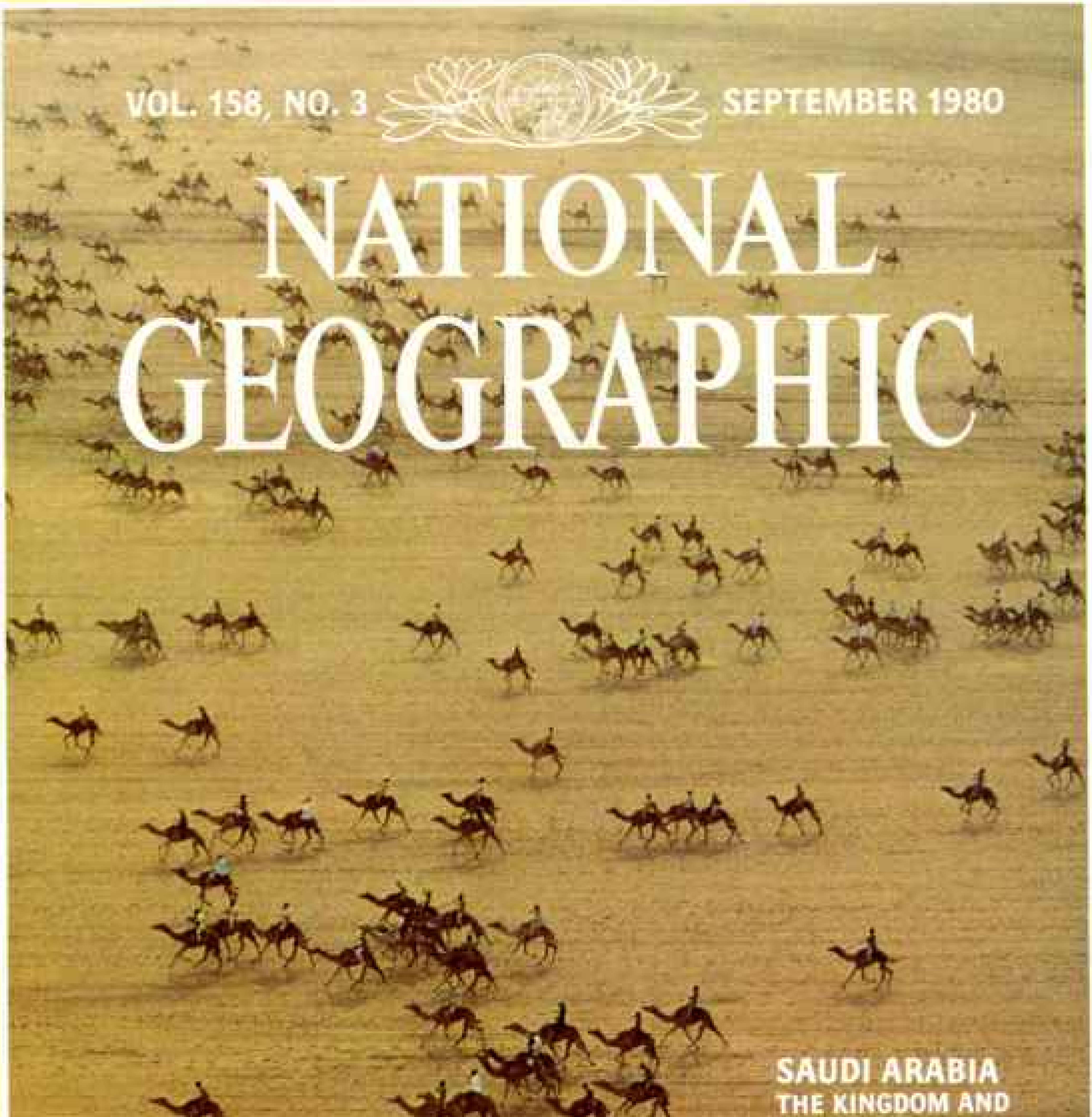
SPECIAL MAP SUPPLEMENT: THE MIDDLE EAST IN TURMOIL

VOL. 158, NO. 3 SEPTEMBER 1980

NATIONAL GEOGRAPHIC



SAUDI ARABIA
THE KINGDOM AND
ITS POWER 286

ISLAM'S TROUBLED
HEARTLAND 335

HURRICANE! 346

MADAWASKA:
FRENCH ACCENT
DOWN EAST 380

UNDERSEA
WORLD OF A
KELP FOREST 411

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

ONCE AGAIN the lens of history has focused on what we think of as the Middle East, a term so vague and redolent of empire that statesmen often avoid using it. It became the Middle, or Near, when the rest of Asia was thought of as Far. In many ways we have been thinking with a Western cast of mind ever since.

Medieval mapmakers sometimes showed Jerusalem as the center of the world, for the good reason that the three largest faiths in that Eurasian region had a special relationship to the city. Inevitably, this central meeting ground of three continents, inhabited by dozens of different peoples speaking many languages and holding varying beliefs, has attracted the interest and concern of every age.

Today the region is in turmoil, as Thomas J. Abercrombie confirmed during a swing through the lands from Kabul to Cairo. The condition is reflected in a special map supplement that traces the grand maneuvers of history as well as the contemporary scene. The major themes of change are at least four, all interrelated:

Russian ambitions in the area, dating back to Peter the Great's interests early in the 1700s, find modern expression in Soviet arms, Cuban mercenaries, and military advisers in Ethiopia and Democratic Yemen, not to mention the full-force occupation of Afghanistan. Not unnaturally, many neighboring states fear the consequences of a Western reprisal, catching them up in the big-power chess game.

Second, the most massive transfer of wealth in history has inundated the oil-rich Muslim nations with Western money and technology, but many of those states, conservative in religion and society, resist and resent the Western values and attitudes that arrive with the bank drafts. This resistance is expressed through religious leaders, with the result that Islam has a new strength.

Third, long-suppressed minorities like the Kurds, Baluchs, Azerbaijanis, and many others see in the turmoil another chance to strive for nationhood. And finally, the question of the Palestinians hangs over the scene like Banquo's ghost.

It is an unsettling vista of an unsettled area that will be a major stage for the events of the coming decade.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 158, NO. 3

COPYRIGHT © 1980 BY NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C. INTERNATIONAL COPYRIGHT SECURED

September 1980

Saudi Arabia: The Kingdom and Its Power 286

Oil wealth beyond imagining has come to a nomadic, patriarchal, long-impoverished desert society. Robert Azzi, a U. S. photojournalist with access to Arabia's royal family, reveals how the nation is dealing with overwhelming change.

Islam Up in Arms 335

A panorama of unrest from Afghanistan to Africa is surveyed by GEOGRAPHIC *writer-photographer Thomas J. Abercrombie and detailed on a timely new supplement map.*

Hurricane! 346

Each summer huge tropical cyclones whirl out of the Atlantic and Caribbean toward North America—and each year people forget their potential for devastation. Newsman Ben Funk and photographer Robert W. Madden report.

Fred Ward records the havoc wreaked in 1979 by Hurricane David on the tiny nation of Dominica.

John L. Eliot flies with hurricane hunters straight into the eye of David to measure its force.

Madawaska: Down East With a French Accent 380

In a tranquil valley along Maine's border with Canada, national divisions blur as independent-minded people cling to tradition. By Perry Garfinkel and Cary Wolinsky.

Undersea World of a Kelp Forest 411

Biologist Sylvia A. Earle and marine cameraman Al Giddings find kaleidoscopic life amid seaweed off California's Santa Catalina island.

COVER: *The desert's swiftest vie in the King's Camel Race near Riyadh, Saudi Arabia's capital. Photograph by Robert Azzi.*

Saudi Arabia: The Kingdom and Its Power

ARTICLE AND
PHOTOGRAPHS BY
ROBERT AZZI
WOODFIN CAMP AND ASSOCIATES

An awesome inrush of wealth brings the Saudi kingdom—founded on Islamic principles and stern desert ways—to a whirlwind clash of tradition and change.

"IN YOUR TERMS I'm a great success, a symbol of all the potential of Saudi Arabia—barefoot Bedouin boy from barren desert goes to U.S.A. to find happiness and a Ph.D.

"You're wrong.

"Sometimes I think I'm the greatest failure in the world. I, Faisal Saffooq al-Bashir, of the Al Sabaa tribe, was raised to be the next leader of my tribe. They expected it of me, and I failed them. Do you know that it took me 11 days to find my family when I first returned from the U.S.A.? Eleven days in a small hotel trying to find a few thousand Bedouin somewhere in the desert.

"What am I now? A technocrat—deputy minister of planning. Trying to find a way to spend a five-year-plan budget of 236 billion dollars. Dollars that will only speed up the disappearance of the nomads. I act against all the forces that created me."

