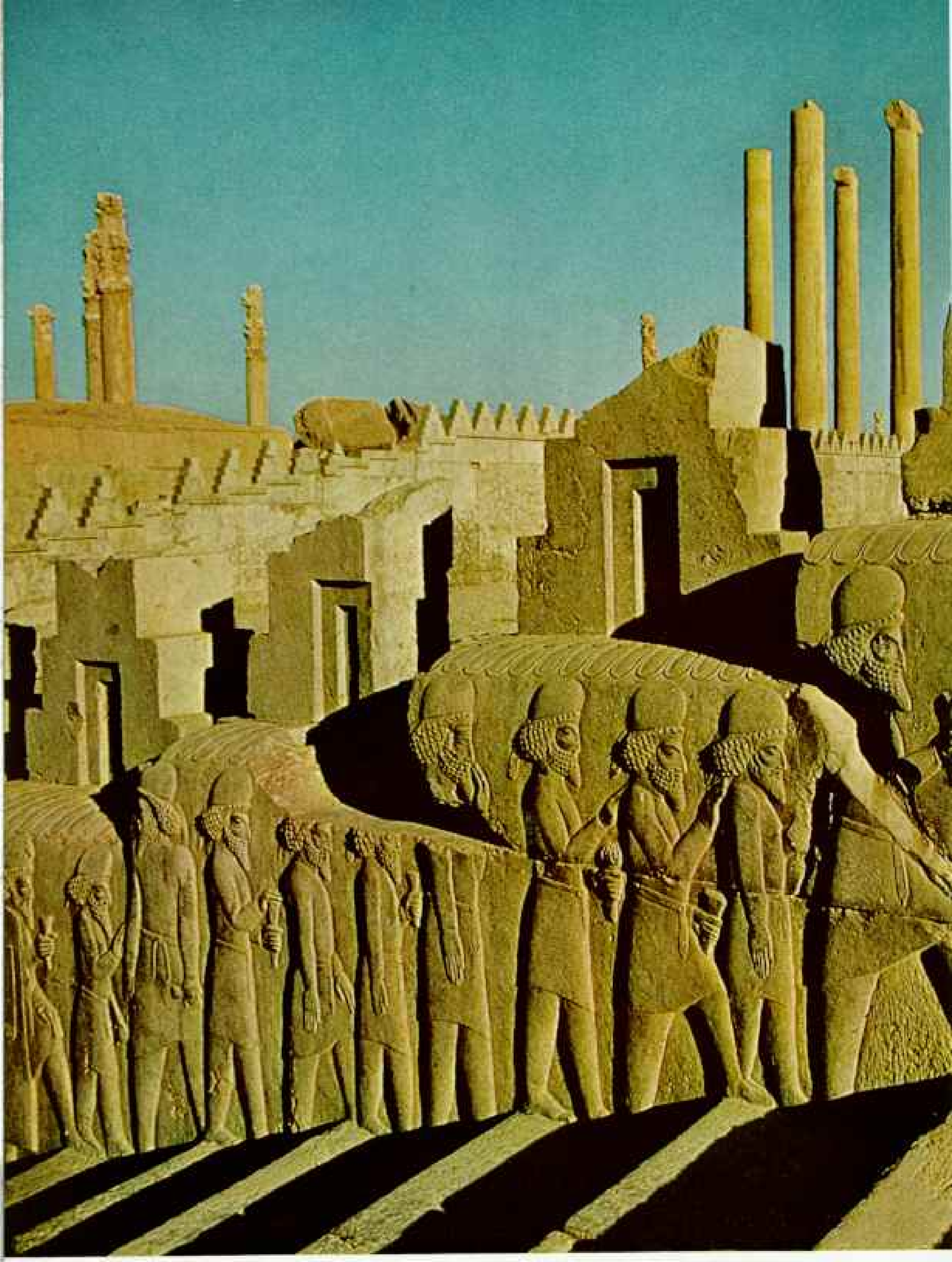
Ali nodded with all the satisfaction of a 12-year-old as he stoked the fire for his next customer. "Now," he assured me, "you will have a successful new year and your days will dance with happiness. You have honored my fire by jumping over it. Ten *rials*, please."

I paid it gladly—fifteen cents for a year of good fortune is a notable bargain—and strolled off down the avenue.

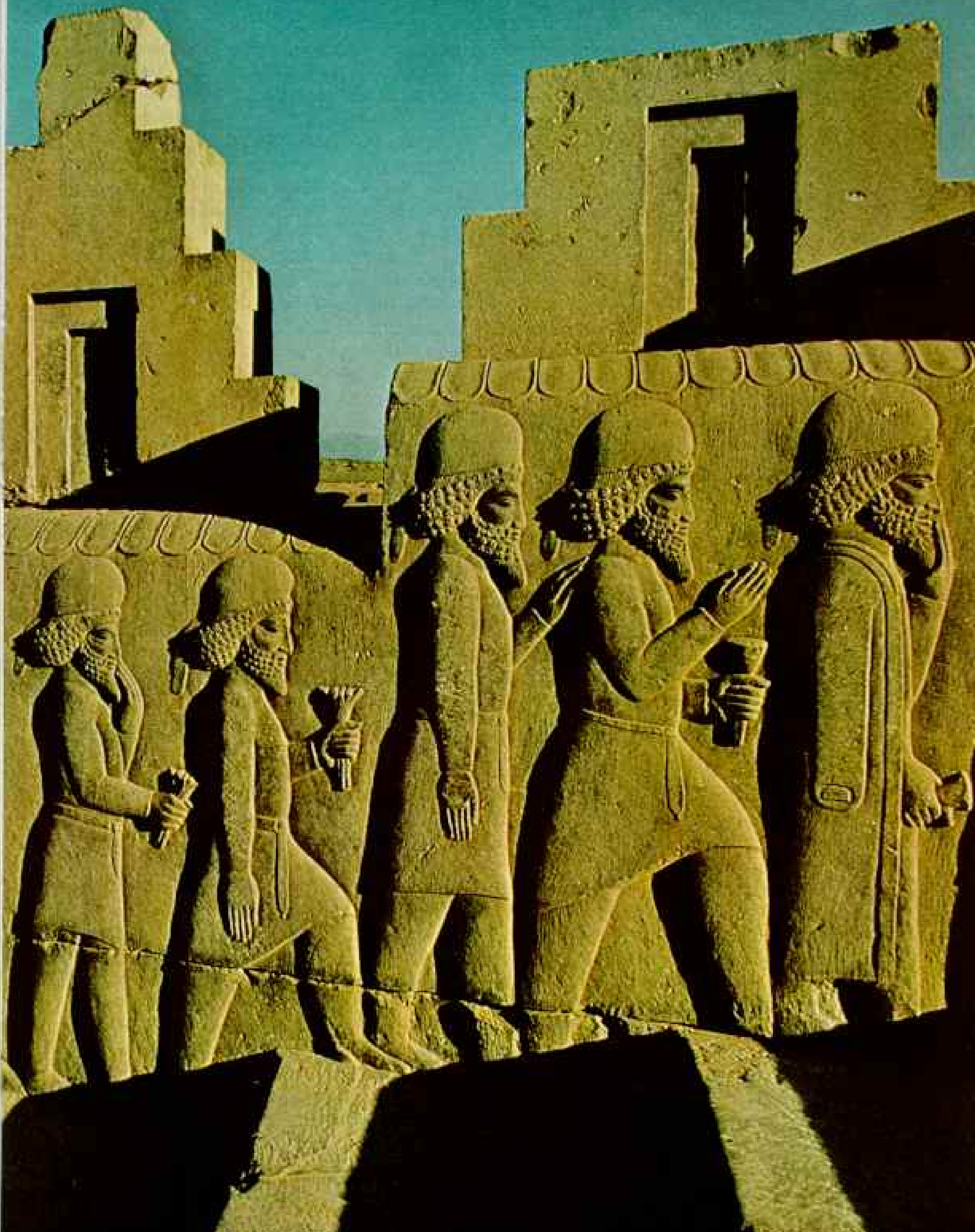
Other fires that evening bordered the streets of Tehran, Iran's enormous capital, for it was Chahar Shanbeh Suri—the Feast of Wednesday. Iranians on that spring night traditionally leap a fire of *boteh*, or desert thorn, in a symbolic swap of past troubles for a fresh beginning. For those who have no fire of their own, Ali and others like him are happy to oblige.

I had arrived in Iran just in time for the

In step with his emerging nation: *An Iranian welder climbs from the hatch of a catalytic cracker at an oil refinery in Abadan, on the Persian Gulf. Ownership of a tenth of the world's oil is the means to Iran's end—to break the bonds of feudalism and assume economic leadership in the Middle East, and to do it in record time.*



Paying homage to an ancient king, *envoys bearing flowers climb a massive staircase amid the ruins of a giant palace at Persepolis. Begun by Darius I in 520* B.C., *the city was the ceremonial capital of Persia, now*



Iran, for two centuries, until Alexander the Great set his victor's torch to it in 330 B.C. Today, echoing former times, Western nations seek to curry favor with the king of oil-rich Iran through offers of trade and technical assistance.

Feast of Wednesday. During two months of travel throughout the country I came to think of that key Middle East nation in terms of Ali's cheerful blaze. In a sense all Iran is jumping over the fire, hoping to discard the burdens and hardships of centuries past for the promise of a new and challenging age.

Challenge denotes problems, and Iran has a wide assortment: illiteracy, disease, pollution, lack of water, inflation, and worrisome neighbors—militant Iraq and the mighty Soviet Union.

Broader still, however, is Iran's range of assets, beginning with what lies beneath the seared and barren earth. With the world facing an energy crisis, Iran's estimated reserves of some 80 billion barrels of oil and a supply of natural gas second only to the U.S.S.R.'s offer the prospect of enormous wealth and economic influence to 32 million Iranians.

"Last year," says Hushang Ansary, Iran's brilliant Minister of Economic Affairs and Finance (page 11), "our national income soared from 17 billion dollars to 26 billion, and per capita income rose from $566 to more than $800. By 1988 our gross national product is forecast at 300 billion dollars—within 50 billion of the current figure for Europe's richest nation, West Germany."

Iran "Turns a New Corner Every Week"

Overnight wealth, however, is commonplace in the Middle East; every oil-producing country has shared in the windfall. What distinguishes Iran is the speed and vision with which she has put the bonanza to work—not only in the traditional form of foreign investments or Swiss bank holdings, but also in the versatile hands of the Iranians themselves.

Against the day when her underground wealth runs dry, Iran has branched out into such diverse fields as petrochemicals, mining, machine tools, irrigation systems, ocean farming, synthetic fibers, and nuclear energy. Meanwhile the country's innovative ruler, Shahanshah Mohammad Reza Pahlavi Aryamehr, has designated one billion dollars to help establish an international fund for loans to underdeveloped nations and to those hardest hit by the energy crisis.

"This country," declares an admiring foreign consultant in Iran, "turns a new corner every week."

Such comments are nothing new to Iran. Foreigners have been making them on and off for the better part of 2,500 years. Known originally as Parsa, or Persis to the Greeks, the forerunner of modern Iran dazzled the ancient world with her civilization.

Occupied during the Stone Age by Aryan peoples from Asia's heartland, Persia in the sixth century B.C. ruled an immense empire from her magnificent desert capital, Takht-e Jamshid—the Throne of Jamshid—named after a legendary king. Today the world knows that vast and haunting ruin by the ancient Greek term Persepolis—City of Parsa.

The empire has long since shrunk to a single nation of 636,000 square miles—three times the size of France—with a capital haunted largely by 20th-century problems.* Lodged against the base of the towering Elburz Mountains in the north (map, page 13), the city of Tehran resembles some enormous earth slide spilling slowly southward onto Iran's great desert plateau.

Contrasts Abound in Busy Tehran

Beneath a colorless expanse of flat-roofed houses and office buildings fashioned of concrete or sun-dried brick, Tehran crowds 3,500,000 residents—more than one out of every ten Iranians—into 85 square miles and adds another 200,000 residents a year.

To the luckless newcomer in Tehran traffic, every resident seems to own a car and to be bent on destruction. In a giant free-for-all reminiscent of a demolition derby, Tehranis collide with one another at the rate of some 65,000 encounters a year, happily more at the cost of pride than human life.

At times the blend of Eastern culture and Western technology yields delightful results. One morning on Pahlavi Avenue in the shopping district I saw a young girl in a flowing *chador*, the modest ankle-length veil worn for centuries past by Iranian women, with a T-shirt beneath it announcing "APOLLO 12."

Tehranis accept such contrasts as a matter of course in the rapid transition from a feudal society to the industrial age. Few see the irony of a new multimillion-dollar municipal hospital for a city where raw sewage still flows with distinct aroma through open ditches along some streets.

Aroma, on the other hand, contributes

*GEOGRAPHIC articles on Iran have included Franc Shor's account of the Shah's coronation in the March 1968 issue; Helen and Frank Schreider's retracing of the conquests of Alexander the Great in January 1968; Edward J. Linehan's look at the country's problems and progress in January 1961; and Gilbert M. Grosvenor's report of President Eisenhower's visit in May 1960.

magically to that teeming caldron of Tehran life, the central bazaar. Along a nine-mile covered labyrinth of 6,000 shops and stalls, the fragrance of innumerable spices and freshly baked bread mingles with the scent of oiled leather, dyeing wool, new lumber, and the perfume of charcoal cooking fires.

With Parviz Raein, a veteran Tehran news correspondent, I explored the bazaar and came to understand its significance beyond the mere exchange of goods.

"Traditionally," Parviz explained as we made our way through swirling crowds in the gold sellers' quarter, "the bazaar was an unofficial forum where Tehranis traded ideas along with merchandise. Its influence was so great that in the old days it was said no law could stand or a government survive without the bazaar's approval.

"Nowadays, of course, power has shifted to the national legislature, and even more so to the Shah. But the bazaar is still an important marketplace of opinion, and it's a wise official who takes a stroll through it now and then."

From the gold sellers' quarter we proceeded deeper into the maze, through the rug merchants' domain, the lapidaries', the tilemakers', and a dozen others. Finally it came time to leave, and I consulted Parviz—a lifelong habitué of the bazaar—for directions.

He produced a pocket compass, studied it for a moment, then pointed down a passageway: "Let's give that one a try."

Jewels Do More Than Dazzle the Eye

Neither the bazaar nor any other center of commerce in Tehran could survive for long without the existence of Iran's Crown Jewels. The priceless stones serve as backing for 75 percent of all Iranian currency.

I inspected the Crown Jewels one afternoon at the Central Bank of Iran in Tehran, where the collection is displayed under tight security. I was welcomed by Mrs. Firouzeh Lashgary, a charming 29-year-old bank official and an authority on the gems. She ushered me down into the vaults past a succession of armed guards and a pair of massive electronically controlled steel doors.

In the dimly lit display chamber the walls seemed aflame with every color of the spectrum. Amid the soft incandescence of thousands of diamonds, emeralds, rubies, pearls, and sapphires, each stone seemed to magnify the luster of every other in a cumulative result that was overpowering. Mrs. Lashgary led me among dozens of display cases featuring crowns, tiaras, earrings, brooches, and varied items whose jeweled encrustations often camouflaged their real purpose.

Struck by the sheer mass of the collection as well as its beauty, I asked Mrs. Lashgary its estimated value.

"Everyone wants to know that," she said with an apologetic smile, "but there is simply no way of judging; all we can say is the collection is priceless. The same is true of other great royal gem collections—the British, Turkish, and Russian." She indicated a gorgeous box inlaid with enormous square emeralds and bordered with flawless diamonds.

"That snuffbox is one of the few items appraised. We had it valued for insurance purposes when the box was to be sent abroad on exhibit; the estimate came to $5,000,000. Then the underwriters quoted us the cost of insuring it, and the snuffbox stayed home."

Former Owner Now Borrows Gems

Now and then, according to Mrs. Lashgary, an item is removed from the collection to be worn by one of the royal family. The transfer is actually a loan, for in 1969 the Shah conferred legal title to the collection on the Government of Iran.

I asked if the royal family could borrow any item they chose, and the cautious banker suddenly emerged in Mrs. Lashgary.

"Of course," she replied, "but His Majesty always signs a receipt and we keep it until the item is returned. One has to be businesslike about such things."

In contrast to the opulence of the Crown Jewels, their 55-year-old former owner is a man of outward simplicity. Only in his ambitions for Iran does Mohammad Reza Pahlavi Aryamehr—Light of the Aryans—and Shahanshah—King of Kings—reveal a sense of inner grandeur. Not long after my arrival in Tehran the Shah granted me an interview at Niavaran Palace, the royal residence.

My first impression was of a man of slightly less than average height, yet of enormous personal presence. Welcoming me in a Western business suit, the Shah offered me a chair and invited me to ask any questions I liked.

I mentioned a statement in his book, *The White Revolution of Iran*, detailing plans for his country's development. He had predicted that in the future man would wage war only on social evils, not on his fellow man. I asked if the Shah *(Continued on page 12)*

The Shah and his Empress

King of Kings, *Light of the Aryans, Mohammad Reza Pahlavi rules with an iron hand gloved in fervent devotion to his people. Here bedecked with medals, including the Grand Cross of West Germany, he waits to greet that country's new ambassador. Should accident befall the 55-year-old Shah, his dynamic queen-regent, the Empress Farah (above), would govern until the Crown Prince comes of age at 20.*

The Shah's men

Big fish *in a sea of power, a handful of men aid their Shah in his quest for the "Great Civilization." Ambassador to the U.S. Ardeshir Zahedi (**left**) responds with an A-OK when asked about relations between the two countries. According to 46-year-old Zahedi, one of Washington's most convivial hosts: "There are no problems. My goal is only to make the ties stronger."*

*Prime Minister Amir Abbas Hoveyda (**top**) has held his position since 1965, when his predecessor was struck down by an assassin's bullet. Here he works at a computer terminal in his office. Economic Affairs and Finance Minister Hushang Ansary (**middle**), a former Ambassador to the U.S., supervises Iran's investments in foreign firms.*

*Smiling as though the price of oil had just gone up again, Interior Minister Jamshid Amouzegar (**below right**) oversees Iran's oil interests as representative to the Organization of Petroleum Exporting Countries. Amir Assadollah Alam (**below**), Minister of the Imperial Court since 1966, is the Shah's most trusted adviser.*

Though their duties differ, these men unite in one single-minded purpose—unswerving loyalty to the Shah. But elsewhere—especially among students abroad—the regime draws charges of dictatorial rule and strong-arm methods.

still considered the statement valid in light of recent Middle East hostilities—among them, Iran's chronic border clashes with Iraq.

After a pause he replied: "If men were intelligent, they would surely join forces against common evils. And if all nations would face the simple fact that no one's well-being can be purchased at the cost of another's, then I believe the statement will stand."

Inevitably we spoke of oil and of Iran's progress in refining her own crude into its thousands of derivatives. During an interview with a European visitor the Shah had summed it up: "In the future I will not sell you crude oil, I will sell you aspirin." When I mentioned the remark, His Majesty smiled.

"That is true," he declared. "Your people in the West find it hard to believe us when we say that in ten years we will be another France or Germany. But I can assure you it is no exaggeration: Our young people will inherit a different country."

When Does Criticism Become Treason?

In fact a number of young Iranians are demanding a different country now, in terms of greater political freedom. A highly vocal group of students, especially those attending universities abroad, have followed the example of students the world over by criticizing their home government for repression.

By Western standards the students have a point: Iran's giant strides over the past two decades have been taken under what many Americans and Europeans view as a benevolent but undemocratic system. In the Majlis, the lower house of parliament, opposition is confined to criticism of the majority party for failing to carry out the Shah's decrees—seldom opposition to the decrees themselves.

In Tehran and elsewhere there is still the occasional dreaded knock on the door by agents of SAVAK, the security police.

"His Majesty," a student in Tehran complained to me privately, "declares that there is plenty of room in our country for complete freedom, but no place for treason. The question is, just who decides the difference?"

A veteran Tehran news commentator puts it another way: "One thinks twice here before sitting down at the microphone."

On the reverse side an overwhelming majority of Iranians approve their monarch's methods and his vision of their country as a powerful progressive force in the Middle East and the world beyond.

"We're still in the process of peaceful revolution," says a professor of Iranian history at Tehran University, "and look at the results so far—land reform, industrialization, vastly increased income, and emancipation of women from the age-old tyranny of Islamic custom. Just recently the Shah decreed free education and medical care for all Iranians. My students are simply too young to grasp the enormity of those changes. I tell them, 'Have patience—one revolution at a time.'"

Nowhere is Iran's transformation more striking than in the military field. Virtually defenseless two decades ago, the country now boasts one of the most powerful armed forces in the

(Continued on page 20)

Airborne heir apparent: *Fourteen-year-old Reza Pahlavi, enthroned in the cockpit of a single-engine Bonanza, prepares for a flight. The youngster may one day become the third Pahlavi to ascend the Peacock Throne.*

U.S.S.R.

TURKEY

Caspian Sea

Increased pollution in the Caspian Sea threatens the sturgeon, source of Iran's world-famous caviar.

U.S.S.R.

Intermittent lake
Salt desert
Intermittent stream
Marsh
Oil field and pipeline
Railroad
Airport

Meshgin Shahr
Ardabil
Lake Rezaiyeh
Tabriz
AZERBAIJAN
Rezaiyeh
Tabriz, a "carpet capital" of Iran and a major commercial center, is also one of the nation's coldest cities.
Bandar-e Pahlavi
Rasht
Lahijan
Gorgan
U.S.S.R.
Battle of Gaugamela
KURDISTAN
Elburz Mountains
Mount Damavand
Mount Dinn
Amir Kabir Dam
Mehrabad Air Base
Tehran
Mashhad
Islamic shrine of Imam Reza in Mashhad attracts more than two million pilgrims a year.
Samandaj
IRAQ
Hamadan
Kermanshah
Qom
Dasht-e Kavir
KHORASAN
AFGHANISTAN
Baghdad
Babylon (ruin)
Tigris
At Susa Alexander the Great and 80 of his officers wed Persian noblewomen in 324 B.C.
Dezful
Susa
Dez Dam
Karun
Isfahan (Esfahan)
A center of Iran's textile industry, Isfahan also preserves some of the finest examples of Persian architecture.
Aryamehr steel mill
Yazd
Zabol
Ahvaz
KHUZESTAN
Khorramshahr
Basra
Bandar-e Shahpur
Zarand
Kerman
Abadan
Shatt al Arab
Bandar-e Deylam
Persepolis (ruin)
Shiraz
SISTAN AND BALUCHISTAN
Zahedan
Bam
PAKISTAN
KUWAIT
NEUTRAL ZONE
Khanehkat Zanyan
Kharg
Farrashband
Shiraz was the home of two of Persia's most noted poets—Sa'adi and Hafiz.
Small oil-rich nations such as Bahrain and Kuwait dot the Persian Gulf's west coast.
Persian Gulf
Bandar Abbas
Qeshm
Khash
Thinly populated Sistan and Baluchistan Province provides space for many of the country's nomads and their flocks.
SAUDI ARABIA
BAHRAIN
Strait of Hormuz
OMAN
QATAR
Doha
Abu Musa
Chah Bahar
Elevations in feet
STATUTE MILES
DRAWN BY ELIE SARKAN
COMPILED BY PAMELA JOETT
Abu Dhabi
Gulf of Oman
BOUNDARY UNDEFINED
UNITED ARAB EMIRATES
OMAN
Muscat

Iran

SNAIL-LIKE in shape alone, Iran bustles with energy. She holds much in common with her Arab neighbors, but her people are Aryans—Indo-Europeans who migrated from the Asian heartland in the second millennium B.C.

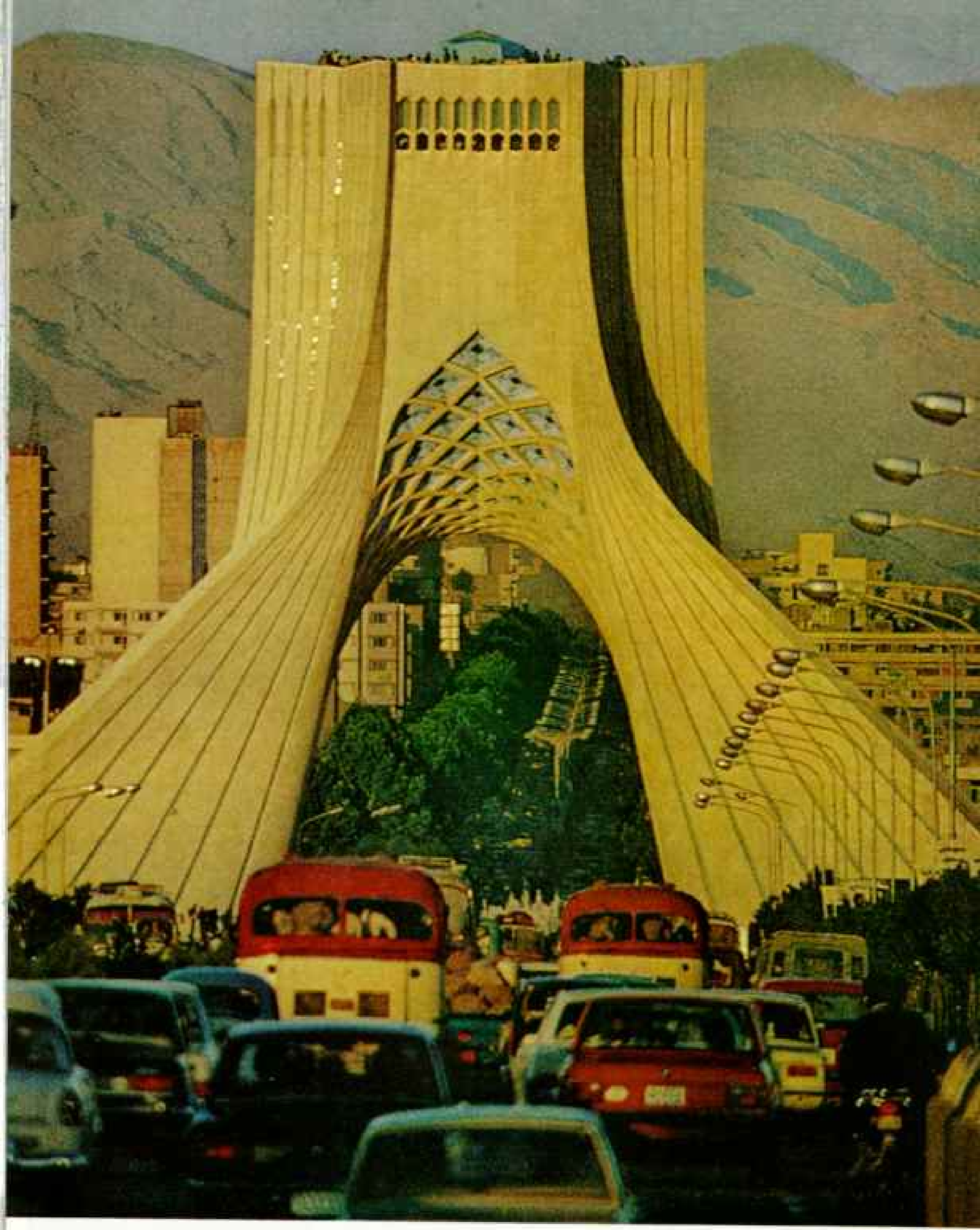
Greek influence waned after the death of Alexander the Great at Babylon in 323 B.C., and Persia entered a 2,000-year period of rule by a succession of invaders interspersed with native dynasties. Arabs in A.D. 636 introduced Islam. Today, after surviving countless wars, Iran has regained a level of national stability comparable to that of her long-ago empire.

AREA: 636,293 sq. mi. **POPULATION:** 32,000,000. **ECONOMY:** Oil, grains, wool, cotton, tobacco. **MAJOR CITIES:** Tehran (pop. 3,500,000), capital; Tabriz, Isfahan, Shiraz, Abadan. **CLIMATE:** Dry, windy on plateau; subtropical on Caspian; hot along Persian Gulf.

A better future takes shape

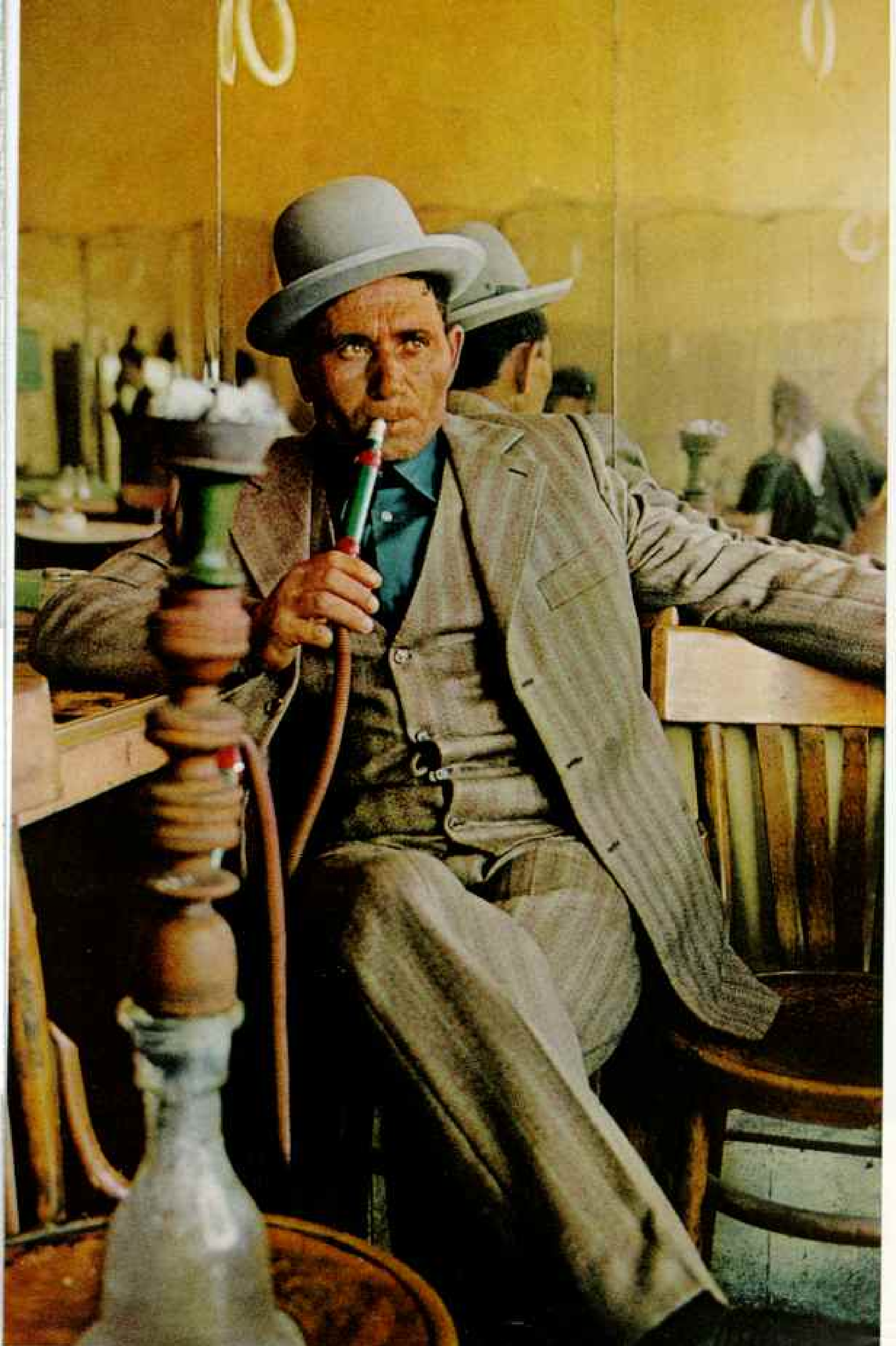
Gateway *to modern Tehran, the 148-foot Shahyad Tower points burgeoning traffic into the heart of the city. Dedicated in 1971, the arch honors Iran's ancient empire.*

The cosmopolitan capital is home to



one Iranian in ten, including most of the nation's small but growing corps of professionals.

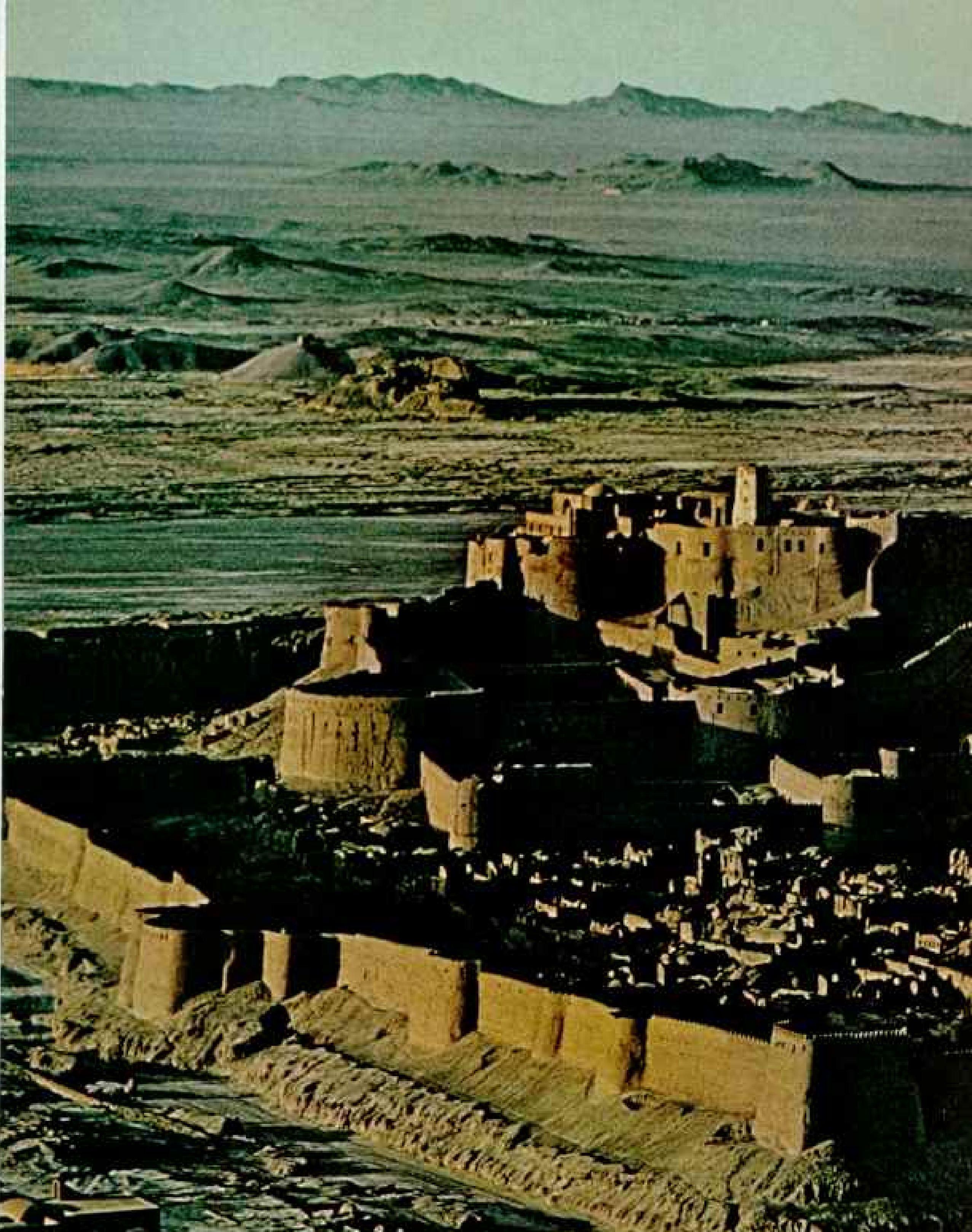
*Dr. Kaivan Saleh (**upper left**), educated at UCLA, heads Iran's most modern hospital. Outside their home, he and his wife show off their sports car, an Italian-made Lamborghini. Architect Nader Ardalan (**left**), who earned his master's degree at Harvard, discusses a building design for the city's Aryamehr Industrial University.*



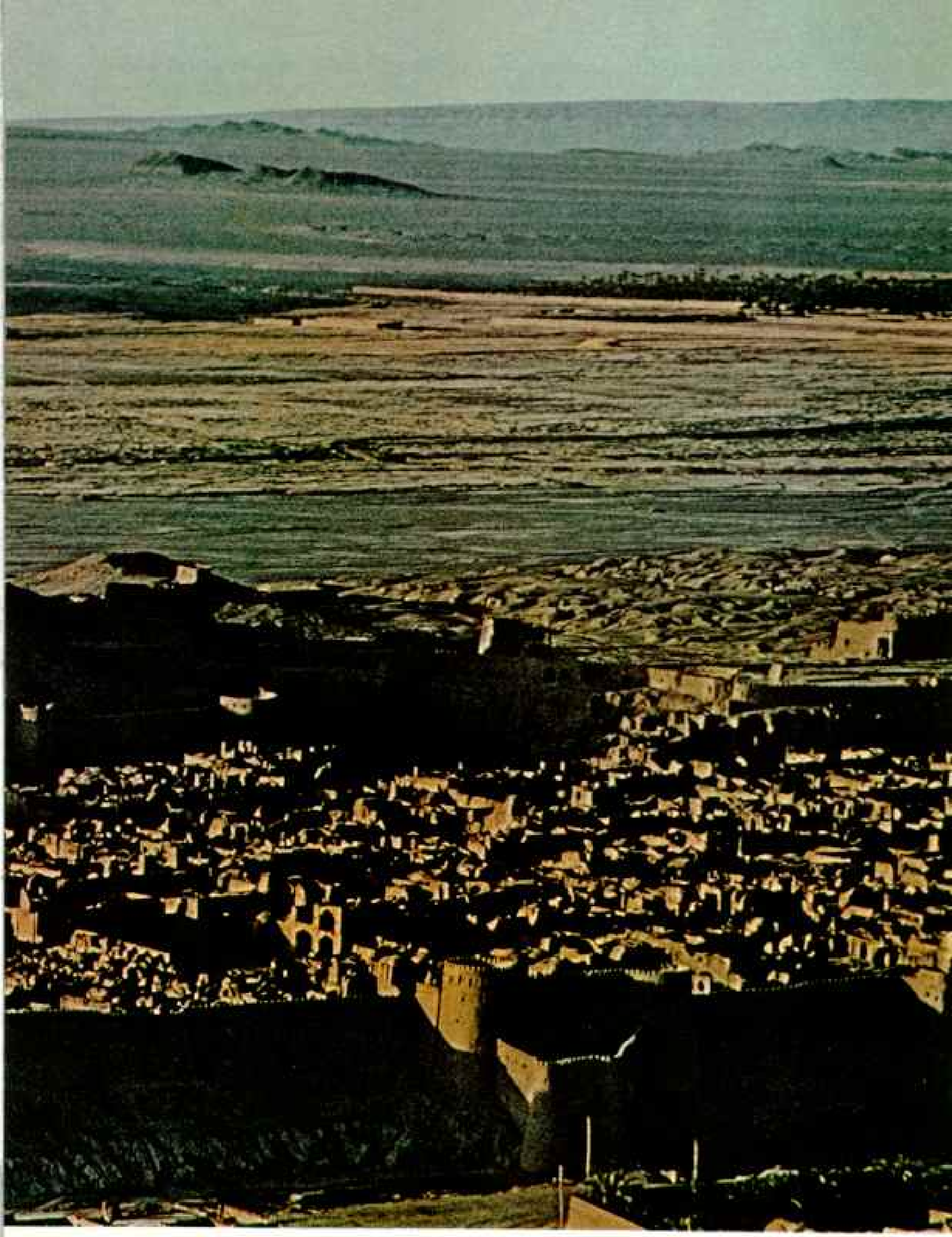
...while old ways linger on

Savoring a water pipe, *merchant Mahbub Zolfogari (left) relaxes at a teahouse in Meshgin Shahr. Such gathering places, called* chaikhanes, *abound in Iran, where they serve as time-honored forums for exchanging ideas, insults, and gossip.*

But the nerve center of every Iranian city is the bazaar. Here may be found goods of all descriptions, from coffins to caviar. A delicately patterned vault in the Shiraz bazaar (below) teems with browsers and buyers. These supermarkets of the Orient sprawl, sometimes for miles, through labyrinthine passageways alive with sights, sounds, and smells of the East. In the Isfahan bazaar, a boy (upper center) sits stiffly for a photograph. World-famous Persian carpets (lower center), seemingly too lovely to walk on, captivate a shopper in Tehran. A new 9-by-12 rug may cost $10,000.



Time now their only enemy, *medieval walls that once shut out Afghan hordes hug the ruins of Bam. The fortified town of sunbaked brick, abandoned in 1850 for a new city*



nearby, lies beside a lush oasis on the western edge of the Dasht-e Lut, a vast desert. Iranian archeologists, directed by the Queen, preserve and restore this and other memorials to the past.

Middle East, most of it trained and supplied by the United States. Iran pays for these services, having dispensed with military and economic aid. The country devotes four billion dollars a year, a sixth of its budget, to defense. The result is men like Khorram Iradj.

I met Khorram, a 35-year-old captain and jet pilot, through the courtesy of the Imperial Iranian Air Force. One morning, with special permission, I joined him at Mehrabad Air Base west of Tehran for a view of his country from the rear seat of an F-4 Phantom jet.

Like most Iranian pilots, Khorram trained in the United States and speaks fluent English. He checked via the intercom to see if I was safely belted in, then rolled the Phantom smoothly down the runway and climbed to brilliant sunlight at 28,000 feet.

Through scattered clouds below I could see the great upturned saw blade of the Elburz Mountains, still covered with late snow and dominated on the east by Mount Damavand, Iran's highest peak at 18,606 feet.

Crossing the range northward toward the Caspian Sea, Khorram indicated a gray-white scallop shell lodged in one of the passes. "Amir Kabir Dam," he said. "It's one of a dozen hydroelectric and irrigation projects in the Elburz and the Zagros range to the south. Mountains are the only real reservoirs we have to store a scant foot of rainfall a year.

"Ask a hundred Iranians what their country's biggest problem is, and ninety-nine of them will tell you, 'Water.'" He suddenly laughed. "The hundredth one will probably say, 'The high price of caviar,' and he has a point—I'll show you why."

No More Bargains in Caviar

Beyond the mountains we streaked over the country's 400-mile-long Caspian Sea coast, now paved almost end to end with crowded resorts. Here the great barrier of the Elburz strips the Caspian winds of moisture, carpeting the northern slopes with lush forest and blocking all but the meagerest rainfall beyond. Khorram followed the shoreline west, gradually letting down to less than 1,000 feet, and tilted one wing over a busy port.

"Bandar-e Pahlavi," he announced, "the center of the sturgeon fisheries. Time was when you could pick up a pound of fresh caviar there for less than $10. Now the price has shot up to $32. Part of the reason is increased demand as well as costs, but another part is pollution—look there along the coast."

Rinsed by the caramel-colored waters of the Caspian, the graveled beach below wore a yellowed fringe of foam with an inner border of scattered debris.

"A lot of that's our own doing," Khorram admitted grimly, "but the Russians don't help matters. They have huge industrial plants that dump tons of waste into the sea. And their offshore wells occasionally produce an oil spill. Russian caviar production is already suffering, and for us it's only a matter of time."

In a final sweep we flew southeast across Tehran over a fringe of the vast desert plateau that makes up 85 percent of Iran's territory. Here Khorram spends a good deal of his flight time over the aerial target range in a salt desert called the Dasht-e Kavir.

Heavy clouds were rolling in. "You must come back one day when it's clearer," Khorram said as we landed back in Tehran. "We'll take a look at the area to the south. You won't believe it's the same country."

Amid a Harsh World, a Blue Oasis

During my subsequent travels, Iran lived up to Khorram's prophecy. In contrast to the lush greenery of the Caspian coast, the region south of Tehran has all the appearance of a cosmic slag heap. Little can survive in that seared wasteland of unending rock and sand.

Often the traveler's only companions are the *gerd bad*, or "round winds"—miniature dust storms whose swirling columns perform a ghostly ballet across the desert floor. Heat combines with silence to produce a weariness of the soul. And all at once there is the miracle of Isfahan.

"*Isfahan nesfe jahan*," declare Iranians in their native Farsi: "Isfahan is half the world." Residents of the city cheerfully agree, without deigning to mention the other half.

In any case Isfahan's portion is one of classic beauty. Set like a choice slab of veined turquoise amid the dark prongs of neighboring volcanic peaks, the city glows with an unearthly blue from a particular shade of tile traditionally used to adorn its mosques. On a visit to its most famous mosque—the Masjid-e Shah—I learned something of Iran's religious heritage from a local authority on Persian art.

"As you know, we are Aryans, not Arabs," a knowledgeable bystander volunteered when he saw me standing in the great central prayer court of the mosque. "When the Arabs invaded Persia in the seventh century A.D.,

they brought the Islamic faith. The Persians adopted the religion, but later split off in a sect known as Shia.

"The effect on Persian art was drastic, some say disastrous," he continued. "Under the Islamic ban on portraits of living creatures, Persian artists were forced to abandon many of their age-old themes." He smiled. "That is, the Arabs *thought* they abandoned them.

"The artistic tradition of disguising human forms grew up and lasted well into the 17th century, when this mosque was built by the ruler known as Shah Abbas. Now look at the tiled fresco up there opposite the blue dome. After a while you'll see the Shah himself."

I followed his glance, and presently made out the suggestion of a Persian nobleman. The figure was ingeniously camouflaged with scrollwork and floral designs; without help I would never have noticed it.

"That was the whole point," my friend said with a nod. "And, one might add, part of the magic of Persian art."