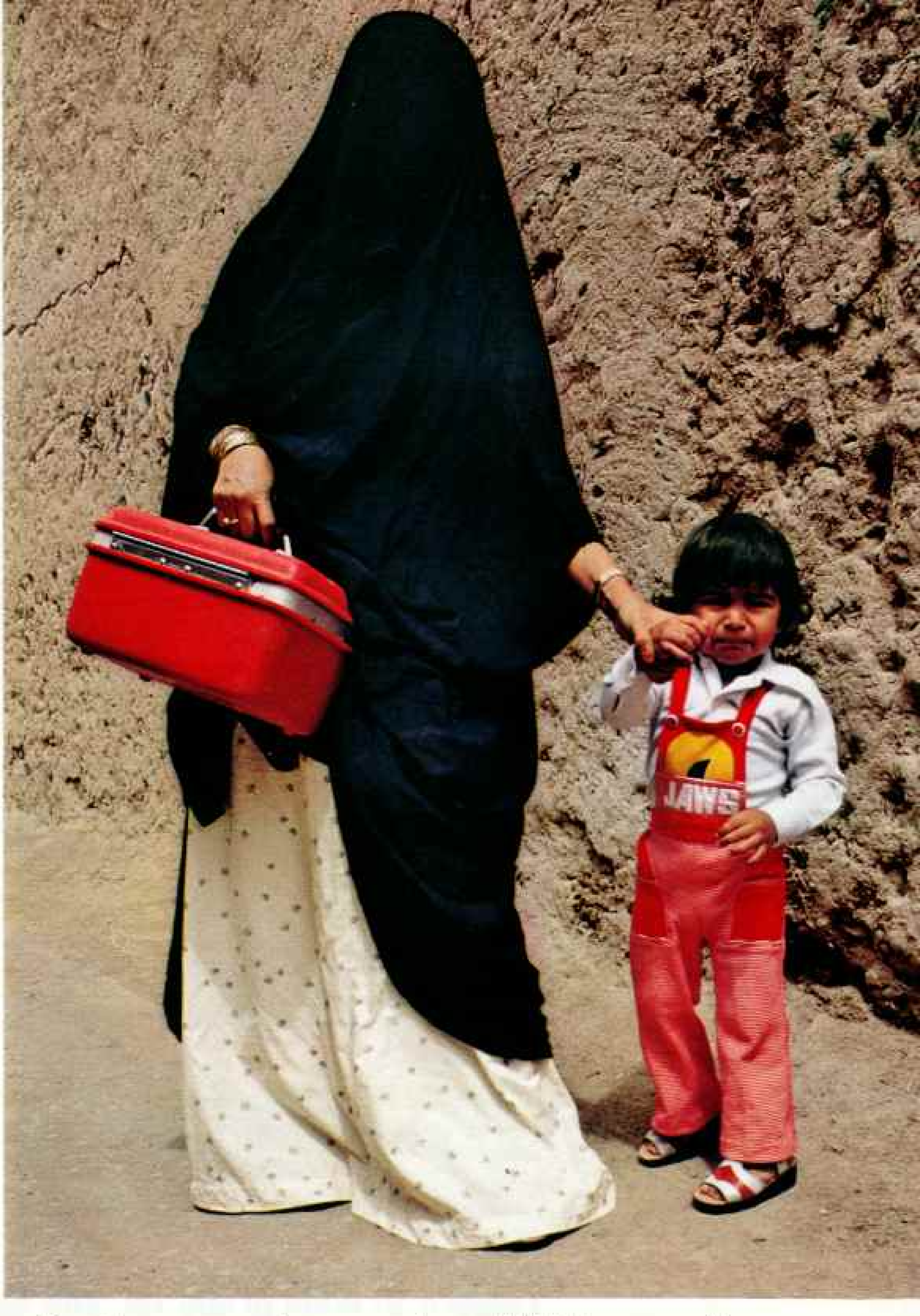
An American photojournalist, I went to Saudi Arabia to find out what happens when an Islamic, nomadic, patriarchal, and impoverished society, after hundreds of years of subsistence living, suddenly becomes rich beyond the dreams of Croesus, and then comes into contact with societies totally alien to its own—societies that are secular, powerful, and technologically advanced.

I visited in the palaces and courts of the royal family. I sat alongside petitioners as they approached their rulers for assistance. I talked to nannies brought in from Western countries to help raise a new generation of Saudis. And I spoke to businessmen exasperated by alien concepts of urgency and foreign business practices.

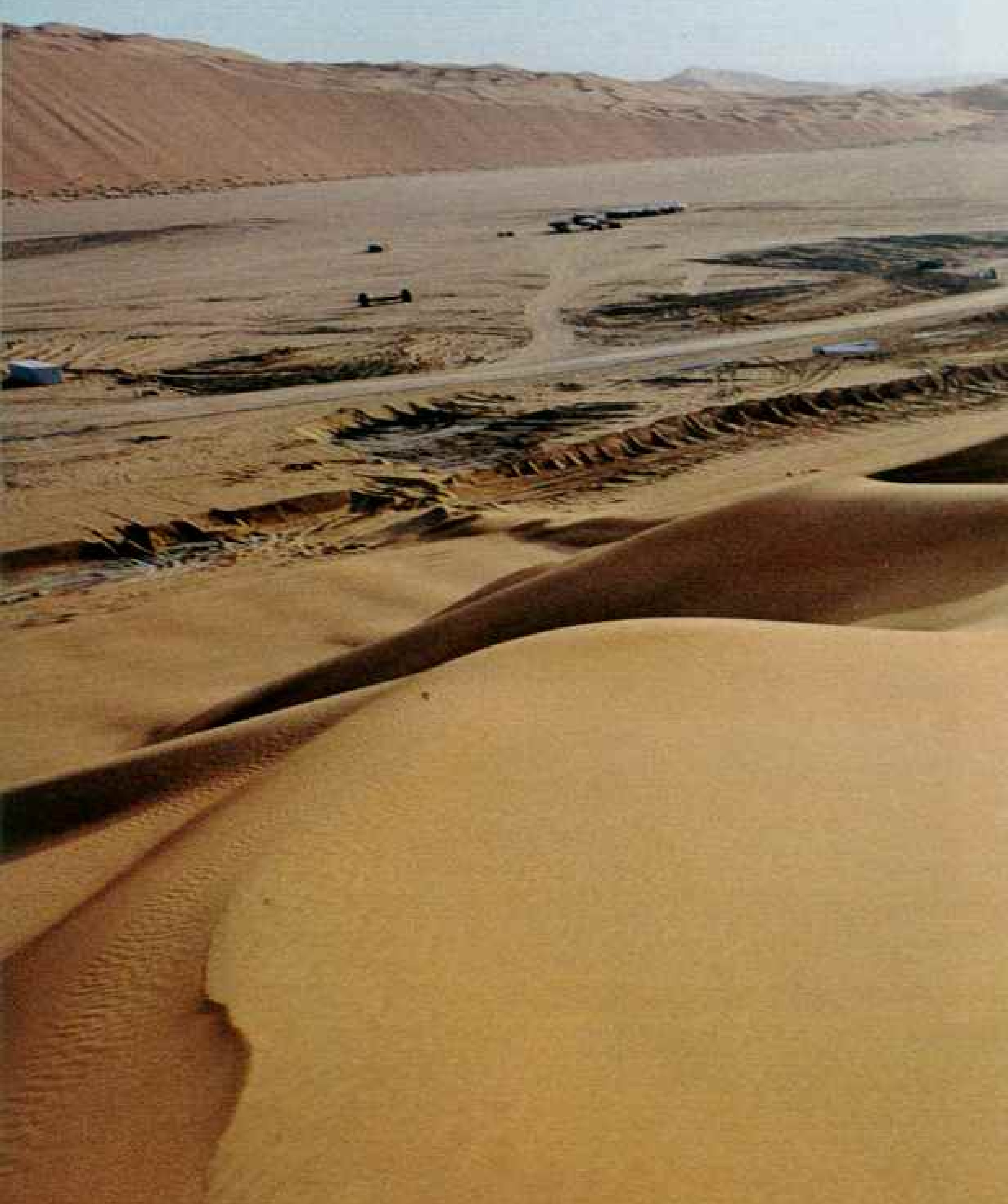
I made the hajj, pilgrimage to Mecca, together with 1,500,000 fellow Muslims, thankful for the facilities and support provided for the pilgrims by the government, dedicated guardian of Islam's most sacred holy cities—Mecca and Medina. But I saw in last year's hajj a dangerous straining of Saudi hospitality.