32 "Sisters" Create a Masterpiece

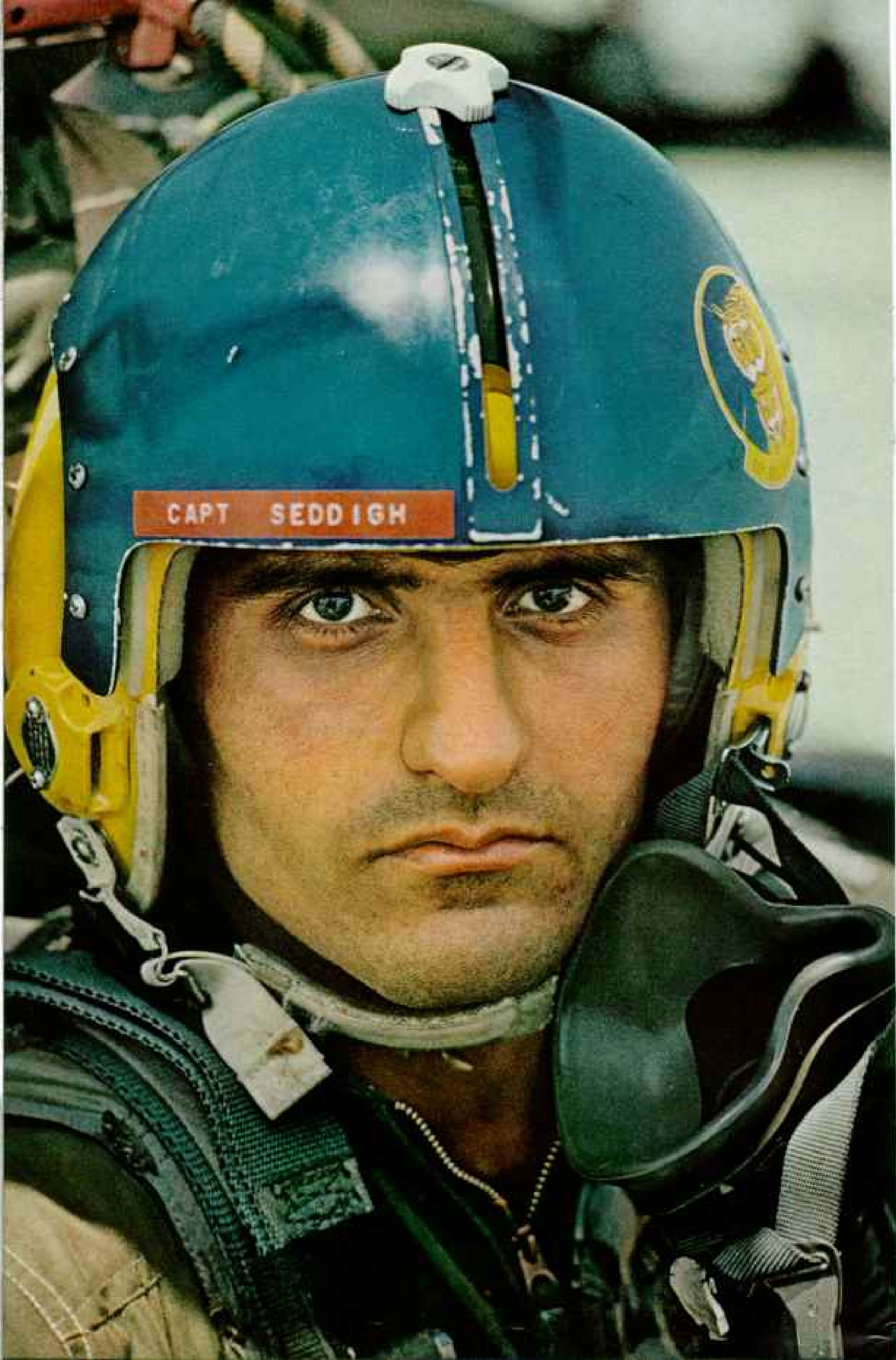
For a blend of magic and unparalleled art, few can match Fatameh Emami and her colleagues. For the past three and a half years Fatameh and 31 other highly skilled women weavers have been at work on perhaps the world's largest Persian carpet, a 35-foot-square masterpiece of brilliant colors interwoven in traditional Isfahan design.

I saw the carpet, then about half completed, at the Isfahan School of Fine Arts. In a cavernous room all its own it hung from a giant loom of steel tubing, with more than a score of women at work on its lower edge. Fatameh welcomed me to the studio and explained that the 32 weavers handle the job in shifts.

Fatameh's art is nearly as old as Persia itself, yet it continues to enrich Iran. More than $17,000,000 worth of handwoven carpets a year goes to the United States alone. The variety is enormous, for nearly every district has its traditional patterns. There can be as many as 500 knots to the square inch.

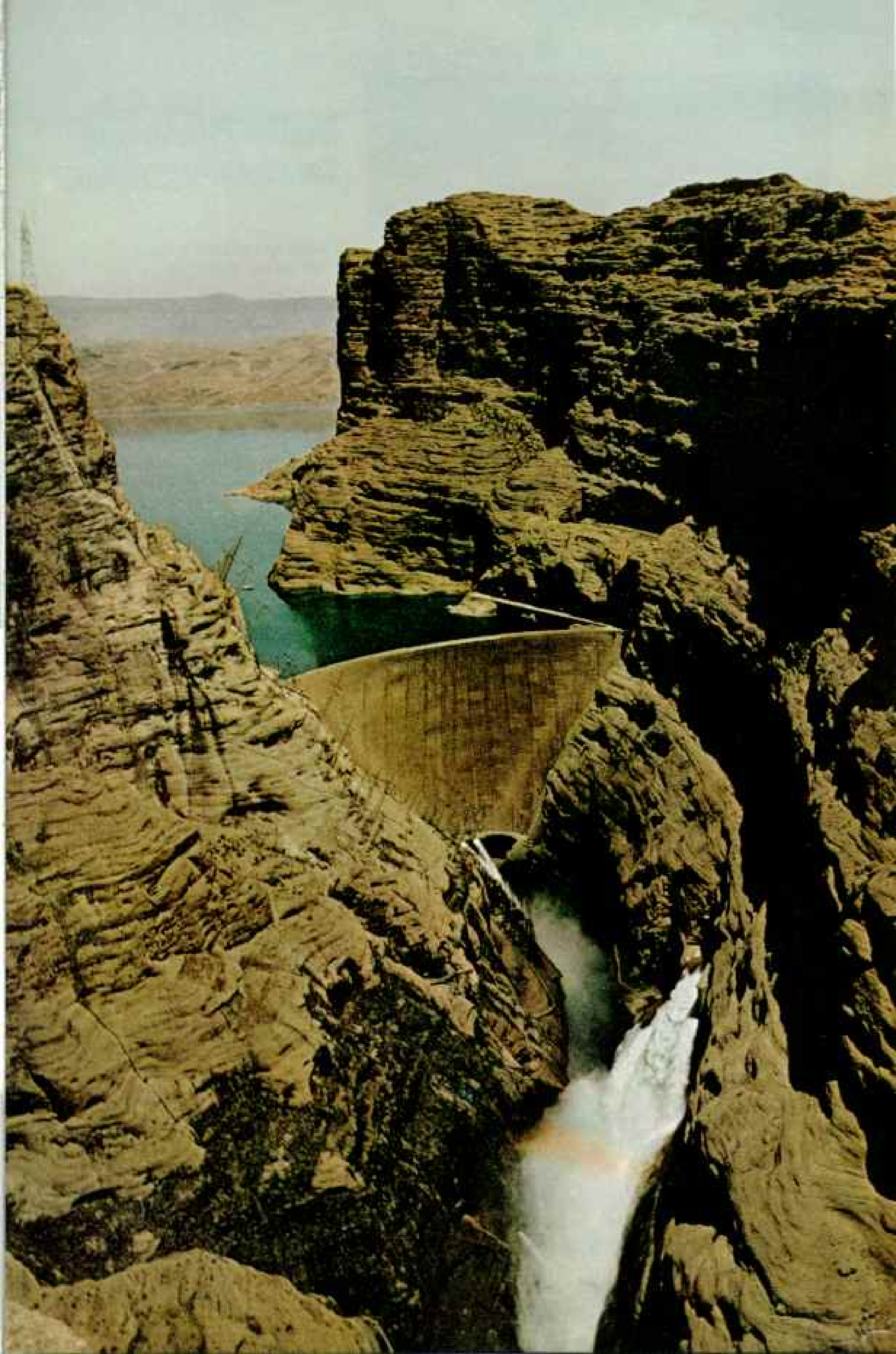
At 41 Fatameh has spent nearly a quarter

Downhill hieroglyphs *tell the story of skiers at Mount Dizin, north of Tehran. The four-year-old resort attracts many from the ranks of Iran's growing middle class. The Shah, an avid skier, more often enjoys the slopes at St. Moritz in the Swiss Alps.*


CAPT SEDDIGH

Modern Persian army: formidable and vigilant

Sentry *on the edge of space, Imperial Air Force Capt. Hooshang Seddigh (facing page) awaits takeoff orders in his U.S.-made F-4E Phantom. To ensure Iran's military readiness, jet fighters stay on constant alert. More than 100 Phantoms and nearly 200 helicopters, like these on a training exercise near Isfahan (left), give pause to Iraq and the Soviet Union—neighbors with whom Iran maintains a cautious stance. Iran also boasts the world's largest fleet of military hovercraft. A practice beach assault at Kharg Island (below) underscores recent remarks by the Shah: "We will tolerate no subversion in the Persian Gulf. Our life depends on the free flow of oil and navigation in the gulf—it is our jugular vein."*



of a century as a professional weaver, including the time she has devoted to the giant carpet. On completion, the masterpiece will lie in the foyer of the National Assembly at Tehran, and a skilled team of seven years' standing will dissolve.

"We are like a huge family of 32 sisters," Fatameh told me, "with all the affection—and sometimes the arguments—of a normal family. We often spend the evening together, and some of the women even vacation together. It will be a historic day when the carpet is finally completed, and a great honor for Isfahan. But there will be sadness, too."

I asked if she would consider taking on a similar task once the carpet is completed, and she shook her head.

"Such things are for younger women, and seven years is a long time." She glanced at the huge work of art behind her: "It is honor enough for one life."

Green Citrus Groves and Yellow Grain

Beyond the Zagros Mountains to the southwest of Isfahan lies another monumental carpet, a vast patchwork of gold and emerald fields that produces nearly a fifth of the country's food supply. After a brief visit to two of Isfahan's modern attractions, the army's new helicopter school and a huge Russian-built steel mill called Aryamehr, I journeyed westward across the great spine of the Zagros to Khuzestan—Land of Sugarcane.

The title is misleading, for *khuz* no longer dominates local farming as it did in ancient times. Today a widespread agricultural revolution is overtaking the area near the Shatt al Arab, the outlet of the historic Tigris and Euphrates Rivers.

With Ahmad Baharestan, a gifted young agronomist, I explored the fertile region so vital to Iran's expanding population. From massive Dez Dam in the foothills of the Zagros (left), we followed another river, the Rud-e Dez, southward among ripening stands of wheat, corn, and barley, interspersed with the dark green of orange and lemon groves.

Many of the farms give evidence of dramatic change: giant sprinklers hooked to

Life-giving spume erupts *from towering Dez Dam, built with U. S. technical assistance. One of 12 dams helping to ease Iran's age-old water shortage, it irrigates Khuzestan Province and lights homes 280 miles away in Tehran.*

irrigation canals; tractors in place of bullocks; mechanized cultivators and harvesting machines that have supplanted age-old manual techniques.

"In a sense," Ahmad said, "Iran's agricultural industry has undergone not one but two revolutions. The first was land reform, with the breakup of large feudal holdings into smaller tracts owned and worked by individual farmers. The second revolution was technological, and in some cases it's produced even larger holdings than before."

Not the same large holdings of the past, however, when a single powerful landlord might own 150 villages, together with their lands and the very lives of the inhabitants. Today's giant farms take the shape of cooperatives and so-called agribusinesses, the latter usually confined to newly irrigated land.

"The small independent farmer is still our mainstay," Ahmad said. "With new technology, equipment, and irrigation he's a match for any farmer in the world. Considering Iran's current need for 30,000,000 acres of cultivated land just to feed herself, he's one of the most important men in the country."

Patrolling a Troubled River

So, too, is Ali Falah-Nejad, for reasons far removed from farming. As Iran's first line of defense in the chronic border dispute with Iraq, Ali provides a slender margin of choice between open war and an uneasy truce. With a two-man crew in an armed patrol boat, he guards a stretch of the Shatt al Arab, the river boundary between two hostile neighbors.

At the Iranian Navy's invitation I joined Ali, a 25-year-old chief boatswain, on routine patrol from the river port of Khorramshahr. As we maneuvered upstream among ocean-going ships anchored and awaiting berths, Ali explained the working law of the river.

"By general agreement," he said, "we share the channel with Iraq from the Persian Gulf to a point above Khorramshahr. There the border leaves the river, and the Iraqis control the rest as their only link between the sea and their inland port of Basra."

The arrangement has its drawback for Iran, thanks to Soviet traffic along the river. Several times a month, Ali explained, a Soviet freighter steams openly past Khorramshahr, bound upriver for Basra with a deck cargo of heavy weapons shrouded in canvas.

"We know very well what is under the canvas," Ali said, "and we know that the Iraqis may use it against us. But the Shah has declared we will never use force unless attacked, so we let the Soviets pass."

Above Khorramshahr we neared the point where the border intercepts the river. Ali slowed the engines so that we hung motionless in midchannel, and waved toward a grove of date palms along the Iraqi bank.

Fortune in tea leaves *steeps in harvest sunshine at Lahijan near the Caspian Sea. Some 200,000 Iranians, mostly women, pick and process more than a million tons a year.*

"They have a command post and an artillery battery there," he said. "A few hundred yards more and they would open fire on us, or perhaps send a helicopter like the one last week." He paused. "But I do not think they will take such a chance again."

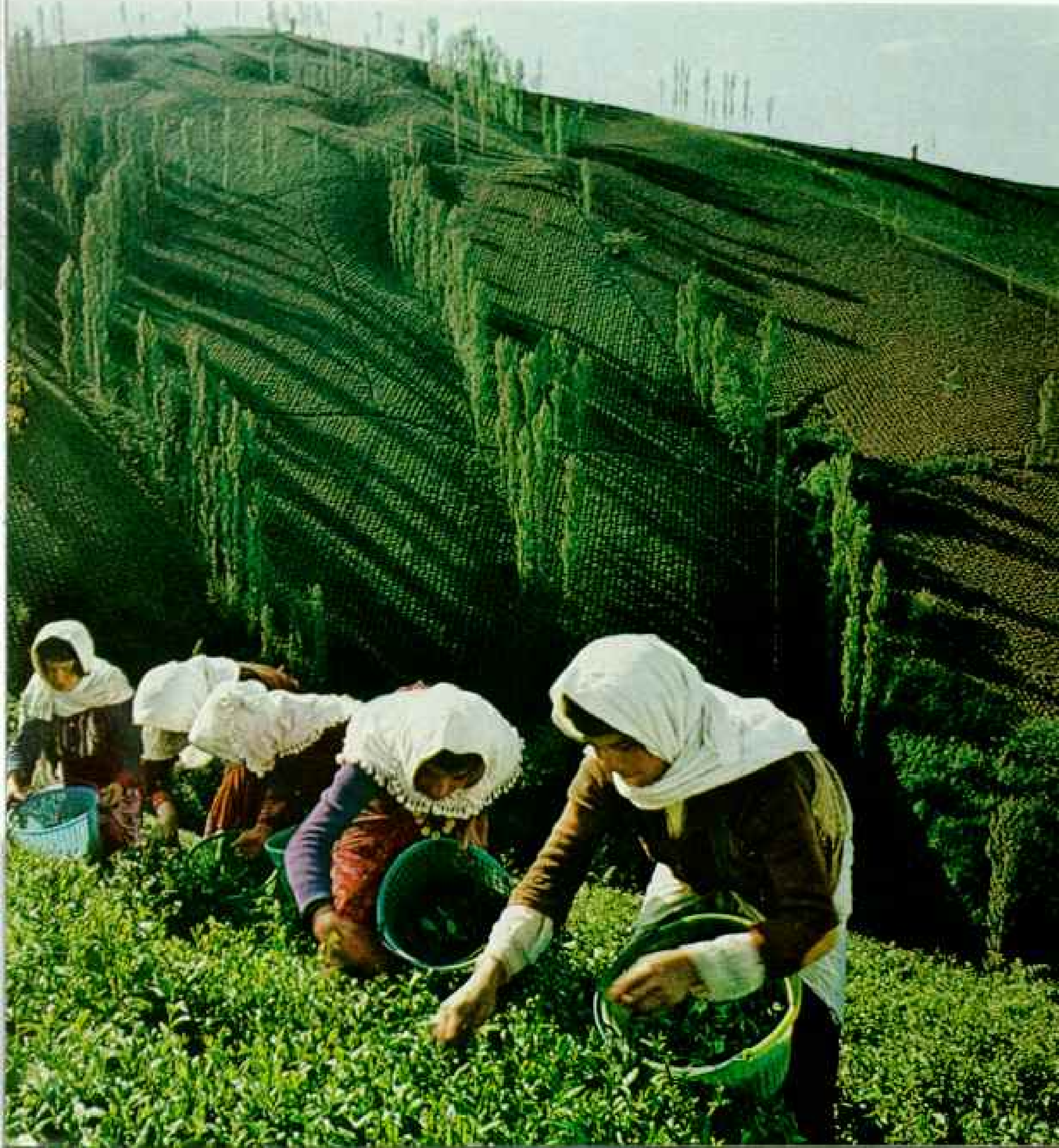
Eyeball to Eyeball With Death

Ali told me the story on the return voyage downriver. The Iraqi helicopter had appeared while he and his crew were well within neutral waters. Skimming above the date palms the pilot had buzzed Ali's boat, then hovered less than 50 feet directly overhead. Through the wash of the rotors Ali and his crew could see a heavy-caliber machine gun in the fuselage trained directly on them.

"He was a maniac," Ali said of the Iraqi pilot. "I do not even know if he had official orders. He just hovered there, grinning, while his copilot made gestures of firing. We were all very close to trouble."

Ordering his crew to uncover the boat's 40-millimeter deck gun, Ali radioed headquarters at Khorramshahr and explained the situation, asking for instructions.

"They told me they would contact the Iraqi command by radio," he continued, "and warn



Oil means power

Thirsty tankers *drink more than 30,000 tons of crude oil an hour at* **Kharg** *Island, one of the world's largest filling stations (***left***). Lifeblood of Persian renaissance, an estimated eighty billion barrels of black gold lie beneath Iran's crusty surface. Oil revenues in 1974 totaled nearly 20 billion dollars—two million for every hour of every day. Such production would exhaust Iran's enormous oil reserves in 30 years. But the Shah has said he will curtail sales by the mid-1980's and boost output of petroleum-derived materials and products.*

Plastic made of petroleum *provides the soles of star-spangled sneakers (***top***), products of Tehran's Melli Shoe Company. The Shahpur Chemical plant (***above***) at Bandar-e Shahpur makes petrochemical products —ammonia, sulphur, and urea, a chemical fertilizer—at a total rate of 5,000 tons daily.*

Iran's growing oil-based industries provide 30,000 new jobs a year—and some new problems as well. As industry grows, so grows pollution. A pipe fitter at the Abadan refinery remarked: "I think we will not live so long working like this. It makes us feel bad." His concern is also the government's, and plans are under way to tackle this industrial curse.

them to call off the helicopter. If the pilot didn't withdraw in ten minutes, I was to open fire. I agreed, though I knew if I did the Iraqi shore batteries would join in, and we wouldn't stand much chance."

The helicopter remained, and Ali thought he could see the pilot talking into his microphone and shaking his head. Ali ordered his crew to arm the deck gun and made ready for a one-sided battle.

"Just as I was about to give the order to fire," he told me, "a second Iraqi helicopter appeared and flew alongside the first one. They must have talked by radio, for the first pilot finally pulled up and followed the second one back to the Iraqi side." He shook his head. "Such people do not belong on the Shatt al Arab."

Southeast of Khorramshahr lies one of the objects of Ali's daily patrol, the great oil refinery at Abadan. In an area subject to surprise invasion, the country's petroleum nerve center is heavily guarded. Equally vital is the huge crude-oil terminal at Kharg Island, through which Iran pumps liquid wealth to waiting tankers at the rate of 6,000,000 barrels a day (page 28). By-products of the country's other great resource, natural gas, flow from an expanding petrochemical center along the coast at nearby Bandar-e Shahpur.

Kharg Island represents what one Iranian oilman calls "the tip of the funnel." At a pier more than two miles long, one of the world's largest oil-export facilities loads ten mammoth tankers at once.

"Frozen" Oil Can Halt Tanker Loading

With Parviz Ajudani, chief of operations for the terminal, I took refuge from the island's blistering 103-degree heat in the air-conditioned main control room, whose walls were studded with an array of dials.

"Each bank of dials," he said, "meters the flow to a single tanker, recording not just the rate of delivery but various characteristics of the oil itself, such as temperature and viscosity. With bunker oil, for example, we must always guard against the danger of freezing."

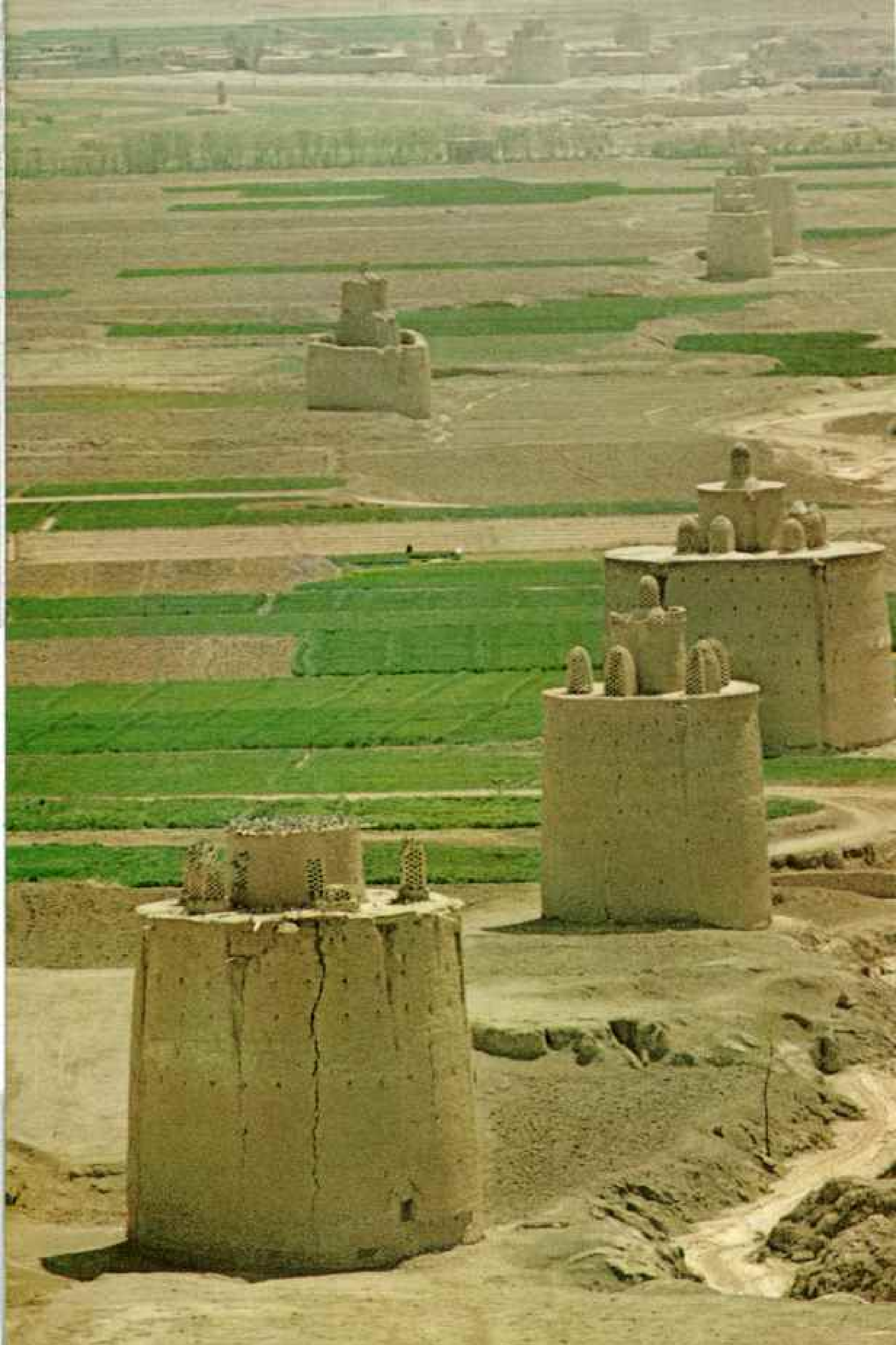
With the sweat still pouring down me I looked astonished, and Mr. Ajudani smiled. "Not freezing in the sense of turning solid," he said, "but of becoming too thick to flow properly. Our loading lines run more than a hundred feet beneath the ocean, and the oil becomes chilled even on a 130-degree summer day. To keep it flowing into a ship, we must recirculate it through heating units."

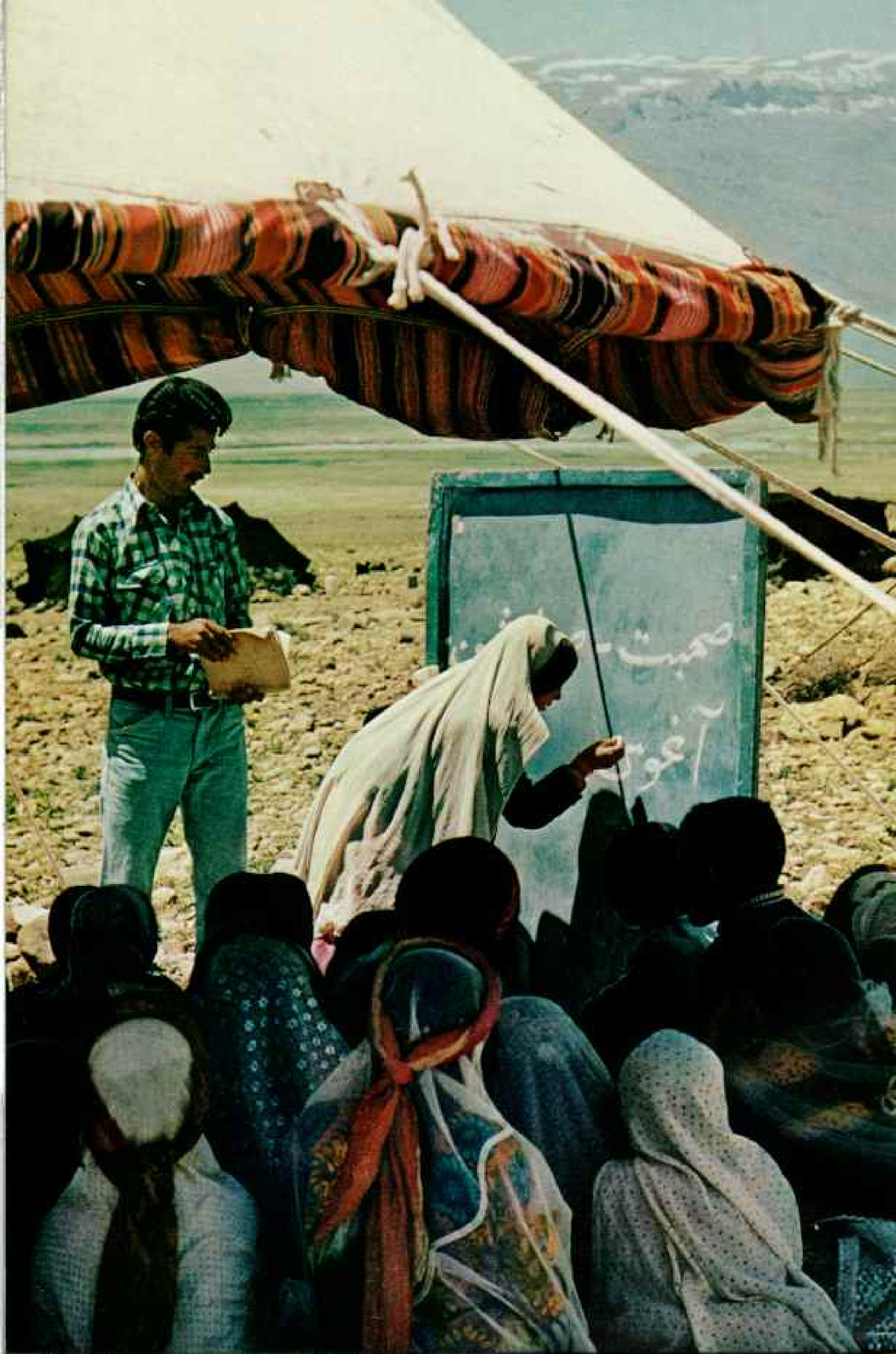
I learned that nearly a third of Iran's oil currently goes to Japan, with less than 5 percent exported to the United States.

"Between the Persian Gulf and Japan," Mr. Ajudani said, "there is an endless strand of loaded tankers sailing at 40-mile intervals the

Heated competition *evidences Iranians' love for soccer, the national sport. These teams play against a backdrop of gas burn-offs in the oil fields of Ahvaz and high-tension lines from Dez Dam. Oil and huge natural-gas reserves give Iran a staggering one-two energy punch.*

Like giant chessmen, *mud-brick pigeon towers dot the landscape near Isfahan (***following pages***). Built in the 17th century by melon farmers, each of these avian high rises collected and stored natural fertilizer from as many as 10,000 live-in pigeons, which raided outlying wheat fields. Today, their glory years ended by chemical fertilizers, the towers are neglected and largely empty.*





entire way. If you are interested in sheer tonnage, visit Bandar Abbas—from there you can see the Strait of Hormuz."

The effort was rewarding but costly, for Bandar Abbas is infamous for its summer heat. Seventeenth-century English sailors observed that there was "but an Inch-Deal betwixt [Bandar Abbas] and Hell," and a traveler noted, "Nothing is left here but a sensible Map of Purgatory."

Oil Armada Never Ends

As it happened, Bandar Abbas was enjoying a mild spring, with temperatures ranging only in the high 90's. During a brief flight aboard an Iranian Navy helicopter over the small strategic island of Abu Musa, I had dramatic proof of Mr. Adjudani's remarks.

Far below, an endless armada of tankers threaded the narrow throat of the Persian Gulf at the Strait of Hormuz, outbound for world ports. According to my pilot, the rate of passage through the strait averages out to a loaded tanker every 90 minutes, with cargoes totaling 600,000,000 tons of oil a year.

"They are not only from Iran," the pilot said of the tankers. "They come from other Persian Gulf states as well—Bahrain, Qatar, Kuwait, Saudi Arabia. Like us, those countries depend on oil for a living, and the only way we can earn it is through the gulf."

To safeguard the vital passageway, Iran occasionally takes drastic steps, such as armed assistance to neighboring Oman in its bitter civil war, and the seizure of vital Abu Musa near the Strait of Hormuz. Beyond the gulf itself, Iran is completing a huge air and naval base at Chah Bahar, near the Pakistan border, to anchor her Indian Ocean defenses.

At least once in the past Iran neglected her own defense at irreparable cost to the world. Through a series of blunders, exploited by a 25-year-old military genius named Alexander, the ancient Persian Emperor Darius III lost both his life and his incomparable capital. After his victory over Darius at Gaugamela near the Tigris River in 331 B.C., Alexander the Great advanced on Persepolis and applied the conqueror's torch.

"Some say it was accidental," Mohumad Sajjadi told me as we explored the colossal ruin near Shiraz (pages 4-5). Mohumad, a local history teacher, had taken the day off to guide me through the remains of that long-ago tragedy. "Whether it was deliberate arson or not," Mohumad continued, "Alexander removed a vast treasure of gold and jewels from the royal strong rooms before fire could destroy them. Ancient accounts say it required no fewer than 30,000 mules and camels to carry the treasure home to Greece."

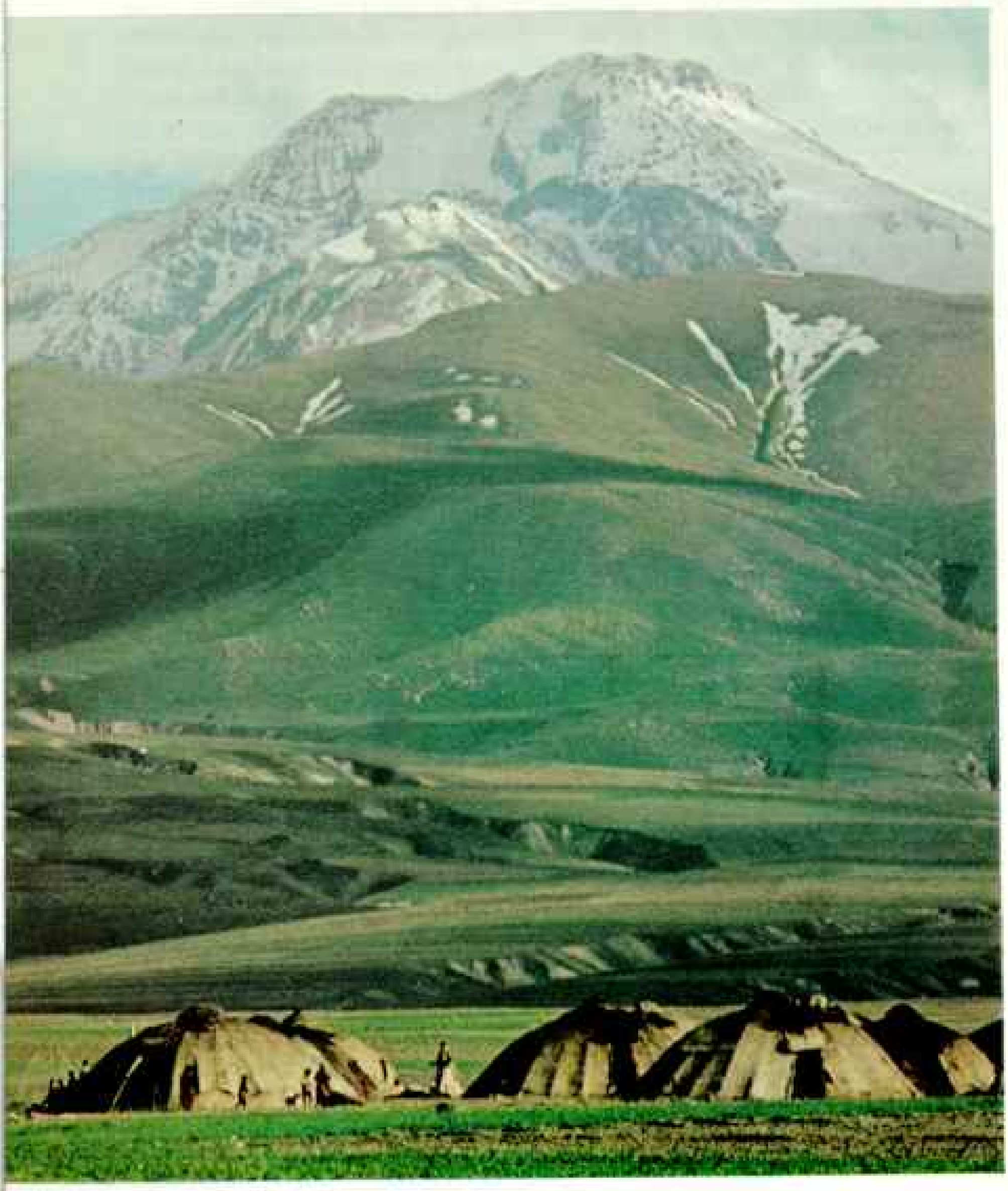
What Alexander and all his troops could never carry home was the infinitely greater treasure of Persepolis itself. For hours Mohumad led me among carved-stone ruins of royal quarters, audience halls, council chambers and courtyards, crowned here and there by soaring columns whose stately capitals now support only the eternal vault of the sky.

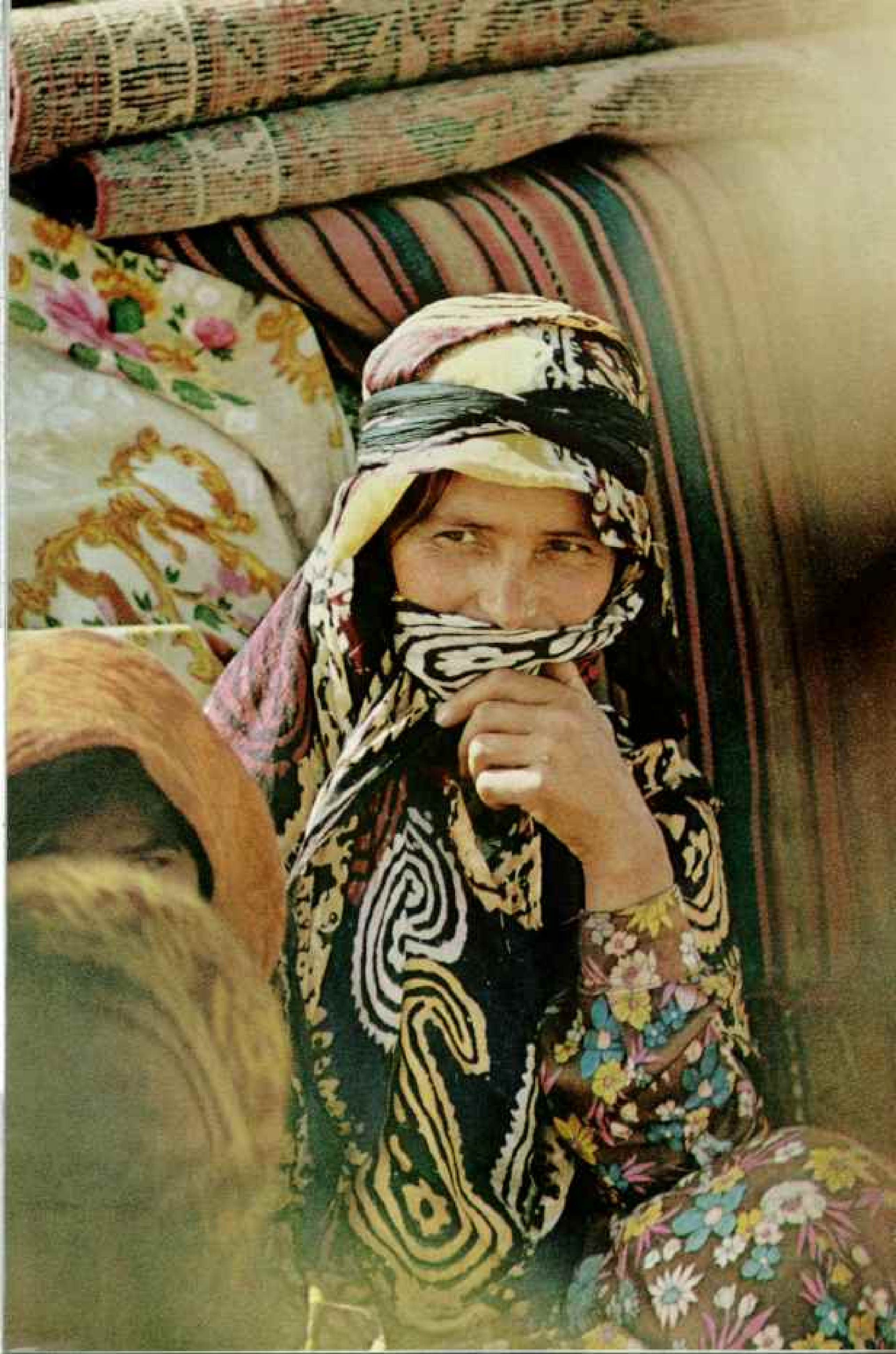
Despite its grandeur Persepolis housed its royal owners no more than a few days in every year. "The residential capitals were at Susa to the west and Hamadan in the north," Mohumad said. *(Continued on page 40)*

Tending his flock, *a Qashqai teacher shepherds children of the tribe through the hills and valleys of learning. The Turkic-speaking Qashqai roam Iran's mountainous southwest. Part of the Shah's peaceful revolution includes war on the nation's 60 percent illiteracy rate. Teaching cadres include Literacy Corpsmen—young educated Iranians who lead classes in towns and villages, the men in lieu of two years' military service. Women of the Revolution's Health Corps (**right**) distribute birth-control pills and disease-prevention information west of Shiraz.*

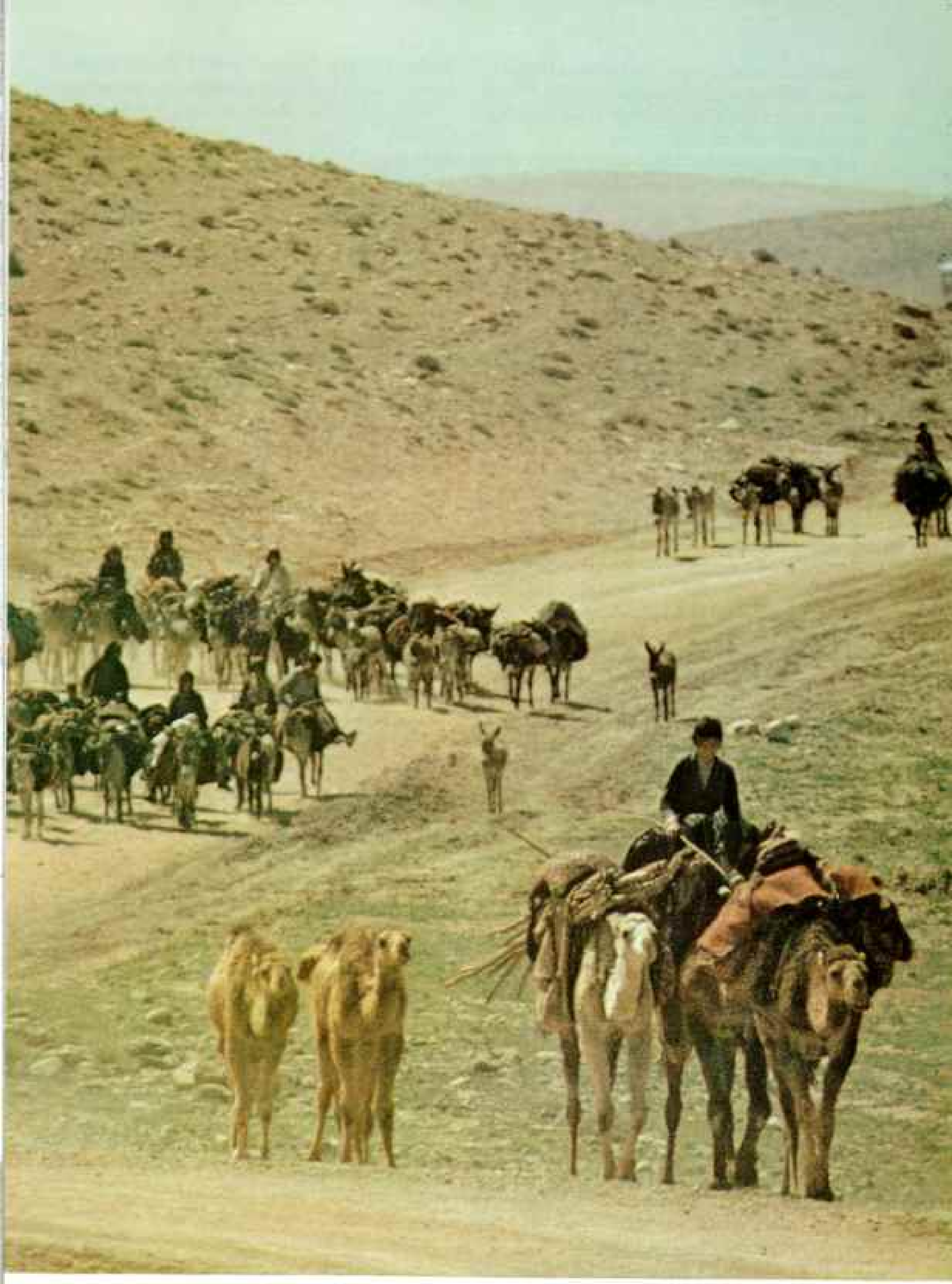
Wandering life on the wane

Smiling *with her eyes, a woman of the Shahsavan tribe modestly veils her face. She and the rest of the tribe will break camp (***below***) as they move their flocks to summer quarters higher in the mountains east of Tabriz. As they have for centuries, some two million nomadic and seminomadic people from 25 major tribes still migrate with the seasons in search of greener pastures for their goats and sheep. But modern society and its values now encroach on these wanderers. New emphasis on education, as well as conscription for military and social service, expose tribal young people to a much larger world than the one their parents knew. The eventual end of their nomadic existence seems inevitable as Iran rushes to embrace the 20th century.*





Stirring the desert's dust, a Qashqai clan heads for the uplands between



Shiraz and Isfahan. Nearly 120,000 Qashqai still follow the nomadic life.

"Persepolis was strictly a ceremonial capital, where the emperors paused to hold official court and to celebrate the spring equinox signaling the start of a new year."

Other Iranians of old followed the same custom of alternating between summer and winter quarters. Among the Qashqai tribe, the practice survives. The route spans roughly 400 miles, from southern Iran to the northwest slopes of the Zagros Mountains. For a visit with this most colorful and independent of Iran's nomadic tribes, I sought out Mohammad Bahmanbegui, director of tribal education for the country and a *khan*, or leader, among the Qashqai.

White Tents Mark the Frontier of Learning

I found Mr. Bahmanbegui at the impressive new tribal high school he has established in Shiraz, where more than 800 resident students from the Qashqai and other tribes study academic and vocational subjects. During a brief inspection of the school Mr. Bahmanbegui explained Iran's goal of educating, and eventually settling, its two million nomads.

"Among non-nomadic Iranians," he began, "the Shah has established an excellent system of conventional schools and a farsighted program known as the Literacy Corps—a volunteer army of young men and women who live and teach in remote settlements. A major part of our new oil revenue is going into a massive effort to wipe out our 60 percent illiteracy rate.

"For our nomadic people," he continued, "we have developed tent schools, each with a young teacher assigned to accompany a group of families wherever the season takes them. We call the schools 'white tents,' for their canvas covering, as distinct from the traditional black goat-hair tents of the nomads."

Once a child graduates from the white tent, Mr. Bahmanbegui explained, he may go to the high school at Shiraz. There he prepares for university, learns a vocational skill, or trains to become a teacher among his own people.

"Except for the teachers," Mr. Bahmanbegui said, "I tell our students, 'Don't go back to your people, *look* back at them as you make your way in life. The real power to help them lies not in the black tents but where the money and decisions are made—in government, industry, the professions. Aim there, and in time your people will have a better life.'"

Next morning I followed the historic route of the Qashqai southward from Shiraz in Mr. Bahmanbegui's Land-Rover. As we jolted along a heavily rutted desert track, he explained the tribe's migratory patterns.

"Fewer families make the long trek than in the past," he said. "Nowadays most Qashqai shift their herds of sheep or camels shorter distances along the route, from lowland pasture to higher ground."

During a day's travel we passed more than a score of distant encampments, most of them featuring a single conical white shape above the dark silhouettes of living tents. Along the upper slopes of rolling hills herds of sheep and goats browsed in tight clusters like enormous black beetles inching across the land. At sunset we reached the remote village of Farrashband, winter quarters of Mr. Bahmanbegui's friends, the well-to-do Jahangiri family.

The Jahangiris have abandoned tent life for two permanent ranches located 300 miles apart. They were about to leave for summer quarters in the Zagros Mountains, and welcomed us to dinner in celebration of the move.

The fare was pure Qashqai—roast wild partridge, skewered and grilled lamb livers, mounds of *tanook*, the traditional wafer-thin Qashqai bread, helped down with innumerable servings of *mast*, or yogurt. As a final treat we shared pickings from a freshly boiled lamb's head, then closed the meal with cups of fragrant tea and memorable Qashqai songs.

The style was reminiscent of Spanish flamenco, with a haunting quality enriched by guitars. Our hosts sang of the desert, of mountains, the long trek, of great Qashqai deeds in the past. And often they sang of love.

One passage in particular remained with me long after we had retired to a soft layer of quilts spread across the ranch-house floor. Translated by Mr. Bahmanbegui, the words seemed to capture the eternal spirit of longing and of loss implicit in the life of every nomad:

The tribe has left, the dust remains;
The sun has gone, the yellow glow remains;
I never kissed those dark eyes—
The sorrow remains.

Northeast of Shiraz along the fabled Silk Route of the ancient caravans lies the town of Yazd, where Mohammad Fayaze plies his hazardous trade. Despite a wealth of new hydroelectric dams and irrigation systems, Iran in many areas still depends for water on the age-old *qanat*, or underground aqueduct. The laboriously hand-hewn tunnels span distances of up to 40 miles, tapping mountain watersheds to irrigate surrounding desert.

I found Mr. Fayaze and his five-man crew at work extending a 200-year-old qanat. At an awesome depth of 254 feet they were chipping with hand tools through solid rock. Now and then they hoisted a worker or a load of rock to the surface by means of a primitive windlass, which had seen better days.

Among rural Iranians the qanat is known as *Ghatell*—the "Murderer"—for the many accidents that befall digging crews. Mr. Fayaze acknowledged that in his village alone some ten qanat workers perish every year.

"The greatest hazard," he told me, "lies not down below but on the surface. If one of the two men on the windlass grows careless during a lowering operation, he may suddenly be jerked over the wheel by the weight of the descending worker, so that both men tumble down the shaft."

To Mr. Fayaze's credit, he has lost only one worker during 33 years in the trade. The mishap occurred in the classic fashion, though one of the two victims—I never learned which—escaped with severe injuries. In response to my congratulations on his splendid record, Mr. Fayaze insisted I take a brief tour of the qanat.

The ensuing half hour is mercifully vague in my memory, though a few graphic details survive: the discomfort of the windlass sling, simply a loop of thin rope running between my legs and over one shoulder; the eerie descent as daylight at the top of the shaft dwindled to a mere pinpoint; the smell of carbide lamps in the qanat itself; and the sensation of knee-deep water in darkness 254 feet underground.

Friend Provides a Needed Lift

Finally I emerged from the shaft to find not two, but four men on the windlass—one more than Mr. Fayaze's surface crew. At my questioning glance he smiled in embarrassment.

"It seems you are a bit heavier than our average worker," he explained. "We had no trouble lowering you, but when it came time to bring you up, a friend of mine fortunately happened by."

Iranians are like that, courteous in the extreme, eager to share life's adventure with outsiders. There was, for example, a memorable day in Baluchistan when Haji Anushirvan insisted that I ride one of his thoroughbred camels. As it happened, the camel had emotional problems, but we overcame them in the end.

I met Haji through the very able governor of Sistan and Baluchistan Province, Abbas Ali Manii. Historically, Governor Manii's domain was one of the poorest and most neglected of Iran's 20 provinces. Nearly devoid of rainfall and barren of sustaining crops, Sistan and Baluchistan survived for centuries on nomadic grazing of sheep and camels throughout its 70,000 square miles of desert scrub and volcanic waste.

The province today is undergoing a massive infusion of government money administered by some of Iran's best brains. Under Governor Manii's direction Sistan and Baluchistan's 600,000 inhabitants have begun to enjoy the benefit of soaring oil revenues in the form of modern hospitals, low-cost housing, new schools and a university, light industry, and the ministrations of the highly successful Literacy Corps.

Meanwhile the provincial roads thunder with heavy construction equipment—bulldozers, draglines, trucks, and graders—leveling and paving as they go. It is only a matter of time before they reach Haji Anushirvan.

Gallop Helps a Lovesick Camel

I met Haji and his fellow khans near the village of Khash in the remote eastern region of the province. Camped within 50 miles of the Pakistan border, they live in the same nomadic style as thousands of fellow Baluchi beyond the frontier.

As his title "Haji" implies, Anushirvan has made the sacred Moslem pilgrimage to Mecca in Saudi Arabia. Handsome and athletic in his late fifties, he welcomed me with a dozen other khans in the camp's ornate reception tent and fell to discussing that Baluchi passion in life, camels.

I learned that inflation is a familiar burden to the cameleer, who has seen his means of livelihood and transportation nearly double in price over the space of five years.

"A good riding camel," Haji said, "now costs 50,000 rials [roughly $700], while a draft camel goes for about a fifth as much. Fortunately we make our own saddles and harnesses, so costs have not risen there."

For endurance and mileage over desert terrain the camel still has no peer. "A good one," Haji said, "can travel ten miles an hour for 12 hours, take a two-hour rest, and go another 12." He eyed me thoughtfully. "Have you ever ridden a truly fine camel?"

I confessed that I had once been on a camel for a portrait beside the pyramids of Egypt.

Like an octopus's sucker-lined tentacles, *access shafts for underground aqueducts reach toward a walled farming community. The shafts (***below***) allow workmen to descend, sometimes 300 feet, to maintain the hand-dug tunnels that bring water from distant mountains. Devised more than 2,000 years ago to help irrigate Iran's water-poor heartland, some 50,000 of these conduits, called* qanats, *today serve 75 percent of the nation's farmland.*

"Oho!" snorted Haji, "that is not *riding.*" Within moments I found myself outside the tent next to a kneeling camel. The creature's appearance was far from reassuring, for it had a distraught look in its eye and its enormous tongue lolled down a good foot or more below its jaw.

"Never mind *him,*" Haji said with a wave of the hand. "It is mating season, and he only wants a wife. Let's find you a driver and be off."

With camels, it seems, the next best thing to a wife is a therapeutic gallop across the countryside. One of the khans climbed aboard the beast, settling me behind him with my arms around his waist, and we were off in a group with half a dozen other khans, careering over the desert at somewhat more than ten miles an hour.

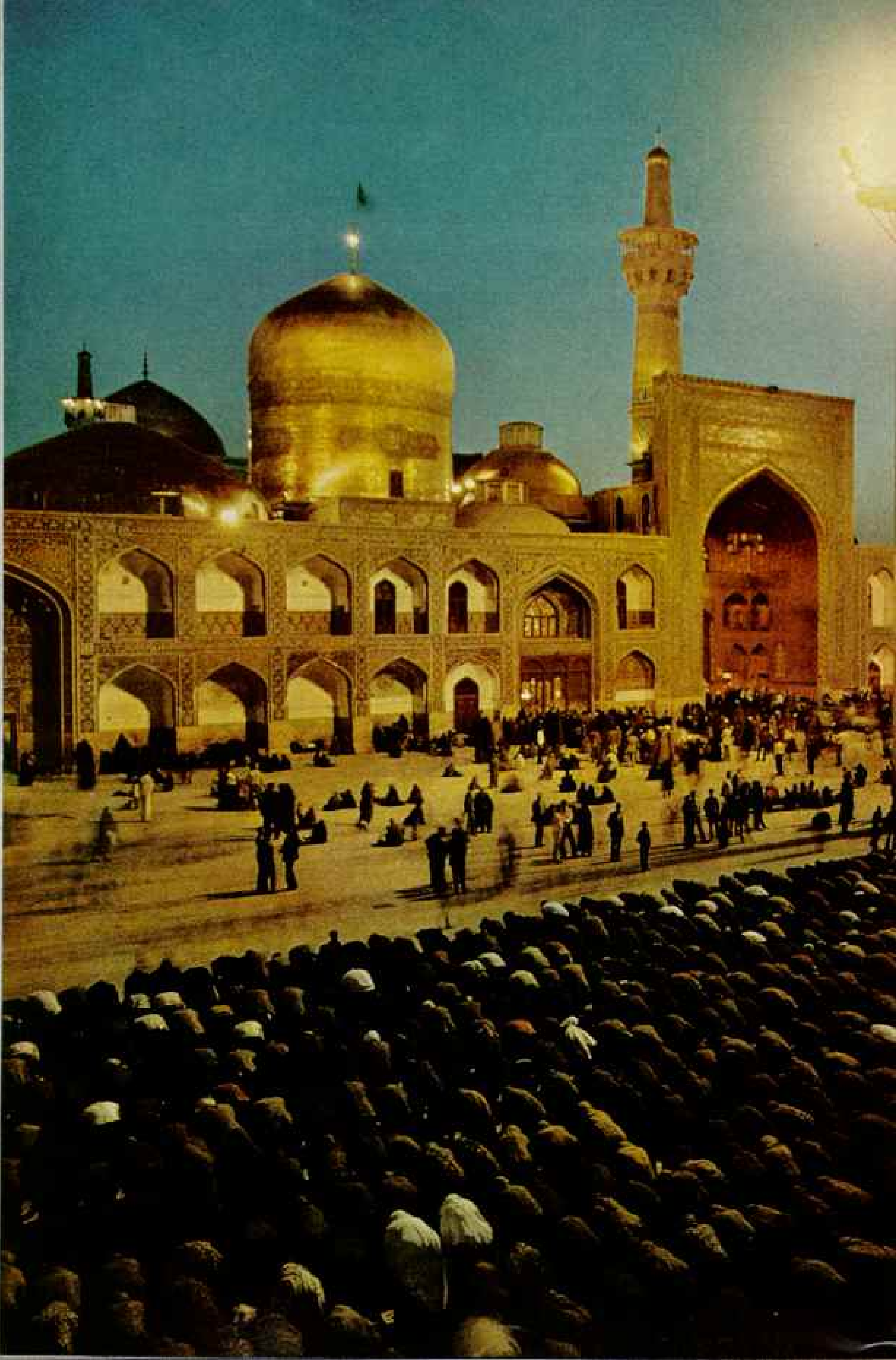
As I grew accustomed to the curious gait, I found it surprisingly smooth, and after a time I felt almost at home. Back in camp once more I remarked to Haji on the unexpected comfort of the ride.

"Yes," he answered, then gave me an aggrieved look. "I am sorry I cannot say the same for your renowned American jetliners. I was told they were very smooth, but when I made my pilgrimage to Mecca, the flight was so rough I became ill. That is what comes of all this hurry and progress. I would have done better to go by camel."

Kurds Continue Freedom Fight

Time grew short, and I made my way to Azerbaijan, a northwestern border region that touches the U.S.S.R., Turkey, and Iraq. To the visitor Azerbaijan offers dramatic contrast to Iran's desert areas, with its vast expanse of snow-capped mountains, dense forests, and rolling plains nourished by a lacework of rivers.

For all their quiet beauty, Azerbaijan's forests serve more than just the woodsman and the tourist. Like Kurdistan, her neighbor to the south, Azerbaijan offers both a lifeline and a sanctuary to beleaguered Kurds across the border in Iraq who are struggling for greater freedom.



DAZZLING SHRINE *of Imam Reza in Mashhad draws an evening throng of the faithful. One of 12 patriarchs of the Shia sect, the Imam died a martyr in the ninth century, a victim of poison.*

Among Iranians, Azerbaijan symbolizes their own struggle for freedom from outside influence. With American support following World War II, Iran regained control of the area from the Soviet Union and set to work expanding the economy.

The results are impressive, for Azerbaijan's two provinces today represent industrial as well as scenic assets to the country. At Tabriz, capital of East Azerbaijan, I called on Taghi Tavakoli, the American-trained managing director of Machine Sazi Tabriz, Iran's giant new machine-tool factory.

Factories, I find, vary little in appearance the world over, and Machine Sazi is no exception. The fact itself is notable, for the plant violates centuries-old Islamic custom by employing women alongside men. As we proceeded through a series of hangar-size shops and foundries, Mr. Tavakoli nodded politely to dozens of kerchiefed workers doing the same tasks as their male neighbors.

Sealed Border Divides Turkomans

Finally there was Mashhad, the capital of Khorasan Province in the far northeast. The name means literally "Place of Martyrdom," a reference to Imam Reza—eighth patriarch of the Shia sect—who was poisoned there in the ninth century. His memorial, Imam Reza Shrine, ranks as the holiest of Iran's sanctuaries (preceding pages).

In another sense the city's martyrdom stems from the historic tide of invasion that swept alternately east and west through the great natural crossroad between Europe and Asia. In its time Mashhad suffered the depredations of passing Mongols, Uzbeks, Turks, and Afghans, and endured the additional hardship of several earthquakes.

Today the historic crossroad is sealed off by the iron security of Khorasan's next-door neighbor, the Soviet Union. One morning I stood with Col. Ismail Yganegy, a member of Iran's crack border patrol, gazing across a mile or more of bleak no-man's-land separating the two countries.

"Unlike the Iraqi border," Colonel Yganegy said, "this one is quiet. The Soviets let no one cross from our side, and it is certain none of their people comes over to us. It is sad, for the inhabitants on both sides are Turkoman and feel very close to one another."

We inspected the border itself, a small sluggish river called the Tedzhen, and Colonel Yganegy gestured toward a flimsy barbed-wire fence along the opposite bank.

"There the U.S.S.R. begins," he said, "but the fence is merely show. The real barrier stands about a mile farther back, in the form of a high electrified fence complete with minefields, frontier guards, and watchdogs. At night we can see the searchlights sweeping the area from observation towers spaced a mile or two apart."

Some Problem Solving, Then a Cup of Tea

Colonel Yganegy shares a 300-mile stretch of frontier with his Soviet counterpart, an army colonel named Kologyn. Now and then the two officers meet to solve minor problems in an atmosphere both cordial and correct.

"He is not a bad sort," Colonel Yganegy said of his opposite. "He has his orders just as I do, and he knows the area thoroughly. We get on reasonably well. Sometimes we even enjoy a cup of tea together."

With the typical foreigner's ignorance I asked if Kologyn was a Turkoman name, and Colonel Yganegy gave me a startled look. "Certainly not," he answered. "The Soviets would never dream of permitting a native to patrol his own district. He would have connections among the people and therefore would be too sympathetic. Kologyn is a decent enough fellow, but he is a Great Russian from Moscow." Colonel Yganegy smiled with sudden inspiration. "Perhaps the district commander there is a Turkoman."

Back in Tehran once more, I dropped by the street corner where young Ali Moradi had introduced me two months earlier to his country and to good fortune. He was elsewhere, of course, and the ashes of his fire were long scattered by Tehran's summer winds.

I wished for him briefly, to thank him for both introductions and to say that in a sense they had turned out to be one and the same. But then Ali is wise beyond his years, and I suspect he already knows. □

Plenty of room to grow in: *A Baluchistan lad, bundled up against winter's numbing grip, proudly displays his two-wheeled steed. With the prospect of at least a high-school education comes a new wealth of opportunities. Tonight he can dream dreams as vast and vital as all Iran, and, waking, may find those dreams coming true.*

How We Found the Monitor

By JOHN G. NEWTON

DUKE UNIVERSITY MARINE LABORATORY

ENGRAVING FROM "HARPER'S WEEKLY" OF JANUARY 31, 1863, CAPTURED—WITH CONSIDERABLE ARTISTIC LICENSE—THE HIGH DRAMA OF THE FAMED IRONCLAD'S LAST MOMENTS.

Match for the Confederate gunboat *Merrimack* but not for the Atlantic's stormy salvos, the Union ironclad *Monitor* sinks off Cape Hatteras as her consort, the side-wheeler *Rhode Island*, stands by helplessly.

AS THE ROWBOAT CRESTED a wave, Acting Master's Mate D. Rodney Browne could barely see the red lantern swinging wildly from the turret of U.S.S. *Monitor*, a quarter of a mile away. The foundering ironclad rolled drunkenly, at the mercy of the storm off Cape Hatteras.

It was Browne's third trip to ferry crewmen from the doomed gunboat to the U.S.S. *Rhode Island*, a big side-wheeler that had been towing *Monitor* south to Beaufort, North Carolina, when a gale struck, endangering both vessels. One towline broke, the other was cut loose. Now about two miles of tossing ocean separated the ships.

Nearly a dozen men still clung to the sinking vessel, but the sea was pouring in beneath her turret, down the ventilation shafts, and through the hawsepipe.

Another wave lifted the approaching rescue craft, but now the gleam of *Monitor*'s lantern was gone. On reaching the scene, Browne later reported, he "could perceive no other trace of her, except an eddy apparently produced by the sinking of a vessel."

The loss of *Monitor*, first gunboat armed with a revolving turret, came on New Year's Eve morning, 1862, less than ten months after her historic duel with the armored vessel *Merrimack*, by then renamed the C.S.S. *Virginia* by the Confederacy. The battle ended the era of wooden fighting ships.

Long Search Finally Ends

Lost but never forgotten, *Monitor* was for decades the object of search. The effort had intensified with development of modern oceanographic equipment.

Now, more than a century after she went down, *Monitor* has been found. The crushed frame of the unconventional "cheesebox on a raft" has been viewed and photographed. Parts and fragments of the vessel, retrieved from the seafloor, plus hundreds of pictures, have made the identification certain.

At the end of August 1973, I was privileged to direct a search for the venerated ironclad aboard Duke University's 117-foot research vessel *Eastward*. A more certain objective was a submarine geological survey of the area. The Army provided two other craft for this dual project, supported by the National Geographic Society, the National Science Foundation, and the U. S. Army Reserve.

Eastward carried conventional and side-scan sonar, still and television cameras, and a precision depth-sounder. Months of careful research had narrowed *Monitor*'s likely location to a 6-by-16-mile rectangle approximately 17 miles southeast of Cape Hatteras. But this still covered 96 square miles of ocean floor, and our target was tiny, measuring only 172 feet overall, with a beam of 41½ feet.

Further complicating the quest, hundreds of known wrecks litter the bottom around this storm-tossed "Graveyard of the Atlantic."* Before our first week was over, our instruments had picked up 21 targets. General size and configuration quickly ruled out most of them. Our camera recorded one vaguely circular shape that raised our hopes, but it was only the pilothouse of a sunken trawler. In the end, fate played a decisive role.

Fish-finder Provides the First Clue

While we followed a depth contour across the northeastern segment of the search area, Fred Kelly, chief of our oceanographic party, had been fishing for amberjack and sea bass from the ship's rail. As he went below to stow his gear, he glanced at the recorder of our "fish-finder" sonar. Although alert, the scientist on watch had paid little heed to a slight echo scribed across the paper.

"Hey—that looks like something," Fred said, and suggested that *Eastward* reverse course to take a closer look.

Aboard was Dr. Harold Edgerton of Massachusetts Institute of Technology, famed for inventing the ultrahigh-speed strobe light used in photography. "Doc" Edgerton at once readied the sensitive side-scan sonar he had helped develop, and this confirmed Kelly's hunch: It revealed from bow to stern the clear outline of a wreck. We also discerned a circular structure that could be *Monitor*'s rotating gun turret.

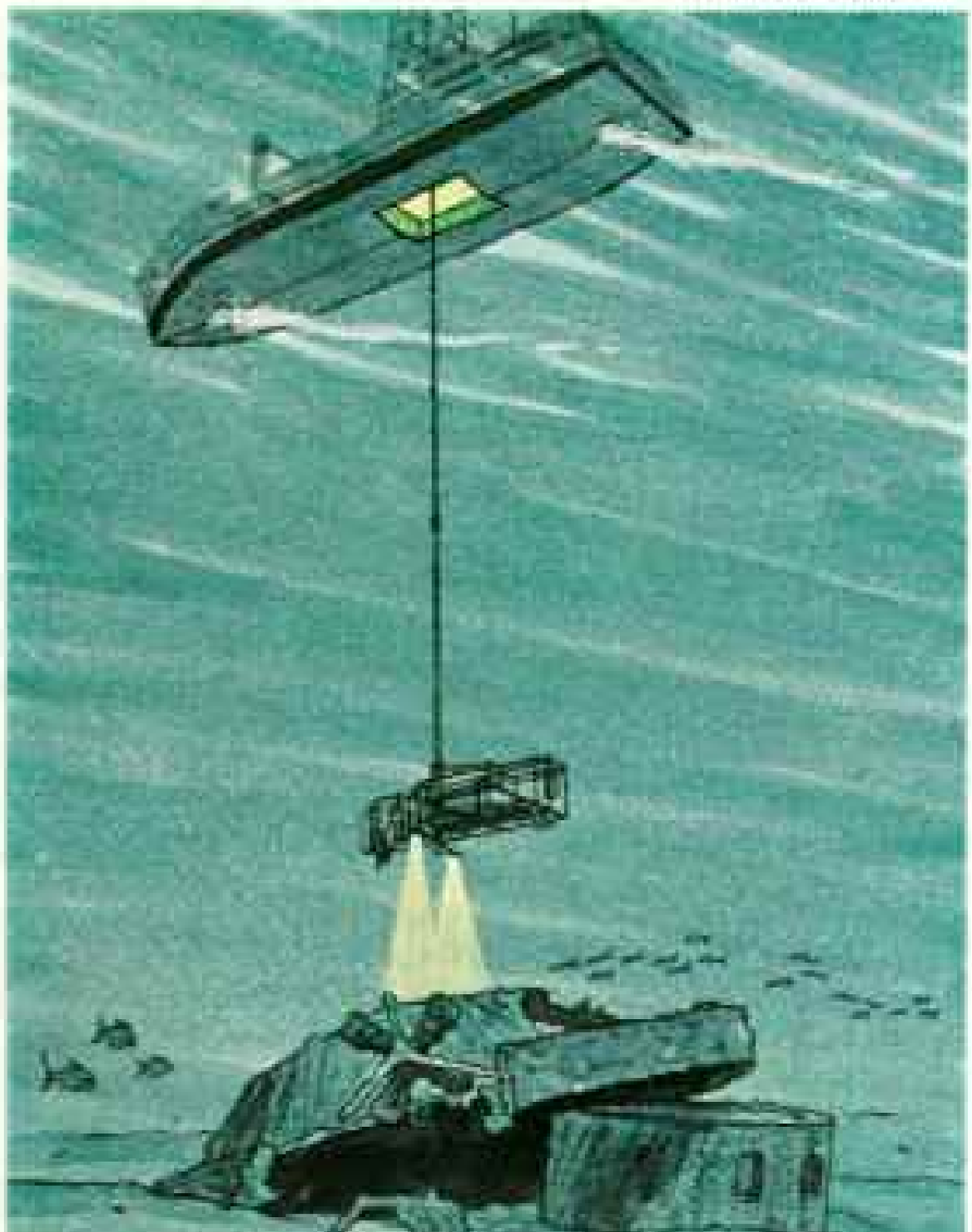
We lowered our television camera. There on the black sand seafloor at a depth of 220 feet, the camera's light illuminated a flattened hulk that in numerous features fit *Monitor*'s description. Our excitement mounted.

"Look at that flat surface—iron plates with rivet holes," said Gordon Watts, underwater archeologist for the North Carolina Department of Cultural Resources. Then, as the camera scanned the far side of the hulk, the long, narrow armor belt of the vessel came into view.

(Continued on page 56)

*The September 1969 GEOGRAPHIC included a map (pages 398-400) charting more than 500 wrecks in Atlantic waters off North Carolina and Virginia.

PAINTING BY PIERRE MION



Photographing the Monitor

JIGSAWED TOGETHER by Navy specialists, some 2,000 exposures, here blended into a remarkable composite view, show the entire *Monitor* (**above**) as she lies, bottom up, bow to the left, in 220 feet of water.

Her distinctive features are at once evident: bow and stern identically tapered; belt of iron armor ringing the deck overhang; flat-bottomed, keelless hull; protected anchor well. Her gun turret, which dislodged during capsize, settled under the port quarter.

When scaled to similar dimensions, the Navy photomosaic matches a plan of

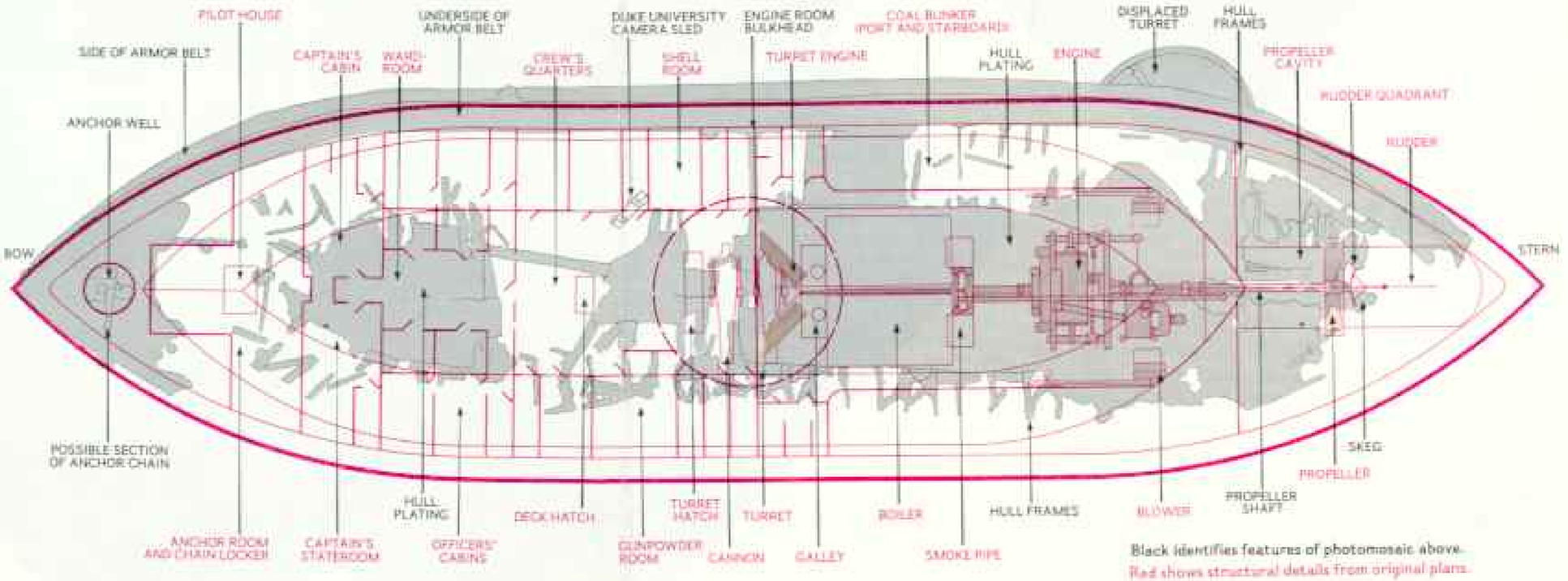
Monitor drafted in 1861. Red overlay (**right**) locates recognizable features on a drawing adapted from the original plans.

As advanced in our day as *Monitor* was in hers, the aluminum-hulled research vessel *Alcoa Seaprobe,* operating under U. S. Navy command, photographs her iron-hulled target in April 1974 (**left**). Fore and aft propellers with omnidirectional thrust make *Seaprobe* a kind of oceangoing helicopter, hovering fixedly above the wreck as the camera shutter clicks off frame after frame.

Seaprobe documented what the author had discovered eight months earlier aboard Duke University's vessel *Eastward;* both voyages were in part supported by the National Geographic Society.

So rests the corroded hulk of an armored vessel that sailed less than a year, and fought only one sea battle, but forever changed naval warfare.

PHOTOGRAPHS BY GLEN TILLMAN, ALCOA MARINE CORPORATION; PHOTOMOSAIC BY U. S. NAVY



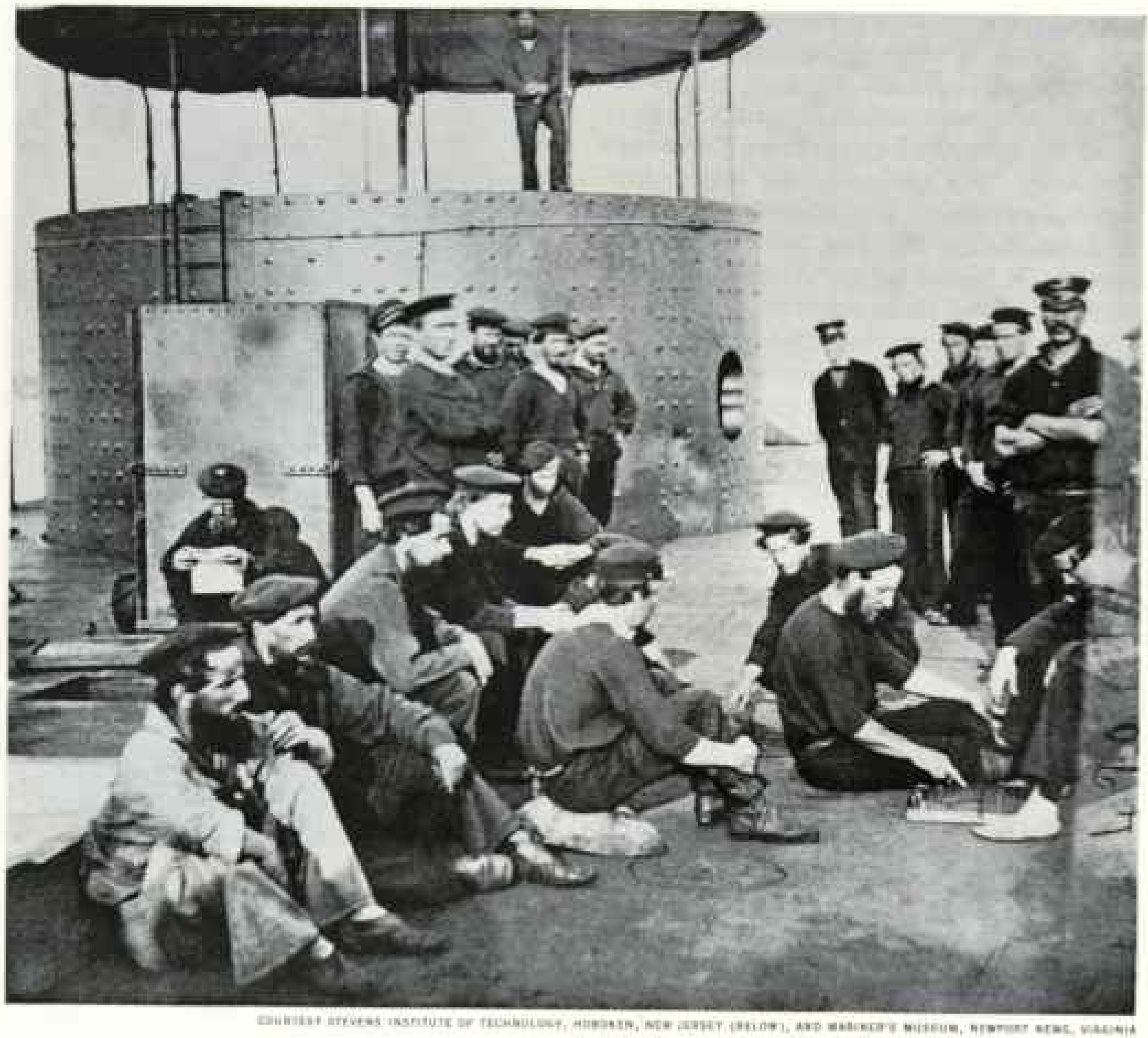
Black identifies features of photomosaic above.
Red shows structural details from original plans.

DRAWN BY LEO ZEBARTH
COMPILED BY DOROTHY A. MCMULLEN

The telltale turret

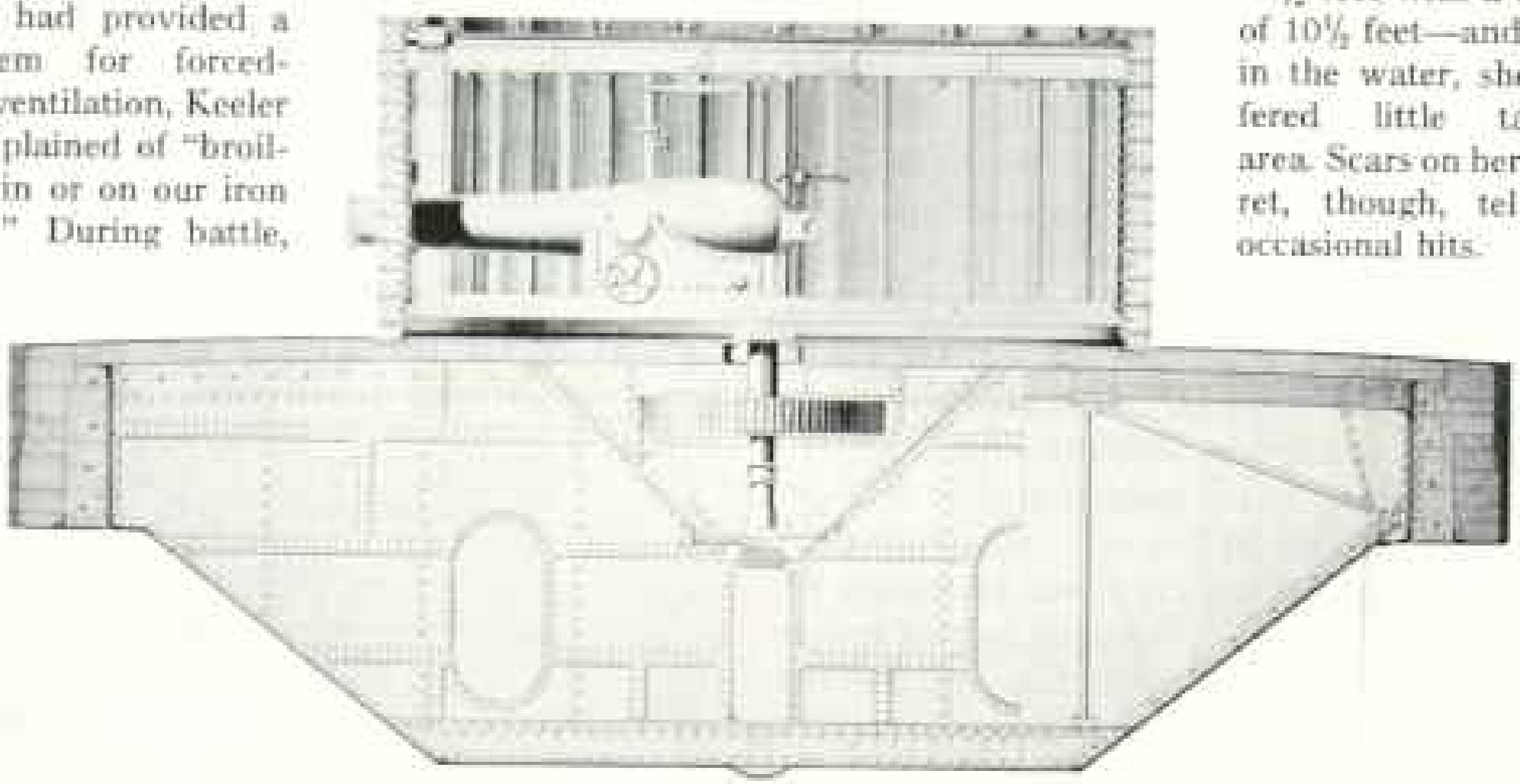
EVEN UPSIDE DOWN and more than half obscured, *Monitor*'s turret shows identifying features as characteristic as a signature. At the upper left one of the beams remains intact, down to the bolt securing it to the turret. The revolving "cheesebox" of 8-inch armor plating permitted the guns to shift aim without the ship changing course. Measurements in the original plans correspond to the diameter of the circular housing and the width of the armor belt, here lying atop the dislodged turret. The forklike object to the lower right is part of the hull plating resting on three crosswise supports; *Monitor* had no major bow-to-stern structural members.

PHOTOGRAPH BY ELLIS TILLMAN, KLEIN MARINE CORPORATION;
PHOTOMOSAIC BY NATIONAL GEOGRAPHIC SOCIETY



COURTESY STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, NEW JERSEY (BELOW), AND MARINER'S MUSEUM, NEWPORT NEWS, VIRGINIA

"**Here we lie,** day after day & week after week, prisoners to all purposes, no going ashore—no nothing, but eat, drink & sleep, & while away the tedious hours as best we may." So wrote Acting Paymaster William Keeler of the dull but essential blockade duty (**above**) for which *Monitor* had been built. Although designer John Ericsson had provided a system for forced-air ventilation, Keeler complained of "broiling in or on our iron box." During battle, temperatures reached 140° F. in the turret. But what *Monitor* lacked in creature comforts, she made up for in simple, angular menace as a "floating battery" (**below**, transverse section through turret). Towed to her mission site, the ironclad steamed into battle under her own power. Relatively small—172 by 41½ feet with a draft of 10½ feet—and low in the water, she offered little target area. Scars on her turret, though, tell of occasional hits.



As our lights probed the wreck, we saw very clearly a large cylindrical form protruding from beneath the hull, which apparently capsized before it struck bottom. A chorus of excited voices filled *Eastward*'s laboratory. "It's obviously not the paddle-wheel of a steamer," Doc Edgerton remarked, "and clearly not the gun tub of a modern warship. It has to be the turret of *Monitor*. Must've slipped off as she turned turtle."

What we saw convinced all of us that we had found *Monitor*. Five months of frame-by-frame analysis of the videotape by Gordon Watts and others confirmed the identification, even though, with our cable-slung equipment, we had not been able to photograph the whole ship.

Further documentation of our find had to await the opportunity for our *Eastward* team to join the 1974 U. S. Navy expedition of the research vessel *Alcoa Seaprobe*.

Ironclad Built to Counter a Threat

Monitor was the brainchild of Capt. John Ericsson, an immigrant engineer from Sweden. A man of bold imagination, he conceived of the vessel as an "impregnable steam battery of light draught"—"battery" in the sense of a mounting of guns. Its construction marked the start of the long race for superiority between armored ships and rifled artillery that fired explosive shells.

Early in the Civil War the South recognized that she could not challenge the North's wooden fleet, and so the Confederacy started building armor-plated ships. Disturbing news reached Washington in 1861: The steam frigate *Merrimack*, a Union vessel partially burned and scuttled, had been raised and rebuilt by the Confederates into a floating ironclad fort called *Virginia*. It was feared capable of destroying the blockading Union squadron and even of bombarding northern ports. To meet this threat, the Federal Navy Department advertised for plans of ironclads.

Ericsson had designed a ship that would float with its deck nearly awash. Its hull was uniformly tapered at each end; two 11-inch Dahlgren guns were mounted side by side in the unique armored revolving turret.

Also unique was a hidden anchor well on the centerline under the bow, where no enemy shot could reach crewmen operating either hook or chain. A massive belt of armor —60-inch-high vertical plating—ringed the whole vessel below the deck line.

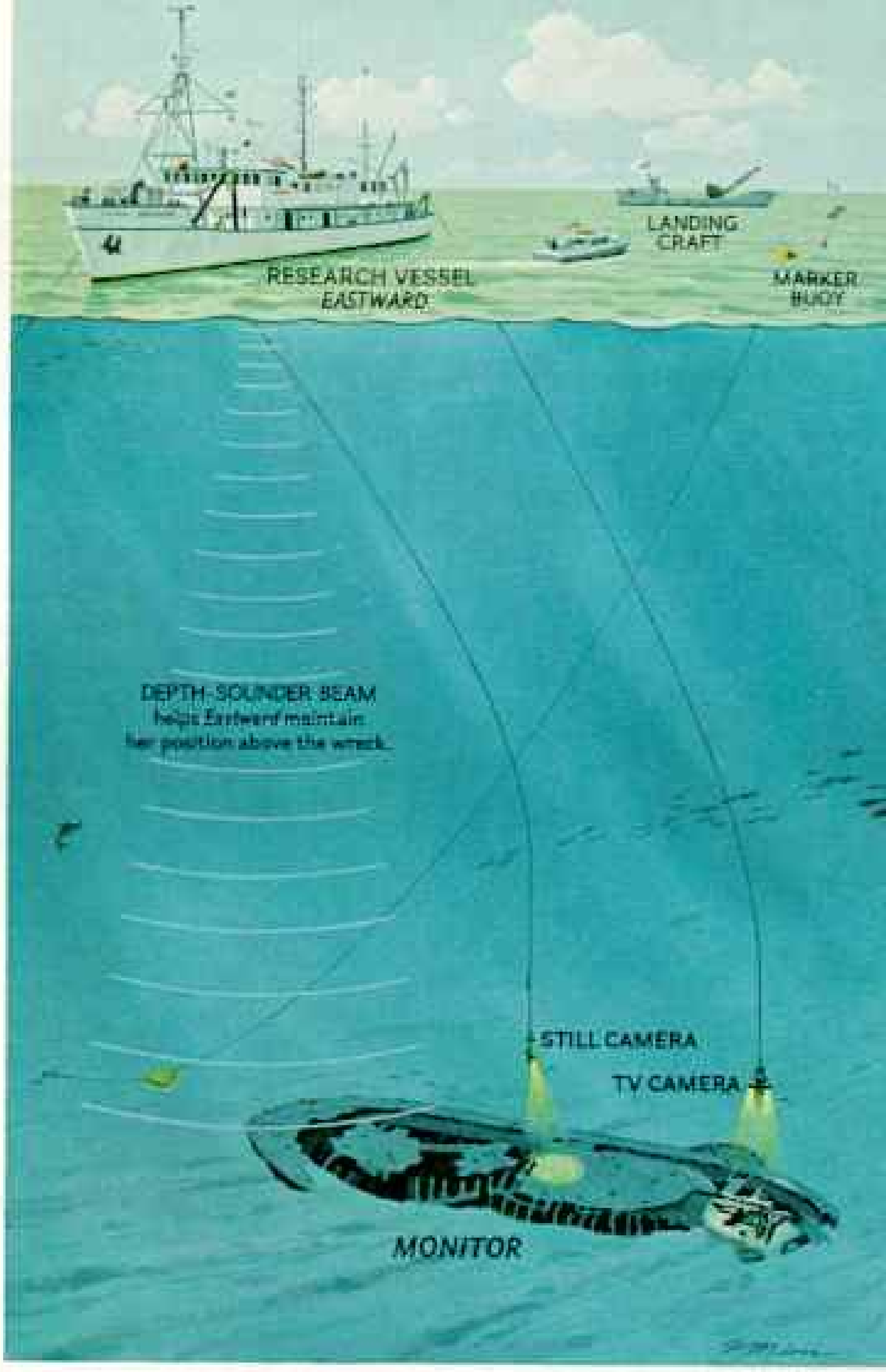
NATHAN KERN

Finding the Monitor

KNOWN: when the *Monitor* sank, how, and why. Unknown: exactly where. Over the years various theories had their champions; claims of discovery were made, but none could be substantiated. The first successful search began not in the Atlantic, but amid a sea of historical documents. Based largely on navigational fixes from the log of *Rhode Island*, which had the ironclad in tow before she foundered, a rectangular search area (**map, left**) was established. In August 1973, Duke University's *Eastward*, loaded with detection gear, put to sea with two support boats of the U. S. Army Reserve's 824th Transportation Company.

Using an advanced navigational system, the author (**left**) plotted a precise course over the search area. Near the northern limits, "fish-finder" sonar picked up something. Dr. Harold E. Edgerton of the Massachusetts Institute of Technology trained side-scan sonar on the object and received back an image of almost photographic quality (**below, right**), one very like the ironclad.

Actual photography proved trying. The strong current made it hard to control the still and television cameras cable-slung from *Eastward* (**right**). The still camera snagged in the wreck, and there it remains. Sweeping the stern, the television camera videotaped critical details of the turret (**below**). The white object is a compass suspended from the camera frame. After careful study, marine archeologist Gordon Watts concluded that *Monitor* had been found.