The Iranian *(Continued on page 296)*

Conventionally veiled,



a Saudi woman dresses her child in overalls



Fingers of steel probe for pay dirt

in an arid waste

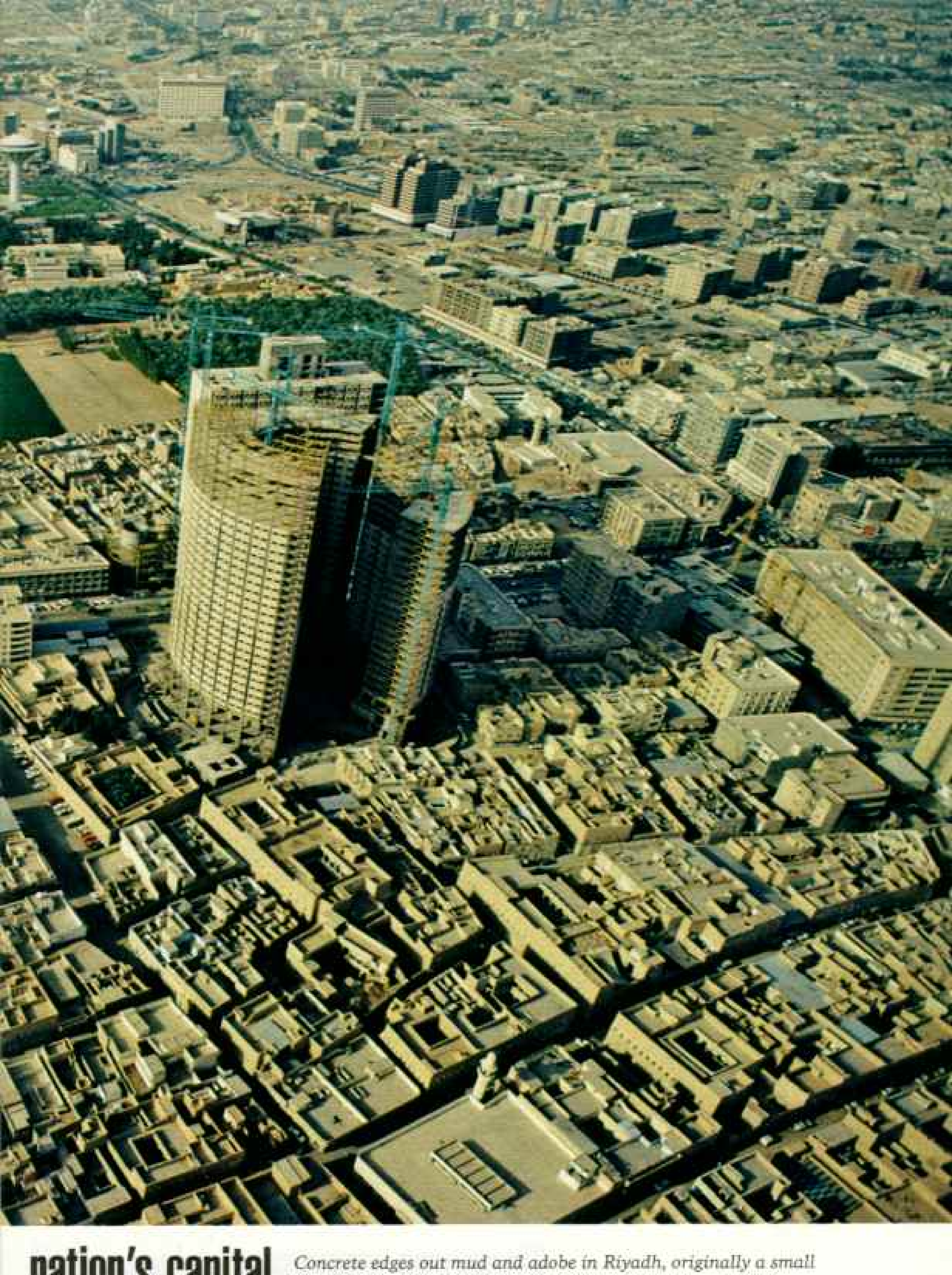
Rub al-Khali: Empty Quarter. Shunned even by most Bedouin, this Texas-size belt of salt flats and shifting dunes hides untapped oil fields. Discoveries of new reserves outstrip the nation's present rate of oil production.

Ships of the desert ride in their

modern successors

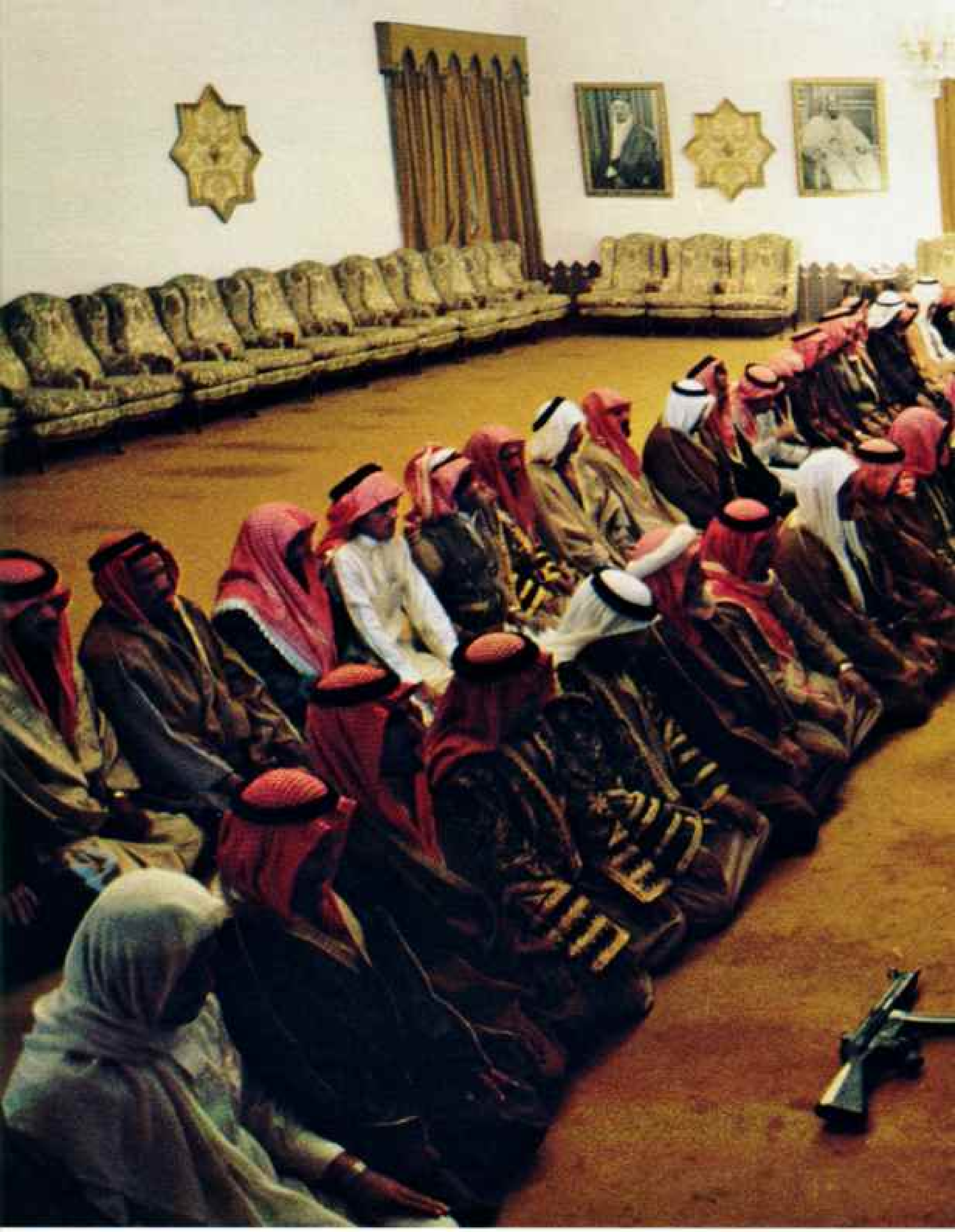
The Bedouin's wandering days seem numbered as the nomads follow government incentives to settle in towns and cities. But pickup-truck mobility links many with their diyarat, traditional grazing areas, and still beloved herds of sheep, camels, and goats.