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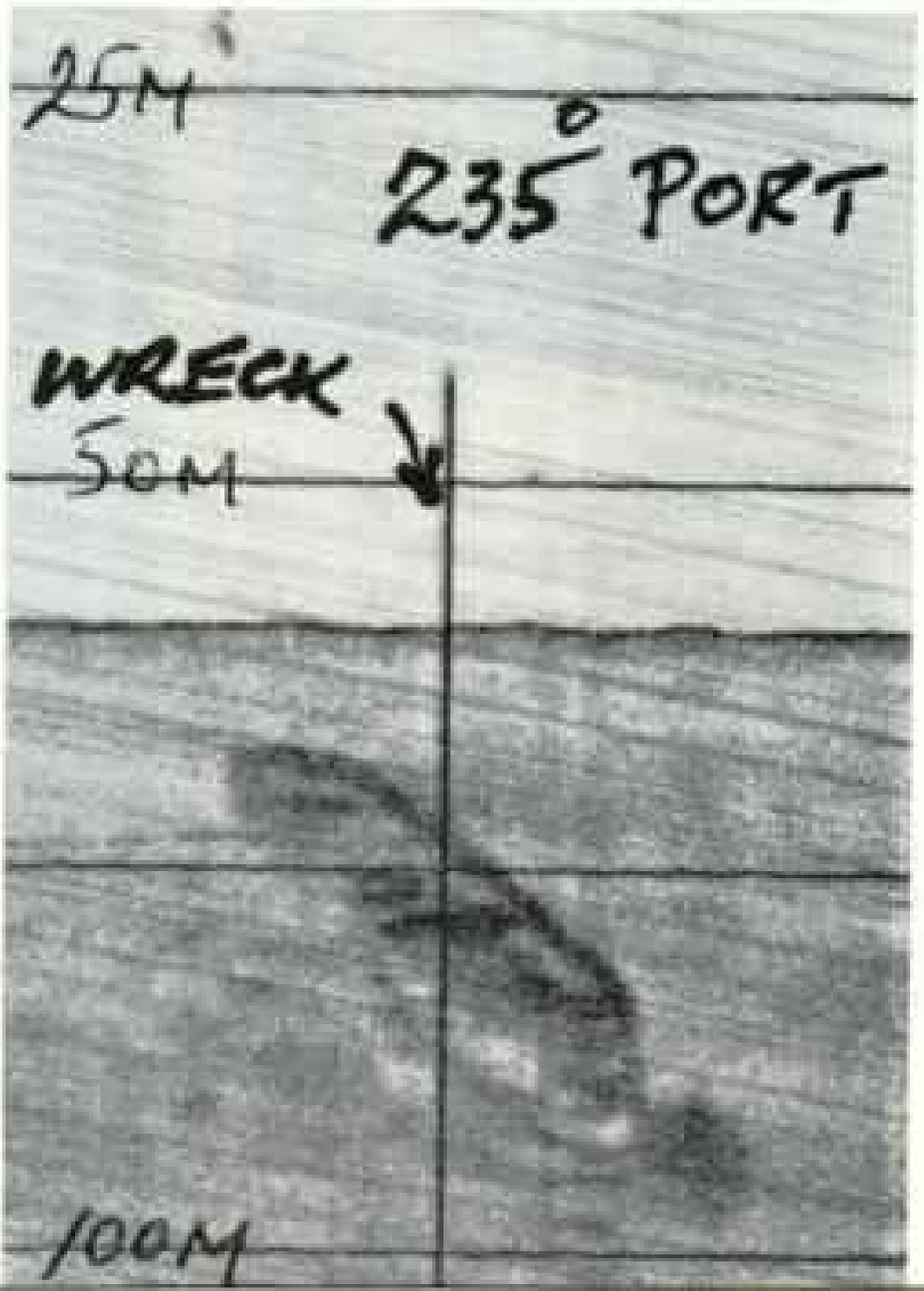
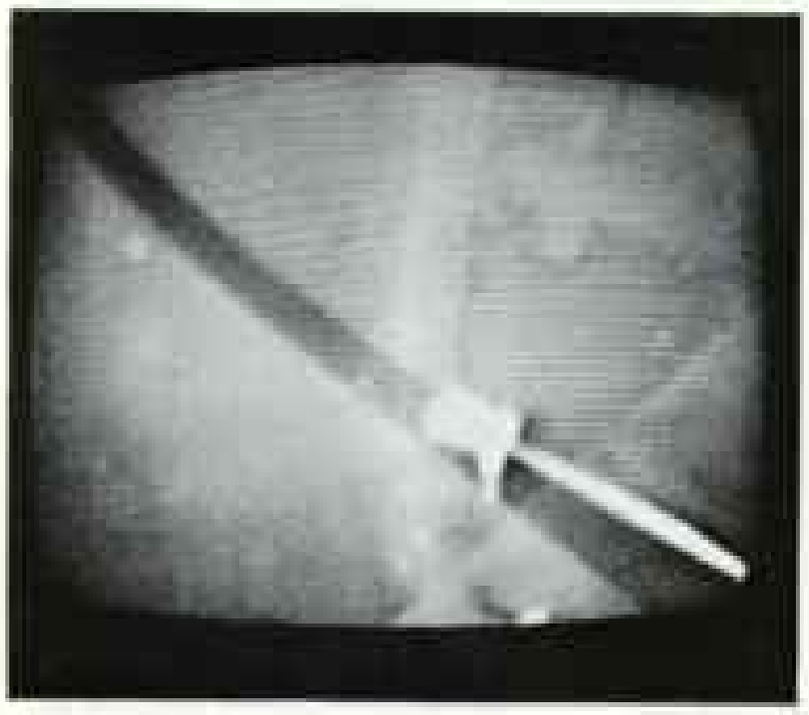




President Lincoln examined Ericsson's unconventional design and observed, "All I can say is what the girl said when she put her foot in the stocking: 'It strikes me there is something in it!' " High naval officials were skeptical at first, but Ericsson's eloquent arguments finally won them over.

The ship, built at Continental Iron Works in Brooklyn, was launched January 30, 1862. Slow and unwieldy at sea, *Monitor* on March 6, 1862, was taken under tow for Hampton Roads, Virginia. The brand-new ironclad arrived at a desperate moment—and, as every schoolboy now knows, in the nick of time. The Confederate's ironclad, the old *Merrimack*, was methodically destroying the wooden Federal fleet, ship by ship.

The first-ever engagement between ironclads took place on March 9, 1862, *Monitor* having steamed in the previous evening. For four hours the ironclads shook off each other's volleys, often at point-blank range, and the battle ended in stalemate. But the age of wooden warships had ended. Before the close of the Civil War, the North had commissioned 31 *Monitor*-type gunboats.

Monitor rode out mid-1862 near Norfolk, occasionally bombarding shoreside forts. Her deck log for May 7: *Moderate breezes from the westward and clear weather. At 1 p.m. President Lincoln and Suite came on board. At 1:30 p.m. the* Merrimack *hove in sight—made the usual preparations to receive her. . . .*

Lincoln, who visited *Monitor* several times,

BOTH BY NOVAN ZERN

An old beacon gets a new beam as "Doc" Edgerton (**above**) attaches a transponder of the ultra-accurate Del Norte Navigation System to Cape Hatteras Lighthouse. *Rhode Island* had taken her fixes on the cape's original lighthouse.

Tempest in a tank (**right**) re-creates the last moments of the *Monitor*. Midshipman Douglas Rau takes notes for "Project Cheesebox," an ambitious Naval Academy study of the ironclad undertaken by interested midshipmen. The model performed much as her iron counterpart did, slicing through waves rather than riding over them.

on this occasion stayed only briefly, disembarking to watch the ironclads from shore. Both vessels leveled their guns, and iron covers were placed over *Monitor*'s deck lights. But—as in every confrontation after their first—neither ship fired a shot in earnest.

On December 29, 1862, the powerful Union side-wheeler U.S.S. *Rhode Island* took *Monitor* in tow, bound for Beaufort, North Carolina, to join in a land and sea attack on Wilmington. Earlier, in May 1862, Union forces had occupied Norfolk, and the South was forced to burn and scuttle *Merrimack*.

Flawless weather saw *Rhode Island* and *Monitor* clear Cape Henry at the mouth of Chesapeake Bay. Fair and calm conditions prevailed until sunrise on December 30, when Comdr. John P. Bankhead of *Monitor* observed an increasing swell from the southwest. Rounding treacherous Diamond Shoals off Cape Hatteras, *Rhode Island* and *Monitor* were sighted by U.S.S. *State of Georgia;* she was towing a new ironclad vessel, *Passaic*. Both later reached Beaufort safely.

As the day wore on, Seaman Francis Butts on *Monitor* reported a deteriorating situation: "The wind shifted to the south-south-west and increased . . . the sea rolled high and pitched together in the peculiar manner only seen at Hatteras." The ship began pounding.

Sea Swallows Valiant Crewmen

At about 7:30 the port hawser parted, and *Monitor* began towing badly. Foreboding entries in the deck log of *Rhode Island* tell of increasing difficulty in negotiating the mountainous seas: "At 9 the *Monitor* made signal to stop. At 9:15 proceeded slow." Taking on water, the ironclad put all pumps to work. The massive pounding continued.

The weight of the slack remaining towline made the vessel unmanageable, so three volunteers went forward to cut it. Two were washed overboard and drowned; the third chopped the hawser.

The engineer sent word that the pumps were not making headway; water had risen several inches above the engine room floor. At 11:00 p.m., *Monitor* "made signal of distress"—the commander ordered a red lantern hung from the turret.

At about 11:30 *Monitor*'s anchor was let go. As rescue boats from *Rhode Island* bobbed through the foaming seas, Second Assistant Engineer Joseph Watters reported that water in the engine room had doused the fires. Without steam the pumps could not function.

Looking into the anchor room, Butts saw water pouring in full force through the hawsepipe, an eight-inch aperture. In dropping anchor, the chain had torn away the watertight packing. The crew was ordered to bail, passing the buckets hand over hand to the top of the turret.

The mournful yowl of a black cat sitting on one of the guns disturbed Seaman Butts. Not wanting to kill the cat lest it bring bad luck, he picked her up, put her inside the gun, and plugged it up; "but I could still hear that distressing howl," said Butts.

Nightmarish Moments Remembered

The scene aboard the dying ironclad was "well calculated to appall the boldest heart," Acting Paymaster William Frederick Keeler later wrote to his wife. "Mountains of water were rushing across our decks and foaming along our sides; the small boats were pitching and tossing about on them or crashing against our sides, mere playthings on the billows . . . and the whole scene lit up by the ghastly glare of the blue lights burning on our consort, formed a panorama of horror which time can never efface from my memory."

"'It is madness to remain here longer; let each man save himself,'" said Commander Bankhead, as reported by *Monitor*'s surgeon, Grenville M. Weeks. "For a moment he [the commander] descended to the cabin for a coat, and his faithful servant followed to secure a jewel-box, containing the accumulated treasure of years. A sad, sorry sight it was. In the heavy air the lamps burned dimly, and the water, waist-deep, splashed sullenly against the wardroom's sides. One lingering look, and he left the *Monitor*'s cabin forever."

The commander, having done everything he could, boarded what turned out to be the last rowboat that came alongside. Bankhead implored men clinging in terror to the turret to save themselves. They, and one man lying seasick in his bunk, were left behind, but with the promise that another boat would return. (It did, but reached the scene too late.)

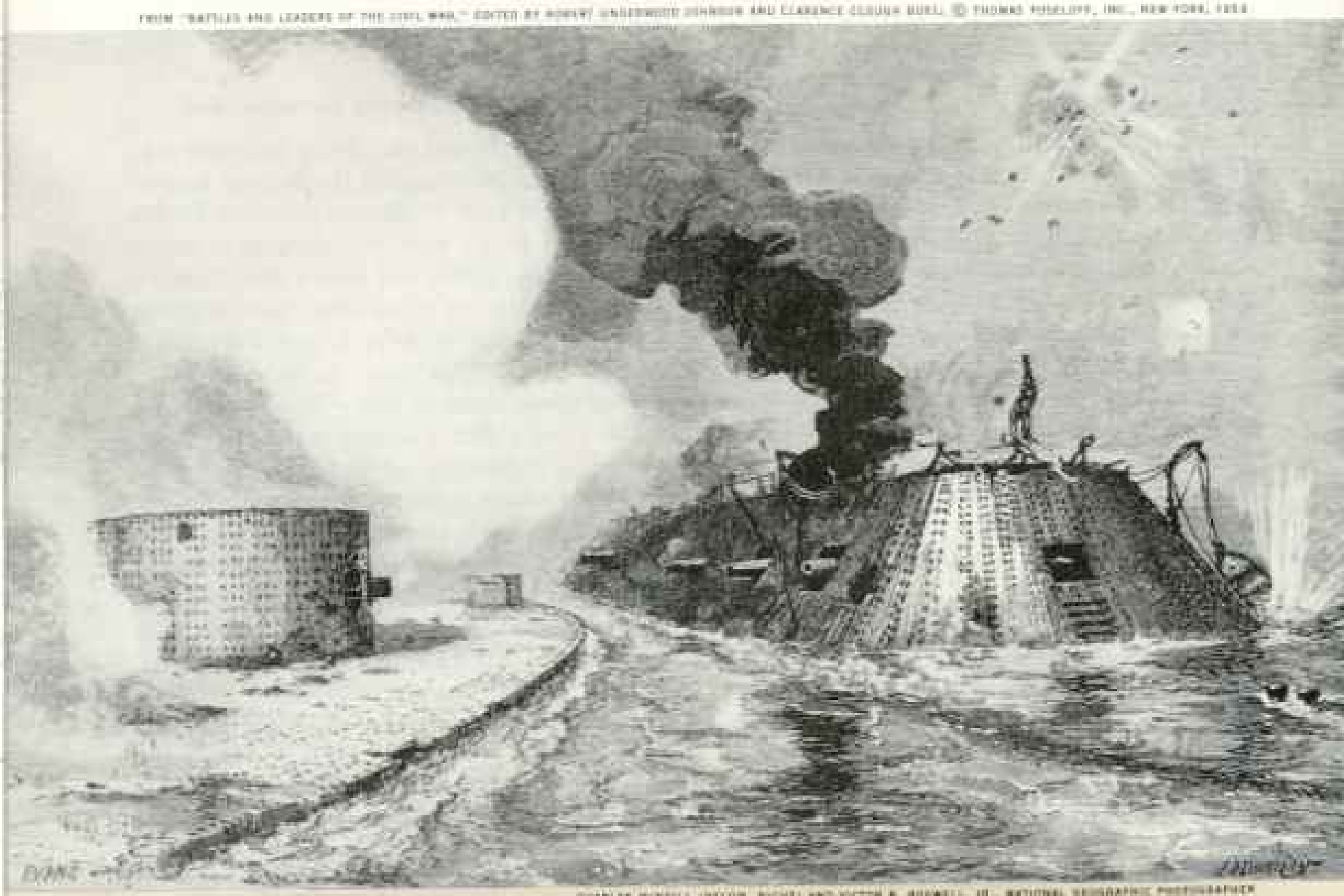
A fearful two-mile passage over mountainous seas brought the survivors alongside the towering hull of *Rhode Island*. Loops of rope dropped from the heaving deck lifted the survivors to safety.

The last rescue boat, D. Rodney Browne at the helm, had struggled three-fourths of the way to the stricken ironclad when the red

distress lantern—and 11 men—vanished beneath the waves. Commander Bankhead reported that *Monitor* sank about 1 a.m. on December 31, 1862, "about 25 miles south of Cape Hatteras . . . depth of water 30 fathoms." In all, 16 men had perished.

One hundred and eleven years passed. Then the captain's reports, logs of *Rhode Island*, *State of Georgia*, and *Passaic*, as well as numerous other accounts of the disaster, enabled Gordon Watts and NATIONAL GEOGRAPHIC researcher Dorothy A. Nicholson to plot the final two days of *Monitor*'s course to catastrophe. An 1857 Coast Survey chart helped to determine soundings and navigational fixes. The wind and sea conditions, culled from deck logs and weighed against knowledge of today's currents, yielded set and drift calculations. These established the likely track of the ships, and led us to *Monitor*'s grave.

On our 1973 *Eastward* expedition, which finally located *Monitor*, turbulent currents



CHARLES MENGEL (BELOW, RIGHT) AND VICTOR A. BUSHNELL, JR., NATIONAL GEOGRAPHIC PHOTOGRAPHER

Thunder of a new age rumbles across Hampton Roads (**above**) where shot and shell of *Monitor*, at left, and *Merrimack* ricochet off each other. Though the battle ended in stalemate, the Union blockade was preserved. Hysteria born of fear that the Confederate *Merrimack* might steam up the Potomac to bombard the Capitol was calmed.

One of *Monitor*'s distinctive iron deck-light covers, wholly encrusted (**right**), has been recovered near the wreck and cleaned (**below**)—ironclad proof of discovery.

prevented our cameras from recording anything but the stern portion. We lost our still camera, snagged on the hulk. Pictures of critical sections of the ship would be essential to match details of *Monitor*'s construction.

In a meeting at the Naval Research Laboratory in Washington, *Monitor* experts evaluated our find. A team of eight U. S. Naval Academy midshipmen presented corroborative magnetic data from an aerial survey. There was agreement that the evidence supported the wreck's identification.

A joint follow-up expedition put to sea in late March 1974. With support from the National Geographic Society and the U. S. Navy and with continuing cooperation from the U. S. Army Reserve, the research vessel *Alcoa Seaprobe* took us back to the *Monitor* site.

Seaprobe, with Comdr. Colin Jones of the Navy's Experimental Diving Unit as officer-in-charge, provided a sophisticated platform and specialized equipment. Largest all-aluminum vessel afloat, *Seaprobe* is driven by cycloidal propellers fore and aft, which allow the vessel to maintain position with a deviation of no more than six inches.

On the first pass, *Seaprobe* homed on the wreck with wondrous precision. The bones of *Monitor* stood out in bold relief on the sonar. Triangulation on Cape Hatteras Lighthouse and Diamond Shoals Light Station from our Army landing craft had pinpointed the wreck.

Guided from the landing craft by Doc Edgerton's side-scan sonar and the Del Norte Navigation System, *Seaprobe* repositioned, and within six hours of the first crossing was ready to send down the television units.

Remote-control Cameras Scrutinize Ship

A tall derrick aboard *Seaprobe* lowered strings of drilling pipe into the sea, with cameras attached to a "pod" at the bottom end. Guided by the underwater television pictures, officers in the ship's Search Control steered the vessel and the camera pod to almost any desired position above and around the famous ironclad.

Seaprobe started photographing and videotaping the wreck from bow to stern. As a positioning marker, a small sonar device called a pinger was placed on the bottom 30 feet north of the center of the wreck. For the first time the vessel's prow and anchor well came into view.

During *Seaprobe*'s week-long mission, seas were calm for only a single day. The landing craft used the brief good weather to dredge for artifacts on the seafloor around the wreck. *Seaprobe* assisted, anchoring buoys around the site, then had to sail away on another leg of her scientific mission. Dredge hauls yielded only bottom sediment, chunks of coal, and fragments of wood.

As the expedition came to an end, the team aboard *Seaprobe* continued to assemble a preliminary photomosaic from at least 2,000 photographs documenting *Monitor*'s remains. U. S. Navy specialists would need five additional months to complete the mosaic.

Century-old Relics Get Tender Care

In May, just a few weeks after we came ashore from *Seaprobe*, Dr. Robert Sheridan, a geologist at the University of Delaware, visited the wreck aboard *Eastward* and dredged from the ocean floor an astonishing variety of artifacts—72 separate items. As the dredge's contents were gingerly transferred to canisters of water (to preserve them from rapid oxidation), the value was apparent—iron plates, one showing a slot for a bolt; a threaded nut; a two-layer disk ten inches in diameter. There were more fragments of coal and wood, and a variety of lesser objects.

These precious relics of *Monitor* were immediately accorded the best available treatment. We closely examined the iron objects as soon as they could be removed from the preservative compounds. The heaviest consisted of the two disks of iron held together by four rivets; we have identified it as a cover for one of the light ports on the deck.

Natural defenses—depth and treacherous currents—long guarded the wreck; now legal protection, too, is extended to it. The *Monitor* site has been listed in the National Register of Historic Places. And on January 30, 1975—113th anniversary of *Monitor*'s launching—the National Oceanic and Atmospheric Administration plans to designate the ironclad a marine sanctuary. The remains are in such a badly corroded and fragile condition that the ship may never be raised intact.

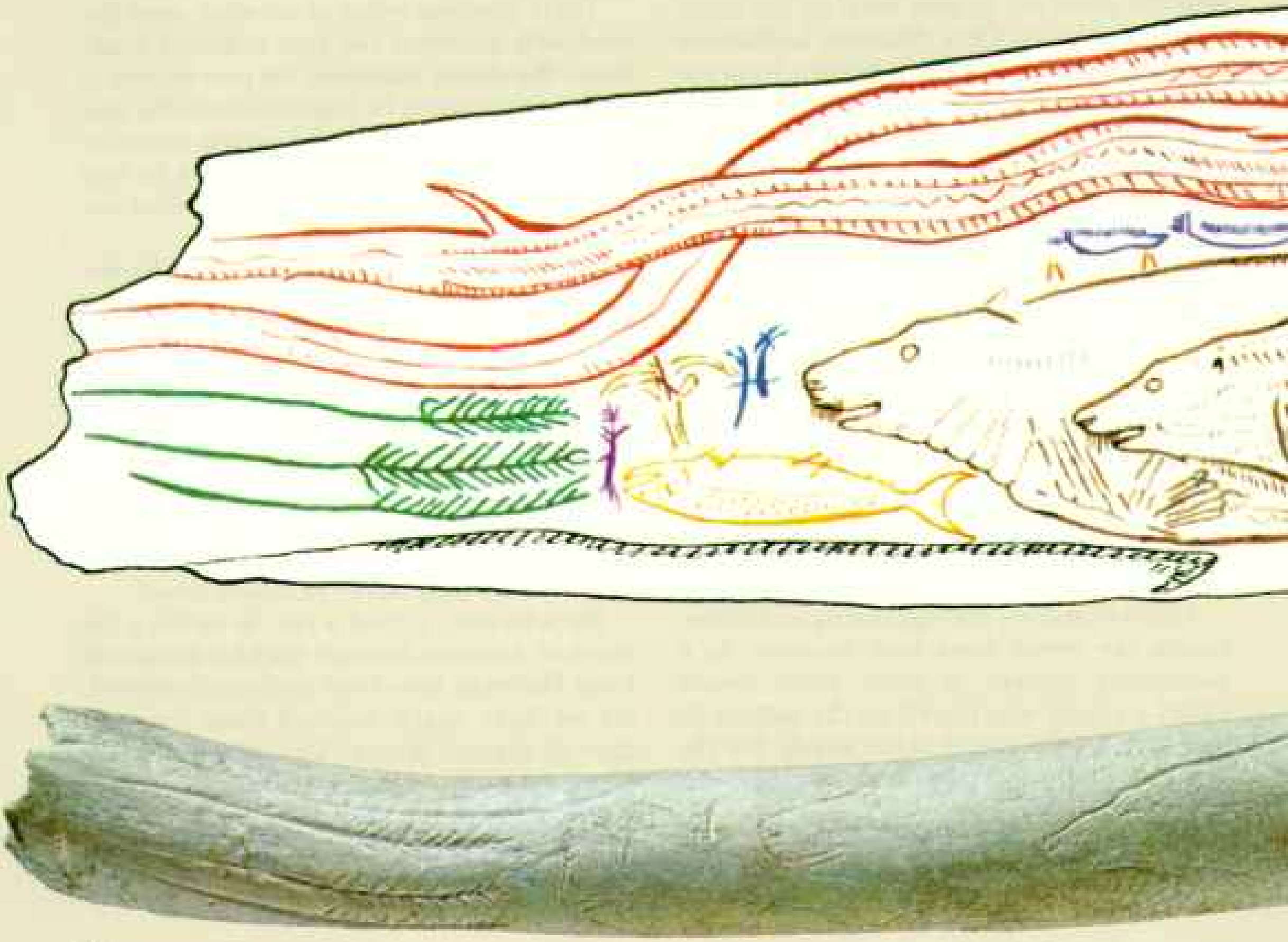
We who have played a part in locating the grave of *Monitor*, beneath the blue waters off Cape Hatteras, have been profoundly moved, for we have nearly touched those long-ago days of highest drama. This silent and forlorn resting-place cradles a tangible record of the hopes of a union of states—and a portentous turning point in the annals of men, ships, and the sea. □

A Bold New Look at Our Past

THEY STAND MUTE, the Europeans who lived 37,000 to 10,000 years ago during the last great glacial age. Yet out of the layers of dust and time have come engravings and paintings that speak of acute observation, master craftsmanship, and, to author Alexander Marshack, a Research Associate of Harvard University's Peabody Museum, something even more—clues to the human motives behind the art.

What did the artisan have in mind, he who set flint point to reindeer antler (**below**) about 12,000 years ago? Various theories have explained this kind of art as hunting magic, or as sexual symbolism, or as ancestor totems. Not satisfied with these concepts, the author began his analysis by taking a closer look at Ice Age artifacts than had ever been attempted before.

This 14½-inch *bâton de commandement*, an engraved staff that may have been used in ritual and perhaps served also as a spear straightener,



had been known for nearly a century. Yet under a microscope Marshack saw details previously overlooked or inaccurately reported. His tracings here show all its images as if unrolled, and color coded for clarity.

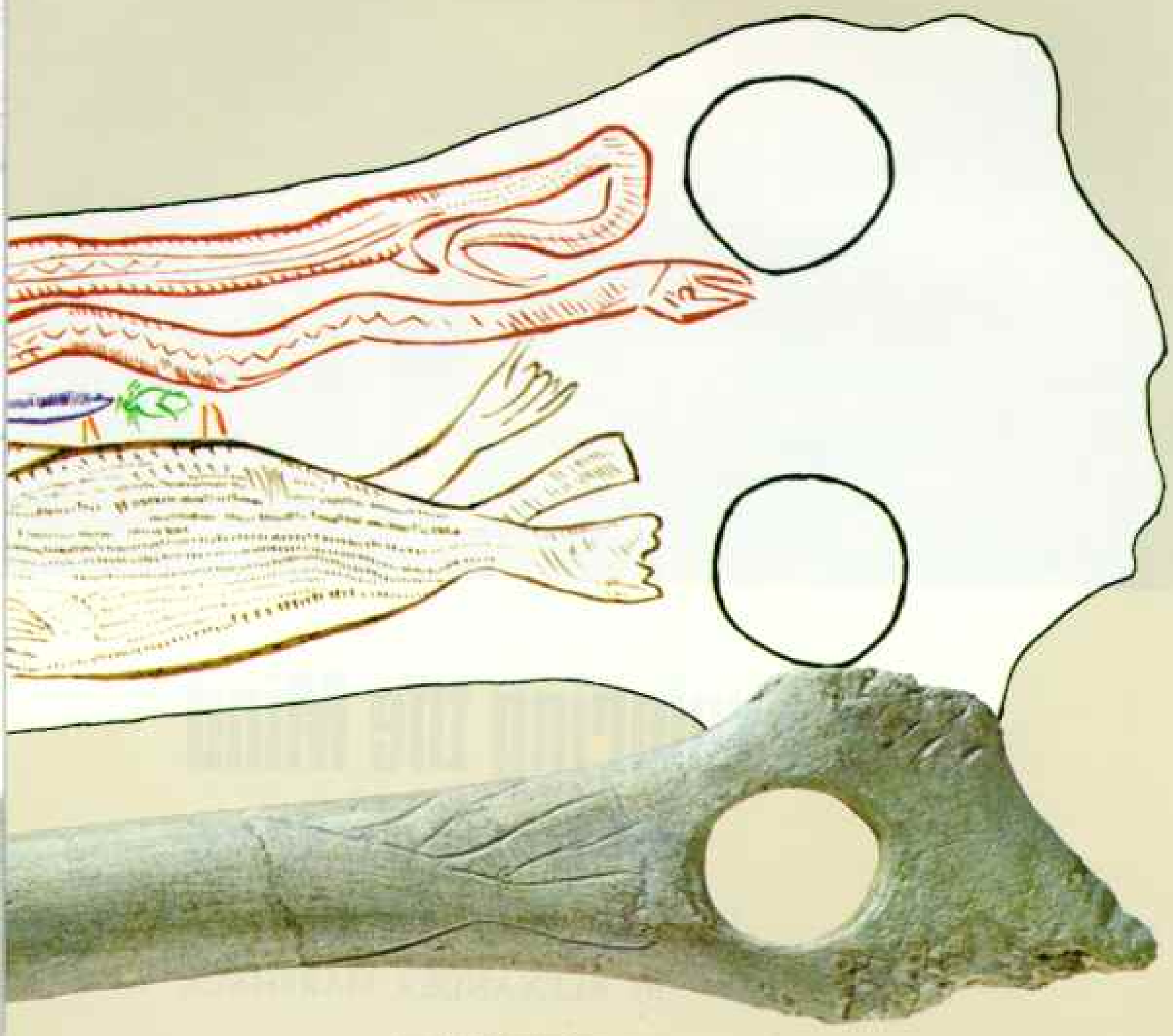
If the bull and cow seals (brown) and the male snakes (red) were self-evident, the upside-down fish (orange) was not. The microscope revealed that it was not a common mackerel, as it had previously been called, but a male salmon with the jaw hook distinctive of the annual spawning migration upstream—a time when seals follow to feast on the fish.

Three graceful forms (dark green) resemble plants, not harpoons for hunting magic. A sprout (lavender), a flower (green), and three small many-legged water creatures (deep purple) round out a visual treatise on seasonal ecology. And, the author feels, a schematic crossed-out ibex head (tan), and perhaps another beside it (dark blue), may be symbols that stand for the whole composition and for the idea behind it—the coming of spring, marked by sacrificial killings.

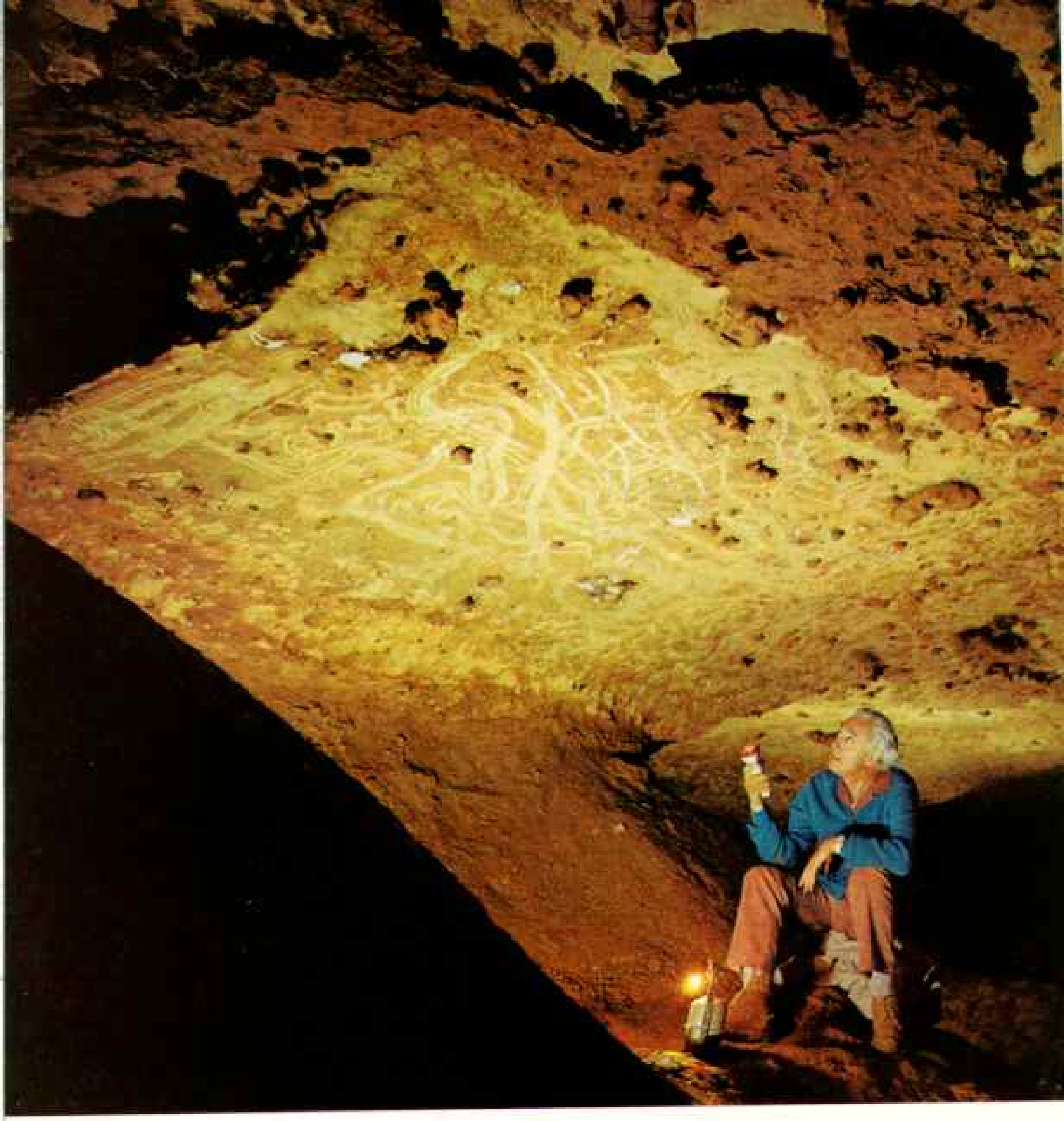
Not all the author's colleagues agree with the conclusions set forth in his startling book, *The Roots of Civilization*, or in this article, which outlines his most recent research, aided by a National Geographic Society grant. Yet most concede that his techniques—microscopic examination and infrared and ultraviolet photography—point the way to profound new insights into the life and cultural development of Ice Age man.

If, as Alexander Marshack has come to believe, man of that dim, often frigid past thought essentially as we think, what he crafted helps to chart the ultimate labyrinth—the complex, subtle, and ever-changing territory of the modern human mind.

—THE EDITOR

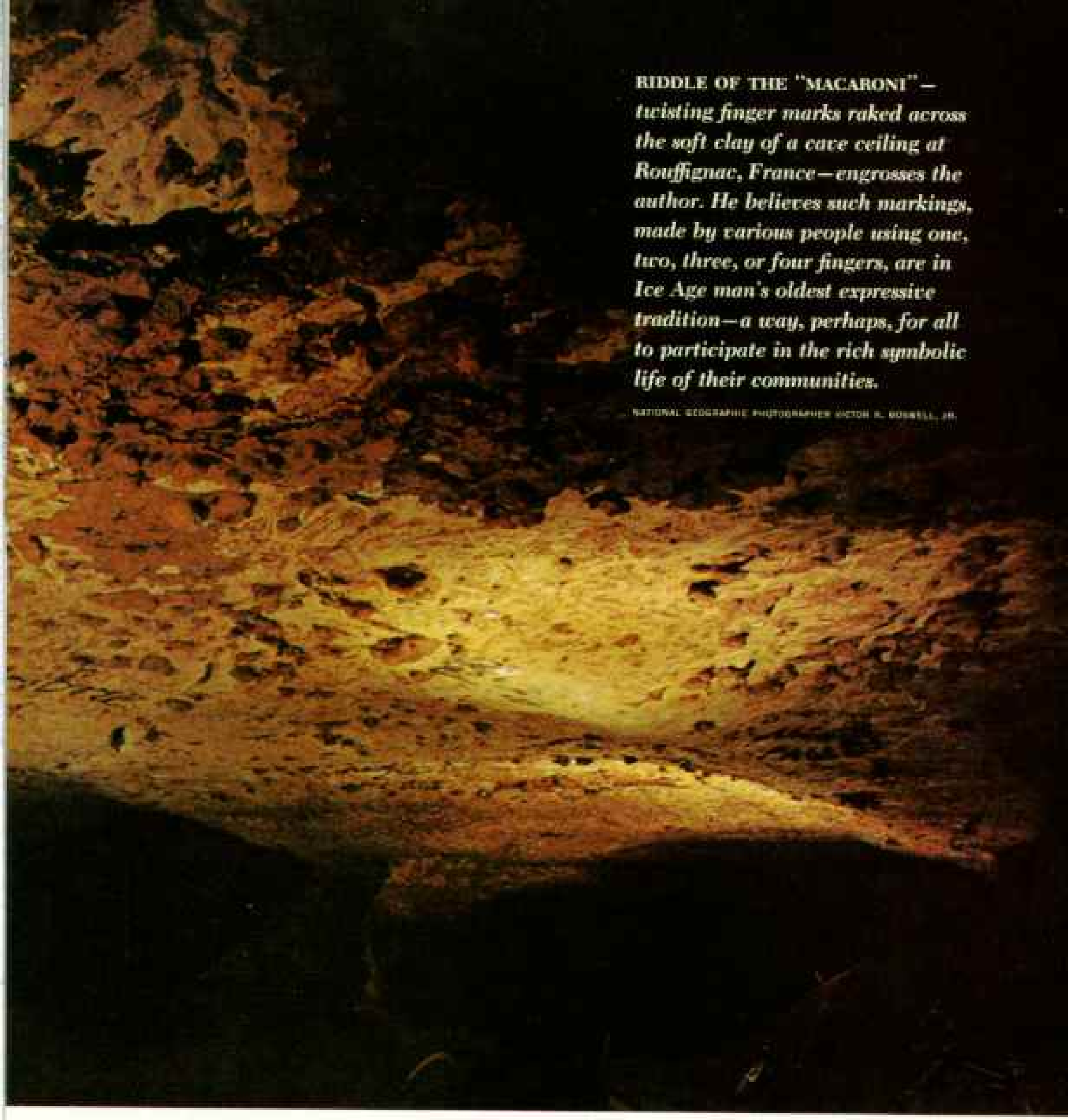


PHOTOGRAPH FROM MUSEUM NATIONAL D'HISTOIRE NATURELLE, PARIS; DRAWING (ABOVE) AND ALL OTHER PHOTOGRAPHS AND DRAWINGS, UNLESS OTHERWISE CREDITED, © ALEXANDER MARSHACK 1974



Exploring the Mind of Ice Age Man

By ALEXANDER MARSHACK



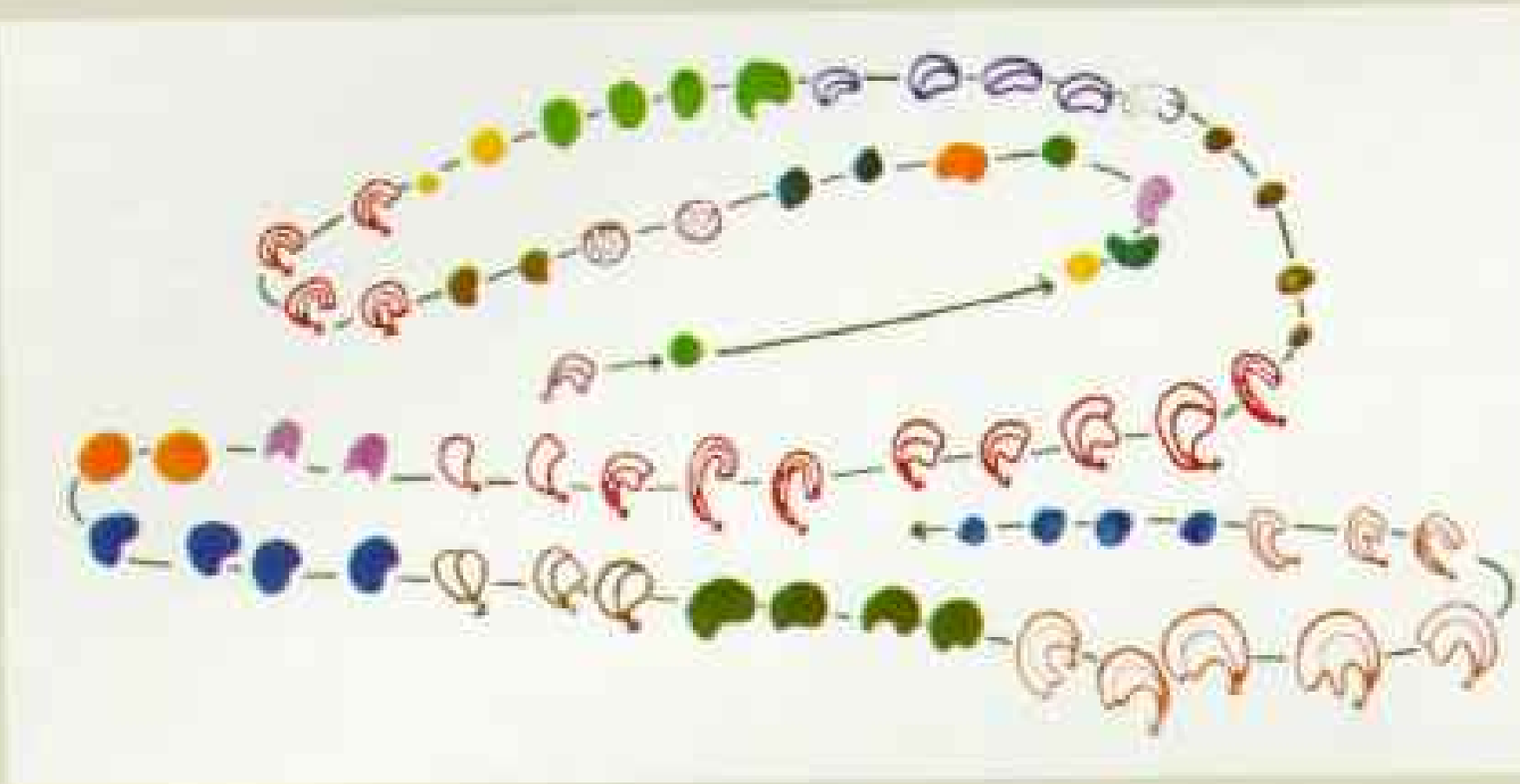
RIDDLE OF THE "MACARONI"— *twisting finger marks raked across the soft clay of a cave ceiling at Rouffignac, France—engrosses the author. He believes such markings, made by various people using one, two, three, or four fingers, are in Ice Age man's oldest expressive tradition—a way, perhaps, for all to participate in the rich symbolic life of their communities.*

NATIONAL GEOGRAPHIC PHOTOGRAPHER VICTOR R. BOSWELL, JR.

FOR MORE THAN HALF A CENTURY the fragment of carved reindeer bone had rested in a dim corner of a French museum, forgotten and never closely examined. When I slipped it under my microscope on that July day in 1965, I suddenly felt that I was looking into the mind of the man who had fashioned and used it more than thirty thousand years ago.

A serpentine series of marks, made with many different tools, had been engraved on the surface of the bone (pages 66-7). They clearly formed an intentional pattern—a record or tally of some sort. Eventually I unlocked the puzzle: With startling precision the image, made during the late Ice Age, coincides with phases of the moon over a period of more than two months.

Whether or not the image is accepted as lunar, as it seems to be, I had discovered the earliest known human notation, made more than twenty thousand years before the development of writing, arithmetic, or the calendars of later cultures we regard as civilized.



A bone notebook suggests that more than 300 centuries ago man was already using one of his most valuable faculties, a sense of time. Fashioned for the shaping of flint tools, the Blanchard bone (**right,** twice actual size) is pitted with markings once regarded as merely decorative.

But would someone decorating a bone change his engraving stroke or tool point 24 times to make 69 marks? That is what the microscope shows, rendered here by the author as a color-

Gradually the bone told me a great deal about the skills of its owner, and how he may have thought. Patterns of wear identify it as a pressure flaker, a kind of prehistoric machine tool, used to shape stone implements. The man who made and carried it over a considerable period also used it as a notebook, apparently to record an important sequence in his everyday life, the changing moon that marked the passing seasons.

Who was this ancient man, with a skeleton and brain like ours? He is popularly known as Cro-Magnon, after the site in France where his remains were first discovered in 1868. He appeared in Europe about 35,000 B.C. Hundreds of thousands of his stone tools have been found during the past century, together with some of his scratched, carved, and painted images. The largest concentration of his Ice Age work occurs in caves in southwestern France and northern Spain (map, pages 70-71). It was in the so-called Blanchard rock shelter, near the French village of Les Eyzies, that the bone with its notation was unearthed in 1911 by a French archeologist named Louis Didon.

This fascinating tool alters our view of Ice Age man. Once considered little more than a primitive toolmaker and hunter, he now emerges as a more modern human, thinking in a far more sophisticated way than was believed possible.

Despite scholarly study of his skeletons, his tools, and his art, the character and thoughts of Cro-Magnon man have until now remained largely a mystery. No effective method had been developed to study his symbolic materials. We know even less about Neanderthal man, who preceded Cro-Magnon in Europe, and who also left scattered clues to a symbolic and ritual life.

In 1964 I had discussed this gap in our knowledge of Cro-Magnon man with Professor Hallam L. Movius, Jr., of Harvard University. I suggested that it might be possible to use scientific techniques to shed new light on Cro-Magnon's little-understood culture.

While cautioning me about the difficulties, Professor Movius encouraged me to undertake the study. Unraveling the mystery of the bone fragment with its lunar notation was the first step in a fascinating research project that has occupied me ever since.

FROM A BASE in Les Eyzies (called "the capital of prehistory"), I have crisscrossed Europe, from Sweden in the north to the southern coast of Spain and the heel of Italy. I have examined thousands of Ice Age artifacts and engravings—a large proportion of what has been unearthed in the way of artistic and symbolic remains of Cro-Magnon man.

I have spent months recording and analyzing the paintings and engravings in Europe's

coded line drawing (**left**). Some marks were gouged from left to right, others from right to left, as indicated by small arrows. Still others were carved in short arcs or jabbed straight in, the various tool points leaving their distinctive tracks.

By beginning in the middle and following the black directional arrow around a serpentine path, the author reads the 69 marks not as literal images of the waxing and waning moon, but as a complex notation of the passage of 2¼ lunar months.

major caves, including Pech-Merle, Cougnac, Rouffignac, and Niaux in France, and El Castillo and La Pileta in Spain. During most of my travels I have been assisted by my wife, Elaine, a faculty member in graduate social work at Hunter College in New York City.

My ten-year search has focused not on the physical aspects of Cro-Magnon man, nor on his stone tools or the remains of his fires or meals. I have sought those fragile and subtle clues as to how he *thought*—that is, how he had become fully "human." But how do you look for lost thoughts 30,000 years old, when there are no written records whatever?

For such a study I had to employ special techniques. Chief among these was the use of extreme closeup photography together with a geologist's field microscope to magnify the engraved Ice Age notations and compositions. Later, in the study of the cave paintings, I used ultraviolet and infrared photography, literally to shed new light on the surprisingly rich art of Cro-Magnon man.

I began my research by re-examining the vast body of evidence archeologists had amassed in the past century, including artifacts wrapped in old newspapers and hidden away in forgotten museum drawers and collections. I then went to the strange signs and symbols man had made in the caves. Together these suggested answers to questions that have absorbed archeologists for decades:

How and why did the first human art emerge? Why did images of animals and females appear suddenly on earth? Why had the Ice Age hunters ventured deep into the caves, not to live in them but to carefully paint their walls with images? Why and how had early man become a thinker, a solver of problems, and a symbol maker?

Cro-Magnon man was essentially a hunter, so it is hardly surprising that many of his symbols represent animals. In a museum in Tübingen, Germany, I spent days examining a group of tiny animal statues carved from mammoth ivory, dating from about 28,000 B.C., roughly from the period of the French pressure flaker. The statues had been discovered in a cave known as Vogelherd. They included a horse, a lion, a leopard, a bear, a bison, a mammoth, and one crudely shaped human female figure.

MANY ARCHEOLOGISTS assume that Ice Age animal images represent only a form of hunting magic. The hunter, so the theory runs, made an animal image and "killed" it, then went out and hunted with the power of magic on his side. Still other archeologists theorize that the animals were totems —figures of ancestor animals from which different human groups or clans supposedly descended. The animals have also been interpreted as sexual symbols, with certain species

Still gamboling with man's power to animate, the 2½-inch-long Vogelherd horse survives both its maker of 30,000 years ago and the source of the artist's ivory, the long-extinct mammoth.

representing the male principle and others the female. I was now to ask new questions.

When I put the Vogelherd horse under the microscope, I discovered that its ear, nose, mouth, and eye had been carefully and accurately carved, but that these features had been worn down by long handling (above). The figure had obviously been kept by its owner and used for a considerable period. Clearly it had not been created for the purpose of being "killed" immediately.

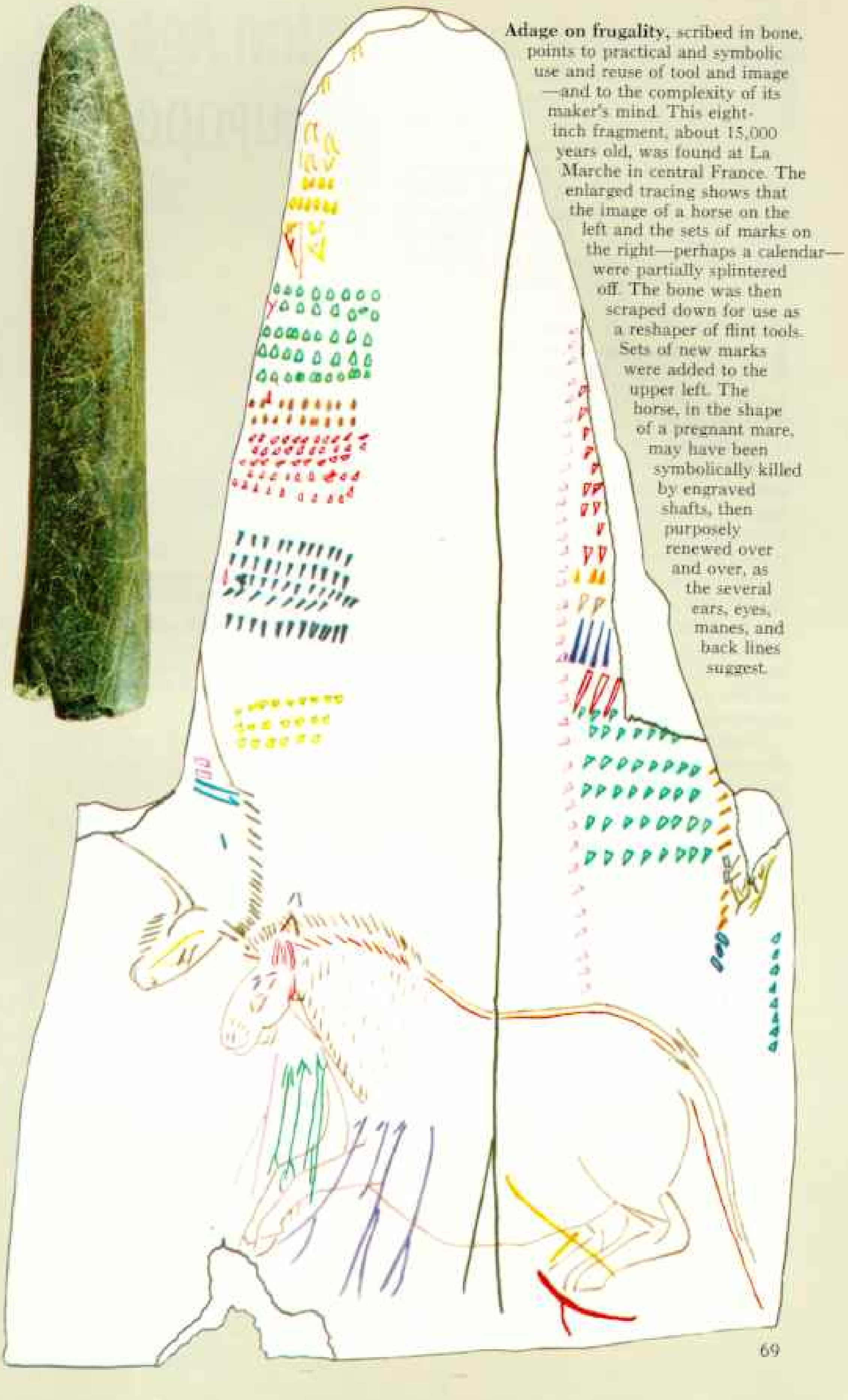
But in the shoulder of the horse was engraved one unworn angle that I took to represent a dart or wound. Apparently some time late in the use of this figure, it *had* been killed. But why? Was the killing intended as hunting magic? Perhaps. But if Cro-Magnon was as sophisticated as I was beginning to find he was, could the killing not have been for some other symbolic purpose, such as an initiation, the casting of a spell, the curing of illness, a sacrifice for the coming of winter, or a celebration for the coming of spring?

WHATEVER THE MEANING, here was an indication that Ice Age images, like notations and certain tools, were made to be kept and used over a long period for specific purposes. One could speculate on the different uses of these images. Did lunar notations, for instance, help determine when an animal was to be ritually killed or the season in which a certain species was to be hunted?

In the 1880's a section of reindeer antler was discovered in the cave of Montgaudier in southwestern France, about a hundred miles inland from the Bay of Biscay. Perhaps used to straighten spear shafts, the antler carries engravings long regarded as perfect examples of hunting magic, since they depict animals and fish supposedly in association with weapons (pages 62-3). Study under the microscope revealed a far different story.

The main engraving consists of two seals in perspective. A bull seal and a smaller female, they are precisely etched even to the whiskers, the line of the skull, and the rolls of body fat. Beside the seals is a salmon, upside down. The lower jaw has the hook, or kype, that male salmon grow during the migratory run upriver to spawn, a time when seals follow them. Though salmon no longer migrate up most French rivers because of pollution and dams, they were once common far inland, even in recent historical times. Salmon migrations begin at the same time each year, some weeks after the first thaw. The first run is a major event, for it heralds spring.

To the left of the salmon are three images of a kind long thought by archeologists to be barbed harpoons. The presence of harpoons with seal and fish seemed natural, at least in



Adage on frugality, scribed in bone, points to practical and symbolic use and reuse of tool and image—and to the complexity of its maker's mind. This eight-inch fragment, about 15,000 years old, was found at La Marche in central France. The enlarged tracing shows that the image of a horse on the left and the sets of marks on the right—perhaps a calendar—were partially splintered off. The bone was then scraped down for use as a reshaper of flint tools. Sets of new marks were added to the upper left. The horse, in the shape of a pregnant mare, may have been symbolically killed by engraved shafts, then purposely renewed over and over, as the several ears, eyes, manes, and back lines suggest.

terms of the hunting-magic concept. But the microscope showed that these were not harpoons. The "barbs" point in the wrong direction to make an effective weapon. Moreover, they end delicately, precisely like plants, and are arranged in the manner of leaves.

Above the female seal is an apparent tiny flower in full bloom. Near the bull seal are three tiny many-legged creatures of water or damp ground. Finally, there is a pair of snakes, each with the genitalia showing, as is the case in spring mating season.

THIS ENGRAVING was a careful seasonal composition, rather than hunting magic. Further microscopic study indicated a possible use. One of the last images engraved on the antler is a tiny abstract head of a male ibex, or mountain goat, seen from the front. In Ice Age compositions the large animals generally were made first and the smaller secondary images and abstracted signs were added in the remaining space or inside the animals.

The ibex is extremely schematic and consists merely of two horns, two ears, and a muzzle. The eyes are lacking. The microscope shows that the image is crossed out, or crossed over, by an X on the forehead. The realistic seals and salmon were not "killed" by such a symbolic overmark.

Exactly the same schematic image of the ibex—front face, without eyes, and crossed out—occurs as a regular motif or sign in late Ice Age engravings that have been found as far away as Spain.

To me the questions were obvious: Did the Ice Age male ibex come down from craggy heights in spring to browse on the new green growth of the lower slopes, as the ibex of today does in the Alps? Was the killing of the ibex a sign of the coming of spring? Was it, then, a ritual sacrifice? We know that sacrifices of this type were common in later, post-Ice Age periods. The engraving suggested an act of killing, not for food but as a symbolic ritual related to the seasons and the behavior of wildlife.

Perhaps this realistic seasonal composition on the Montgaudier antler had been summed up by the schematic ibex head made in a totally different style. Could I take the clues from these engraved bones and apply them to the painted caves of the Ice Age?

Three major French caves, Niaux, Pech-Merle, and Rouffignac, which today receive

Ice Age Europe

Major Ice Age Art Sites

- *Cave with wall art*
- *Other art site*

When Cro-Magnon man flourished in Europe, glaciers covered much of a continent made larger (blue lines) by an ocean level 300 feet lower than it is today.

Prehistoric pioneers, men fully modern in form, appeared in Europe 37,000 years ago, a time when millions of cubic miles of today's ocean water lay locked in glaciers. Forbidding as such a world may appear, the Europe of tundra, steppe, and woods ran rich with game. Where they could, as in southern France, the hunters settled along rivers, using rock overhangs or cave mouths for shelter. Their way of life persisted for more than 25,000 years. Then the warming climate melted the glaciers and raised the seas. Encroaching forests drove the great grazing animals, their chief prey, north, some to extinction. Something new and profound would eventually sweep across Europe—agriculture.

MUSK OX

GIANT ELK

WOOLLY RHINOCEROS

REINDEER

CHAMOIS

IBEX

SABER-TOOTHED TIGER

LION

CAVE BEAR

PREGNANT MARE

STEPPE BISON

BIG DEER FAWN

HORSE

MARE WITH FOAL

ROE DEER

PAINTING BY NATIONAL GEOGRAPHIC ARTIST LLOYD K. TOWNSEND

Meat for survival and food for thought

AN ENTIRE ECONOMY on the hoof, Ice Age animals supplied man with food, garments, and tools. Of necessity, men knew them intimately: their range, habits, seasonal behavior.

The woolly rhinoceros, musk ox, giant elk, and woolly mammoth sought the coldest terrain, perhaps retreating from snow-filled valleys to open country in the dead of winter. Seasonal game, seals and salmon may have brought men from different areas together to hunt, fish, and perhaps to trade. Deer and bison, heads strained high, mouths open in the bellow of rut, marked the autumnal mating season. These, and the other animals rendered here, are all represented in Ice Age art.

Man the hunter also knew plants. Just outside the French cave of Lascaux the author found growing plants identical to those depicted inside the cave. Another time he asked a farm woman if she recognized stalks engraved on an Ice Age bone. "Ah, that is farina, but we don't eat it. It is wild—*sauvage, sauvage!*"

This same natural panoply also supplied what was useful to man as it was to no other predator. It gave him subjects which he could observe and contemplate, and by which he could visually express the world of his experience.

The hands of an Ice Age man shown working a bone have already engraved a *farina sauvage*, a sprout, and a crossed-out ibex, shorthand for the model to its upper left. Apparently an image associated with spring, the schematic ibex often appears with other seasonal images, such as plants. Thousands of years later, schematic cattle heads were totally abstracted into the forerunner of our letter A.

With a pencil grip the right hand adds a line to a set of notations. No Ice Age Rosetta stone has yet been found to prove conclusively that such markings were, indeed, lunar notations. Yet man the expert hunter, who knew and portrayed seasons, had one most usable model for time —the moon, with its observable, regular, and recurring cycles.

Based on his careful and systematic research of more than a decade, the author holds that Ice Age man indeed kept a deliberate and often detailed record of the changing moon and passing seasons by use of both literal images and abstract symbols. Our distant forebears thus revealed a level of observation and thought far too complex to be explained by previous interpretations of their art.

thousands of visitors each summer, became the test grounds for developing a new kind of archeological research.

SINCE THE 19TH CENTURY scholars have debated the meaning of Ice Age cave art. In a way these dramatic images are a trap for the archeologist.

A cave wall is a more or less public surface —artists from different periods may have entered hundreds or thousands of years apart. How, then, can one call what appears on a wall a "composition"?

Beginning in the 1930's Abbé Henri Breuil, the first great interpreter and illustrator of cave art, proposed a chronological sequence of prehistoric art styles. It began with the simplest outlines and proceeded to the more sophisticated multicolored images displaying great detail and perspective. But, if my interpretation of the engraved materials is correct, beautifully realistic images that appear on a bone side by side with crude, schematic ones were made in a limited period by the same hand. Why could the same not be true of cave art? Moreover, since some paints fade and deteriorate, how could we know what was originally on a cave wall and what is now missing?

The first cave I studied was Pech-Merle, in southwestern France. In this area, and in neighboring northern Spain, what we call the Ice Age was not as bitter as the term implies. There was ice to the north across Britain and Scandinavia, to the east in the Alps, and to the south in the Pyrenees, but the valleys of southwestern France were protected from the fierce northern winds. Temperatures were not arctic and the ground was not frozen. The entire area had a cultural continuity throughout the last glacial age.

Pech-Merle today is extremely chill and damp. The first visit is so overwhelming one can scarcely think. The silence and heavy air can literally be felt. Huge irregular winding chambers have been carved inside the hill by ancient underground rivers, the architects of many Ice Age caves. These chambers have been further altered by formations of stalactites and stalagmites. The passage twists in a random, chaotic manner.

Suddenly one comes upon a flat, dry wall with two large painted horses surrounded and covered by red and black dots (facing page). The composition is startling because it is so complex. There is a huge red fish—a pike—in the body of one horse, as well as a large circle. The horses have human hand prints appearing above and beneath them. On neither horse is there any sign of weapons or symbolic killing.

PAINTING BY LLOYD K. TOWNSEND

"I was here." Whatever his intent, when he put his hand on a cave wall and blew pigment through a tube (**above**) to leave negative hand prints, Ice Age man left that message. In a cave at Gargas even an infant, whose hand was clearly held in place by an adult, participated in the communal act.

Infrared light allowed the author to find the order in which images at Pech-Merle (**right**) were built up: first, a large red fish and smaller circle (under the mane at far right), now all but invisible; over them, a horse; next, sets of dots filling the horse; then another horse was added, and more dots; finally, the hand prints of adults, which give a sense of scale to the composition.

Another wall of Pech-Merle contains only red dots and one red hand print, all made with ocher, an iron oxide clay. A separate chamber has eight abstract human female images of the kind I had found on engraved bones, plus more red dots and animal outlines.

In adjoining chambers there are hundreds of finger tracings in clay of a kind known among archeologists simply as meanders, or "macaronis." These are interspersed with an occasional abstract figure of a human female or an image of a mammoth. Still another section of the cave contains nothing but groups of red dots.

The impression of Pech-Merle is one of great variety—females, animals, meanders, dots, hand prints, and abstract signs—and

the questions are equally varied. How, for example, do you interpret a circle in the chest of a horse? How do you begin to understand sets of dots, or interlaced meanders? A female image is "feminine," but what does an animal image represent—a meal?

Instead of searching immediately for the meaning of these images, I tried to find out how they were made and used. I began by using invisible light from lamps that radiate infrared or ultraviolet rays. One can take photographs by means of this invisible radiation, using special films and filters. I devised the techniques with Cro-Magnon man's painting materials in mind. Ice Age artists used two kinds of mineral paints: the ochers, or ferrous oxide clays, ranging from pure red through yellow and brown to violet; and manganese oxide for black. These pigments were often available in the caves themselves.

Infrared film sees through red ochers as though they were glass. Paintings in other pigments under them become visible. Impurities in the ochers also can be detected, since those are not transparent and therefore show up in the photographs. Various mixes of paint become clearly differentiated.

When I began a breakdown of the spotted horses, I found that the sets of red dots mixed in with the black dots had been made by different types of ochers. Each set apparently had been added to the horse at a different time. Without trying to interpret this strange composition, I could nonetheless suggest a sequence to the buildup. A fish and a circle were first painted on a wall, the contours of which suggested a horse. Then the outline of a horse was drawn to fit the shape of the wall. Then, set by set, black and red dots were added inside the horse, and when it was filled, black dots were put above and below.

Next a second horse outline was added, and this, too, was slowly filled up with sets of red and black dots. When both horses were

filled, hand prints rather than dots were placed around them, marking a final use of the wall. Whatever meaning the fish, circle, and horses had, the dots and hand prints apparently were related to that meaning.

Like the early Vogelherd horse that was handled, used, and then killed, this wall with its horses had had use and reuse. Over how long a period one could not tell. But clearly these were not mere pictures of horses meant to be killed and eaten.

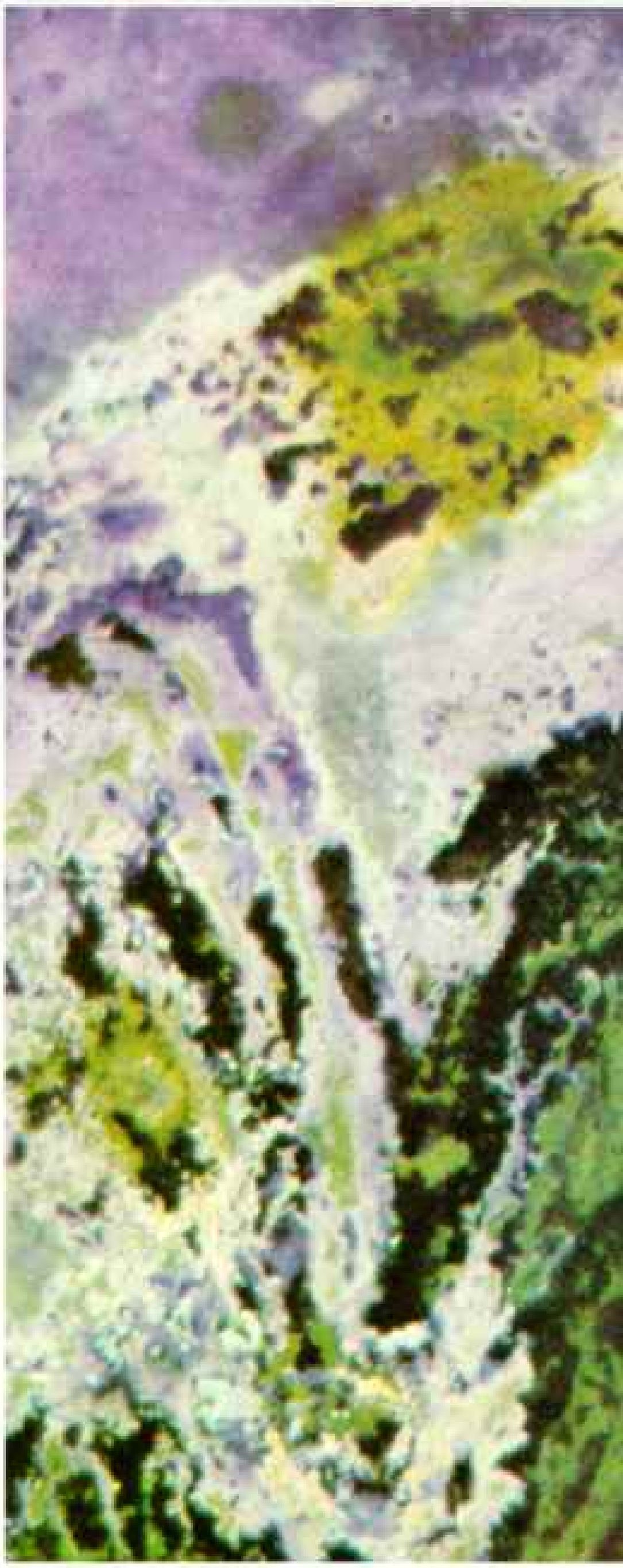
Although I had not discerned the meaning of the panel, I had shown that by the use of infrared light it was possible to begin an analysis of the Ice Age caves in a new way. As a result, I began tracking and probing the caves to try to understand the sets of dots, meanders, female figures, animals, and the many kinds of signs.

I FOUND that ultraviolet light causes dramatic effects in many caves. Various minerals and living organisms on the cave walls react to ultraviolet radiation, causing a ghostly fluorescence. The ochers and manganese pigments themselves do not fluoresce.

When I trained an ultraviolet lamp on the walls of Pech-Merle, the effect was startling. Eerily, the stalactites and stalagmites there fluoresced as though they were wired internally for electricity. By noting the amount of fluorescence on the wall, one could tell that in different parts of the cave unequal processes of growth and aging were under way. The knowledge could be helpful in determining what might have happened to images painted on the walls.

These new analytic techniques demonstrated that animal images and walls had been used and reused, just as the surfaces on the engraved objects were used and reused. For example, a single animal image such as a horse could be used in many different ways by the addition of different kinds of symbols. Such discoveries opened up a new stage of cave research and offered a new insight into the complexity of the Ice Age symbol systems.

Ultraviolet light also revealed traces of modern man as well as of Cro-Magnon. In the famous cave of Lascaux, closed to the public since 1963 for protection of its paintings, the ultraviolet lamp disclosed a colorful fluorescent dust on many shelves and ledges. The dust consisted of tiny blue-green specks and long twisting serpentine forms of brilliant red and blue-green. In total darkness



Nature imitates art while destroying it. In normal light, the white "eye" of a horse in the cave at Niaux (**right**) glares hotly. Under the author's ultraviolet light (**above**), the eye stands out for what it is: A spot of calcite glowing eerily. Water seeping through the rock bleeds the original eye of black manganese down the horse's cheek.

Ultraviolet light also restores such fading

detail as the muzzle line, forelock, chin whiskers, and neck muscles. It adds pastel hues of green, yellow, and orange, probably bacterial action conspiring to obliterate the image already coated by calcite.

This technique has a fringe benefit: The author's ability to diagnose ills of cave paintings brings him permission to photograph where he might otherwise be refused.

one had the sensation of looking down at a city at night from a plane.

Mystified, I took a strip of gummed tape and touched it to a ledge, picking up some of the fluorescent dust. Under the microscope the particles proved to be a mixture of pollens, spores, and artificial fibers brought in by visitors before the cave had been closed. In effect the sightseers had been like pollinating bees, spreading outside dust and organisms in a cave that had been undisturbed for thousands of years. In unsuspected ways they were helping to destroy man's first art. As a result of these studies, French authorities asked

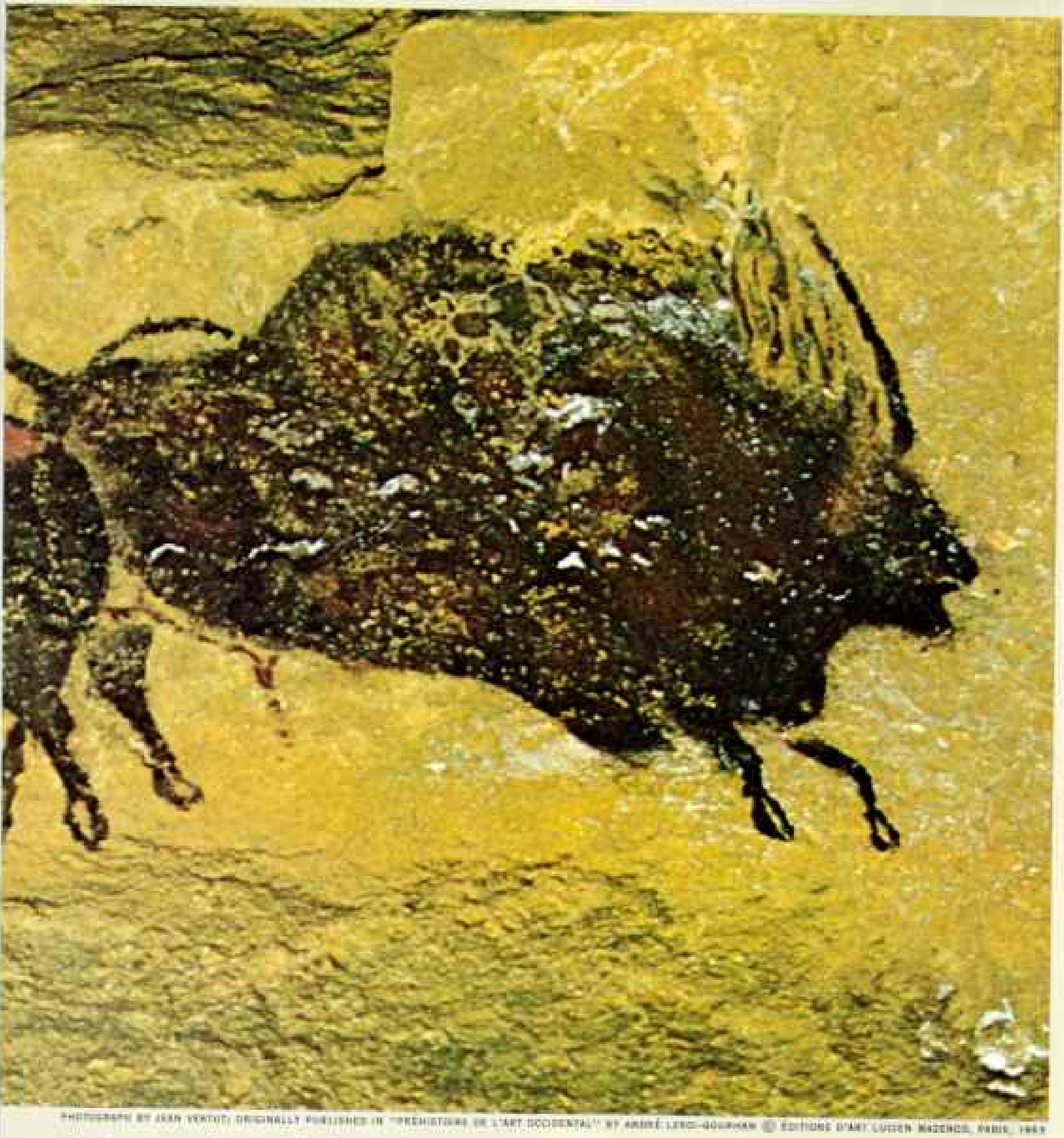
A ballet of bison, alive with animal power and grace, surges across the walls of Lascaux. The artist, a careful observer and draftsman, painted two four-foot-long bulls, the left in summer molt, one of many seasonal details that intrigue the author.

Stumbled upon in 1940, after 15,000 years of darkness, Lascaux was perfectly preserved. No cave yet found matches the variety or elegance of

me to conduct research in Lascaux and other caves and to recommend steps for their protection, which I have done.

FROM PECH-MERLE, my attempt to understand symbols of early man led to the cave of Niaux in the foothills of the French Pyrenees. Niaux contains some of the best art of the late Ice Age—animals so realistically and beautifully painted that, as in the case of the Montgaudier reindeer antler, one feels that the artist must have used living models.

But the main chamber of Niaux is half a



PHOTOGRAPH BY JEAN VERTUT; ORIGINALLY PUBLISHED IN "PREHISTOIRE DE L'ART OCCIDENTAL" BY ANDRÉ LEROI-GOURHAN © EDITIONS D'ART LUCIEN MAZENOD, PARIS, 1965

its images, and none displays such a palette of colors ground from ochers and manganese oxides.

By 1963, organisms borne by a tide of visitors were obliterating the beauty that had been so long preserved. Sealed now, Lascaux seems to ask: How much other art of comparable beauty and significance was lost on materials that perished, and how much survives but is still hidden?

mile inside the hill, and the farthest chambers with images are almost a mile inside. Obviously Cro-Magnon man painted from memory rather than from a living animal so deep inside the cave.

We know that he entered barefoot, for his prints remain on the clay floors. He carried a flaming torch that lasted at least an hour or two, or a dish of oil with a floating wick.

The area of Niaux actually offers two sets of paintings and engravings—one in the main cave and another across the valley in a smaller rock shelter called La Vache. My plan was to compare the art of the cave and of the shelter and to relate the various images to the prehistoric ecology of the valley.

ARCHEOLOGICAL EVIDENCE suggests that the hunters at La Vache lived in the valley somewhat later than the painters of Niaux. But both groups illustrated the same key animals: bison, horse, ibex, deer, and fish. The same favorable hunting climate must have existed in both periods, and the behavior of both the hunters and the animals could not have differed much.

The engravings of La Vache are extraordinary for their detail. A bone found in the shelter bears an engraving of a pair of frog's legs. Whether they were an item of diet in Ice Age France, as they are today, we cannot tell. But they are clearly a seasonal image of late spring and summer.

A bone knife that shows no evidence of wear on its edges, and was therefore probably used for ceremonial or ritual purposes, has an engraved doe on one face, with serpentine lines suggestive of water above its head (page 83). On the same face of the knife there is the familiar symbol of an ibex head with one crossed-out horn and three abstract flowers in bloom. The images seem to represent spring in the foothills, just as those on the Montgaudier deer antler apparently represent spring in the lowlands.

The other face of the knife may represent autumn, depicting the head of a bison bull with mouth open and tongue out in the bellowing posture of the autumn rut, or mating season. The plants on this side of the knife are of a different type—perhaps conifers or leafless trees, with what seem to be nuts and one dying flower.

Here the Ice Age hunter was depicting species of animals with sexual designations and species of plants at various stages of growth.

Harpoons or plants? Images within and to the right of a Lascaux horse were long thought to be harpoons for hunting magic, but the author identifies them with other plant images in the cave.

PHOTOGRAPH BY JEAN VERTUT, ORIGINALLY PUBLISHED IN "PRÉHISTOIRE DE L'ART OCCIDENTAL" BY ANDRÉ LEROI-GOURHAN © EDITIONS MAZENOD LUCIEN MAZENOD, PARIS, 1965

A geometric sign above the five-foot-long horse is one of many such symbols the author is studying.

The painters who made long and dark, hard and often dangerous journeys as much as a mile into the bowels of the earth went on no mere casual impulse. Whatever their intentions, they must have had compelling reasons no brutish "cave man" could have known.

The combination of seasonal animals in relation to seasonal plants indicates a knowledge of the behavior of local species suggestive of the master hunter and gatherer. These engraved bones from La Vache indicate a complex use of animal images for symbolic and ritual purposes.

The cave of Niaux offers similar indications of Cro-Magnon's complex use of images and sense of seasonal relations. The wall of one side corridor displays the figure of a small red horse, perhaps a colt, with a drawing underneath of the familiar "harpoon" symbol found on the Montgaudier deer antler. Here, too, the image is a perfect plant, with the barbs facing forward and arranged in the manner of leaves.

Infrared light revealed that the horse and plant were made with the same ocher and were probably created as a unit. A few feet away there are other red plants of a different species, some apparently growing upward in a suggestion of spring, others seeming to me to be bare autumnal plants.

If the Ice Age hunter depicted plant species in different seasons as accurately as he depicted animals and their behavior, and if he symbolized these changes and differences with both realistic and abstract images, he probably had words for these differences and processes. Thus he was capable of that most symbolic of human functions, speech. If so, this early hunter had the lore and skills that would have prepared post-Ice Age man for the coming stage of human culture that brought planting, agriculture, and the domestication of animals.

TO ME the great surprise was the discovery of plants as key images in the caves of Lascaux. When and if Lascaux is ever opened again to research, some of the major problems in the century-old debate over the meaning of Ice Age art may be solved. If the association between animals and plants of different species and periods of growth is eventually accepted as fact by the scientific community, then the discussion concerning the nature of man's first art and his knowledge of his environment will have undergone a revolution.

In their role as hunters, men had a special relationship with the world of animals and of animal images. Probably compositions on tools such as pressure flakers and the major paintings of animals in the caves were made by men as part of masculine lore, skill, and ritual. The tendency has always been to see human evolution in masculine terms, that is, as the product of man the toolmaker and man the hunter.

The approach is understandable in light of the stone tools and animal bones that archeologists dig up. For this reason, the presence of female images as old as the earliest animal images, and the persistence of these throughout the whole Ice Age, posed a special problem for my analysis. Like animal images, these female figures have been found all the way from Spain to Siberia. In the same way that animals had been called hunting magic, these often naked wide-hipped images had been termed fertility magic.

It was the microscope that gave me a clue to some of the uses of these Ice Age female images and opened still another door into the Ice Age way of thinking and use of symbols.

IN THE CAVE OF LA ROCHE near Lalinde, in the Dordogne of France, two heavy chunks of limestone were discovered in the 1920's on the floor of a late Ice Age habitation, dating from 12,000 B.C. On these stones are engraved outlines of extremely abstract human female figures, without heads, hands, or feet. The main feature is greatly exaggerated buttocks (page 84).

The figures are unusual, with little that we today would stress as either human or female. Yet we know that this basic recurrent buttocks form is female, because occasionally a breast is attached to it.

When I put the La Roche stones under the microscope, it was instantly clear that, like the Ice Age animals, these images had been used over and over again. After an image had been engraved, sometimes quite crudely, it was later crossed out or marked within the central region as many as nine separate times. Each mark in a female was made by a different tool point, presumably at a different time.

Someone had engaged in periodic marking of these female images, either for purposes of ritual or notation. But what was being periodically marked or recorded? Did these marks notate the months in the female cycle or in gestation?

Hundreds of stones with these female images have been found at Gönnersdorf, Germany, on a hill overlooking the Rhine River. The site was an Ice Age camp later covered by a volcanic eruption. Here, as at La Roche, the female images seem to have been used and

Ode to spring, elegy on autumn

A WAY OF LIFE was melting with the glaciers when two seasonal compositions were engraved on a bone knife at La Vache. Never used to cut but perhaps employed in some Ice Age ritual, the knife can be read as homage to spring and fall.

The left face shows a doe; three wavy lines, perhaps water; three flowering plants; and the familiar ibex head crossed out by two short marks on the top of its right horn —in all, a set of spring images. The face at right portrays a bison in autumn rut; four plant forms, perhaps conifer branches; a drooping plant (green in the overlay); and three seeds or nutlike forms.

La Vache, a habitation cave, lies just across a narrow valley from the ceremonial cave of Niaux in an area where the Atlantic and Mediterranean climates meet in a kind of ecological salad of flora and fauna.

In the world of women, a singular birth

HUMANKIND'S oldest self-images were mainly of women, often abstracted by a few quick strokes. The engraved stone from France (**left**) and the color-coded drawing demonstrate that some female images were crossed out repeatedly with various tool points. Such deliberate use and reuse of the images may be a form of record keeping related to the menstrual cycle or some periodic ritual associated with women.

A slate from Germany, with color overlay (**right**), adds to the female images a pair of horses' heads and what seems to be a fetus attached to a woman by an umbilical cord, a scene unique in Ice Age art. The fetus without arms is in the style of many of the human representations.

renewed many times. Some figures had been re-engraved so many times that deep grooves had been cut into the rock. One stone contains two female images, one of which is slightly more realistic than usual, since it includes a breast and two upraised arms.

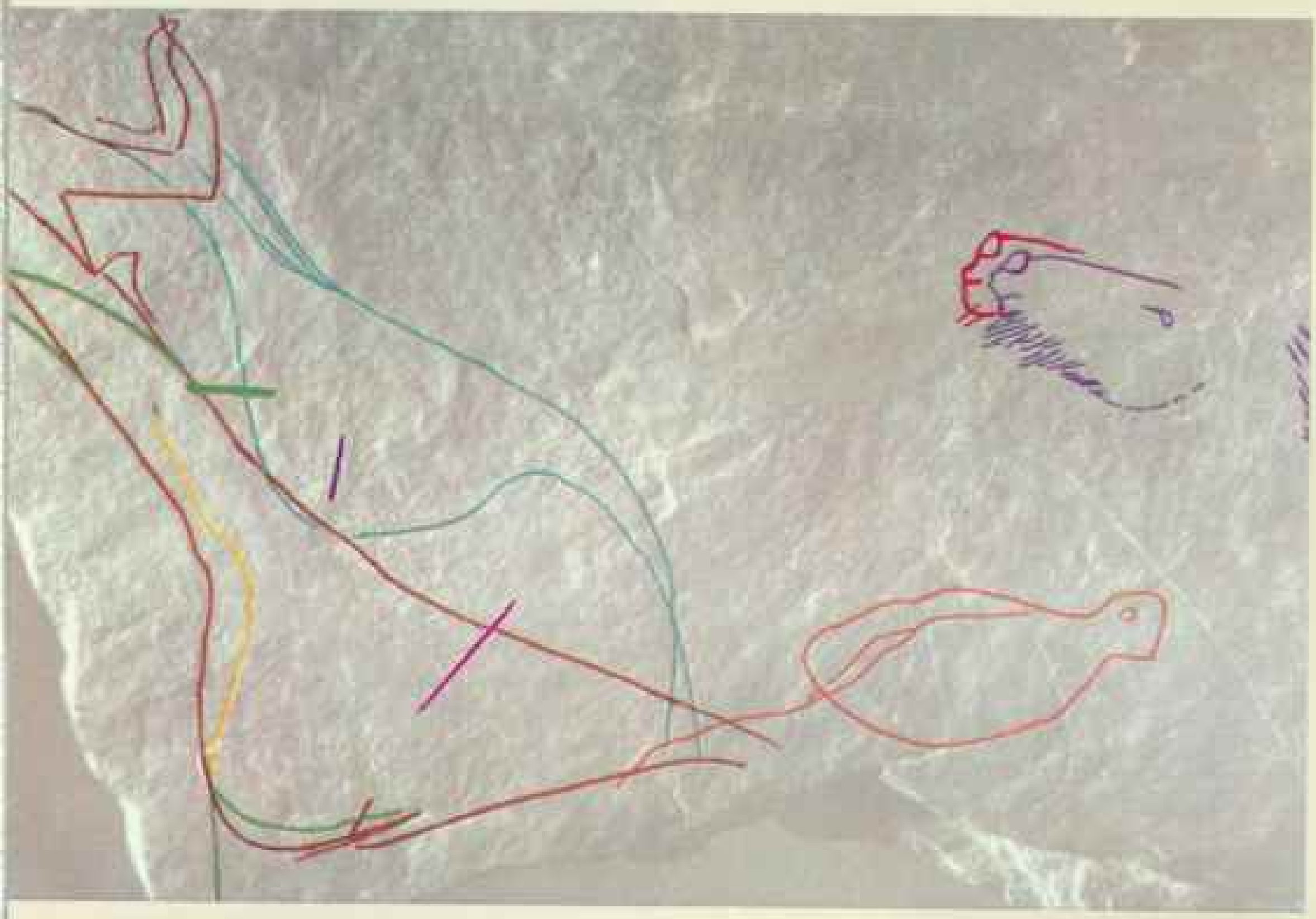
This image was marked twice by the kind of lines found on the La Roche stones and was then used in a most unusual way, by the addition of what appears to be a fetus (opposite). The microscope revealed what I think is an umbilical cord connecting the female image to the fetus, which is depicted with neither arms nor legs. If so, this is the only image of a human birth ever found from the Ice Age. The engraving, perhaps made by an adult woman living in the camp, may have been related to the monthly periods and eventual pregnancy.

At what point in the biological sequence the fetus was engraved we cannot tell, but in the hundreds of Gönnersdorf stones found in the habitation we seem to have evidence of a female symbol system or a form of record keeping, very likely by adult women. The markings seem to indicate a knowledge and use of symbols to document human processes and activity.

OF ALL THE MYSTERIOUS IMAGES and markings surviving from the Ice Age, the most obscure are the seemingly random scribbles and doodles occurring on rocks in habitation sites or on cave walls. These markings appear to have neither shape nor form; when tourists or archeologists come to a wall full of macaronis, they usually smile. What can you say about such doodles?

The Abbé Breuil suggested that art and image began when Cro-Magnon man marked serpentine meanders on a wall and found that some of them accidentally looked like animals. But why would anyone go deep into a cave to mark a wall so meaninglessly?

Even more puzzling, these meanders, or macaronis, continued to be made on rocks and cave walls much later than the animal images, even after some of the animals themselves had disappeared from Europe along with the ice. In fact, the tradition of making meanders continued into the more recent Bronze and Iron Ages.



Since I was trying to piece together how Ice Age man thought and used images, these macaronis posed a challenge. Other archeologists had not seriously studied them, but had merely documented the fact that they existed. Did they have some meaning?

In 1969 a French geologist and archeologist named François Bordes, who is one of the world's experts in the study of Neanderthal man and the tools of Stone Age man, published a brief paper on an intriguing discovery. In a cave in France's Dordogne region, at a level tens of thousands of years earlier than Neanderthal man and more than 200,000 years earlier than Cro-Magnon, Bordes had found an unusual engraved ox rib.

The engraving was a serpentine form, made as a series of arcs with nearly parallel lines. It was not notation or an animal image, but it was the oldest intentional engraving ever found. Bordes suggested that I study it by microscope, and I accepted the offer. If my analytic results are correct, they may change our concept not only of the origins of art and symbol making, but also of the intellectual and cultural evolution of *Homo sapiens*.

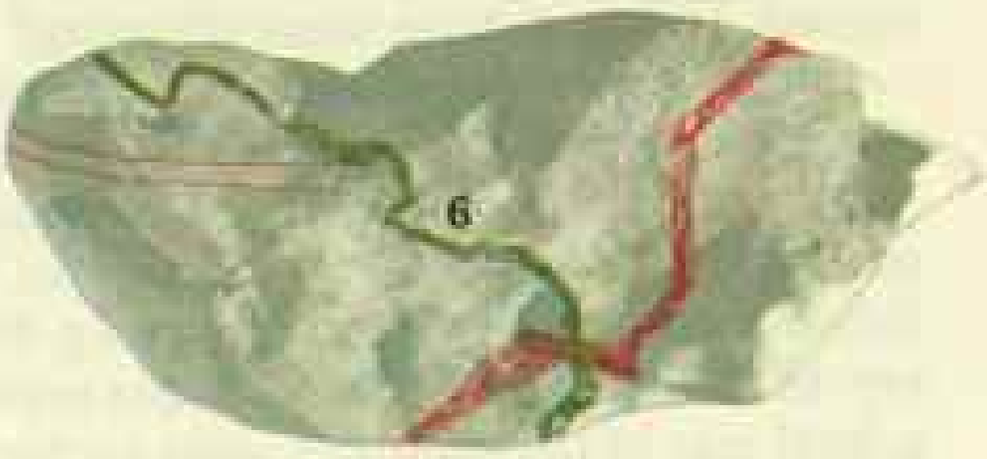
The engraved image was made by a man who was not yet fully modern and who had a somewhat smaller brain capacity than Neanderthal or Cro-Magnon. Yet the microscope revealed that he had built up a sequential structure and image. He had carved two nearly parallel lines (1), then created another pair of lines in the form of a rough arc attached to the first (2). He repeated the process several times (3). Each double arc or branch was made by a different tool.

This prehistoric artist quite clearly was not doodling. He was slowly accumulating or building up an image, adding one section at a time. He then later added certain signs as associated symbols to his main image, such as a series of angles (^ \/\/) and sets of tiny double marks.

I could not determine the meaning of this main image, which looks like a snake or a river. But the engraving was certainly intentional, cumulative, and sequential, and the bone had apparently been kept for some time.

Meanders: man's oldest markings?

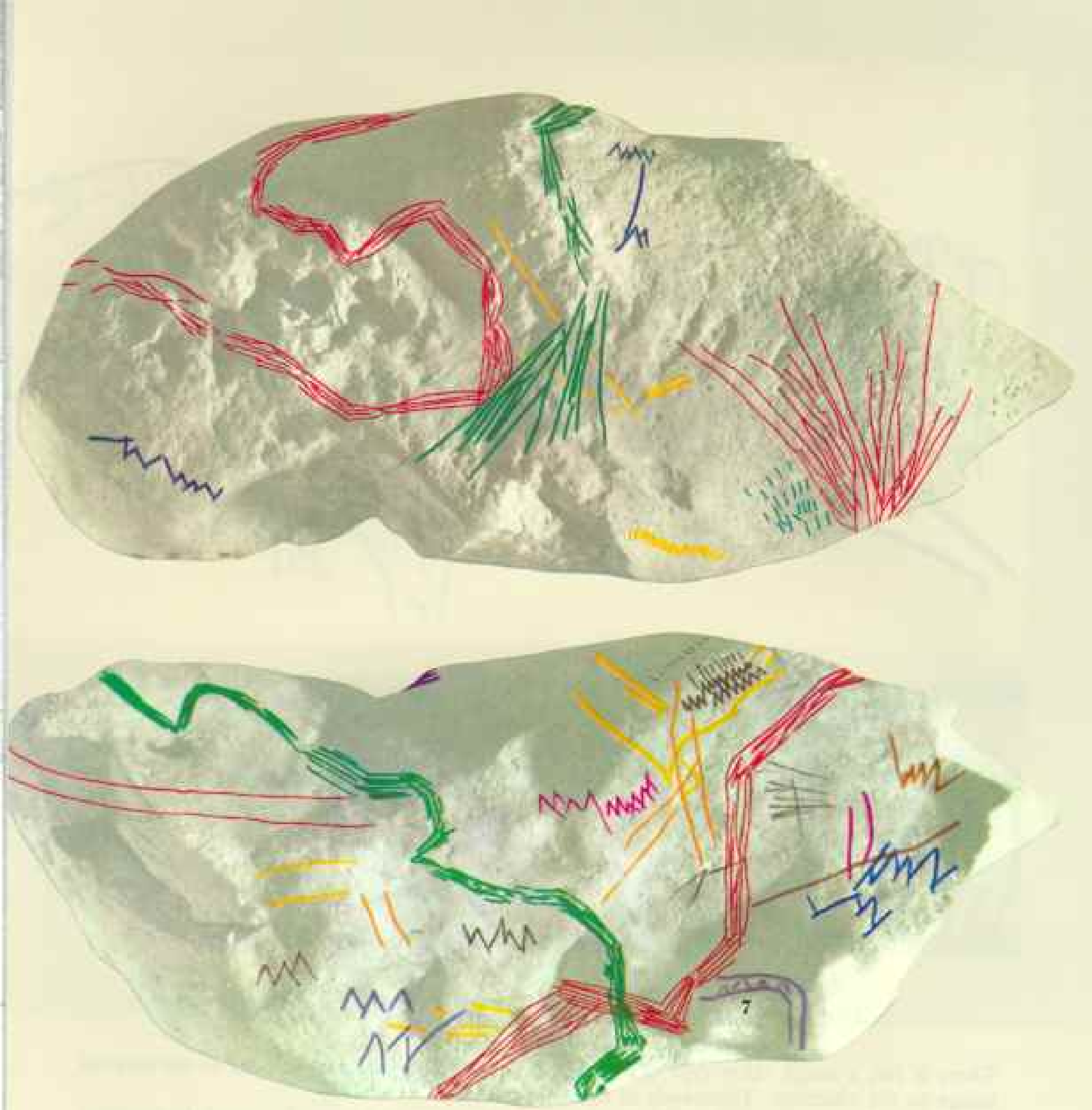
THE SINUOUS ENGRAVINGS on many stones found at Romanelli in Italy had been as largely ignored as the Rouffignac macaronis (pages 64-5) until the author looked closely. On the one above (**inset**), he found a carefully accumulated set of markings beginning, typically, in a fan shape, then funneling into meanders that circumscribed the stone. A series of colored overlays (**left**) shows the two main meanders, red and dark green, as they were built up over both faces of the stone. In the final views (**right**) all markings are shown on both faces, including the saw-toothed running angles. Like the meanders, they are perhaps water symbols. Recent discoveries have found simpler, but similar, markings dating from Neanderthal times and before—suggesting that man conceived and used symbolic images far earlier than has previously been surmised.