Building explosion rattles the

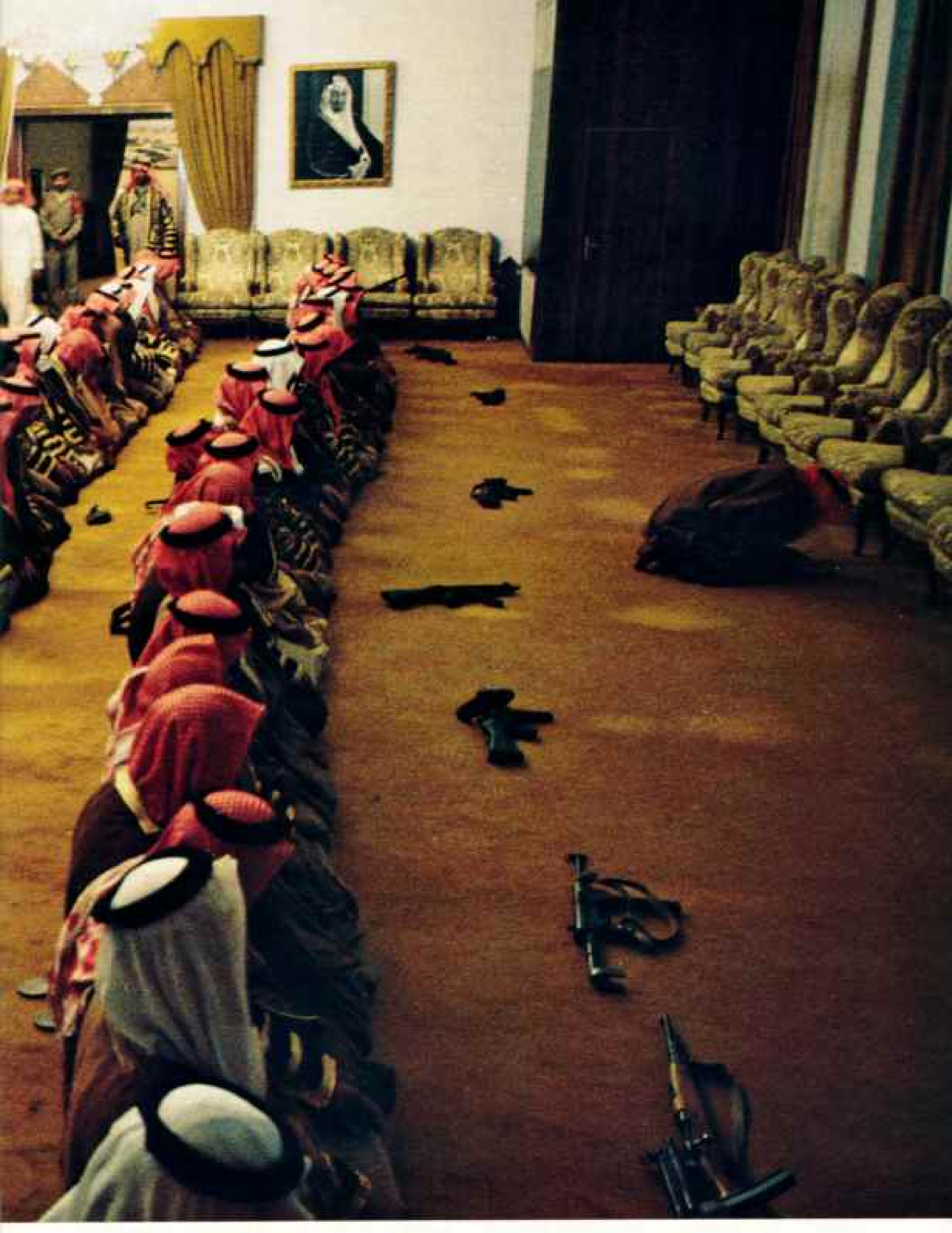


nation's capital

Concrete edges out mud and adobe in Riyadh, originally a small oasis town—its name means "gardens." A walled city until recently, this seat of Saudi royalty is now a growing commercial center of a million people.



Noontime summons princes and



subjects to prayer

Guards lay down their guns and kneel with petitioners alongside Prince Salman ibn Abdulaziz, Governor of Riyadh. The Al Saud family has ruled the kingdom since founding it in 1932. Key members in vital positions must concur on major policy decisions.

(Continued from page 286) pilgrims arrived with pamphlets and photographs of Ayatollah Khomeini, politicizing Islam's most sacred rite and offending the sensibilities of the millions of worshipers for whom the pilgrimage is wholly a religious duty.*

"This is not the place for politics," my outraged Pakistani friend Sultan said. "Most people save for their entire lives to fulfill this one duty before they die. They don't come to take part in the struggle between Iran and the United States."

I traveled to a plain 15 miles north of Jiddah, where a modern airport, greater in area than the Dallas/Fort Worth and Toronto airports combined, is taking form in the desert—a ten-billion-dollar monument embodying the grandiose dreams of a people emerging from centuries of obscurity.† Within the airport a hajj terminal, designed by United States architects Skidmore, Owings & Merrill, is made with Teflon-coated fiberglass; it will be the largest covered space in the world.

But wait. . . .

When I got to the capital, Riyadh, in the center of Najd, Arabia's sere desert heartland, traditional home of the ruling Al Saud family, I was told that Riyadh would soon have the largest airport in the world.

And then. . . .

When I reached the Eastern Province, the country's oil-producing region on the Persian Gulf, I was told that an airport planned for there would be the largest.

SAUDI ARABIA is a country of superlatives. In keeping with its emergent power and wealth, it is planning a billion-dollar causeway, a 15-billion-dollar-or-more gas-gathering system, a five-billion-dollar university in the capital, and multibillion-dollar military cities. All on one of earth's most inhospitable landscapes.

The size of the United States east of the Mississippi, Saudi Arabia has not one natural body of sweet water. It contains both the world's largest sand desert, the Rub al-Khali, the Empty Quarter, lying mostly within the country's borders—250,000 square miles of sand, about as big as Texas—and perhaps the world's largest oasis, al-Hasa. Only one percent of all the nation's land is under cultivation.

Through the country's driving modernization runs the theme of U. S.-Saudi interdependence—and oil. Saudi Arabia has a quarter of the world's proved petroleum reserves, and these are expanding faster than they are being depleted by production. At Saudi Arabia's present production rate of 9.5 million barrels a day, its proved reserves would last at least 60 years. The country supplies about 15 percent of the free world's oil and 23 percent of U. S. oil imports. The dollars it receives from these oil sales, an estimated 90 billion in 1980, make possible its present rapid modernization; it has also enabled Saudi Arabia to become one of the world's leading foreign-aid donors.

"The new Arab world is interdependent with America," Dr. Ghazi Algosaibi, Minister of Industry and Electricity, said in a recent speech. "Your industrial way of life . . . will collapse without Arab oil. The independence of the Arab countries in the face of expanding Communism cannot be maintained without your strength and resolve."

In recognition of this interdependence, Saudi Arabia has been willing to sell its oil cheaper than other members of OPEC, the Organization of Petroleum Exporting Countries. It has also been willing to sell more oil than is economically advantageous to its future—a million barrels a day more than the official ceiling. But now the Saudis are worried that they may be getting the worst of the bargain. Sheikh Ahmed Zaki Yamani, Saudi Arabia's Minister of Petroleum, told me over lunch at his villa near the Red Sea in Jiddah: "You think that our oil is in your strategic interests. The Soviets may someday, when they become net oil importers, think that our oil is in their strategic interests. We think that our oil is our exclusive interest. The colonial era is gone forever. We are masters of our own affairs, and we will decide what to do with our oil.

"There is a great amount of bitterness accumulated in the area as a result of the unsettled Palestinian issue. We are patient as Arabs and as Muslims, but I don't know for how long. We do our best to produce what is needed, but how long can we continue?

---

*See "Pilgrimage to Mecca," by Muhammad Abdul-Rauf in the November 1978 NATIONAL GEOGRAPHIC.

†The tumultuous history of the Middle East and its recent economic emergence were traced in John J. Putman's "The Arab World, Inc." in the October 1975 GEOGRAPHIC and in "The Sword and the Sermon" by Thomas J. Abercrombie, July 1972.

"We lose at least seven billion dollars a year in keeping Saudi crude at less than the world market price. And it would be in our national interest to keep the oil in the ground rather than accumulate dollars that depreciate faster than we can invest them."

What the Saudis want most from the U. S., in return for assured supplies of oil, is not dollars but a transfer of technology to enable them to develop their own industrial base, a concerted energy-conservation program, *and* political solutions designed to produce stability in the Middle East. In the forefront is the problem of the Palestinians, which Foreign Minister Prince Saud al-Faisal calls the "Israeli problem."

He told me: "The thing that prevents this being a stable region is the Israelis' occupation of Palestinian and Arab territories and the making of refugees. This has created the turmoil in the Middle East. The United States has a responsibility to resolve the issue with justice, not on the basis of what Israel will accept. Israel cannot continue to refuse to allow Arabs to return to their homes. What is meant by 'the commitment of the U.S.A. to Israel?' Is it a commitment to continued Israeli occupation of Arab lands, or to the fulfillment of human rights and stability in the Middle East?"