This was the way meanders had been built up on rocks, bones, and cave walls in the later Ice Age, and after the ice melted, before the beginning of recorded history.

Dramatic meander engravings have been found in the cave known as Romanelli, far down the heel of Italy. The date of habitation in the cave is about 8500 B.C. On the walls are images of animals and female buttocks, plus meanders. On the floor archeologists found a collection of limestone rocks engraved with meanders and strange geometric patterns.

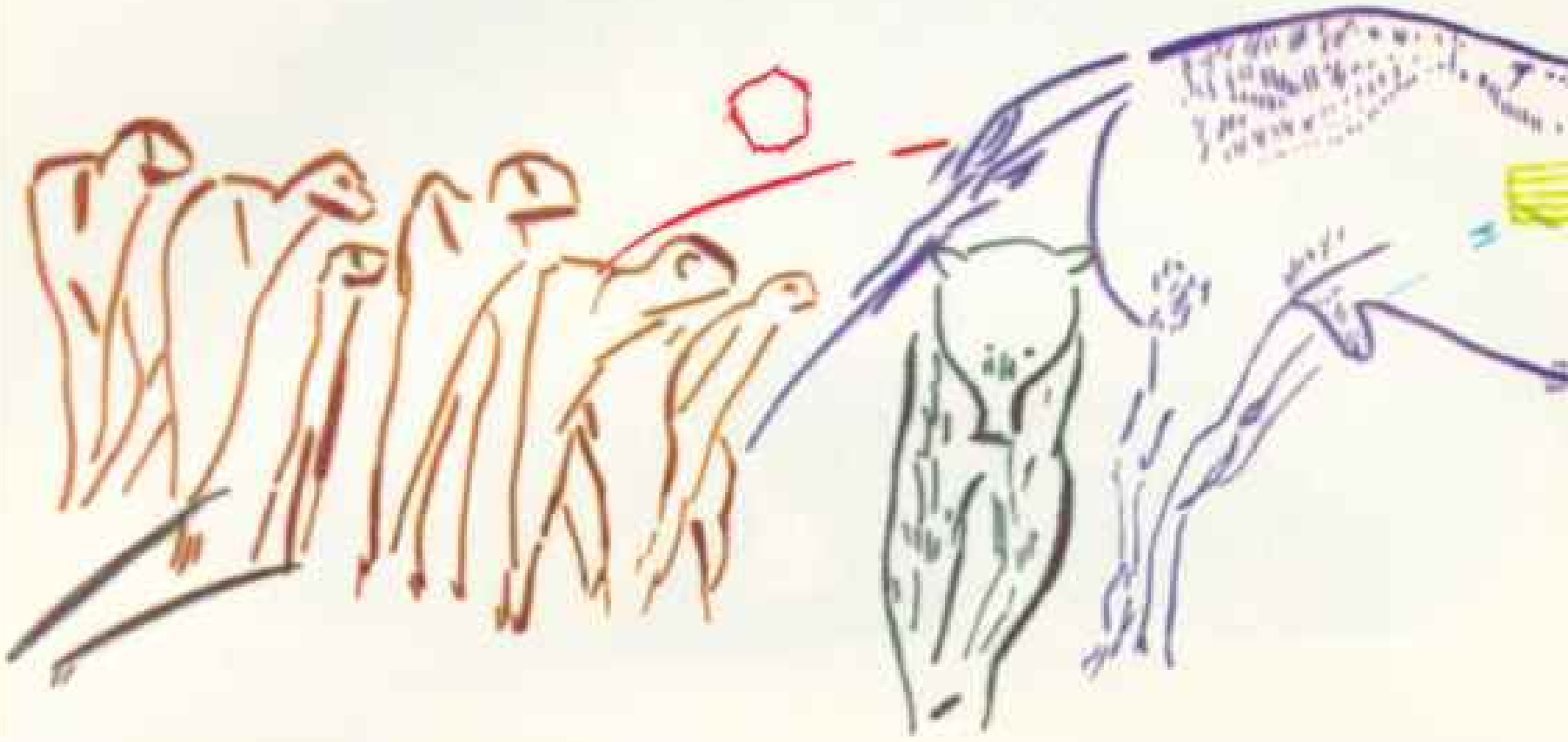
One of the largest and most complicated of the Romanelli limestones is a ten-inch-long, irregularly shaped, waterworn rock that was obviously nonutilitarian (above and facing page). Yet it had been kept in the habitation and had been carefully engraved on every surface with macaronis. It was the microscope that unraveled the sequence and thus gave me a clue to the possible meaning of this strange tradition.



The first marks were a series of lines that funneled down to a point at the bottom edge of the stone (1). The stone had then been turned and the marking continued as a meandering ribbon made in sections (2 and 3) consisting of many strokes that circled the stone and finally petered out as an empty double track (4). A second meander had been engraved on the first face, funneling in the opposite direction (5) over to the reverse side (6).

There was nothing random or accidental about these serpentine images. They had been carefully, intentionally engraved. Added to the first meander was a branch with angles inside (7). Finally, signs had been added to the rock similar to those on Professor Bordes's ox rib that is almost 300,000 years older than the Romanelli finds.

THE MOST DRAMATIC MEANDERS in Europe occur in one large deep chamber of the cave of Rouffignac in the Dordogne.



There is not a single other type of Ice Age image in the chamber. Thousands of finger marks have been made on the wet clay of the ceilings and walls. The red-clay ceiling is so interlaced with crisscrossing finger marks that no meaningful pattern can be detected. But, as one descends the walls toward the floor, these macaronis thin out, and one can see how they were made and accumulated.

Different persons, leaving finger marks of different size, depth, and spacing, made their marks on the clay, using one, two, three, or four fingers at a time. Each marking, made by one hand, is a single unit, even though it looks multiple to us. In some places a serpentine form has been extended by a second person, and sometimes a branch has been added at an angle. Elsewhere the additional mark occurs alongside and parallel to the original meander.

Apparently the significance of the tradition lay in the act of participation and the process of accumulation, performed by adding one's marks next to or over another's. Thus there is no recognizable image, such as an animal, plant, or female. It is probably the oldest kind of human symbol making, yet nothing in either historic or modern times is precisely comparable or helps explain it.

The meanders often appear on special walls in separate chambers, or on certain rocks, much the way the female images seem to represent a separate specialized tradition. The meanders have their own associated signs, such as running angles and sets of very tiny marks. But what do they represent?

The elusive image of man

SIX CHARACTERS in search of what? A file of manlike figures at left in a bone composition from La Vache, shown in a colored line drawing and in a photographic detail, seems to have been engraved in relation to the horse, realistic down to the blood gushing from its nose. The author sees this as a ritual involving men and a symbolically killed horse. The circle may be the sun or moon above the horizon, the only such scene yet found. The bear, fish, and bovine were added later.

If Ice Age man could and did portray realistic animals, he almost never portrayed fully realistic humans. Many explanations for this anomaly might be given, but the net result is this: What we know of how Ice Age man thought derives from his use of art and symbol. While his face remains an anonymous mask, the mind behind the mask projects a being very like ourselves.

It was the essentially serpentine form and its associated angles that led me to assume the meander was related to a water mythology and ritual.

If images of plants are to be considered as part of Ice Age symbolism, then the powerful image of water should not surprise us. It is a symbol related to the freeze, thaw, and flood, to the migration of salmon, the seasonal coming of water birds, the lakes, ponds, rivers, and even the water found deep in caves. It is the source of life at which animals and men congregate.

WHAT SEEMS TO BE EMERGING from these new studies is a view of early man's way of thinking as being exceedingly complex and surprisingly modern. In this culture of early *Homo sapiens* the real and the symbolic worlds were intertwined, and there was a continuity and sequence in man's ritual and ceremonial relationship to that world. Art, image, and notation were means of expressing that complex reality, of recognizing and participating in it.

These are all human actions that require intelligence and a use of language. Moreover, they are aspects of man's early life that cannot be deduced merely from stone tools, for they are what anthropologists refer to as cognitive—that is, they are a result of recognitions, abstractions, and solutions to problems, all of which take place in the brain.

No more profound question exists than that of when and how this capacity began, and where, eventually, it will take us. □

New England's "Little Portugal"

ARTICLE AND PHOTOGRAPHS BY
O. LOUIS MAZZATENTA
NATIONAL GEOGRAPHIC STAFF

IT IS NO SMALL FEAT to retain grace and dignity while edging through a crowd with a heavy suitcase. But somehow Catarina Alves was managing it on that golden afternoon at Boston's Logan International Airport. Using sign language, I offered to carry her luggage to an immigration booth. She smiled a silent thank-you.

A tall woman with salt-and-pepper hair and the brown skin of a Cape Verdean, Catarina is one of more than 100,000 Portuguese who have immigrated to the United States in the past decade.

Others had arrived even earlier, of course. Many Portuguese-Americans firmly believe that a Portuguese explorer—Miguel Corte Real—and his crew lived among the Indians a century before the English landed at Plymouth.

Over the years an increasing flow of Portuguese came to settle—mostly in New England. A quota system adopted in 1924 restricted the flow, but a law passed in 1965 opened the gates again. With limited land and opportunities at home, Portuguese have been arriving since then in greater numbers than ever. Thousands still head for New England—including Catarina Alves. Her immigration form indicated that she would stay at first with friends in Pawtucket, Rhode Island.

The next day, with Professor T. Steven Tegu—

Portuguese folklore blends with Yankee patriotism when Bristol, Rhode Island, celebrates the Fourth of July. These whirling dancers perform before a model windmill that symbolizes the Azores, Portugal's mid-Atlantic islands. New England's flavorful Portuguese-American community—counting only European-born immigrants and their children—now numbers roughly 150,000.

"**My oldest son cried** when I told him we couldn't afford to send him beyond the fourth grade in the Azores," recalls Manuel Moniz, here arriving with his family at Boston's Logan International Airport in 1972. Today three of the Moniz children enjoy free educations in English and Portuguese in a Cambridge, Massachusetts, elementary school. Working as a cabinetmaker, Manuel now earns more in an hour than he did in a full day back home.

friend, translator, and teacher of modern languages at Rhode Island College—I called on Catarina at her temporary new home.

An attractive woman who answered our knock listened cautiously as the professor explained in Portuguese our interest in Catarina. In effect, we quite presumptuously invited ourselves to join the immigrant Catarina for her first breakfast in America.

The woman nodded, won over by Dr. Tegu's good humor. "Yes," she said, "she arrived last night. When I came home late from work at the factory, I found her in my bed."

Soon we were engulfed by Catarina's friends and relatives. Her daughter, Eugenia, appeared, along with Eugenia's husband and four children. They had preceded Catarina to America by three weeks.

It was a bustling, cheerful breakfast, though communication was difficult. Catarina

spoke only *crioulo*, an Afro-Portuguese dialect, so her conversation had to be translated into Portuguese, and then into English.

She had lived on Brava, one of Portugal's Cape Verde Islands. It was a 48-day trip from there to Pawtucket. First an island-hopping boat. Then a plane to Lisbon. Then a long wait while documents were sought and slowly processed—and finally that flight to Boston's airport.

Was the long trip worth it? Catarina looked lovingly at her family. "*Está contente*," her son-in-law said. Yes, it was worth it.

As we prepared to leave, I gave each of the children a dollar—an old Italian custom I had learned from my father. Eugenia's youngest daughter, Ester, clutched the bill in one hand and a toy in the other.

"*Quero dar ao Senhor a minha boneca*," the 2-year-old said. "I want to give you my doll."

Immigrants Transplant Island Pageantry

Such open warmth greeted me again in Fall River, Massachusetts, the heart of New England's Portuguese communities. I went there on a sun-kissed Sunday to attend the Feast of Santo Cristo, a duplicate of one held yearly on the island of São Miguel in the Azores, Portugal's mid-Atlantic archipelago.

Surely someone in Fall River must speak English! I felt like an immigrant myself, unable to communicate with the happy throngs around me. And then a smile wove its way toward me, attached to Raul Benevides.

"*Bom dia*," he said. "You want to take pictures? I'll clear the way. You can use the porches, the roofs, the balconies—anywhere. I get you there."

His smile was like a flashbulb going off. Teeth gleamed, wavy hair glistened, nose puckered, and a precisely trimmed moustache stretched across his lip. He used that smile often as he towed me through the crowd.

Suddenly a shattering explosion of bells came from the church, where a procession was forming. Out of the darkness emerged a striking statue of Christ, borne on the shoulders of six somber men in formal dress. A shaft of sunlight fell on the statue's scarlet cape, embroidered with gold thread by women parishioners.

Raul led me up three flights of stairs in a building near the church. "My sister lives here," he said.

We entered an apartment filled with children in Sunday finery, and with the fragrance

New day dawns for Catarina Alves on her first morning as a United States resident; she holds a 2-year-old granddaughter. At last the relocation of the entire family to Pawtucket and East Providence, Rhode Island, from the Cape Verdes, Portuguese islands off the West African coast, is complete. "We were separated for many years," the stately grandmother said, "but we were never really apart."

Still, they must live with *saudade*—"the memory of the things we left behind. We were farmers," she added, "but now our land is sad. There is no rain."

of a feast. Once again, Portuguese hospitality overwhelmed me. The senhor must sample the food, I was told firmly. They stuffed me with marinated roast beef, a spicy sausage called *chouriço*, sweetbreads, and *favas*—large beans baked in the Portuguese style.

Through lace curtains Raul and I watched the procession passing below. Dark-suited men genuflected at the curb as the priest strode by carrying the monstrance containing the Host. It was a scene brought straight from the Azores.

Success in America Has Its Price

What prompts a man to tear up roots and begin again in a new country?

"Back in São Miguel," Raul answered thoughtfully, "I worked for the government, and earned about $1,500 a year. But things were so expensive, it was very difficult."

And so seven years ago Raul brought his wife and two children to the U.S. For six years he painted houses. Now he sells automobiles and conducts a weekly radio show.

"The show is all in Portuguese. I call it 'Açores-Madeira.' I rent the station, and sell ads for the program. I'm independent."

But Raul's transition from blue to white collar has exacted a price. "My stomach gets upset now, and I don't sleep so good," he said. "You know, that never happened before."

Relationships between Fall River's Portuguese and the city's other ethnic groups are seldom upsetting—but one lively incident occurred some years ago on the 800th anniversary of Portugal's birth.

An impressive statue of Portugal's famous Prince Henry the Navigator had been commissioned for the occasion. Who would object to such a worthy project?

"Unfortunately," news editor Herman Melo of the *Fall River Herald News* told me, "the statue was erected at the intersection of Eastern Avenue and Pleasant Street—which happens to be in the heart of the city's French-Canadian community! The French got a bit excited and there was talk of tearing the statue down."

Herman chuckled. "But word got around to the French that some Portuguese with a tow truck were ready to pull down their statue of Lafayette. So it was a standoff. There was a lot of tension, but it quieted down finally.

(Continued on page 100)

New World reminder of an Old World miracle, Our Lady of Fátima graces Jose Dias's front yard in Bristol. The tradition began in Fátima, Portugal, where worshipers believe the Virgin Mary appeared to three shepherd children six times in 1917. Jose brought back the Portuguese flag on his porch from Angola, where he served as a soldier for two years.

"Only in America," laughs Fred Pacheco (**right**), "could I be voting for the first time in my life—and vote for myself!" The Azorean campaigns for Rhode Island state senator only a year after his naturalization ceremony. He also serves as immigration adviser, tax consultant, and travel agent for many of Bristol's Portuguese.

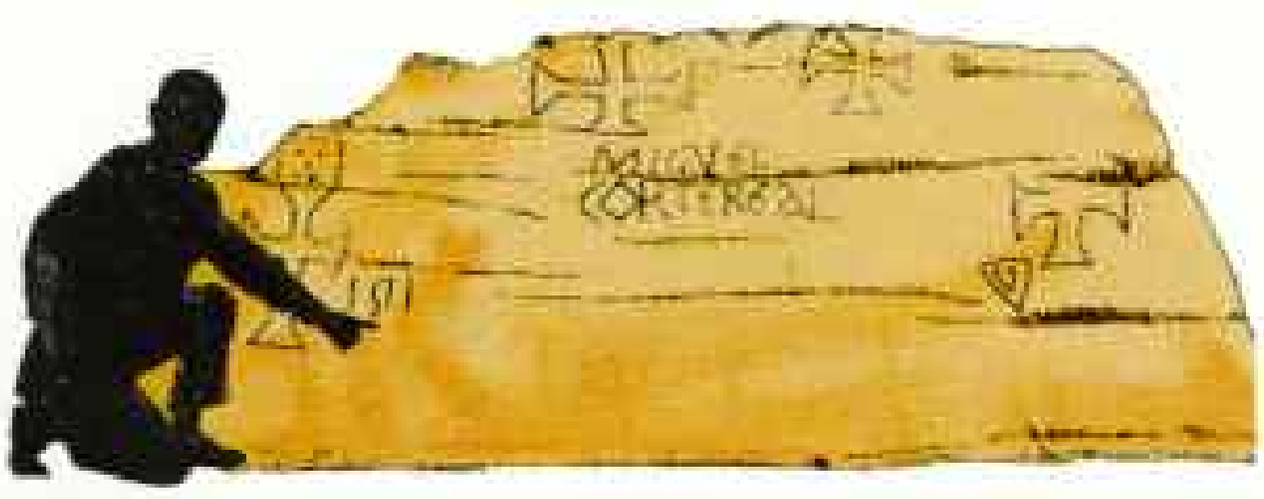
"IT WAS ALL WORTHWHILE, *that I lived and loved,*" *sings Valentina Felix, pouring out her soul in her husband's Acushnet, Massachusetts, restaurant. He named it for the haunting Portuguese music she performs—*fado, *meaning "fate."*

The tide of immigration has washed tens of thousands of Portuguese into the Bay State over the years. Rhode Island also claims a large colony, nestling around Narragansett Bay.

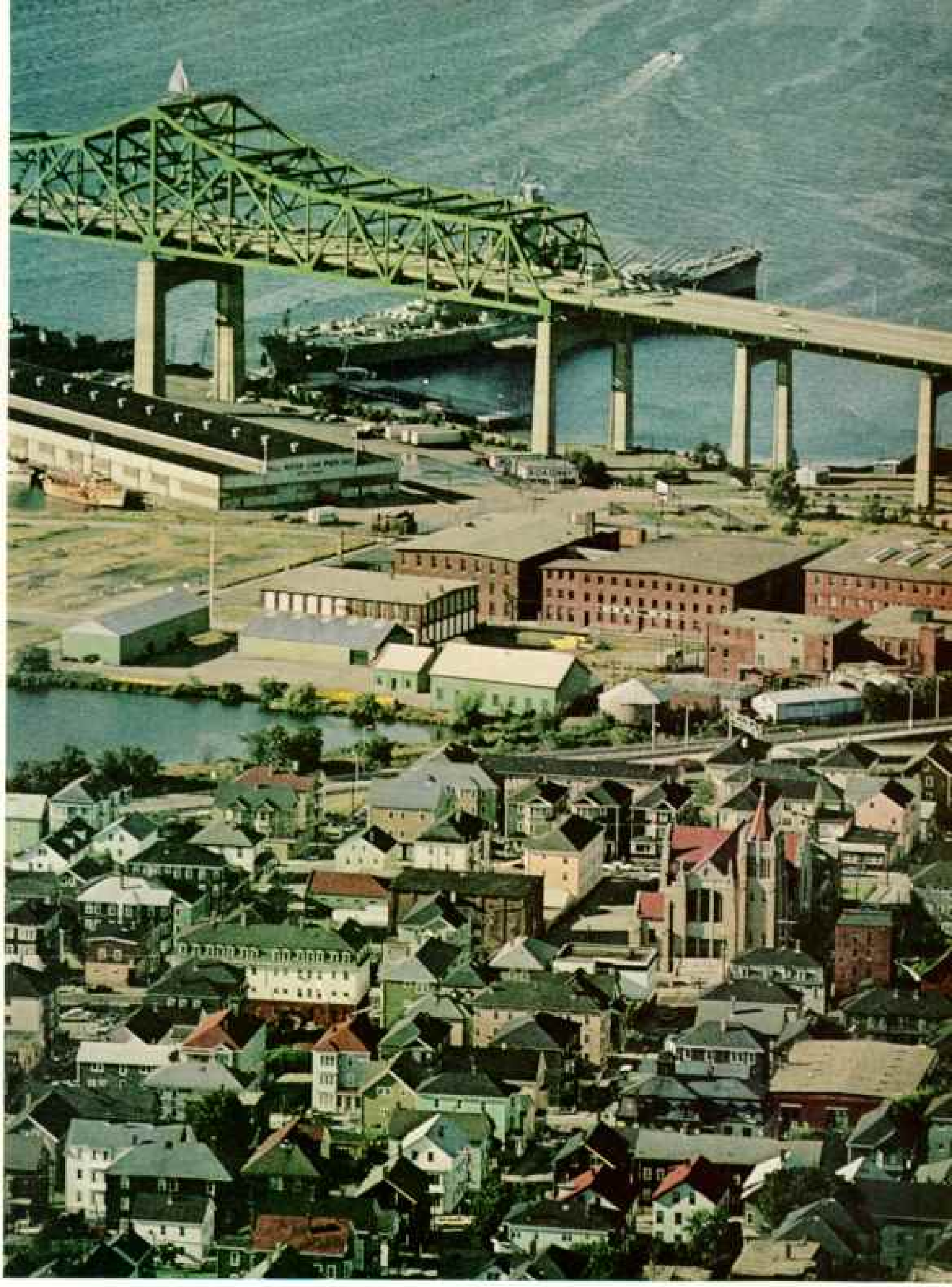
During the great whaling era of the 19th century, New England vessels bound for the Pacific built up their crews en route. The Azores and the Cape Verde Islands became favorite sources of seamen; thus began the influx to U. S. seacoast towns.

Portuguese-Americans add a colorful, independent stitch to the American patchwork quilt, with countless festivals, a tangy cuisine, and a special love for the sea. The nation also counts the writings of John Dos Passos and the marches of John Philip Sousa among their gifts.

A revised immigration law in 1965 threw wide the gate for the Portuguese. The previous year, 2,000 came to the United States; the year after, the number soared to almost 9,000.



Forty-ton calling card? Dr. Manuel da Silva (**above**) theorizes that Dighton Rock in Berkley, Massachusetts, proves Portuguese explorer Miguel Corte Real was the first European to set foot in what became the United States. The sketch (**left**) shows Dr. da Silva's reading of some of the markings: the date 1511, Corte Real's name, and Portuguese coats of arms and Crosses of the Order of Christ.



If Corte Real and his men were in fact the first colonists, they discovered the site of Fall River, Massachusetts, where their countrymen's descendants today make up more than half the population. The Portuguese-American section crowds around the Braga Bridge, named for a sailor of Portuguese descent who died at Pearl Harbor. "Big Mamie," the battleship U.S.S. *Massachusetts*, rests enshrined beneath the span.

Both statues are still standing, and we're all friends now."

There remains some rivalry among the Portuguese themselves, even though most of the immigrants—mainlander, Azorean, Madeiran, and Cape Verdean—share a common fishing and agrarian background.

Cape Verdeans are perhaps the most distinctive group, a racially mixed people whose African heritage has blended with the Portuguese. They were among the last who came to man New Bedford's whalers in the past century, and later to pick Cape Cod cranberries.

Theirs has been an isolated existence at times. Older Cape Verdean immigrants tend to claim Portuguese identity, but younger ones often seek ties with New England's black communities. Mutual acceptance among the parties—white Portuguese, Cape Verdeans, and blacks—has not always been the result. The coincidence of dark skin and deep Roman Catholic faith places many Cape Verdeans apart from both of the other groups.

Nonetheless, the dignity and character among the Cape Verdeans I encountered were impressive. I still recall Tony Andrews, a farmer and leading citizen of Falmouth, Massachusetts. (An immigration officer "simplified" his name from de Andrade when Tony arrived in this country 45 years ago.)

I found him riding a tractor in the middle of a cornfield one day and handed him my business card by way of introduction. A handsome man, Tony pushed back his hat, and clapped the dust from his hands. He reached into his work pants and handed me a beautifully embossed card of his own. "COMMONWEALTH OF MASSACHUSETTS," it read, "MEMBER, BOARD OF AGRICULTURE."

Factories Aid Promising Newcomers

Some older immigrants have worked their way into independent enterprises, but new arrivals usually begin in the lower-paying jewelry, shoe, clothing, and textile industries.

Fall River's textile plants are granite-walled fortresses with an eternal look. But the Great Depression, the southward movement

Cranking out *chouriço*, a spicy Portuguese sausage, Maria Louisa Neto fills casings with marinated pork. She and her husband, Frank, own the factory, one of nine in Fall River. "Everybody eats chouriço," Frank grinned. "Irish and Italians too."

of industry, and foreign competition have conquered many of the mills. A few still hum with life, though. In the Providence Pile Fabric Corporation's plant, Fall River's largest, nearly half the 1,200 employees are Portuguese. Company manuals, newsletters, and safety signs are printed in both English and Portuguese. Employees with supervisory potential may be sent to English classes.

But there are not enough jobs to go around. "There's about 10 percent unemployment here," City Councilor John Medeiros told me. "Some of the settled Portuguese resent the newcomers. They're afraid the immigrants will take their jobs."

I talked to one of the 10 percent: Tony Medeiros. Yes, the newcomers, or "greenhorns," are helping to cause the unemployment situation, he told me. But a few weeks later I saw Tony again, at Fall River's airport, and he was more cheerful. He had a job as a painter on the big Braga Bridge (named after a Portuguese-American) that spans the Taunton River at the city's edge (page 99).

"I was just kidding about greenhorns the other day," he said with a grin. "A bunch of them were standing right beside us, you know. Half my relatives are greenhorns!"

I asked Tony what had brought him to the airport, and in his answer sensed something of the adventurous spirit that launched so many Portuguese explorers into the unknown.

"Painting that high bridge got me interested in parachute jumping," he said. "This Saturday I jump for the first time. But I thought it would be good to go up in a plane today. I've never been in one before."

Fate Dominates Portuguese Song

One evening I drove down a lonesome country road a few miles north of New Bedford. Through the open door of an old farmhouse I walked into a bit of Portugal—the Fado Restaurant (pages 96-7).

A dark-haired woman named Valentina stood in the center of the room, eyes closed, hands clasped passionately. She seemed possessed by an inner struggle. A guitarist struck

Cooling a temper, Armando Spencer, Cape Verdean soccer coach of the Bristol Sports Club, soothes gesturing team member Manuel Teixeira. "The Portuguese buy shortwave radios so they can hear games from Lisbon," says one aficionado. "All they know is soccer."

a chord. The tension snapped, and she began singing from her soul.

It was my introduction to *fado*—the Portuguese equivalent of our American blues. Fado means "fate." Usually it is a melancholy one, involving unrequited love, and it can loosen tears from almost any listener's eyes.

As she sang, I dined on *carne de porco à alentejana*—pork with clams—on endless side dishes, on sweet *pudim flan*, and washed it all down with *vinho branco*. Portuguese food is as flavorful as Portuguese song.

Next day I approached another side of Portuguese life in New Bedford's famed whaling museum. George Avila, one of the curators, and an expert on things Portuguese, showed me the ship's articles of the whaler *Acushnet*, which sailed out of Fairhaven, across the river, more than a century ago.

Acushnet? Herman Melville partially modeled the fictional *Pequod* after her in his book *Moby Dick*. And sure enough, his signature was scrawled among the others when the real vessel sailed in 1841.

"Here," said Mr. Avila, "are some of the Portuguese in her crew: George W. Galvan and Joseph Luis, both from Fayal, in the Azores. And John Adams, a Cape Verdean. His name was probably Adão, Anglicized by the captain."

Pardelas Point the Way to Fish

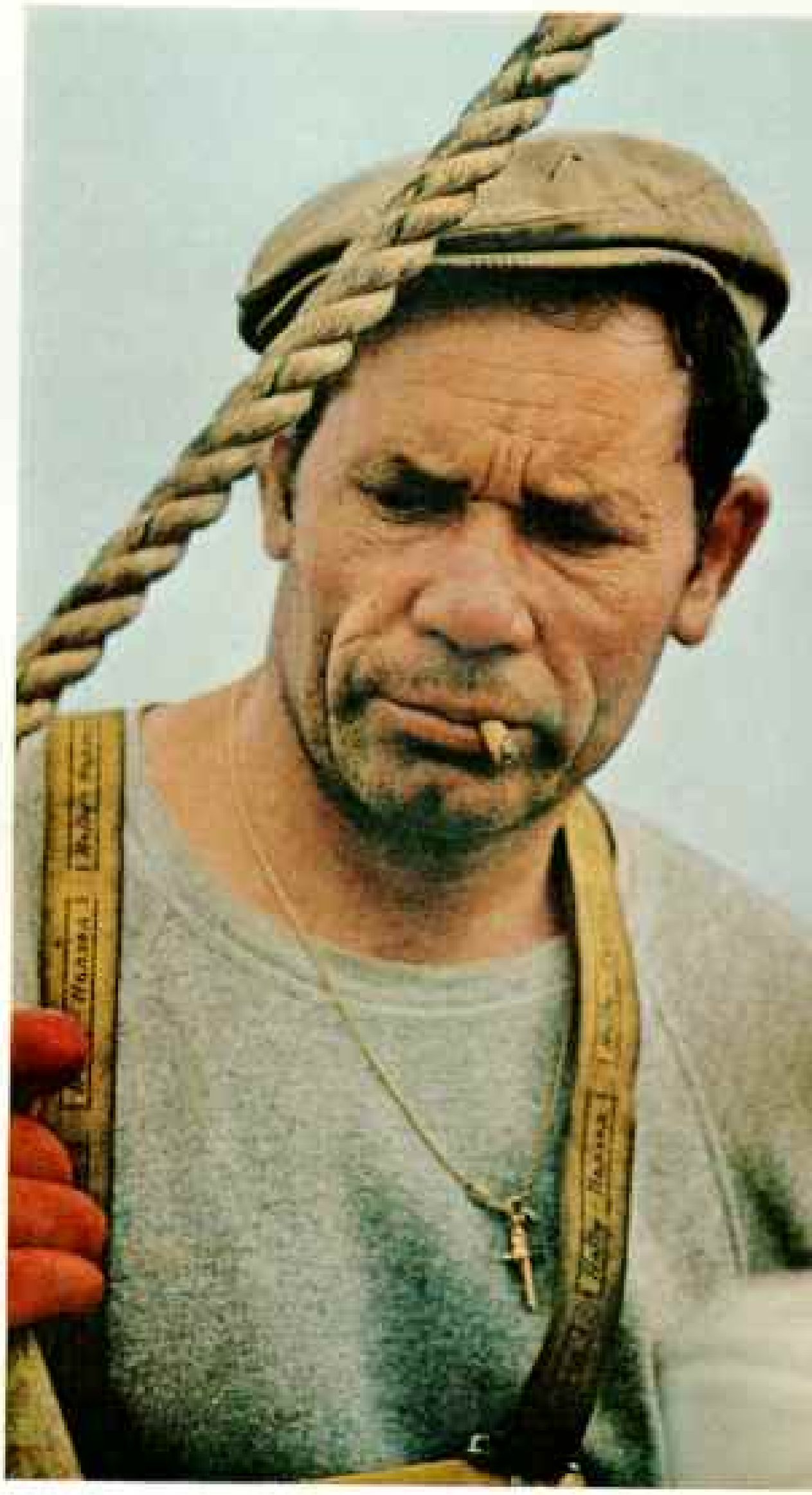
The museum rekindled a boyhood notion of going to sea, so I arranged to sail with Armando Estrella aboard his fishing trawler, *Venture I*.

From the Fairhaven dock we headed for the fishing grounds. "Very dangerous," Armando said as we entered a channel past Woods Hole on the southwest tip of Cape Cod. "Strong tides. Very skinny channel. Many boats go down here." We made it through without incident, though.

Soon a spicy aroma drifted up from the galley. Rabbit stew. Delicious.

A heavy rumbling awoke me early the next morning. We were fifteen miles off the Cape and the crew was paying out the net. Armando leaned from the pilothouse window as he steered a half circle to let the net deploy. I went on deck to help, but the mate shook his head. I was a guest.

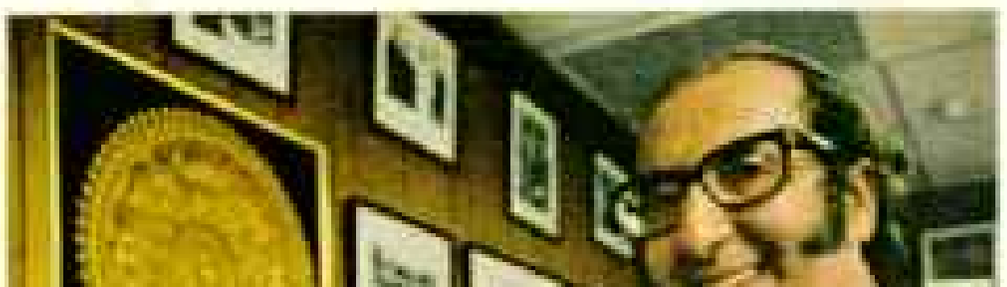
Three times that morning the net went down and was brought aboard again to spew its cargo of fish, mud, sand, and shells onto the deck. The men worked with precision,



Ruddy burn from sea and sun marks Jorge Cintra's face (**above**) on a New Bedford trawler. Such rugged Portuguese fishermen once helped make the town the whaling capital of the world.

Joaquim Rivers (**facing page**), 77, fished as a boy off Portugal. Now helped by a grandson, he sorts out a finny cascade—mostly hake and whiting—on the family's trawler off Provincetown, Massachusetts. "I eat fish every day," Joaquim says. "On Sunday, I eat it for breakfast. That's why I'm so healthy."

From politicians to priests, Portuguese-born Americans are gradually making their way into New England's power structure. Edmund Dinis (**left**) of New Bedford first grabbed headlines as a crusading district attorney. Joseph Fernandes (**below**) owns a chain of 32 supermarkets in Massachusetts. Joseph Faria (**bottom right**), holding ceremonial groundbreaking shovels, is a leading banker in Fall River. Humberto Cardinal Medeiros (**bottom left**), born in the Azores, succeeded Richard Cardinal Cushing as spiritual leader of Boston's large Catholic population.



separating good fish—mostly gray sole, flounder, haddock, and cod—from unmarketable ones. Hungry gulls screamed overhead.

"We call those sea gulls *gaivotas*," Armando told me. "But we look for another bird, *pardela*—you call it shearwater. Important bird. When the pardelas fly down, they go for sardines. When they do that, we put our nets down for the good fish that feed on sardines. One hundred percent they are there."

Fog rolled in that night, but the fishing continued. I asked about the hazard of other ships suddenly looming out of the night.

"We have radar for that," Armando said. He turned on the set hidden behind the cabin wall and peered at the illuminated screen for a moment. "Nothing," he said casually and flicked the set off to return to his work. Somehow, my landlubber's fears were not allayed by that fleeting radar image.

A few days later I transferred at sea by dinghy to another Portuguese fishing boat heading for Provincetown, Massachusetts. Armando continued on to the Georges Bank, where the fishing would be better.

Were Portuguese the First Colonists?

From the city of Provincetown, near Cape Cod's tip, a tower rises. "That commemorates the Pilgrims' first landing in 1620," I was told by a Portuguese-American sailor. "When those Pilgrims arrived, we had the harbor all buoyed out for them."

The subject of who the first "pilgrims" were is no laughing matter in New England. Adherents of the theory that they were Portuguese point, as proof, to a 40-ton sandstone boulder on the bank of the Taunton River, 30 miles upstream from Narragansett Bay.

Dighton Rock, it is called, and it is covered by a mosaic of mysterious carvings (page 98). Among them appear what some regard as clues that the Portuguese, indeed, came first.

In 1920 Dr. Edmund Burke Delabarre, psychology professor at Providence's Brown University, spotted an inscription he believed to be the date 1511. He had already published several articles about the rock, but suddenly he had a specific year on which to concentrate.

He found from royal charters in Lisbon that two brothers sailed from there to North America on separate voyages. Gaspar Corte Real embarked in 1501. His brother Miguel left, probably the next year, in search of the missing Gaspar. Neither ever returned.

I visited the rock with Dr. Manuel Luciano da Silva, a doctor of internal medicine and a dedicated student of Portuguese history. Dr. da Silva showed me a cross carved on the boulder. "There are more than 300 variations of crosses," he said, "but this is the Portuguese style, with the 45° angle at the base."

Then he showed me the 1511 date that the late Dr. Delabarre had found. "Note that the five is shaped like an 'S.' That's the way a Portuguese would have written it."

With his finger he traced another carving: an "M" with "COR" beneath it. "To me, that stands for Miguel Corte Real. He could have arrived here in mid-1502, and stayed for at least nine years.

"Surely in those nine years there would be intermingling of Portuguese and Indian blood." He paused, building up to his point.

"When later Europeans—Verrazano and Roger Williams—arrived here, they noted the Indians were light in color. They called themselves Wampanoag, 'People of the Dawn Light.' I believe their pader hue was a characteristic passed on by Miguel's crew."

Dr. da Silva waved at Grassy Island in midriver. "An Indian burial ground has been found out there. I wish excavations would begin on this shore, so we could fit more pieces of the puzzle together.

"After all," he said firmly, "this is an American monument, not a Portuguese one."

Family Thrives on Togetherness

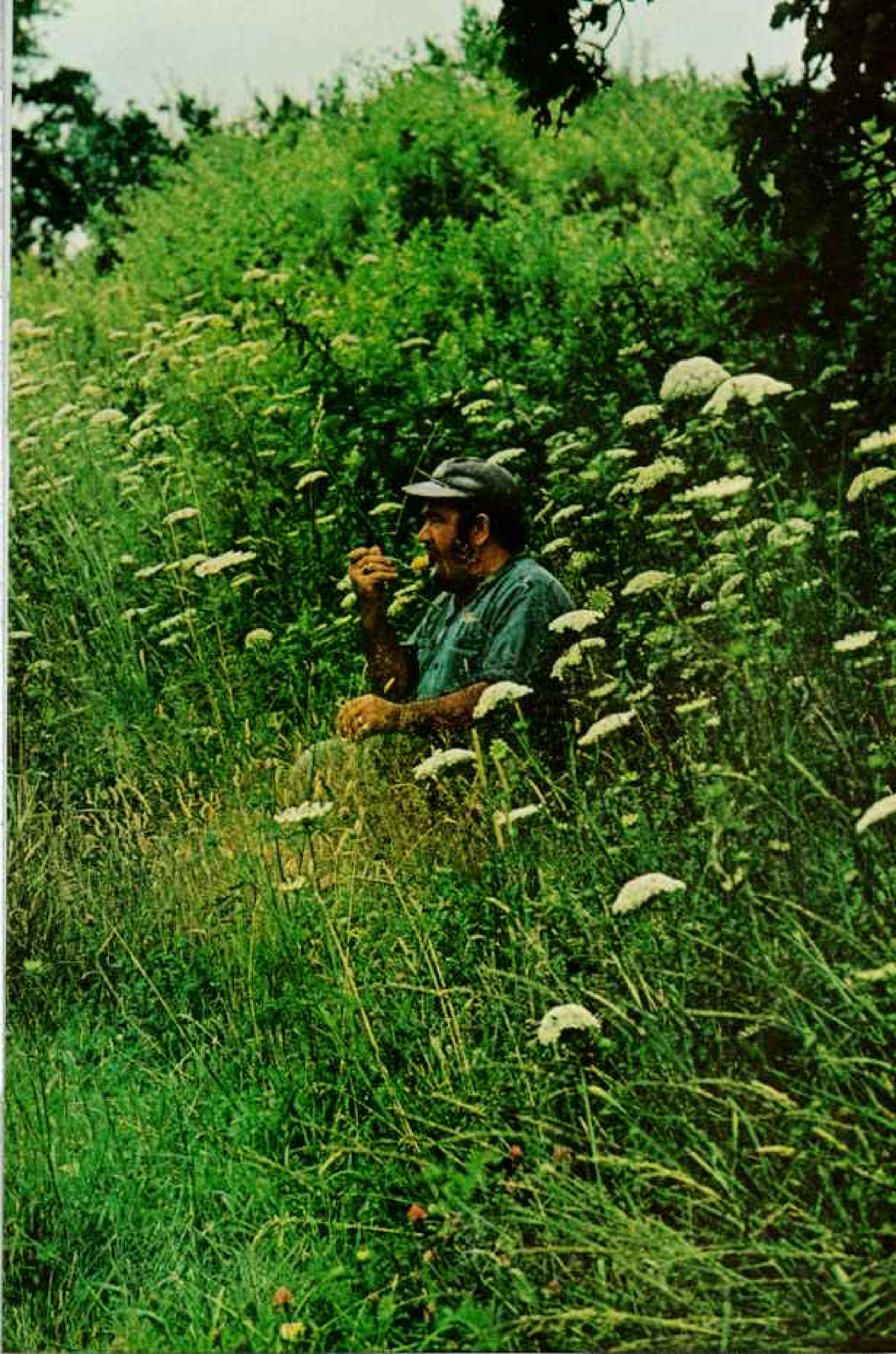
The bond that sent Miguel Corte Real across an unknown ocean in search of his brother is the same one that links the Portuguese today. Family loyalty.

I talked with affable Joseph Fernandes, who arrived in this country in 1924 at the age of 13 months, later graduated from Boston University, and now heads a chain of 32 Massachusetts supermarkets. His management team is made up of brothers-in-law, nephews, nieces, and other relatives. They work together in a modern campuslike headquarters in Norton, 19 miles north of Fall River. They live together in a compound of handsome houses tucked away in a grove of pine trees.

"The lines of authority have to be clearly understood in a family situation like this," Mr. Fernandes told me. "The others have a right to question my reasoning when I am reaching a decision, and we can all argue about it, too. But once I make the decision. . . ."

A nephew finished his sentence: ". . . it becomes law!"

ROADSIDE IDYLL: *Delfina Pestana sits silent and apart in the noonday light of lazy summer as her son-in-law, Adelino Rodrigues, eats the lunch she has brought him. Delfina knows but a single set of directions in Bristol—"how to come to the boats"—the boat factory where Adelino works.*



An emigrant can take comfort from the knowledge that relatives will be waiting when he arrives—and that many schools in Portuguese New England offer classes to help him understand his adopted country.

With my language-professor friend, Dr. T. Steven Tegu, I visited one of those classes. When we reached the classroom door, the students were reading in English, droning the phrases in a dry flat monotone.

Dr. Tegu winced. The regular class instructor grinned and waved the professor in.

"When you speak a country's language," my friend announced, "you must adopt the manners of that country. If you are a lover, you must live the part of a lover."

He raised his arms. "Now, say after me, 'I love you,' *te quero*—but with *feeling!*" Dr. Tegu's soulful "I love you" nearly steamed the classroom windows.

The students roared back in unison, "I l-o-o-o-ve you," and dissolved into laughter.

"Now say, 'I kiss you,' *beijo-te,*" Dr. Tegu bellowed, lunging with outstretched arms toward a stout woman. Her startled shriek was drowned out by another howl of laughter.

As Dr. Tegu and I left, the students were reading aloud again. Rarely have English words been uttered with such drama.

Ceremony Seals a Lifetime Vow

"Graduation" for these students takes place in a Providence, Rhode Island, courtroom. On a day when new citizens were being sworn in, I took a seat amid an overflow crowd of friends and relatives. Raymond J. Pettine, Chief Judge of the U. S. District Court, presided. He spoke with earnest eloquence.

"My father came here as a poor Italian immigrant some eighty years ago. I think of the day he took his oath of allegiance as you will today. How could he have dreamed that someday his son would be sitting on this bench—perhaps the very court where he swore his own allegiance to the United States."

Every eye was fixed on the black-robed judge as he continued: "Keep alive the heritage and culture of your homeland. When people like you become citizens, America is enriched. I ask you to hold your citizenship dear—to hold it sacred. Love your country."

They stood then, those Portuguese, and all the others who had come to this nation in hope of a better life. They repeated, as if with one voice:

"I pledge allegiance. . . ." □

Fuel for the melting pot that is America, a granddaughter of Portuguese immigrants and an American of English parentage embrace (**facing page**) after their Fall River wedding. Carlos Costas of Providence (**above**) listens to the national anthem of his new homeland moments after becoming a U. S. citizen. He and fellow Portuguese immigrants will contribute to what President John F. Kennedy called "the secret of America: a nation of people with the fresh memory of old traditions who dared to explore new frontiers. . . ."

Bad Days for the Brown Pelican

By RALPH W. SCHREIBER, Ph.D.

Photographs by WILLIAM R. CURTSINGER and the author

SWAYING THEIR HEADS, stretching their necks, lifting bills in unison, distending and then relaxing their pouches, a score of brown pelicans were celebrating the rites of spring. As I sat watching in a Florida mangrove thicket on that bright March morning, my joy was shadowed by the fear that man's presence and his pollution would ultimately destroy this tragicomic bird.

To the delight of residents and visitors alike, brown pelicans are still fixtures on the coastal landscape of Florida—wheeling majestically on broad wings, waddling along the tide wash, or squatting

With a gift of twigs for his mate, a brown pelican pitches in for an ungainly landing at a mangrove refuge on Florida's Tarpon Key. Feeding on a school of fish (**above**), pelicans wheel and dive in Tampa Bay near the Sunshine Skyway. Man's steady encroachment has placed this familiar seabird on the list of endangered U. S. wildlife.