AS FOREIGN MINISTER, Prince Saud, son of the late King Faisal, nephew of present King Khalid, brings an intimate knowledge of the West to his diplomatic tasks. Now 39, Prince Saud spent ten years as a student in the United States and was graduated from Princeton University. The prince believes that some Western ways can be usefully adopted within Islamic tradition.

"What happened in Iran was not caused by modernization. The alienation took place because of an effort to impose the trappings of a Western society on a society that wasn't geared to it. Furthermore, in Iran, feudal interests were opposed to modernization, and the cohesive effects of Islam were ignored to bring about development. It didn't work.

"In Saudi Arabia, Islam permeates every aspect of life, in a way not familiar in the West. Islam is based on individual rights and liberties. The separation of the Muslim judicial system from the executive is centuries old. Furthermore, every citizen can personally ask the king and other officials for assistance or redress in the frequent *majlises* [audiences]. Democracy reflects the social structure of Western countries. Our Islamic system reflects ours, and is just as viable and cohesive."

COHESIVENESS, however, became a serious problem on November 20, 1979. Some 50,000 worshipers, celebrating the beginning of Islam's 1,400th year, had gathered at Mecca's Sacred Mosque for the start of *salat al-fajr*, dawn prayers. Suddenly a group of perhaps 350 armed men and their followers burst into the Haram, the mosque that encloses the Kaaba, Islam's most sacred site.

They demanded that one of their number, Muhammad ibn Abdullah al-Qahtani, be declared the *mahdi*, the messiah that some Islamic sects prophesy. The chief imam refused, calling the claim heretical, and shooting broke out. The 26 gates of the Sacred Mosque were shut and bolted; snipers were sent into the seven minarets, and the siege of the Kaaba began. It lasted two weeks, tormented the Muslim world, and shook the ruling House of Saud. As the guardians of Islam's most holy shrines, they took this defiance as a challenge to their temporal as well as spiritual power.

The rebels, led by a religious fanatic, Juhaiman al-Utaibi, held off the army, national guard, and ministry of interior forces, chiefly in the mosque's vast subterranean labyrinth. Aiding their long resistance were the restrictions placed on the armed forces by the *ulama*, the country's leading religious authorities. The Kaaba was not to be damaged nor any of the hostages injured; the rebels were to be taken alive if possible.

The renegades were mostly Saudis, with a smattering of Kuwaitis, Pakistanis, Egyptians, Somalis, Sudanese, Yemenis, and a lone Ethiopian. These heretics believed that the time had come to rid Islam of influences they alleged were corrupting it. They demanded that Shia Muslims, who predominate in Iran, be prohibited from worshiping at the Kaaba. They were also antigovernment and antidevelopment.

Best and biggest *are the standards for modernization projects that include three new jetports. In one at Jiddah* ***(below)*** *separate terminals handle domestic, in foreground, and international traffic. Beyond, work continues on an enormous pavilion of fiberglass tents hung from 150-foot poles* ***(facing page)****, a facility for pilgrims en route to Mecca. Throughout Saudi Arabia, foreign workers—Yemenis and other Arabs, Pakistanis* ***(bottom)****, Koreans, Europeans, and Americans—lend muscle and skilled labor in numbers exceeding the estimated million-man Saudi work force.*

They called for the banning of women's higher education, television, soccer.

When the mosque was retaken, the Kaaba was spared; only three bullets hit it. The rebels fared worse; 63 of them were later beheaded, including their leader, Juhaiman. Their messiah died in battle.

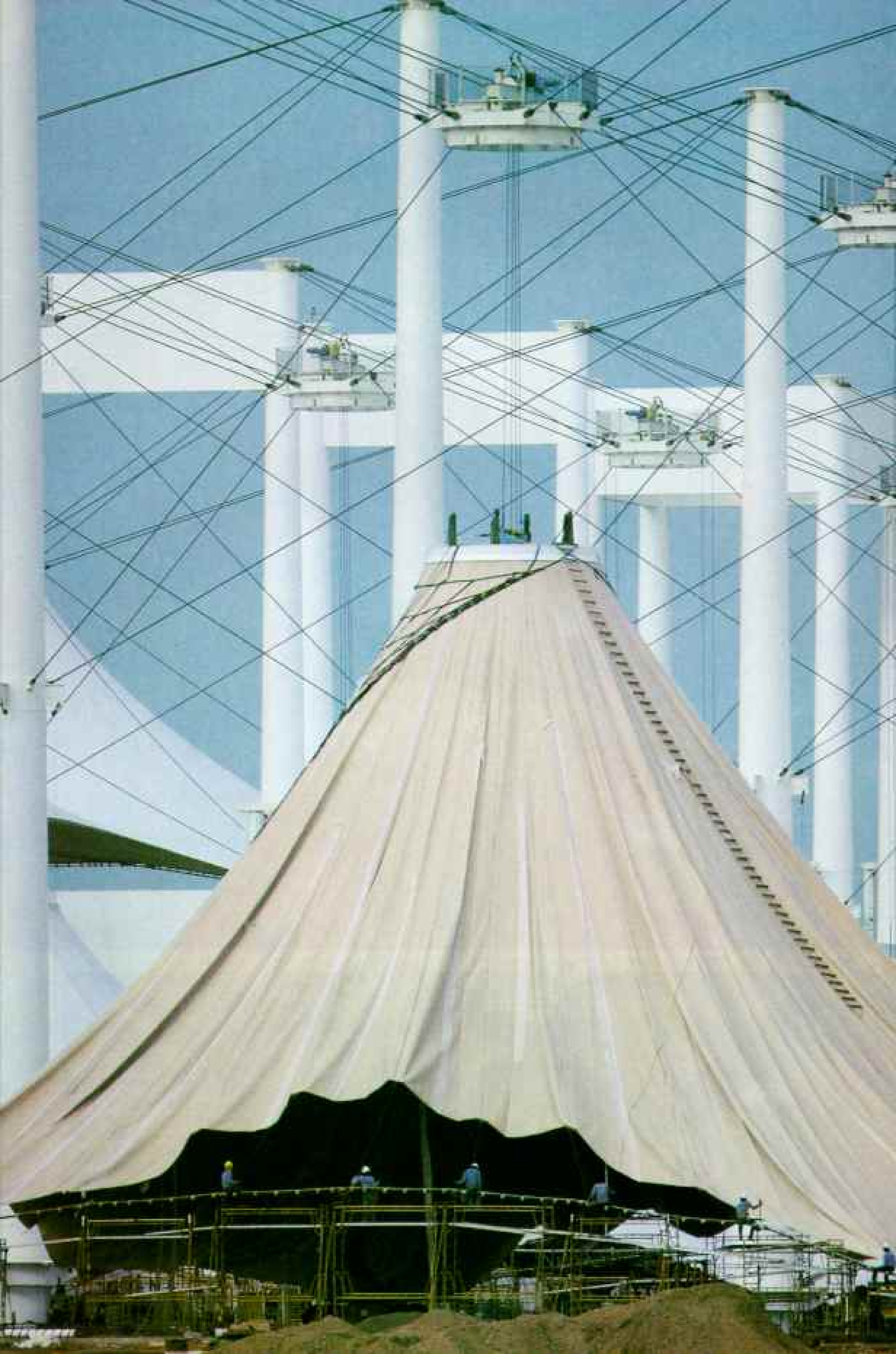
Meanwhile, taking advantage of the government's distraction in Mecca, a group of Shia rioted in Qatif oasis in the Eastern Province. The Shia minority in Saudi Arabia numbers some 200,000 and feels politically isolated. On Ashura, a day of atonement, pious Shia flagellate themselves, and that day, December 1, they spilled out of the area to which their ceremonies were traditionally restricted. Crowds exploited the occasion to express years of pent-up frustration. Chanting praise for Ayatollah Khomeini, they attacked a police station and seized arms. Shots were fired. When it was over, 15 people were dead, a Saudi national guardsman and 14 demonstrators.

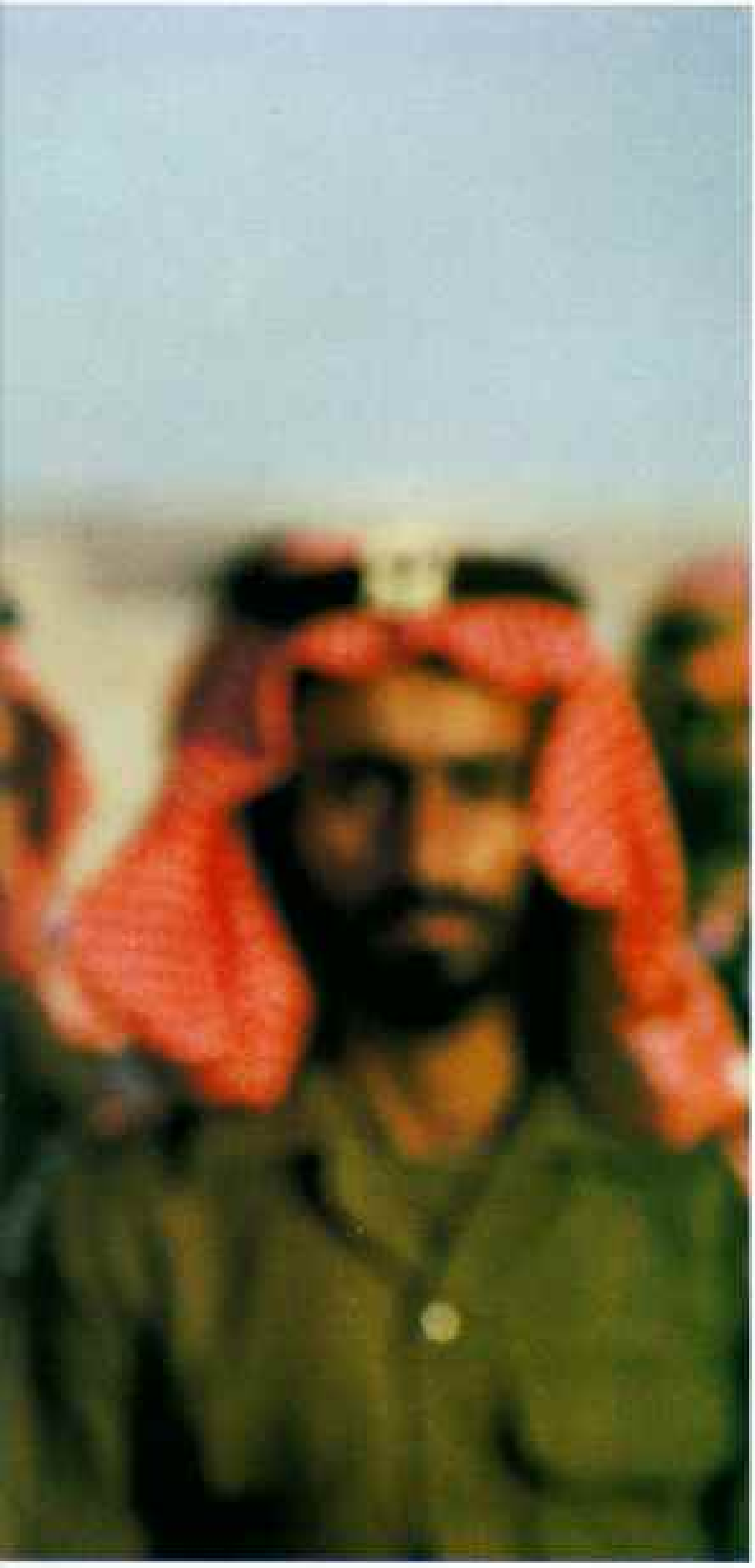
IN FEBRUARY 1980, on the first anniversary of the ayatollah's return to Iran, another demonstration occurred in Qatif. Dozens of cars were burned and two banks were sacked.

Qatif shopkeeper Ali ibn Muhammad told me that perhaps such encounters would make the government aware of the dissatisfaction of many Shia. "Before the time of King Abdulaziz, we Shia were less than slaves. Any Bedouin from any tribe could come and carry off our women, and nothing would be done. After the kingdom was established under King Abdulaziz in 1932, we were given some rights. They said we were equal, but we aren't. We can have schools but we can't teach in them, and we can't work in sensitive government jobs."

All Saudis, whether Shia or Sunni, the prevailing form of Islam in Saudi Arabia, whether from the Eastern Province, from Najd, or from the Hijaz, the mountain-edged western region on which Mecca and Medina lie, are unanimous in recognizing Abdulaziz's ascension to the throne as a turning point in history.

Come, O men of Riyadh,
Here I am
Abdulaziz ibn Abdulrahman—





Crossed swords and a palm, *official emblem of the kingdom, adorn headbands of the Bedouin who make up the national guard* (**above**)*. The 26,000-man force acts independently of the regular military, whose 40,000 members bear primary responsibility for defending the long, empty borders of a nation that holds at least a quarter of earth's oil. The United States supplies most Saudi arms. Americans, both military and civilian, train jet pilots* (**left**)*, and the U. S. Army Corps of Engineers participates in both civil and military projects.*

Of the House of Saud—
Your rightful ruler.

In 1902, with this rallying cry, Abdulaziz, the 21-year-old son of exiled tribal leader Abdulrahman Al Saud, captured Riyadh from the competing Al Rashid family and began a series of conquests that were to unite the warring and squabbling tribes of the Arabian Peninsula and create a nation.

THE STRUGGLE HAD BEGUN about 1745 in ad-Diriyah, a village near Riyadh. There religious scholar Muhammad ibn Abdulwahhab, finding the practice of Islam in Arabia corrupt, vowed to return it to its original precepts: no idols, no saints, no one between man and God.

Muhammad ibn Saud, ancestor of Abdulaziz, the village's impoverished but pious leader, embraced Abdulwahhab's reform movement. By 1806 he or his descendants had subdued pastoral Najd, captured al-Hasa, and conquered Mecca and Medina.

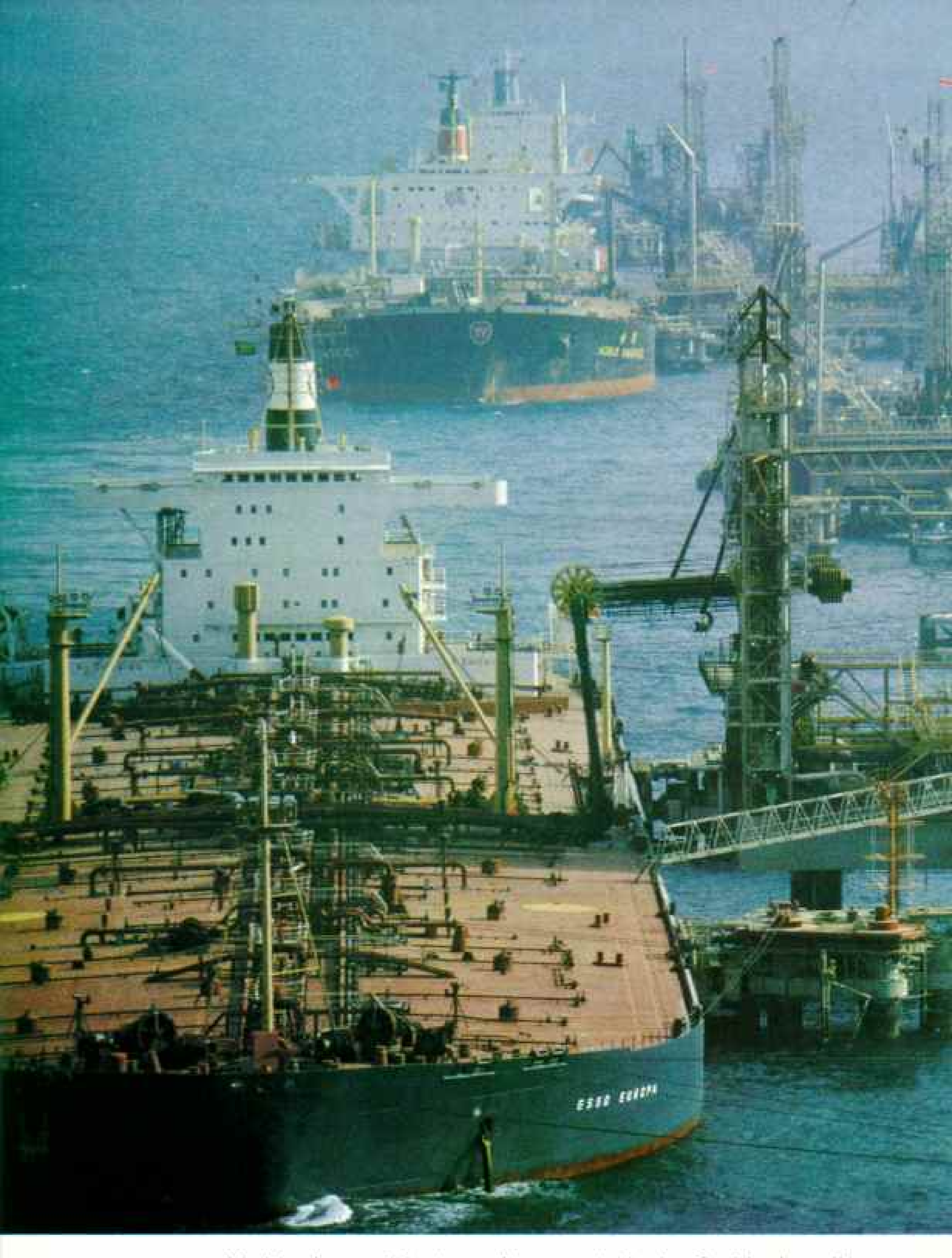
The Ottoman Empire reacted forcibly to this challenge to centuries-long Turkish hegemony over Arabia's Red Sea coast. By 1818, after a seven-year struggle, the Arab forces were scattered and the Al Sauds subdued. Not until Abdulaziz were all the tribes again united. In 1932 Abdulaziz, known in the West as Ibn Saud, declared himself king of the Kingdom of Saudi Arabia.