BOTH BY RALPH W. SCHREIBER

WILLIAM H. CURTSINGER (LEFT); RALPH W. SCHREIBER

Fatal string attached: Fisherman's hook and leader were the downfall of a year-old brown pelican (**above**), banded as a nestling. Another bird, dead in the shallows (**left**), may have become ensnared by an angler's line. During a six-year-study, chiefly in Tampa Bay, the author found that four out of five pelicans bear scars of such encounters.

Scientists worry about another peril: man's pollutants. When breedings declined in California, researchers found thin-shelled eggs and blamed a buildup of DDT residue in the birds' fish diet. The U. S. banned DDT use on December 31, 1972, and now hatchings rise. Critics of the DDT explanation challenge data interpretations and blame other factors for the thin-shelled eggs.

Brown pelicans range from British Columbia to Chile on the Pacific Coast and from New Jersey to northern South America along the Atlantic. Texas once had many birds but today counts only five to ten pairs. Louisiana's brown pelicans—which embellish state flag and seal—were wiped out in the late fifties, but several hundred, introduced from Florida, are now breeding smugly, like puffy magistrates, on pilings and pierheads. Pelican watchers stand spellbound as the ungainly birds flap comfortably along, skimming the wave tops, their wings beating in slow unison as they fly by in file or V formation.

Unhappily, increasing human pressures have placed the brown pelican on the endangered species list of the U. S. Department of the Interior. Once abundant along much of our warmer coastline, *Pelecanus occidentalis* has now all but disappeared from Texas and Louisiana, with one notable exception: Young birds transplanted from Florida appear to be established as a protected breeding colony in Louisiana's Barataria Bay. In California, only a few hundred young have been hatched during the past six years. And now even in Florida, its last stronghold in the United States, the bird appears to face an uncertain future.

Man's World Crowds the Pelican's

To identify and accurately assess the perils to the survival of a species posed by encroaching mankind, one must become thoroughly familiar with its habits and behavior. Surprisingly, the scientific literature has largely overlooked this conspicuous bird. It was the search for such knowledge that had brought me to this sweltering mangrove thicket on Tarpon Key, part of a 377-acre national wildlife refuge in Tampa Bay, in a study that would take me years to complete.

As I watched the primordial scene before me—the nesting ritual of burly, prehistoric-looking birds with ponderous bills—it seemed hardly credible that civilization had crept so close in time and space. More than a million people live in greater Tampa-St. Petersburg-Sarasota, within about 30 miles of this prime pelican nesting site on Tarpon Key. Only minutes away, cars, buses, and huge trucks roared over the Sunshine Skyway spanning the bay.

Swooping in to land with clumsy flappings, ardent males carried sticks in their bills and presented them to their mates as building material for their bulky nests. Some birds lunged, snapping bills fiercely, at trespassers on their chosen territory.

Wooing and home building proceeded in the silence of a primitive charade. The adult brown pelican neither sings nor calls; therefore its language of gesture and movement is highly developed. *(Continued on page 119)*

Aerial acrobat, the pelican uses feet and a six-foot span of powerful wings as air brakes in making a landing (**left**). But when it sights a fish, it becomes a sleek dive bomber.

Head cocked, wings bent, the bird plunges (**below left**), changing body attitude to keep its eye on the target.

BAM! Wings and legs thrust back, neck rammed forward, the diver spears the water (**below**) just after another pelican, beyond, smashes through the surface.

Only after studying such pictures did the author learn that the bird's head remains fixed on the prey even while the body twists as much as 180° for aim and balance. With exceptional vision, pelicans can spot a fish and dive from as high as 75 feet. Air sacs under the skin cushion the crash. But the momentum still thrusts the bird a foot or two beneath the surface.

Young pelicans must fend for themselves once they leave the nest; they improve inherent diving skills by practice and imitation. However, three-quarters of the banded birds recovered in the past 40 years died during their first year—the majority, the author believes, because they were unable to master the dive, essential to fishing success.

ALL BY WILLIAM H. HUNTSINGER

ALL BY WILLIAM R. CURTSINGER

Superbeak does its stuff in some of the most extraordinary pelican photographs ever published. Less than a second after breaking the surface, a pair of feathered Pinocchios (**left**) scramble for a frozen bait fish released under water by the cameraman. The winner (**below**) suffers a jab in the pouch from its competitor.

Bad timing costs a pelican its prize (**right**). In these first color pictures showing a fully distended pouch underwater, the expandable dipper swells a foot deep, scooping in fish and 2½ gallons of water. Strong muscles snap the mandibles closed. Then the bird tilts its bill downward to drain the water, lifts its head, and swallows the fish.

Bright plumage (**far left**) heralds the breeding season, in contrast to the pelican's more subdued costume after nesting (**left**). Early winter finds both sexes with new feathers, straw-colored eyes ringed by pink, yellow head, and white neck. Later the neck feathers molt to dark brown, part of a sequence that is perhaps the most elaborate color cycle in the world of aquatic birds.

Bush-league pantomime: Bill and wings flashing, the pelican at right guards its nesting area—the length of an outstretched beak. Bill popping—the snapping of mandibles—punctuates the encounter atop the mangroves.

Evolved over eons, the displays are signals to male and female alike that an individual is aggressive, submissive, or sexually aroused.

On early trips to Tarpon Key I found its central lagoon at low tide a treacherous mud flat, sucking me in sometimes to my armpits. I soon learned to coordinate visits with high tide, when I could easily row my 13-foot Boston Whaler around the lagoon.

From October to February, Tarpon Key is empty of pelicans, although many of them remain in the Tampa Bay vicinity, fishing, posing for tourists, and panhandling in small flocks. Then suddenly, in late February, hundreds of adult birds descend on the island, ushering in the breeding season.

At the start of my pelican watching, I could not distinguish males from females and did not understand the birds' strange posturings and mock attacks. So, to observe their daily habits, I built a 12-foot tower about 25 yards from a cluster of mangroves where a large group of pelicans had built nests. The birds did not seem disturbed by my presence.

Spring courtship, I found, is a time of high drama. The male pelican, distinguished from the female not by plumage but by a slightly heavier build and a noticeably longer bill, picks the nest site in the mangrove branches.

Figure-eight Wobble Wins a Mate

From my tower, in the second spring of my study, I watched a pair of pelicans I called Cas and Bill set up family life. His territorial claim staked out, Bill sought to attract a female with an odd soliciting display: a single or repeated sideways head movement in a figure-eight pattern. It seemed almost as though he were sharpening his bill on a razor strop. Before long Cas succumbed to these wiles and alighted near the site.

Now the courtship began in earnest. Cas had to be pushy enough to intrude into the territory that Bill defended, yet properly submissive, so that he would allow her to approach. Bill had to defend his site against

intruding males without being so aggressive that he drove away his chosen mate as well.

Before long, wooed and won, Cas was standing on the nest site beside her mate, and Bill now began a two-week-long series of trips to bring sticks and grasses to Cas, who stayed home to build the nest.

The only territory pelicans seem to claim is that within reach of their bills. Cas and Bill both protected their new home with aggressive postures, and with much lunging and bill snapping at any bird that came within reach.

Peace and harmony, however, prevail in the usual pattern of pelican life. The female normally lays a clutch of three chalky-white eggs, twice the size of chicken eggs. Her mate shares the incubation duties, which last about a month.

The newly hatched chick, featherless and so ugly that only a parent could love it, is barely able to move its pink wrinkled body and can't even hold up its wobbly head. The parents regurgitate partly digested fish on the floor of the nest for the youngster to pick up and swallow, an effort that soon completely exhausts the chick.

At about ten days of age, a chick is strong enough to beg food directly from the parents. The young bird, screaming, squawking, and flailing its stubby wings, repeatedly pokes at its parent's bill. When the bill opens, the young bird thrusts its head into the pouch, forcing the adult to regurgitate.

Hazards Include an Odorous Bath

Once, engrossed in watching the proceedings from my platform, I heard an ominous cracking sound. I sat helplessly as the 12-foot tower—the product of my rather casual carpentry—slowly and majestically toppled, dumping me into the malodorous muck below. Fortunately only my dignity was wounded, but I had to replace both my cameras and my perch. The pelicans seemed unmoved by the disaster.

Another down-to-earth, and often grueling, experience was the gathering of information on nestlings' growth. On a typical day I would climb out of my boat and wade through knee-deep mud under the mangroves. I had to scrape cobwebs from my face and shake crabs and spiders from arms and legs.

Frightened by my intrusion, the parents would leave their nestlings to fend for themselves. As I pulled eight pounds of squawking, scratching bird down through the mangrove branches, it would inevitably spill its breakfast on top of my head and send guano dribbling down my arm. But I had to hold onto each temporary captive long enough to record weight and the length of bill, leg, wing, and tail, and to make notes on plumage.

To ease my burdens, I frequently invited some interested but unsuspecting helper to join me as recorder. Few ever offered to do it again. But in 1971 I did find one person—amazingly—who agreed to accompany me a second, a third, and then a fourth time! After sharing a year of weekends measuring pelicans, we knew we had something more in common than fondness for the big birds. Happily, this faithful assistant—her name is Betty Anne—agreed to marry me. She has aided me uncomplainingly ever since.

Young Birds Learn Fast—or Perish

Pelican chicks fly from the nest at 11 or 12 weeks of age. Once fledged, they are on their own; rarely have I seen an adult feeding a young bird away from the nest. The youngsters, however, frequently join the flights of their elders and learn—by imitation and by the lessons of trial and error—those things a pelican has to know.

A young bird must quickly become adept at fishing in order to survive. To catch fish, pelicans dive headfirst into the water, usually from an elevation of 10 to 35 feet, though occasionally from as high as 75 feet. Preying upon a tight school of fish swimming near the surface, a pelican will scud along barely rising off the water.

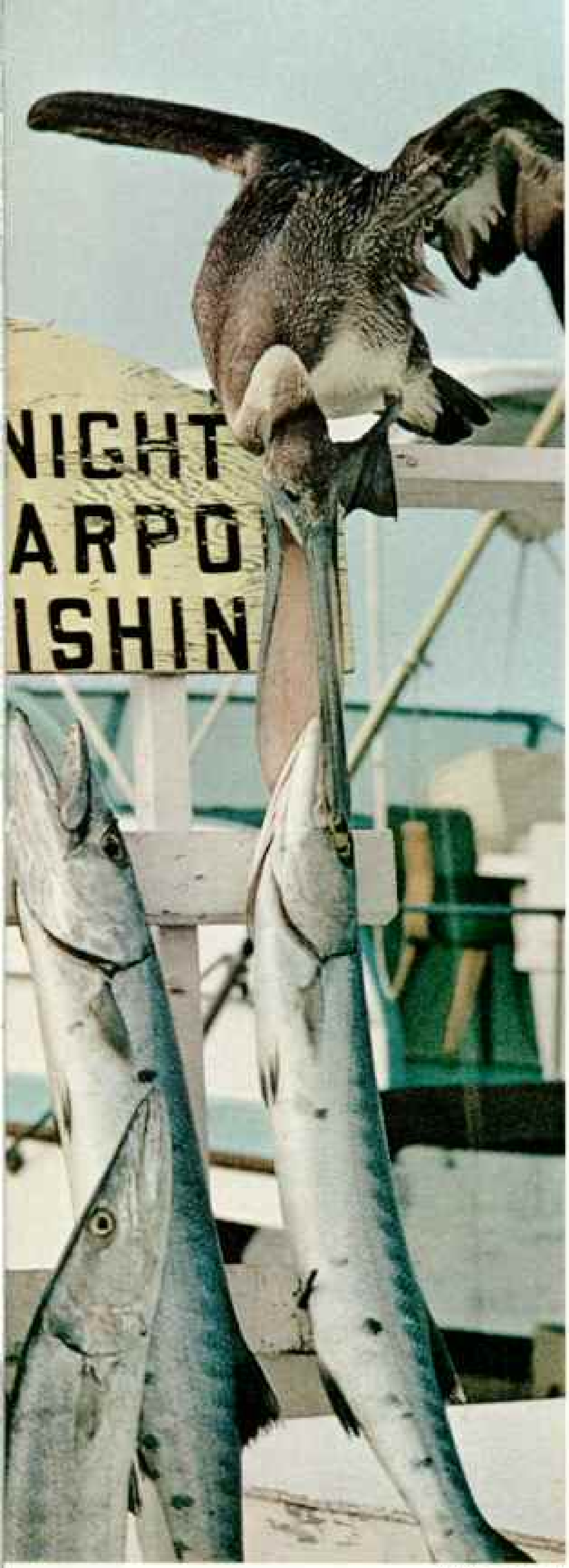
Most prey—menhaden, pinfish, thread herring—are caught in the pouch a foot or two below the surface (pages 116-17). The pelican then sits on the water with bill closed and pointing down, allowing the water to drain out of the pouch. Finally, with a toss of his head, he swallows the fish.

A pelican never stores fish in the pouch, Dixon Merritt's unforgettable limerick notwithstanding:

A wonderful bird is the pelican,
His bill will hold more than his belican.
He can take in his beak
Food enough for a week,
But I'm damned if I see how the helican.

Each summer since 1969 I have joined other biologists in South Carolina and Florida in banding and color-marking nestling pelicans to learn more about their migration

Headed in for breakfast, a month-old nestling routinely forages in the parent's pouch for partly digested fish (**above**). For the first ten days this chick ate regurgitated fish dribbled on the nest floor by the parents. At about two weeks (**below left**), the baby birds become raucous beggars for handouts. Downy nestlings two months old (**below right**) huddle in one of Florida's few ground-level nesting areas, their legs marked by the author's red streamers. He also tagged them with aluminum bands to help in researching population, life span, plumage characteristics, and migration. Once they leave the nest, at about three months, pelicans skim the seas in a lifetime of silence, having lost the squawking voices of their juvenile days.



WILLIAM R. CURTSINGER

and movements during the post-breeding dispersal. We leg-band them with numbered U. S. Fish and Wildlife Service aluminum markers and attach plastic streamers on a leg or wing, a different color for each nesting area, for ease in identifying a bird's origin. Newspaper alerts and posters on fishing piers elicited more than 1,500 reports of color-marked birds sighted between 1969 and 1973.

Pelicans in South Carolina move south during the fall and spend the winter and spring months on the east coast of Florida and in the keys. Birds I banded in Tampa Bay have been sighted primarily south along the Florida west coast and in the keys.

Recovery of banded birds allows us to check off milestones of their life span. We don't yet know how long a brown pelican can live, but one bird was recovered at age 25. Most banded birds found dead are less than a year old. Recoveries of birds between 5 and 20 years old are numerous.

Breeding Season Brings Dramatic Change

Banding also permits us to relate plumage changes precisely to age. At fledging, the young pelicans' first suit of soft white down has been replaced with brown feathers on the wings, back, head, and neck, and by white feathers on the belly.

Over the next three to five years, the birds undergo successive costume changes leading to adult plumage. The white belly of the immature bird changes to black, the brown back and wings to silver gray, and the head and neck to white.

Upon reaching full adulthood, the brown pelican displays seasonal transformations that are perhaps the most elaborate among water birds. During fall and winter the head becomes yellow, the neck white, and the bare skin around the eye dark blue, while the bill takes on varying shades of orange. As the breeding season nears, the distensible throat pouch becomes deep black, the iris straw yellow, and the eye ring bright pink (page 118).

Eyes bigger than its beak, a young bandit tries to make off with a fisherman's barracuda. An eight-pound pelican may eat a pound of fish a day, but shuns those favored by man. If this comedian of the seas is to survive, humankind will have to assure it room to raise its young, free of the snares and pollution that threaten it.

When the birds move to Tarpon Key in late February, the neck undergoes a very rapid molt from white to chocolate brown.

While the adults are incubating in March and April, the yellow feathers fall out of the head and are replaced by white ones. The eye turns dark brown, and the pouch and bill fade to gray-green.

In six years of study I have enlarged our understanding of the biology of this appealing, ungainly bird—and acquired a deep, unsettling awareness of its vulnerability to the growing pressures of man.

Curious visitors and sun worshipers increasingly disrupt the birds' normal routine on the beaches and sandspits, the offshore islands, and in the mangrove thickets that provide the pelicans' daytime loafing areas and nocturnal roosts.

Four-fifths of all free-flying pelicans I've handled have had either anglers' hooks or fishing lines attached to them somewhere, or have shown the scars of such encounters. I regularly find pelicans hanging in the mangroves entangled by monofilament line and dead of starvation.

Pelicans mooch food from fishermen—from their bait boxes and from the anglers' catch. Unfortunately the birds are not wise enough to avoid hooks and lines. I offer fishermen this advice: If you suddenly find a pelican on your line, reel in the ensnared bird, grab his bill, and fold up the wings. Then remove the hook and line—and save a life.

Pollutants in Water Add to the Toll

But direct human interference is by no means the whole problem. Also serious is pollution of the waters in which the birds feed. Many scientists suspect that pollutants washing into the Gulf of Mexico are a factor in the birds' disappearance from Texas and Louisiana. Similarly, sewage, industrial wastes, and agricultural chemicals all pour into Tampa Bay. Fish ingest these pollutants, and then the pelicans eat the fish.

Attention has focused most critically on the residual effects of the pesticide DDT. Research on the U. S. West Coast, principally by Dr. Robert W. Risebrough and associates at the University of California's Bodega Marine Laboratory, pointed to extremely high levels of contamination from DDE (a break-down residue of DDT) as the cause of recent failures in pelican breeding on the Channel Islands off southern California.

Researchers conclude that the presence of DDE and its increasing concentration up the food chain to fish and thus to pelicans has upset the birds' calcium metabolism, causing thin-shelled eggs. So fragile are these eggs that they are crushed while being laid, or by the weight of the incubating adults. Each broken egg means one less baby pelican. In time this lowered reproductive success can imperil the total population.

Barometers for Man's Own Future?

The almost total ban on DDT use, in effect since 1972, has resulted in lowered DDE levels in California, and the birds' future there appears less grim.

Pelican populations at the two dozen nesting sites in Florida vary year by year, yet overall the birds are maintaining their numbers. Aerial surveys by the Florida Game and Fresh Water Fish Commission record 6,000 to 8,000 breeding pairs over each of the past seven years. But it is too early for complacency.

Bob Risebrough has measured significant amounts of chemical pollutants both in the egg-yolk fat and in the tissue of the Florida birds. Biologists of the U. S. Fish and Wildlife Service have found that the shells of Florida eggs average almost ten percent thinner than specimens in museums collected prior to 1943.

And my own research indicates a slight decrease in hatching success in Florida over the past five years, with one to three percent of the nests containing crushed eggs. This development almost certainly is the consequence of eggshell thinning.

Because pelicans are long-lived and late-maturing birds, learning the ultimate effects of sublethal amounts of chemical residues will require monitoring of their reproductive success over a long period of time. If all the adverse factors continue, their combined impact could drastically reduce the numbers of brown pelicans within a few years. My own view is not optimistic, but perhaps we can learn enough in time to avoid extinction as the eventual and tragic outcome.

Man, a top-level carnivore, might be wise to pay more heed to the pelican and other animals high on the food chain as sensitive indicators of ecological imbalance. Their plight can be a warning of the danger of cumulative low-level poisoning—and of the absolute dependence of all living creatures on an environment shielded from degradation. □

Martinique: Liberté, Egalité, and Uncertainty in the Caribbean

Half a world from Paris, Martinique unfurls her beauty and her pride. Atop a marble pedestal, Napoleon's beloved Josephine surveys the homeland she left to become an empress. Laced and beribboned, Mme Georges Velmont (**facing page**) proclaims her loyalty to the blue-white-and-red *tricolore*, attesting that her Caribbean island is not only French but a part of France itself.

By KENNETH MACLEISH
SENIOR ASSISTANT EDITOR

Photographs by
JOHN LAUNOIS
BLACK STAR

FOR THREE HOURS we have run the dugout straight up the trade winds, out into the open Atlantic. Slender, heavy, keelless, she's called a *gommier* after the gum tree from which she was carved, and she seems only slightly more stable than the tree itself. We move in her with caution.

Planks give her a little freeboard; a big outboard motor gives us 20 knots and an endless drenching. The hull is Carib Indian, centuries old in style. She has two crude spars and a rough sail that could be stepped forward. Under canvas, she will not go to windward.

Our base is Martinique—specifically, the village of Grand' Rivière. But if the engine quits, we could probably sail to British Dominica in the north or British St. Lucia in the south. The islands of the Antilles, that broken chain between the American continents, have been distributed by senseless history among the Western nations; but a poor gommier can find refuge in any of them.

I sit in the middle, shivering under the sun. The captain, small, deft, snub-nosed, sits on the fishing box in the stern. The mate, jut-jawed, pale-eyed, with a big, straight Norman nose, searches, standing in the bow, holding the painter for balance. Like 92 percent of the Martiniquais, the boatmen are "colored"—of mixed blood.

The skipper, Symphar Léopoldie, throttles back. "Unhappily there are no fish in this region today." He speaks French for my benefit, rather than the native Creole. "Thirty miles, even twenty, farther out, there would be dolphin or tuna, but if we went so far we could not get back before dark."

That would be serious. Grand' Rivière has

no dock. Coming in through the breakers is tricky. A man has to see, and he must know what he's seeing.

Martinique was a silhouette dimmed by distance. Pelée, the murderer mountain whose eruption of flaming gas and ash killed 30,000 people in minutes 72 years ago, topped its north end, jagged, unhealed, unquiet.

"Sometimes when the fishing is good, we go out of sight of land. In the *temps blanc*, the white weather, when haze lies over the sea, we cannot see the island even from here. We have no compass. Yet always we find our way home." He took in his trolling lines. "We will go closer in where we can reach bottom and try for *poissons rouges*. Red fish. Several kinds, all of the first quality."

On the way out we'd pulled up beside another gommier (named *Christus Natus Est*—Christ Is Born), which had nets out for balao, little halfbeaks a few inches long. We needed some for bait. The boatman had been about to drop his pants and plunge naked into the sea to guide the school into his net, but

he hesitated when he saw me, a white stranger.

"Who's *that?*" he asked in Creole.

"A poet," said my skipper.

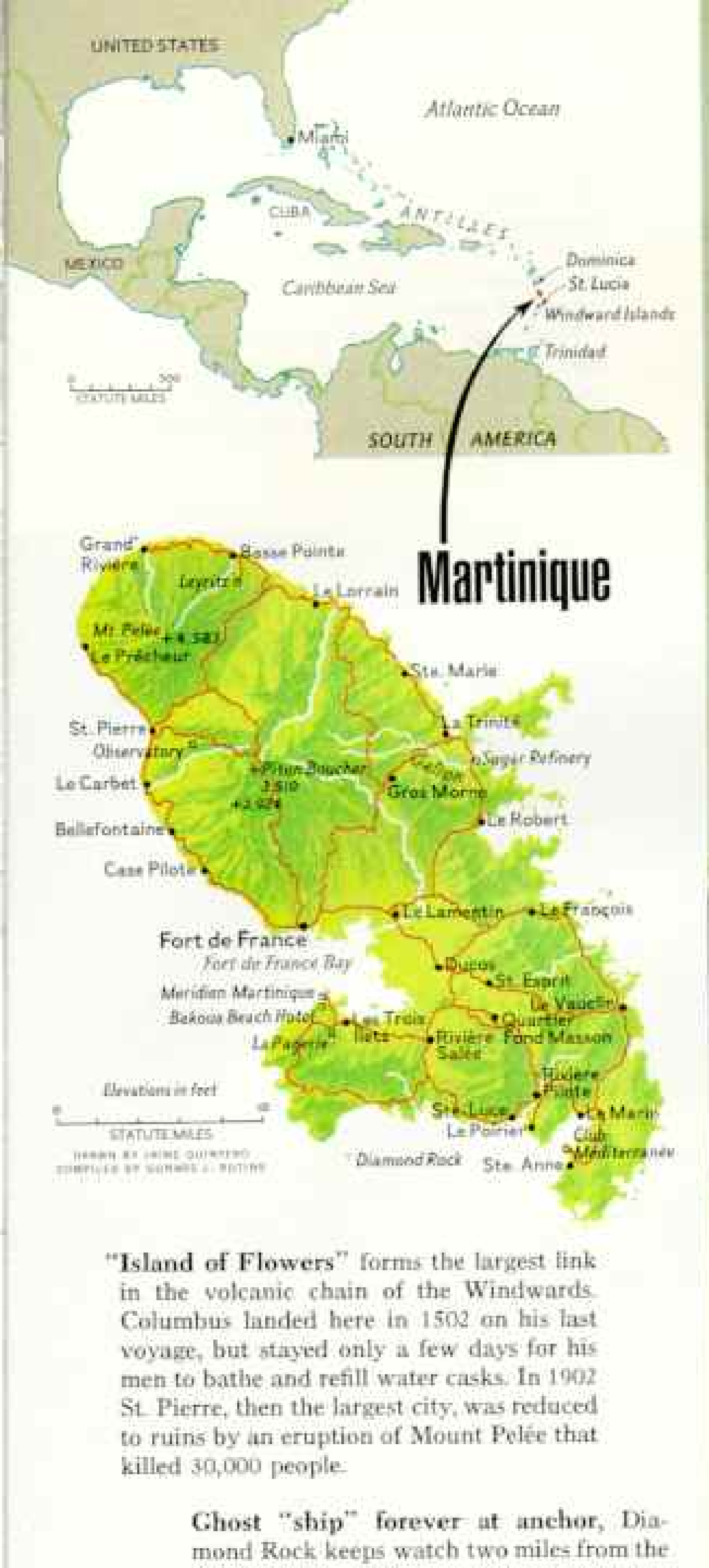
"Oh, that's all right then," the boatman replied, and dropped his pants.

I had not claimed that honor, but Symphar knew that his countrymen respected creative people as much as they mistrusted officials and businessmen.

Now Symphar opened his box and took out a coil of line weighted with a grooved stone and armed with gang hooks. He baited these

"**How gray seem the words of poets** in the presence of this Nature!" wrote essayist Lafcadio Hearn of Martinique's green world. On the island's east coast the crumpled hills reflect the dawn.

Martinique's 340,000 people stem from African slaves, French planters, and laborers from India and China. Under France's wing for 300 years, the island in 1946 became a *département* of France.



"Island of Flowers" forms the largest link in the volcanic chain of the Windwards. Columbus landed here in 1502 on his last voyage, but stayed only a few days for his men to bathe and refill water casks. In 1902 St. Pierre, then the largest city, was reduced to ruins by an eruption of Mount Pelée that killed 30,000 people.

Ghost "ship" forever at anchor, Diamond Rock keeps watch two miles from the palm-shaded south coast where children frolic. British sailors fortified the 575-foot crag during the Napoleonic Wars. For 17 months they harassed French shipping; then they were overwhelmed and their cannon silenced. The sloop that supplied the islet was registered by the Admiralty as H.M.S. *Diamond Rock,* which led to the tradition that the rock itself was commissioned as a British warship. To this day ships of the Royal Navy salute as they pass.

with bits of balao and found bottom a little below three hundred feet. Symphar sat staring past me, "listening" to the line with his finger.

A sudden grin, a waving of arms. He got the line about 15 feet off the bottom and stopped to listen again.

"A fair fish. A second has escaped." He hauled in. So it was. He rebaited, relowered. Another jerk, another test. His face fell and he said, "There were several fish, but a shark has taken all save one, and he has bitten off some of my hooks."

He was right. One good red fish, one gasping head, four hookless leaders. Symphar repaired the damage, tried again.

"This time I had three fish. Monsieur the shark has taken two. And now he has frightened the wise large ones. We will have to go home. You see, it is not always easy for us fishermen. We may spend a hundred liters of fuel and catch nothing," Symphar shrugged wryly. "If there were other work, we would do

Life offers a different tang to two island households. Industrialist Herman Siniamin (**below,** center) and friends from Martinique and metropolitan France enjoy the sea breeze aboard his 44-foot yacht.

On a different level, the small home of Christiane Bazile (**lower right**) fills with the aroma of simmering breadfruit. Martinique boasts one of the highest standards of living in the Caribbean, yet many know the bitter taste of poverty. The island has a birthrate almost twice as high as the French national average, and a level of unemployment above 20 percent. Wages are good, but many like Christiane are lucky to find work six months out of the year.

it, though we love the sea, and are used to it. Martinique is a paradise, but not for us."

Off Grand' Rivière the surf was fairly heavy. We circled, waiting, then raced in diagonally between two breakers. Just off the rocky shore we swung hard around and took the following sea, broken now, on the bow. Half the boat cleared the water. The skipper uptilted the engine and the crewmen rowed frantically. We jumped out, and a dozen villagers helped us haul the heavy boat up the shingle above the high-tide mark.

Competition Favors Colored Heads

"Come, we will have a punch and I will give you a dry shirt," Symphar said. "The trousers are of no consequence, but one must have a dry shirt."

His house was tile-floored, iron-roofed, solid, very plain. It contained many children, a few chickens, and a flush toilet whose lid he tastefully lowered.

Good local rum, clear and strong and cheap, a little sugar syrup and a bit of lime peel—that's a *punch Martiniquais*. The first one of the day is called *le décollage*—the takeoff. We took off, clicking glasses, and drank. Symphar grew philosophical.

"You know, most of the erudition here is in colored heads. The pure whites, the *békés*, descendants of the French colonists, will admit this. They are born to the exclusive class. But we must compete, and only our best are selected. Perhaps that is why our people produce the doctors and the lawyers.

"Yet we are all French. This is a *département*, not a colony. We are part of France."

In one sense or another, France has mothered Martinique since 1635, when Pierre Belain d'Esnambuc claimed it in France's name. Columbus landed there in 1502, during his fourth voyage. Before his brief visit, its splendid forests and perfect beaches lay untouched except by Arawak and Carib Indians,

First civilian surgeon on the island, Dr. Paul Lodeon (**below**), his wife, and the family pets entertain at their summer home in Ste. Anne. Dr. Lodeon was offered France's Legion of Honor for his work in medicine in 1935, but refused out of modesty. He finally accepted the award in 1964.

Sweet days of sugar growing long gone, patriarch Joseph Hayot (**facing page**) savors the soft air of a tropical morning. Wandering through his shut-down refinery, the 80-year-old laments, "I have worked on every piece of equipment here for 52 years—*et voyez*, it is in ruins."

up from South America (the latter being among the few human groups who liked people because they tasted good). Later, European buccaneers used the island to plunder selected European shipping.

The French colonists, although invaders like their predecessors, were more civilized. They grew sugarcane, then grew rich when African slaves replaced European convicts and indentured laborers. The small French community kept socially to itself. But its men peopled the island with a new breed of mulattoes. These had no rights, but their fathers gave them favored jobs and some education, and kept their mothers out of the cane fields.

Abolition did not come to Martinique until 1848, 15 years after England ended slavery in her islands. The French slaves, however, acquired not only freedom but franchise. They were suddenly voting citizens of France.

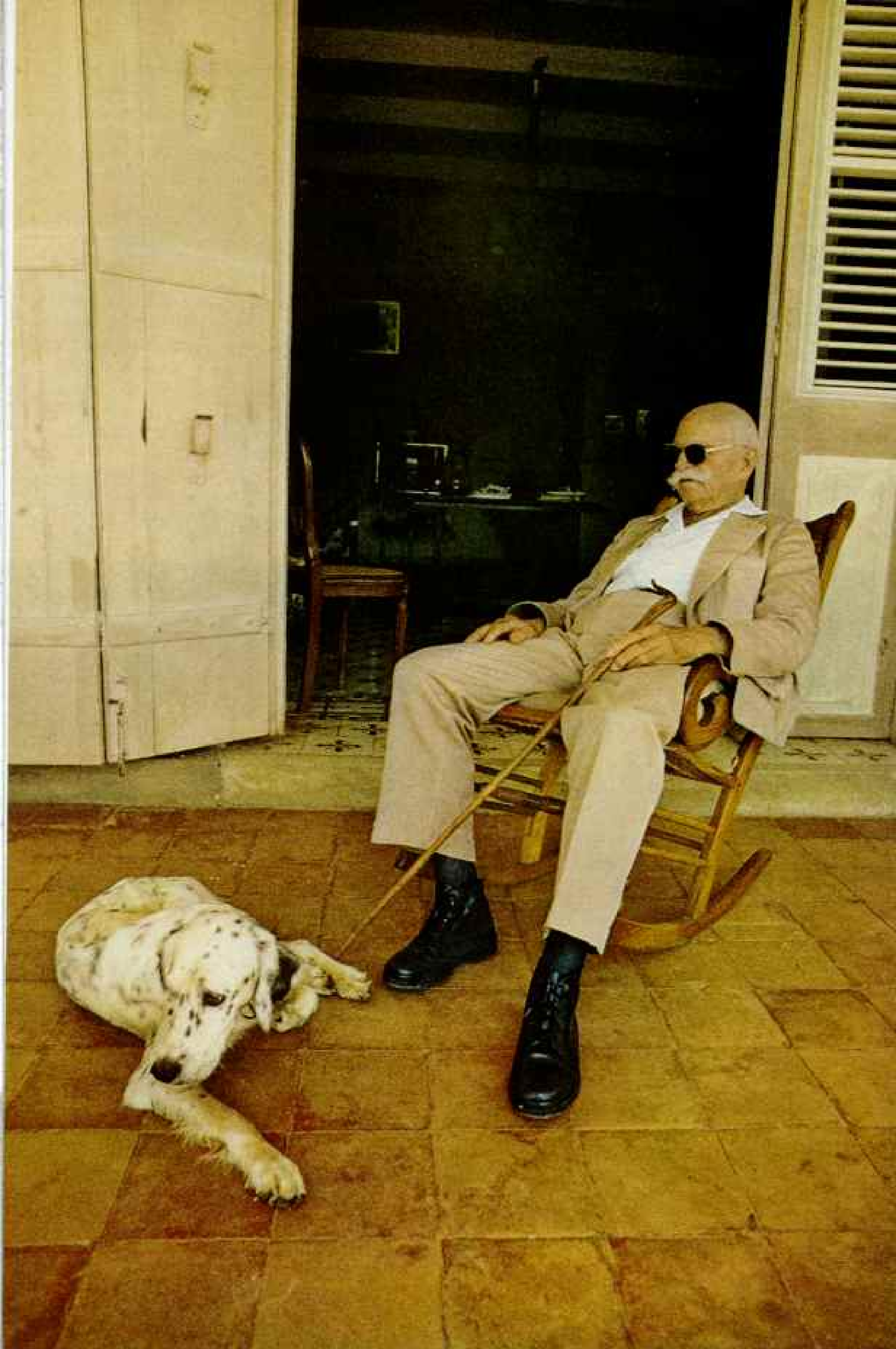
Asians Took Over When Slavery Ended

I drove along the northeastern coast of the island, where gentle gradients and good earth support fine growths of cane, bananas, and pineapples. Here the wild sea, endlessly wind-driven, makes beautiful, dangerous beaches and sends rain-heavy clouds to drench green-mantled slopes.

These are largely béké lands. Most mulattoes do not care for land work, which smacks of slavery, or for land itself. The plantations persisted after slavery ended only because laborers from India were willing to come and work the land on contract. They stayed on as free men. As I drove, I noted Indian features among the colored masses of the handsome Martiniquais, a people neither black nor white, and proud of it.

But the common heritage of mixed blood in Martinique doesn't bestow common and equal social status. Financial and educational achievement determines the nonwhite class to which an *homme de couleur* belongs: *grand bourgeois*, *petit bourgeois*, artisan, laborer. The very dark cane cutter sweating in the sun at the roadside, the pretty girl tying his stalks into bundles, are not in the same class as the well-dressed coffee-colored gentleman who passes me in his cream-colored Mercedes.

At least, all are born Martiniquais; thousands of Frenchmen in Martinique are not. These are the *métros:* people from *La Métropole*—continental France. They hold key jobs, they enforce the national laws (French departments have little lawmaking



power). They control the island and are therefore sometimes resented. But the government they represent supports Martinique, whose economy is as artificial as its history is accidental and its population mixed.

The Only Answer: Guaranteed Markets

Near the Galion River, I talked to a métro supervisor in one of the two sugar refineries still in action. The others closed down as the cost of producing sugar in a region of high labor prices soared above its worth.

"We lose money here," he told me. "I myself work for a French sugar-beet company. We operate this place. We do not need it, but if we close it, we will put perhaps 1,500 people out of work."

Back up the coast near Basse Pointe I found a pineapple-canning factory, once closed down, about to open again. "We've mechanized," said a foreman. "And we get a guaranteed share of the French market. So we may make it, this time. But we can't sell cheaply, competitively, like the Ivory Coast. We pay wages and French social security determined by Paris. Look: Martinique has 340,000 people on 425 square miles, mostly mountainous. So we get special support, or we go out of business."

Bananas, also blessed by a protected French market, thrive on these pleasant slopes; indeed, all over the island (pages 138-9). Deep in one of these leafy groves, where blue-plastic bags protect the ripening fruit, is a fine manor house and the ruins of a refinery. Leyritz, the place is called, and its young owners, of bluest blood and warmest hospitality, welcomed me to their restaurant, wonderfully blended into the remains of a sugar mill, and their handsome home-cum-hotel, where old mahogany shines in high-ceilinged rooms.

Mme Yveline de Lucy de Fossarieu is a gay, quick, restless lady who has decided she has entered an insane profession but is

determined to prosper regardless. Her small kitchen uses good local foods rather than the imported French fare of most other inns. Here mangoes and citrus grace good lawns, and there is a sense of peace not to be found where crowded guests squeal and splash beneath beachside terraces.

Her husband, Charles, added his thoughts about bananas and politics, echoing those of the sugar and pineapple producers: "We can make a modest profit on bananas now. But as an independent producer we'd be lost. We are small and without resources."

Scars Still Tell of City's Agony

In the morning I drove up over the spine of the island on the road south of Mount Pelée, that green and haunted crag, toward St. Pierre on the calm Caribbean coast. There's an observatory on a small mountain across from Pelée where scientists keep constant watch. The mountain erupted as recently as 1932, and probably will again in years to come. The town it killed in 1902 has been rebuilt, but it's still cruelly scarred by wounds that have become memorials: the ruins of the cathedral, a demolished theater, a scorched cemetery. It was flame and ash, not lava, that brought death and destruction.

In St. Pierre almost everything from the foundations up postdates the disaster that even destroyed ships in the harbor. Still, the streets are straight and orderly as becomes the capital city it then was. Called the "Paris of the West Indies," it was the nerve center and heart of what the Caribs knew as Madiana—Island of Flowers.

Near the leveled cathedral, where the pious died at prayer, there lies a great wooden cross, fallen but scarcely scorched.

"A sort of miracle," said my friend Michel Louis-Jean, who awaited me there. "Food charred on tables, watches sagged like Dali's, glass melted, but the cross remains." We saw

Wheeling off the miles, a contestant in the annual Tour de Martinique labors up the main street of Le Marin. Reminiscent of the famous Tour de France, the race attracts crowds all along its island-circling route.

French customs pervade life in Martinique. In Fort de France bistros cater to local clientele and to the *métros*—civil-service workers from metropolitan France. In truly Gallic fashion, streets are flooded each day at noon as office workers race home for a leisurely two-hour lunch.

Laying out the future, Frantz Jean-Joseph, right, and an assistant check the progress of a new road. Frantz's brother Serge heads one of the island's largest construction firms.

Martinique's economy is heavily subsidized by France. Increased tourism and industry have added to the island's wealth, but lack of major natural resources hampers development. Today Martinique must import four times as much as it exports.

the thick-walled prison cell in which one Ludger Sylbaris, reputedly the sole survivor of the holocaust, lived out the fire cloud. He was burned only where heat rays entered through a narrow hole above the doorway.

"Legend says he was to be executed the next day," Michel told me. "But in fact he was a minor offender. This cell saved his life. Later, he joined Barnum and Bailey's circus."

In the cemetery nearby, crones in black scuttled and prattled like jackdaws, tidying tombs. They directed us to the ossuary wherein lay the remains of St. Pierre's people, dug out of thick layers of volcanic ash. Through small windows we could see the piled and tumbled bones mouldering in cool silence. But one of the windows had been smashed in.

"Why?" Michel looked embarrassed. "The practitioners of *quimbois*, soothsayers and spell casters, use human bones. Perhaps they have found here what they needed."

"It Is the End of the World"

A short walk away sleek brown children glistened in the surf in innocent defiance of death. I hoped they would never see what an old man told me he saw 72 years ago as he netted flying fish miles to the south.

He leaned back in the shadows, his half-blind eyes wet and wizened, searching the sky in remembrance: "We saw in the north a cloud that was red, red, red. There were explosions as of cannons. Soon all the sky was in flames. A great wave came and left fish thrashing on the sand. Then, darkness; in full day it was night. We could see nothing. All the fishermen cried out. 'It is the end of the world,' they screamed. 'What have we done?'"

The great mass of Martinique is its mountainous northern segment, a near oval (map, page 128), tapering southward to a narrow waist. Beside its large bay the island's present capital, Fort de France, sprawls with its feet in the sea and its head in the hills (pages 144-5), radiating both the law and the heady vibrations of opposition politics. There are two routes south to the capital from St. Pierre: the west coast and mountain roads. Along the former, dry slopes plunge into a quiet leeward sea. The wet trade wind sheds its rain in the high country, and there the rain forests stand silent and splendid. I took the winding woodland route to Fort de France.

There are not many people in the forest. Vegetation rules. Great tree ferns sparkle with raindrops in sudden sweeps of sun. Bamboo a foot thick sways, gently curving. Vines wind, creep, drop straight to earth from orchid-laden limbs of tall trees whose species surpass a hundred. The jungle smells of life and death: fresh sweetness and decay.

As I said, people are few in this wet, green world. Still, there are some. A hardy pioneer, Joseph Bonne, makes a good living in the mountains growing anthuriums for the French market—5,000 a week. And under the great green tooth of Piton Boucher a family of subsistence farmers have a little wooden home. They have no electricity, no water nearby. But they have land enough for vegetables, a few beasts of assorted kinds, and flowers. Flowers, just to look at. A son has a job in a village. He goes by bus, and in the evening brings home bread.

"Il faut se contenter," said the old mother. "One must content oneself. I have lived in this place for 50 years. Here there is peace, and silence. You see, evolution has done nothing for this part of Martinique."

Fort de France Suffers Modern Ills

But evolution has done a great deal for, or to, the central portion of the island and Fort de France, a military garrison before St. Pierre's extinction made it the island's major city. As you come in from the north, there are high-rise apartments of varying disharmony, and sharply defined neighborhoods for the solvent, the comfortable, the affluent ($75,000 houses are not uncommon), and the socially distinct békés. These latter mix carefully with the upper echelons of officialdom from metropolitan France.

Getting into the capital can be a discouraging experience. Its streets were never meant to bear the great and growing traffic that clogs them. Yet, if you want to know about Martinique, you had better not heed the temptation

"We are different from the rest of France," explains renowned poet and politician Aimé Césaire, here gazing from his office as mayor of Fort de France. "Sometimes our voices are not heard so far away." Césaire fought for years to bring Martinique the status of a French department. Today he hopes that the island can achieve a greater degree of autonomy from the mother country.


VILLE

Yellow bird of growth sweeps low over a banana grove, dusting the young plants with fertilizer. Some 200,000 tons of the fruit leave port each year; like the island's pineapples, the crop is mostly

bound for the shopping bags of metropolitan France. Though vulnerable to disease and windy weather, bananas earn Martinique three times as much export revenue as any other product.

to keep right on going toward the charming south. For one thing, if you're a tourist you have almost no option. Most of the hotels are within a few miles of the capital—by boat or car—though none of the best are actually in it. They are generally expensive, and in some cases, less than luxurious. Yet, in spite of that, the tourist industry, which is still in its infancy, already accounts for something like a tenth of the island's income and offers its best hope for acquiring foreign funds.

As a department of France, Martinique need not depend upon tourist dollars. But it can make excellent use of them, and has what it takes to draw them. It is a lovely island; its accommodations are comfortable if not always swank; its people are attractive and courteous. In the face of well-publicized troubles of some West Indian resorts, the French Caribbean finds itself more attractive than ever to people seeking a safe and pleasurable holiday in the southern sun.

Paris Shops Attract One-day Visitors

Fort de France contains almost a third of Martinique's population. Here are the shops to which the thousands of one-day cruise ship passengers throng, the branches of such famous French emporia as Au Printemps, Prisunic, and Manufrance, and the renowned duty-free establishments of the island, where tourists who may never know a Martiniquais crowd well-stocked counters in search of bargains.

In Fort de France one hears the voices that speak most eloquently and disagree most interestingly. One of them is that of its brilliant mayor, Aimé Césaire (page 137), who is also a left-wing deputy to Paris, an internationally known poet, and a man committed to progress (his enemies would make that "change"). He is also a colored man—insistently so.

It was he, more than any other, who brought to Martinique the full status of a department 28 years ago. It is he who now calls for a new form of government.

"We of the PPM [*Parti Progressiste Martiniquais*, a socialist group] have strong support among the young. When you consider that at least 50 percent of our population is under 20, that counts for something. Ideals are important to youth.

"We live now on French aid. If that aid were removed and we continued to live as we do now, we would face a crisis. But there is the crucial point. We would not, we could not

live in our present fashion. We must change our standard of living, emphasize our own culture, our own traditions. It may be that so great a change is not possible, all at once. There are real advantages in our departmental status. But we must have a far greater degree of control over our own destinies.

"It is true that we of the left did not fare as well politically in the recent elections as we might have hoped. Many people who want greater autonomy for our island are fearful of losing the status of a department, of being totally deprived of the advantages and aid the French Government can offer.

"We Want Association, Not Domination"

"What we have now is camouflaged colonialism. We have no voice, no say. The prefect, picked by Paris, rules. Army, gendarmes, radio, television, all support the departmental regime. But this can't last. There were strikes, even violence early in '74; their causes still exist. We consume much, produce little; our unemployment runs to 20 to 30 percent; prices are astronomical."

He leaned back and smiled. "Do not misunderstand. We want close friendship with France. But we want association with her, not domination by her."

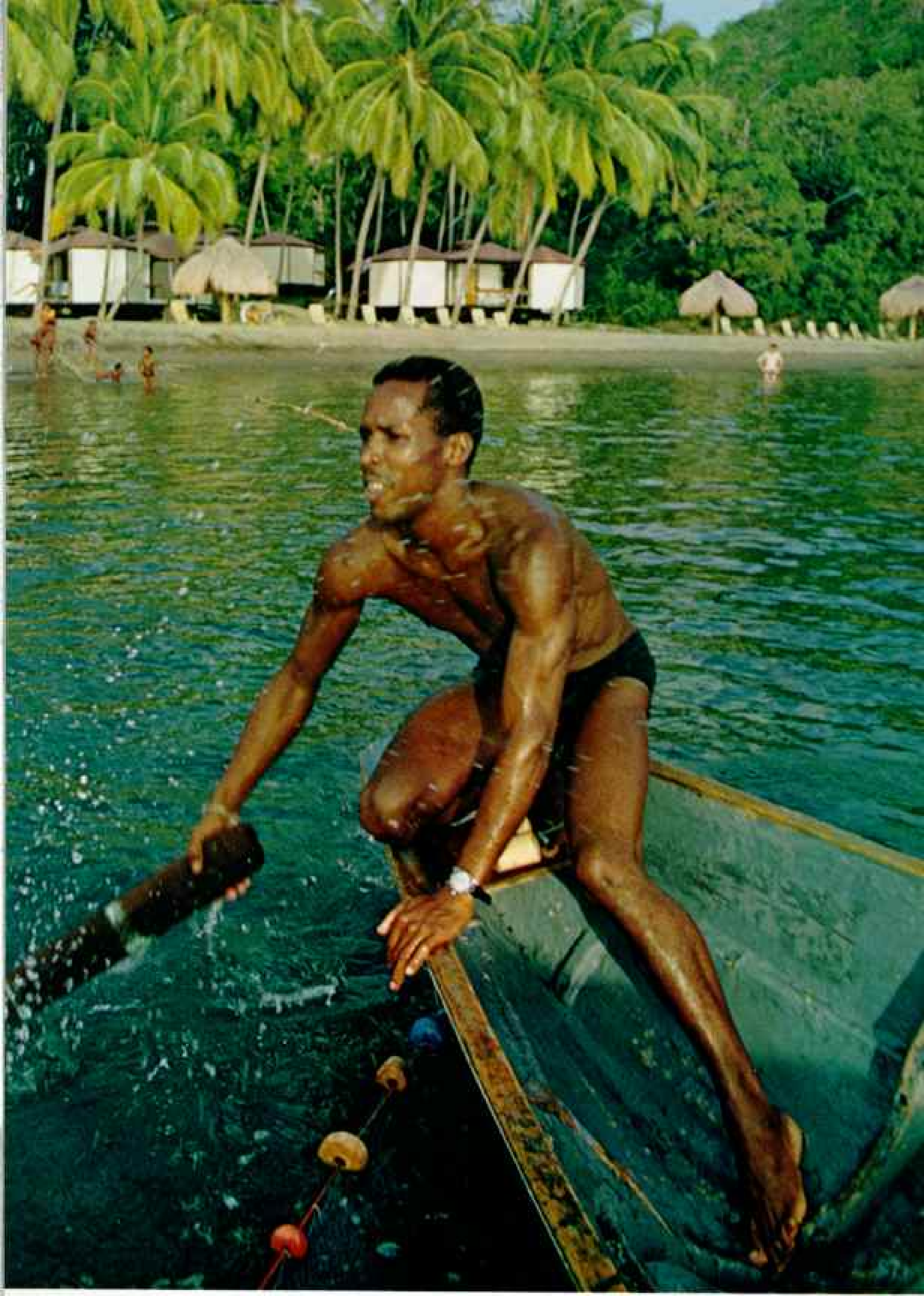
On a hill above the town lives a senator named Georges Marie-Anne, a supporter of the status quo, and, like other senators, chosen by an electoral-college process rather than by direct popular vote. He is also a "gentleman of color."

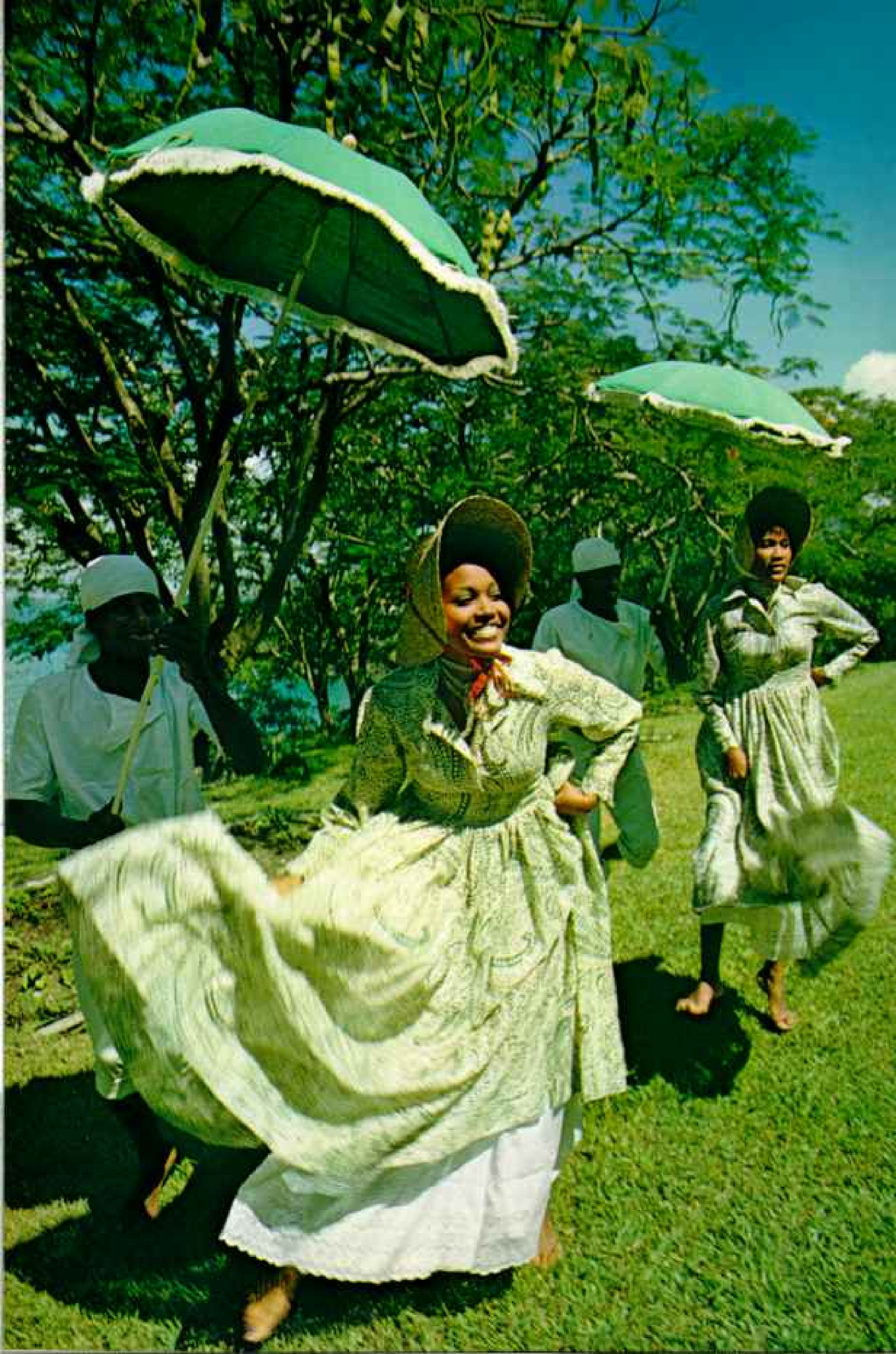
"Our left-wingers were powerfully in favor of departmentalization," he said. "Then, instead of a policy aimed at integrating the overseas departments with the Métropole, they set as their goal the autonomy of Martinique. But the clamor for full independence has stilled to a whisper.

"I did not share their point of view, and

Leaning from his *gommier*, a fisherman of Le Carbet gives the water a vigorous *fwap!* to prevent his catch from escaping above the net; companions on the beach draw tight the float-rigged noose. Palm-shaded tourist cabanas line the shore.

Armed with their courage and their luck, islanders venture out as far as 20 miles in their canoes, trolling for tuna or dolphin. *"Bon Dié manié moin*—the Good God touched me," fishermen declare when they return with a bountiful catch.





stayed on in the senate as an independent until 1968. Then I was reelected for a nine-year term as a Gaullist.

"We have one of the highest standards of living in the Caribbean," the senator pointed out. "Would our people consent to be poor but politically liberated? I doubt it. They will not accept the peasant life. And they realize that, for us, a divorce from France brings no alimony."

The chief official of any French department is its prefect, an appointed official responsible only to the French Government. Jean Terrade, who was then winding up 12 years in the French West Indies, the last four as Prefect of Martinique, gave the French point of view.

"These islands are not like any others," he told me. "Integration has been the rule here for more than a century. Martiniquais are citizens, not subjects. Even a partial rupture now would be catastrophic for them, the more so because they have virtually no natural resources to exploit. France has no economic or strategic interest here. She pays to support this poor department as she pays to aid, let's say, those of Normandy. All are part of the nation, and deserve help."

Education Brings Painful Problems

Having explored the northern mountains and coasts, I cut eastward from Fort de France into the central interior. The little towns seemed overcrowded. Unwed mothers with four or five children, the poorest of the poor, lived in shacks along back alleys. Villagers did what they could to make ends meet. One constructed cheap coffins for the very poor; a second made zinc-lined coffins for those who would lie in tombs. Another man built simple, inexpensive furniture. "It is without beauty," he said, "but people will no longer pay for an artisan's best work."

Children were everywhere, for it was the noon break. Girls wore uniform blouses and trim miniskirts. Boys wore clean shirts and long trousers—shorts are rarely seen in Martinique, except belted to the bellies of tourists.

A morose young teacher told me, standing in the shade of a church: "They go to school because they must—at least to the age of 16—and learn far less than they could. Some go to trade schools. The brightest go on to a *lycée*—high school—and to a university, usually in Paris. They are educated, yes, but for what? Ask them what they want to be in this land of farmers and fishermen."

I did, polling the students who stood nearby: nurse, policeman, salesman, office worker, civil servant. All city jobs, white-collar jobs. How about fishing or farming? Silence.

"They are not psychologically ready, nor sufficiently disciplined, for self-government," the teacher added. "Their social evolution has been too rapid, and there are too many of them: We acquire 7,500 new Martiniquais each year. But they are good children, well able to learn and develop."

Without Collateral, Credit Comes Hard

I went on to Le Robert to talk to a man with a different kind of problem. Colored, Paris-educated, and married to a Parisienne, possessor of two degrees, a lot of ideas, and endless eloquence, Etienne Verneuil runs a small boat works. He would like to expand. Larger boats are needed. So are jobs.

"We're lost in a painful drama: instructed enough to understand our lot, powerless to improve it. What I propose is reasonable, but I cannot get a loan. Why? Because wealthy men of color do not risk their capital, and the békés, who do, lend to other békés. Their credit is good."

I checked this point with a businessman of Fort de France. "It is true that we whites do most of the borrowing and spending. We do invest where rich colored people might not. But, yes, a poor man with skills and ideas would find it hard to get a loan—not because he is colored, but because he would lack collateral.

"I have faith in my relationship—personal and financial—with the vast majority of Martiniquais who *are* colored. Would I expand my business here if I did not? I am doubling my store, building a hotel. And I am neither a fool nor a hero."

Another béké, Bernard Hayot, in business

Atop imaginary steeds, dancers of the Ballets Martiniquais re-create a scene from the island's past, when delicate-skinned plantation ladies would ride their horses about the countryside and slaves would walk beside them with parasols to ward off the midday sun. Drawing inspiration from island history and custom, the professional dance group was warmly received on European and North American tours.

Brash, bright, and beguiling, Fort de France glitters in evening's rosy light (**upper right**). With a hundred thousand residents—by far the island's largest city—the capital bears the brunt of a growing tourist trade. Eyes quick for a bargain, sightseers try on hats at a street stall (**above**). Spangled with color and noise, the annual carnival packs city streets (**right**). Though hotel capacity has grown substantially since 1967, most of the island's tourists—nearly 300,000 in 1973—come by cruise ship and stop for only a few hours, long enough for a wallet-depleting tour of duty-free shops.

at Le Lamentin, talked about labor relations.

"I feel that human relations in Martinique are good, and that is an essential element in the island's future. You've been told that there is a flight of capital to France? No, not of mine—and I believe that most money made in Martinique is invested here. In five years' time, my family will have been here three centuries. *Ça commence à compter, quand même.* That begins to count for something."

The southern segment of Martinique is another country entirely, full of steep, small hills and little hidden villages. Three of the best tourist centers are in this charming region, two of them closely connected by launch to the capital, across Fort de France Bay: The Bakoua Beach, named for the high-crowned straw hat worn by local fishermen, and the Meridien, owned by Air France. The third is the isolated vacation village of the Club Méditerranée, on the splendid south-coast beach at Ste. Anne.

"France . . . Doesn't Hear Our Voice"

After a clamorous, if informative, stay in downtown Fort de France, I settled into the Bakoua with a sigh of relief, enjoyed a superb performance by the Ballets Martiniquais, who have perfected the old island dances (page 142), and set out to explore the south.

For this purpose I got hold of my friend Michel Louis-Jean, who was born in a southern village and has relatives all over the region. His cheery Creole broke what little ice we encountered, after which conversation flowed like wine—or rather rum, which often flowed with it. For the most part we collected people, not scenes or centers:

• A small farmer (two acres), near Ducos, who lived on government allowances, odd jobs, and his own produce: "You can't support yourself by growing things," he said. "The work's too hard. Insects are waiting to eat what you produce. The soil is heavy and tired and must be fertilized. So to make a little profit, you have to charge more than the price of the vegetables shipped in from France, where land is flat and machines do the work. Of course, ours are much better. But we are miserably poor."

• A mayor who is also the school superintendent at St. Esprit, eating a dismal-looking fish in a small apartment in an ugly building. He is serious, courteous, cultured. A bust of Lenin rests on his cluttered bureau.

"We've tried for the past 28 years to be a department, and it hasn't worked. We are not like metropolitan France. We must remain in the family of France, but with the status of one of your states. No prefect, but a lawmaking body of our own.

"Paris will not like this idea, but it can learn to accept it. France is generous to us, but she doesn't hear our voice."

• A girl in a market at Ste. Luce—an old schoolmate of Michel's: "*Bonjour*, Chantal. Remember me, Michel? How are you?" "*Je me débrouille*, I manage." "Any children?" "Only four." "Are you married yet?" "No."

• A muscular woman, packing bananas by

Devils' glances and sparkling paint proclaim the vitality of *Carnaval*. Disguised by ribbons of silvery makeup, a gypsy-earringed girl peers from a crowd of merry-makers (**above**). In the celebration's dying hours, fire consumes an effigy of "Vaval" (**facing page**). The guiding spirit of mischief will be gone till next year's revelry calls him from the dead.

Martinique's gaiety masks moments of concern. "Some say, 'Let's have freedom,'" notes a fisherman. "For what? To starve? We need France. But does France need us? *There* is a question to worry about."

the roadside at Quartier Fond Masson: "I make three tons a year of bananas, and no profit." She pares her nails disconsolately with a curved banana knife. "How can I make a profit? I take what price is offered. *Et puis voilà!*—and that's it."

"Would you fare better if we were an independent country?" asks Michel innocently. "Don't say that," she screams. "No! No! Do you want us to starve?" She throws down the knife and swipes her palms across each other, perishing the thought.

Islanders Preserve a Bitter Memory

It being a Wednesday, cock fights were on at Clery's *pitt* near Rivière Pilote. No sport so excites the Martiniquais, particularly the men. I watched one, then left to see the Empress Josephine's early home, favoring past human drama over present ornithological combat. At nearby La Pagerie, Dr. Rose-Rosette showed me his own repairs and reconstructions of the buildings. "I had no money to give, so I gave time—29 years. The Martiniquais are not fond of Josephine and Napoleon, for he reinstated slavery, they felt, at her suggestion. But it is part of our history, and should be maintained."

In the clustered hills, another banana grower, Jean-Louis, packed his fruit. He has several men and seven acres. "I make a crop. I live. I even have a son who shares work, one of six children—six legitimate children. I have surely twenty bastards. Why not? A great many Martiniquais are illegitimate. Life is difficult, you see, but not worthless. Come, we will leave these miserable bananas and go to my house for a drink."

We drove down through hibiscus and oleander and blazing flame trees to Le Poirier, a very poor fishing village where Michel had a ramshackle house at the sea's edge.

Four men were peeling eels in the sun. Their hands being sticky, I shook their elbows. "*Dites bonjour au monsieur,*" said Michel. They said good-day, doubtfully. Poirier does not get many visitors. "Monsieur's a writer. He wishes to learn about our life." "Here?" said one, sardonically. "Foreigners get their information from the Préfecture in Fort de France, and then they leave." "Fort de France is not Martinique," Michel replied. "Monsieur understands this."

"*C'est déjà quelque chose*—That's a start, anyway," said the doubtful man, pausing to pick up another eel. "He speaks French, if not Creole. We will talk to him of fishing."

They did, with growing friendliness. "We are sentenced to this work," they said, listing the same problems that cursed the men of Grand' Rivière in the north, where my story began. "No organization, no means of storing fish, no proper marketing. No big boats. No other work. We sometimes go *à miquelon.* Do you know what that means? Far, far out. We say '*miquelon*' because in France there are two islands called St. Pierre and Miquelon. They are obviously very far away, so to us '*miquelon*' means 'distant'."

I saw no reason to point out that St. Pierre and Miquelon lie near Canada. The analogy was clear enough.

We drank sparingly at a shack of a bistro, near a little garagelike chapel where candles guttered. The men had built it themselves. "There was nothing, you see. It is best to have a chapel of some sort." They brought me fruit and told stories, often of bitterly amusing failures. "I filled my gommier with flying fish," said Pierrot, a burly, cheerful man. "Hundreds of them; never have I seen so many flying fish. But so did the other boats. So I got 25 francs [about five dollars]. And the fuel cost me twice that."

But he laughed, healthy and happy in the soft evening. The men shook hands and went off to eat whatever there was for supper. No beef, we could be sure, but plenty of bread and enough good seafood stew—*blaff*, they call it in these parts—boiled sea urchin and vegetables, to send hungry men well-filled to their rest. We ate similarly at Michel's house, where his wife had used herbs artfully to make fine dishes of simple ingredients.

"France Is Our Mother"

I stayed three days. One night as I drifted toward sleep to the rustle of wavelets among clean stones and the bell tones of frogs, warm, low voices reached into my consciousness: two fishermen making their way home. Their Creole came through to me, for the subject was familiar.

"This affair of autonomy, of independence, I don't know, I'm not a politician, but I'm French, I fought for France. . . ."

"Listen, *mon vié*, it's simple enough," said the other. "France is our mother. She created us. She supports us. But . . . ! She should listen to us and treat us as a mother treats a son, a son grown to manhood. *Pi c'est tout!*—That's all!" □

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Aluminum building products can help your house put the crunch on energy consumption. One example is Alcoa® Siding. When properly applied over reflective aluminum foil, it forms a protective insulating envelope that can reduce heat loss in winter and heat gain in summer. Read on for more ways to beat the weather.

Storm windows and doors can effectively "button-up" your house. They're a traditional barrier against cold and can save up to 15 percent of the energy used to heat the typical home. Low-maintenance aluminum frames can stand up to all kinds of weather. Tightly closed aluminum venetian blinds can reduce heat gain through windows and save on air conditioning costs.

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If you'd like to learn more about how Alcoa Siding can help insulate your home, write for our brochure, *Home Insulation Can Be Beautiful*, Aluminum Company of America, 975-A Alcoa Building, Pittsburgh, PA 15219.

The reasons for using aluminum are found in aluminum itself.

ALCOA

1692 must have been a "horrible vintage year!"

It was, in fact, a dreadful year for the thirsty owner of an onion-shaped wine bottle like this one, retrieved unopened from the sea bottom after almost 300 years. Its contents, said an inquisitive diver, "tasted like strongly salted vinegar."

Nor was it a good year for the prosperous citizen whose handsome brass watch fixed for eternity the moment of disaster, or for the hungry patrons of James Littleton's tavern, whose savory lunch of beef-and-turtle stew remained forever in its copper cook pot.

For it was in 1692 that Port Royal, Jamaica, a roaring, wide-open seaport, hub of New World commerce, pirate headquarters known far and wide as the wickedest city in the world, shuddered delicately, lurched, heaved, and slid majestically into the blue-green Caribbean.

Two thousand persons and a way of life perished with the drowned city—entombed in an instant of time against the day when other men, seeking to reconstruct an era or to find rumored treasure, might lift Port Royal again from the sea.

Nearly three centuries passed before *Sea Diver* anchored over the spot where Port Royal had settled. The incredible ship was designed especially for underwater archeology by Edwin A. Link, famed inventor of aviation's Link Trainer.

Equipped with powerful suction hoses to scour the silted sea bottom and with modern echo-sounding devices to "see" below the water, *Sea Diver* proved uniquely able to unlock the secrets of the drowned city.

Working with yellowed records to pinpoint landmarks long buried in the sea, the Link expedition, sponsored in part by the National Geographic Society, first went about preparing a map of the city as it stood before the quake.

Once mapped accurately, Port Royal's ruins gave up hundreds of artifacts to Link's silt jets and divers—plates, platters, and kitchen utensils, the copper pot with its turtle and beef bones, the watch whose vanished hands had etched on encrusting coral the moment of disaster. And clay pipes and rum bottles enough to indicate that the chief occupations of the wicked old city must have been smoking and drinking.

As the Caribbean hurricane season came on, *Sea Diver* pulled away to safer waters with a wealth of information on the life and times of the old pirate haven where one of history's immortals, Horatio Nelson, had once served a hitch as a young lieutenant. But, as Mr. Link summarized it, this was "only a beginning."

"Think of the houses," he said, "the shops, the King's storehouse, warehouses, ships which sank at the docks. Somebody will go back there and be rewarded with such an array of artifacts and riches as to make our effort seem trivial."

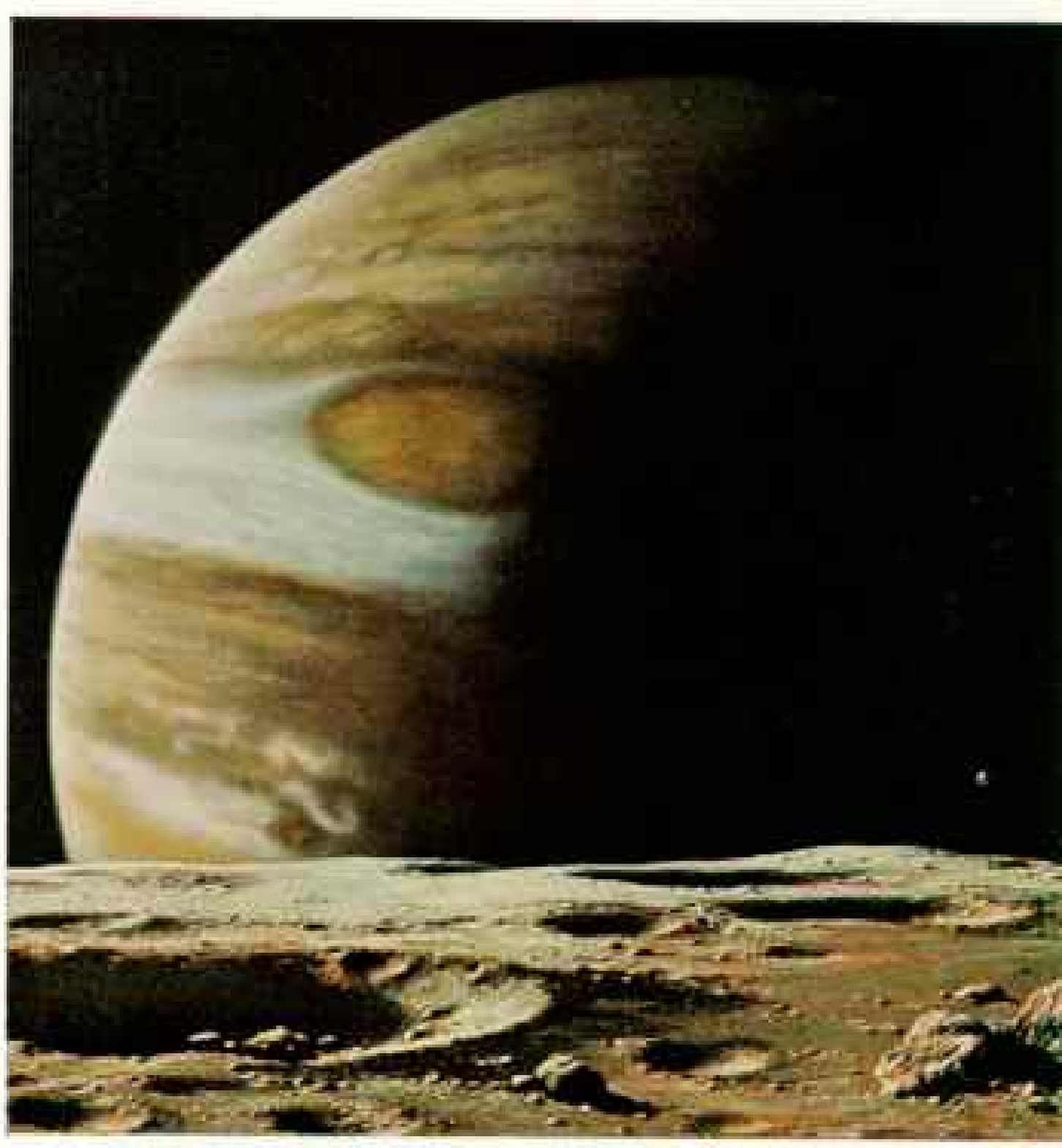
Few readers are as well equipped as Edwin Link to probe the murky ocean bottom off Jamaica. But they do find endless fascination in such explorations into the past, and so turn each month to travel the colorful pages of NATIONAL GEOGRAPHIC.

CORAL-ENCRUSTED ONION BOTTLE, SLIGHTLY REDUCED

Does life exist on stormy Jupiter?

"HOSTILE THOUGH IT SEEMS, the largest of the planets may harbor life," reports Kenneth F. Weaver, NATIONAL GEOGRAPHIC's science editor and author of the May 1974 article "The Incredible Universe." Here he confers with Dr. Tom Gehrels, right, of the University of Arizona, a principal investigator during the flights of Pioneer 10 and 11, which examined the giant planet. NASA's spidery spacecraft gathered new facts about Jupiter's complex environment, which some scientists believe may sustain living organisms. Artist Ludek Pesek shows the planet as it rises above the most fascinating of the Jovian moons, Io.

Mr. Weaver's lucid, up-to-the-minute articles have won nearly a dozen honors. Next month he will lead readers on a vivid odyssey through Jupiter's seething atmosphere. Give your friends tickets for such fantastic voyages by nominating them for membership on the form below.



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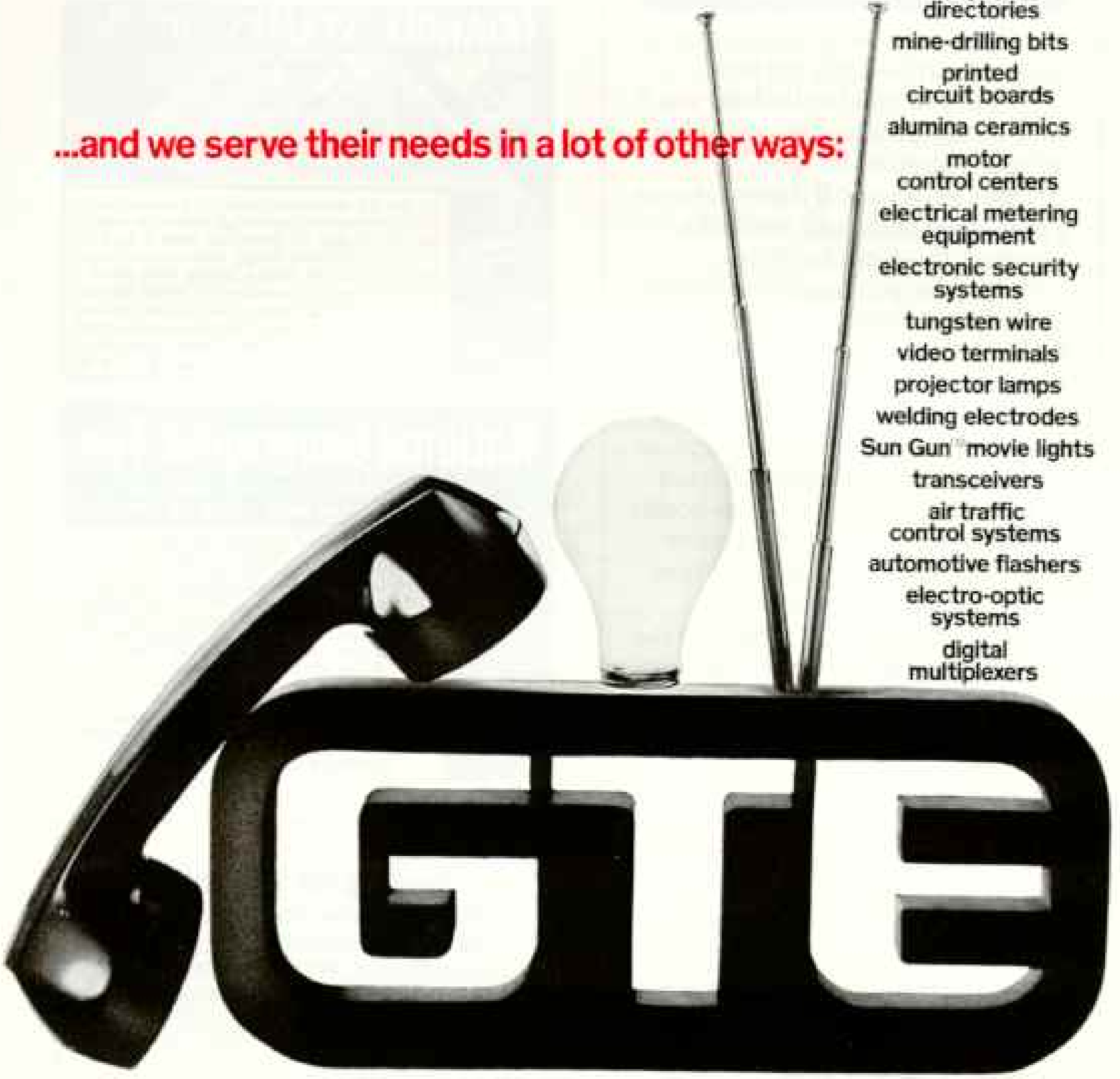

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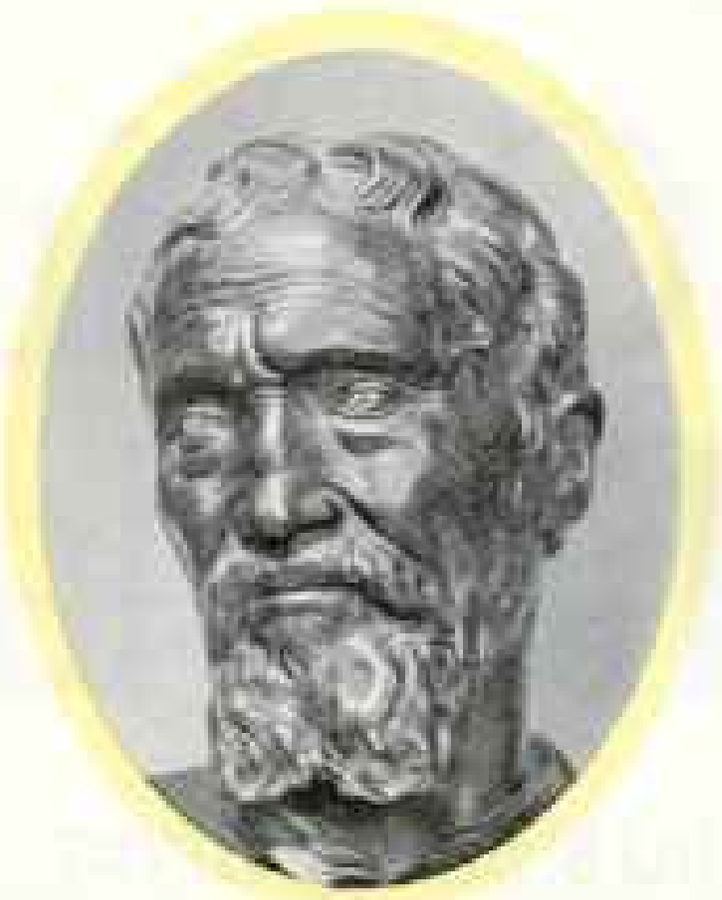

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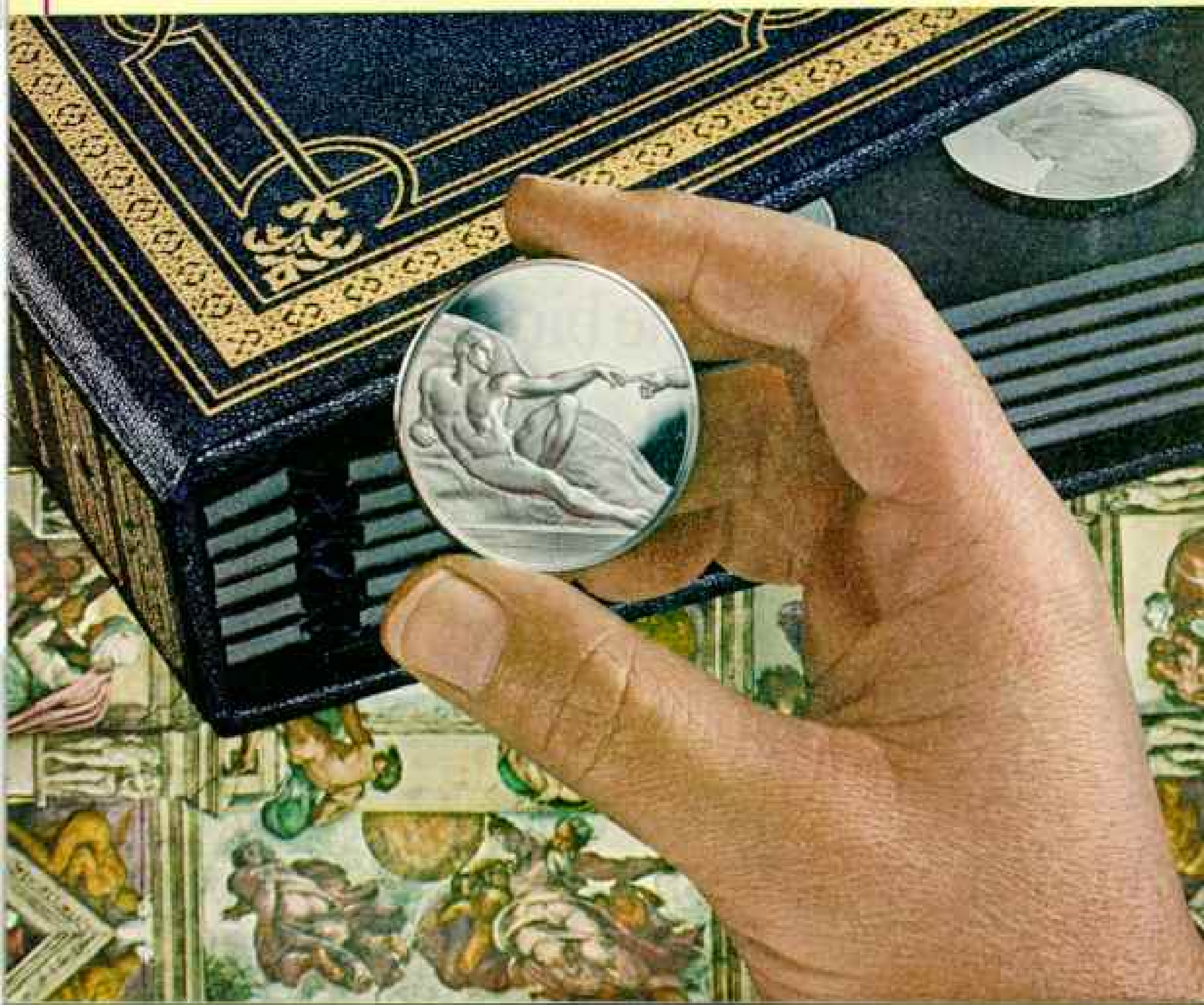

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Fortunate indeed is the man or woman who, in shifting and uncertain times, possesses an acknowledged work of art. For, as astute collectors and connoisseurs well know, the value of great art steadily increases no matter how the winds of change may blow.

Among the world's enduring art treasures, few are valued more highly than the extraordinary works wrung by Michelangelo from his agonized heart and soul. Although nearly five tumultuous centuries have passed since he gave the world his Pietà, his David, his Moses, his Dying Slave, his Allegories of the Medici, and his Sistine Chapel frescoes with their monumental Story of Creation and Redemption . . . Michelangelo's art still expresses, with undiminished power, the innermost yearnings and ideals of man. For experts and laymen alike, Michelangelo remains the most nearly universal artist who ever lived.

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How fitting, then, that now—on the 500th anniversary of Michelangelo's birth—the masterpieces of this genius of all time should be the subject of an important series of art masterpieces created *in our own time*. A series of sixty fine art medals, reflecting the inspiration of Michelangelo's greatest works, as chosen by an Advisory Board of internationally recognized experts on the works of Michelangelo.

Magnificently sculptured in solid sterling silver, these beautiful and significant art medals will be minted by The Franklin Mint, foremost contemporary inheritor of the tradition of fine medallic art that began in the Renaissance—Michelangelo's own time. The craftsmen of The Franklin Mint are world renowned for their skill in blending the exacting standards of fine art with the permanence of precious metal—an art that attains its highest expression in *The Genius of Michelangelo*.

To capture the greatness of Michelangelo in medallic form, The Franklin Mint commissioned the distinguished Italian sculptor Piero Monassi to work *on the scene* in Florence, Milan and Rome. Just as Michelangelo spent nearly five years, bent and aching, on the scaffolding below the ceiling of the Sistine Chapel, so Piero Monassi has devoted virtually all of the past five years to the awesome task of sculpturing the bas-relief models from which the dies for these superb art medals have been engraved.

To accurately reflect the full scope and power of Michelangelo's works, moreover, the medals themselves will be impressively large. Each will measure a full 44mm (1¾ inches) in diameter and will weigh 600 grains. Thus, the complete collection will contain *more than six pounds troy of solid sterling silver.*

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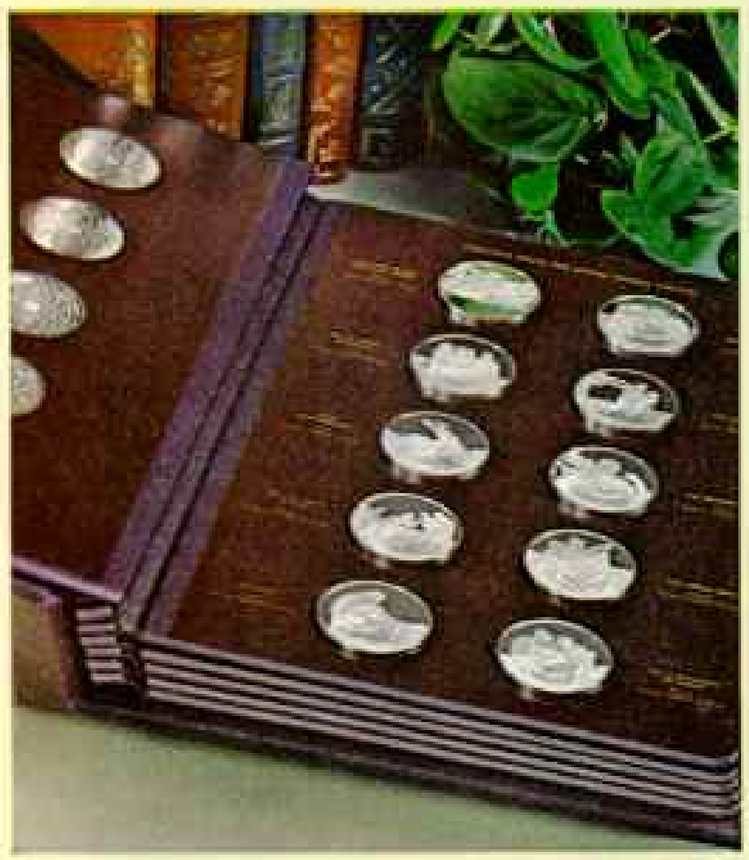

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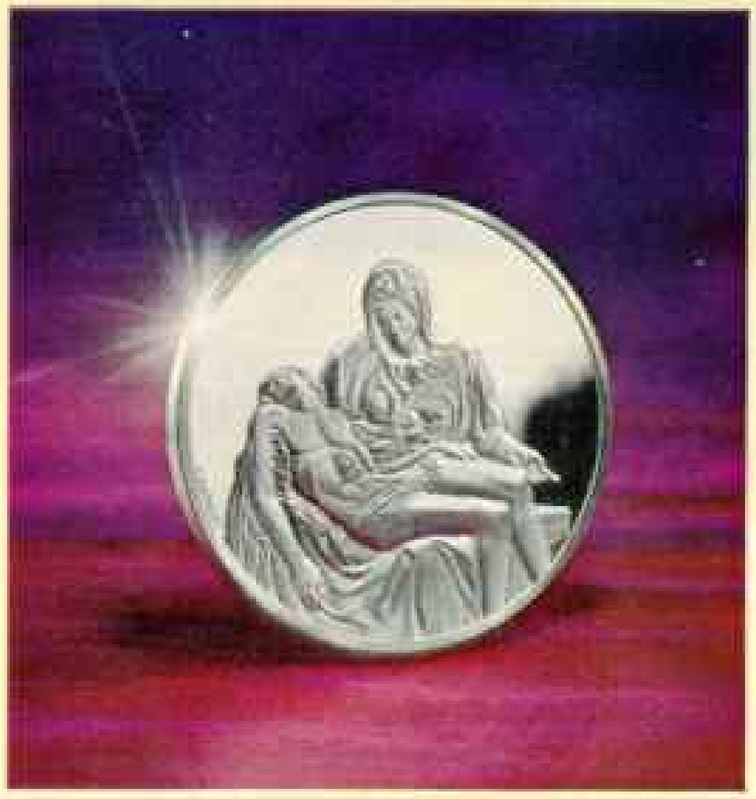

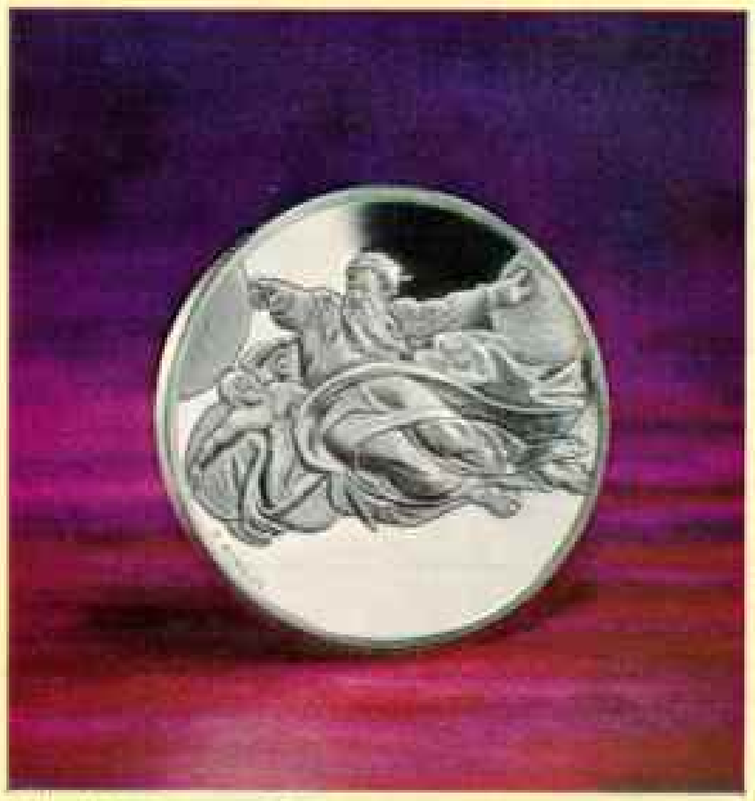

All medals shown actual size.

NATIONAL GEOGRAPHIC

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For their assistance in selecting the sixty most appropriate subjects for this important medallic series, The Franklin Mint is grateful to this eminent panel of scholars and art historians.

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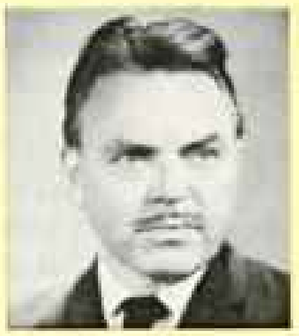

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"That dam destroys the beauty of the land."

Are dams good or bad? The answer is *both*. Because water control, like many problems today, has *both* environmental and economic impact.

Dam building can disrupt lots of land. Reservoir back-up can submerge valuable acreage, forcing people and wildlife to move. We must recognize those drawbacks.

But damaging floods are a recurring threat in many areas. Dams, levees and contingency plans can minimize, or prevent, the effects of such natural disasters.

The Mount Morris Dam in western New York's Genesee River Valley is an example. It's the keystone of a water control system affecting 2,476 square miles. Its impoundment area covers just over 5 square miles. But it protects farmlands, cities and towns in the Genesee River Valley for about 40 miles below the dam.

During the flooding caused by tropical storm Agnes in 1972, the Mount Morris Dam averted $210 million in damage to those downstream farms and towns, including the City of Rochester. The dam's cost was $25 million. Without it, that single flood would have cost *nine times* as much, according to Corps of Engineers figures.

The benefits of a successful dam project do not eliminate the drawbacks. They outweigh them.

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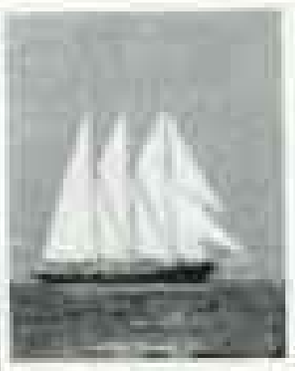

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