At his death in 1953, Abdulaziz, who had used the institution of marriage to forge ties between the Al Sauds and other Bedouin tribes, left 34 surviving sons and uncounted dozens of daughters (page 322). Today the Saudi royal family numbers perhaps 4,000 princes and at least as many princesses.

Abdulaziz was succeeded by his eldest son, Saud ibn Abdulaziz, establishing the pattern that continues: The succession passes to the oldest capable surviving son of the nation's first king—not to the current king's son. What happens when all brothers are gone? No one knows.

Both the family and the ulama found King Saud incompetent, dissolute, and wasteful. In 1962 Prince Faisal, the next oldest royal brother, became prime minister and took over the government. In 1964 Faisal replaced Saud as king.

King Faisal brought a new day to his



Maritime heavyweights *in unending succession berth at Sea Island, an offshore supertanker loading facility operated by Aramco, the Arabian American Oil Company. These and other Aramco loading docks clustered along the central Persian Gulf pump most of the kingdom's crude-oil exports, the ultimate source of*

90 percent of its revenue. Government plans call for diversification through construction of petrochemical plants, a steel mill, and other factories at two brand-new industrial cities. Heretofore-unused supplies of natural gas will flow through a pipeline network, now under construction, to power the new industries.

country. A tall, austere man, he returned the throne to fiscal responsibility and moral rectitude, and led the country into its first modernization phase. But in 1975, while receiving petitioners at a majlis, he was assassinated by a deranged nephew.

Crown Prince Khalid, his brother, became king and prime minister, and another brother, Fahd, is now crown prince. As first deputy prime minister, Fahd runs the day-to-day government. Prince Abdullah, the commander of the national guard, is second deputy prime minister.

I TALKED with Prince Fahd, noted for his good humor and patience, at a majlis in the sumptuous al-Maather palace in Riyadh.

"You notice that no one here has much room for protocol," he told me. "I am only Fahd to these men. My brothers are Khalid, Abdullah, Sultan, et cetera. We are all equal

under God, and such men bow to no one."

As we sipped on the traditional three tiny cups of hot and bitter cardamom-flavored green coffee, followed by a cup of sweet mint tea, the crown prince said: "Those people who today speak about our wealth and riches forget that Saudi Arabia once suffered generations of deprivation. They forget also the limitations of our geography—among the harshest on earth. Today we are accelerating attempts to provide our people with a proper standard of living, which they have never had and which you take for granted." He smiled and said, "Come and share our culture. It's dinnertime."

Prince Fahd rose, and with him everyone else. He left the room first and all followed to the dining room, a vast chamber, hung with chandeliers, that could seat about 250.

As we ate, Prince Fahd said: "Look about you. The room is full of ministers, princes, servants,

(Continued on page 314)

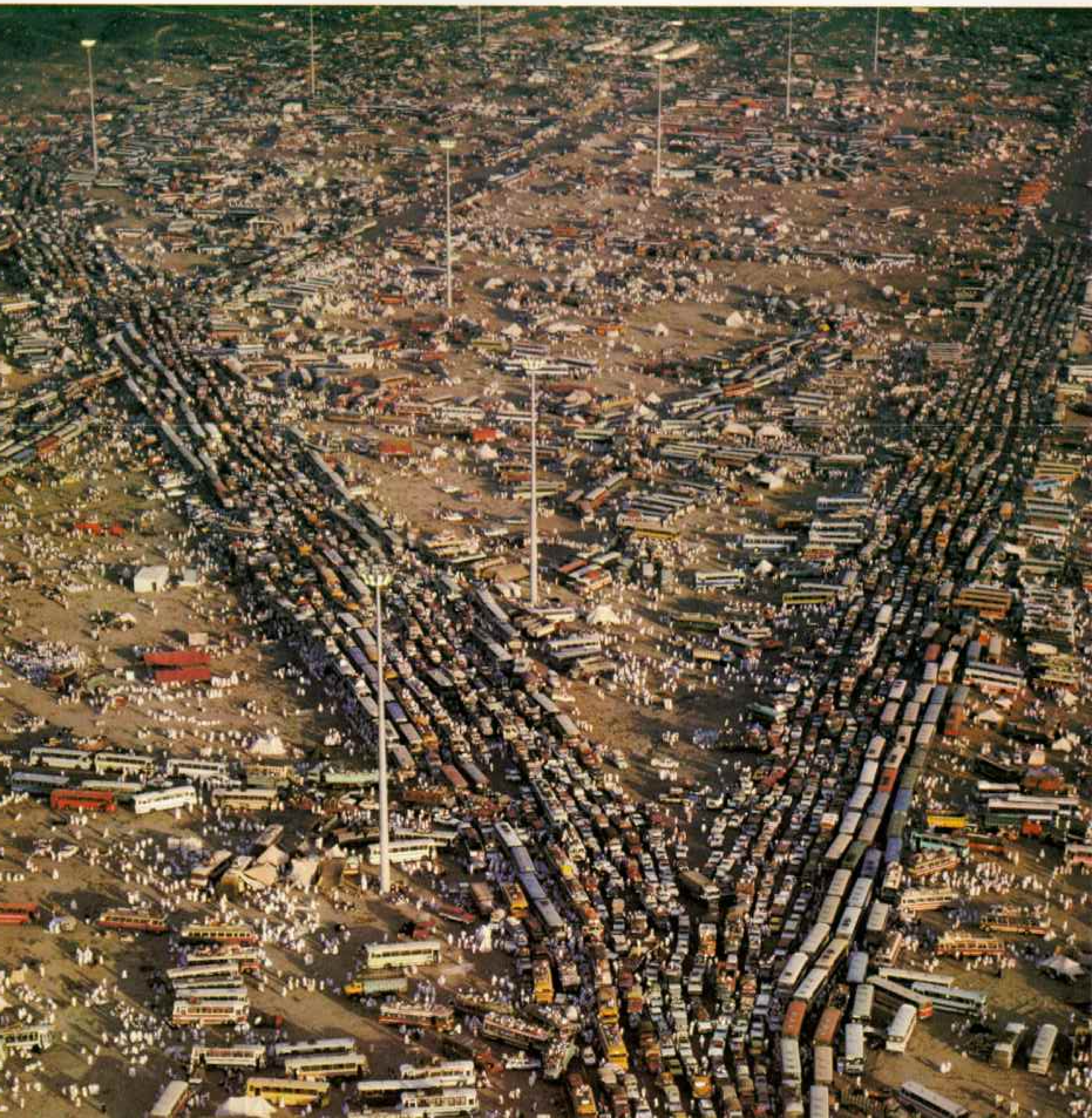
Jet-age geopolitics *whisked oil minister Sheikh Ahmed Zaki Yamani, here seated by the window* (**left**)*, to Jiddah on an Aramco aircraft. Son of a prominent nonroyal Mecca family, the U. S.-educated technocrat shares a quiet moment aboard with his mother* (**above**)*. Since his appointment in 1962, he has influenced and helped carry out policy decisions ranging from the 1973 oil embargo protesting U. S. support for Israel to last year's oil-production increase that helped the West over drastic cuts in Iranian oil exports.*

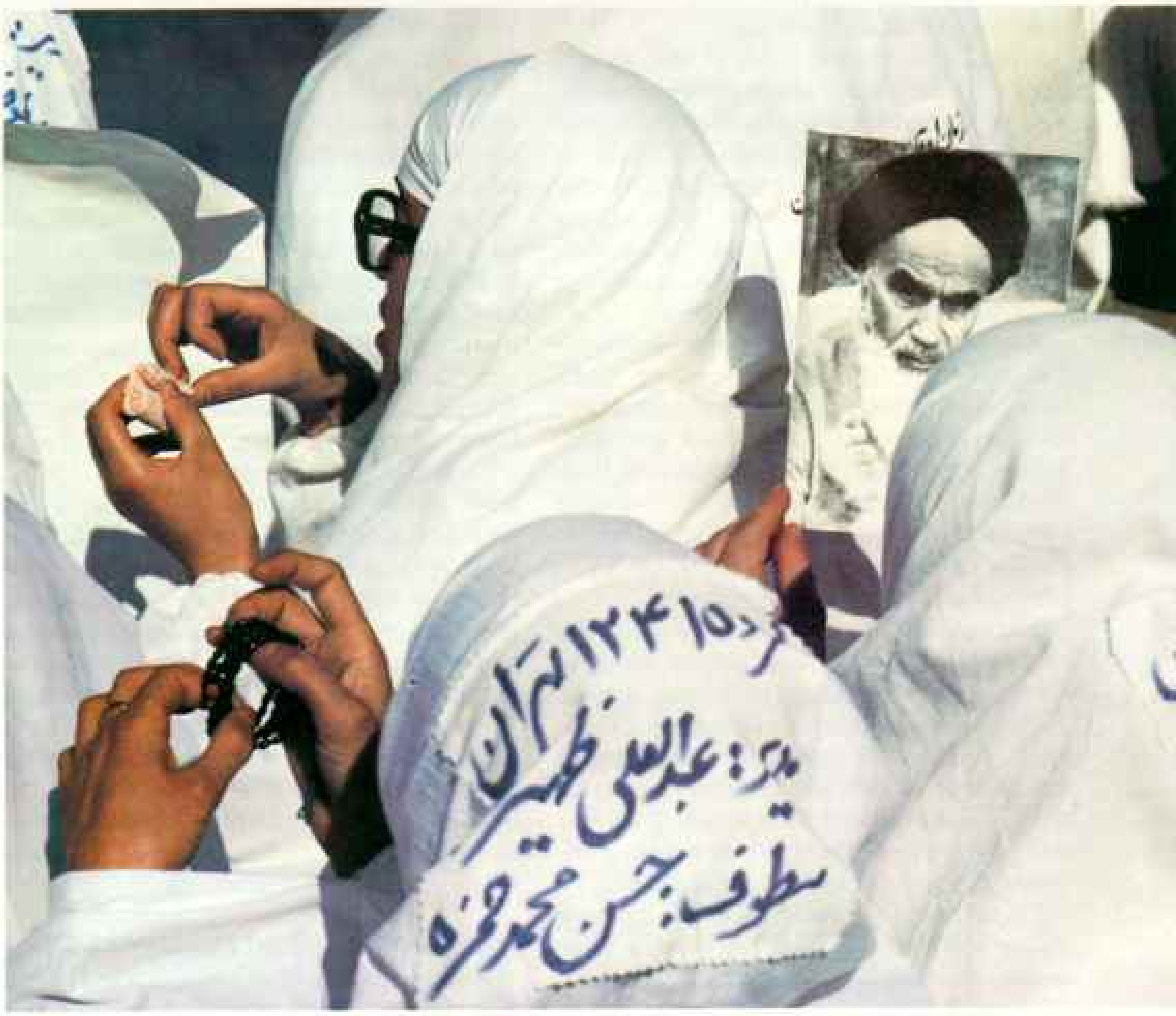
Many-tongued multitude *fills the Plain of Arafat* **(below)** *as a caravan assembles to carry pilgrims from the "standing," an afternoon of prayer, to the next rite of the hajj, or pilgrimage to Mecca.*

One and a half million faithful come each year to the city where Islam was born. As recognized guardians of Islam's two most holy cities, Mecca and Medina, Saudis tend the spiritual hearth for some 800 million believers.

▲

Pick of the desert herds *lope over the sand in the King's Camel Race* **(overleaf)**, *an annual spring event open to all comers. Last year 2,704 entrants eyed the first prize—a purse equal to $15,000, a gold* khanjar, *or dagger, a water-tank truck, and a reputation accruing to the winning camel that makes it a lucrative asset to its owner.*





***Shock waves** ran through the Muslim world on November 20, 1979, when perhaps 350 religious zealots invaded the Sacred Mosque at Mecca, trapping 50,000 worshipers inside. Repair work on the mosque's minarets (**left**) attests to the intensity of fighting that lasted two weeks before Saudi troops ousted the attackers. The zealots proclaimed one of their number as the* mahdi, *a messiah prophesied by some Islamic sects. Saudi Arabia's* ulama, *a body of theologians who oversee the nation's religious life, pronounced them "renegades of Islam." All the attackers were killed or captured; 63 were later beheaded.*

*In the city of Qatif, minority Shia Muslims rioted during religious celebrations that occurred while the siege was under way. Echoes of nearby upheaval had already arrived with Iranian Shia pilgrims who displayed pictures of Ayatollah Khomeini (**above**), injecting a discordant political note into the pilgrimage. Script on headcloths identifies their travel group.*

In reaction to the events, Saudi rulers have sought to limit non-Islamic influences and reestablish policies closer to the puritanical tenets of Wahhabism, a fundamentalist form of Sunni Islam embraced by the majority of Saudis.

(Continued from page 305)

drivers, clerks, businessmen. Whoever is in the palace at mealtime joins us—without exception. It's a tradition that King Abdulaziz started and that we continue."

I next saw Prince Fahd at the annual King's Camel Race, where the king, members of the royal family, Saudi citizens, and an assortment of foreigners gathered to watch 2,704 camels race over a 22-kilometer course (pages 306-308). Here, observing a sport that the Saudis' forefathers delighted in for generations, I began to get a sense of the Arabia that is being left behind.

Arabic music and recitations from the Koran filled the air—but issuing forth from prerecorded cassettes. Bedouin desert dwellers, with falcons on wrists, and silky Saluki hunting dogs seemed less real than their own reflections in the window of a passing Datsun pickup truck. All conveyed a sense of a people passing a culture by—gently, slowly, but sadly passing by.

The majlis, however, is not passing. "Any citizen can approach any ruler asking redress for real or imagined problems," Prince Salman ibn Abdulaziz, Governor of Riyadh, told me. At his majlis, bandoliered guards with automatic weapons and gold *khanjars,* daggers, at their waists lined one side of the room. He dealt with each petitioner slowly and carefully (pages 324-5).

I even heard my escort, Khalid, a young college student, petition Prince Salman for assistance in getting a scholarship to study in the United States. The prince promised to help and turned to me and said: "Seventy-five percent of these petitioners don't need me. They come because they want assurance that if they ever have a major problem, access is assured. The rest have exhausted bureaucratic procedures. They want land, or a bigger home loan, or to get a relative out of jail. We try to help.

"Occasionally someone comes to the majlis only to complain that we're moving too fast. But technology and Islam are not incompatible, as we find in the Holy Koran—the word of God."

Saudis devoutly believe that the answers to all their problems can be found in Islam, either in their holy book, the Koran, or in the Hadith, traditions based on the sayings and deeds of the Prophet Muhammad. The roots of Islam, a word that means submission to the will of God, reach back to Abraham. With his son Ishmael, from whom Arab Muslims claim descent, he built a temple to God in Mecca. But by the seventh century A.D. Mecca, a major center on the trade route between the lands of frankincense and myrrh in the south and the lands of the eastern Mediterranean, had become the center of worship of a pantheon of gods. For the Meccans there was money in polytheism, offering facilities to travelers of many beliefs.

When Allah, through the angel Gabriel, revealed the Koran to the Prophet Muhammad, and with it the strictures of monotheism, the ruling families of Mecca, foremost among them Muhammad's own tribe, Al Quraysh, rose in wrath. In 622, concerned with the loss of income from the pilgrims who came to worship the various gods at the Kaaba, they forced Muhammad and his followers out of Mecca.

The worshipers of the one God, Allah, took refuge in Yathrib (Medina), and this migration, known as the Hegira, was the turning point in the triumph of Islam, and therefore provides the starting date for the lunar Islamic calendar. Today Saudi Arabia defines its primary role as guardian of the holy places of Mecca and Medina and considers itself the spiritual homeland for the world's nearly 800 million Muslims.

ALTHOUGH SPIRITUAL VALUES remain paramount, I was shocked by the temporal effects of high income and rapid development. A watermelon I priced in al-Qasim, the fertile part of desolate Najd, was $16. In perspective, my hotel room at $110 a day and my $5 hamburgers no longer seemed expensive.

Building costs are two and a half times what they are in the United States; almost all materials must be imported. Some 85 percent of the country's food is imported, and basic commodities are subsidized. Perhaps the biggest bargain in the country is gasoline. At 31 cents a gallon, it retails below production costs; imported mineral water, by comparison, costs about five dollars a gallon.

But the average Saudi seems to have the means to acquire luxuries as well as commodities. One day, returning from a journey, I asked my driver, Faraj, if he wanted to rush on home to catch the weekly soccer game on TV.

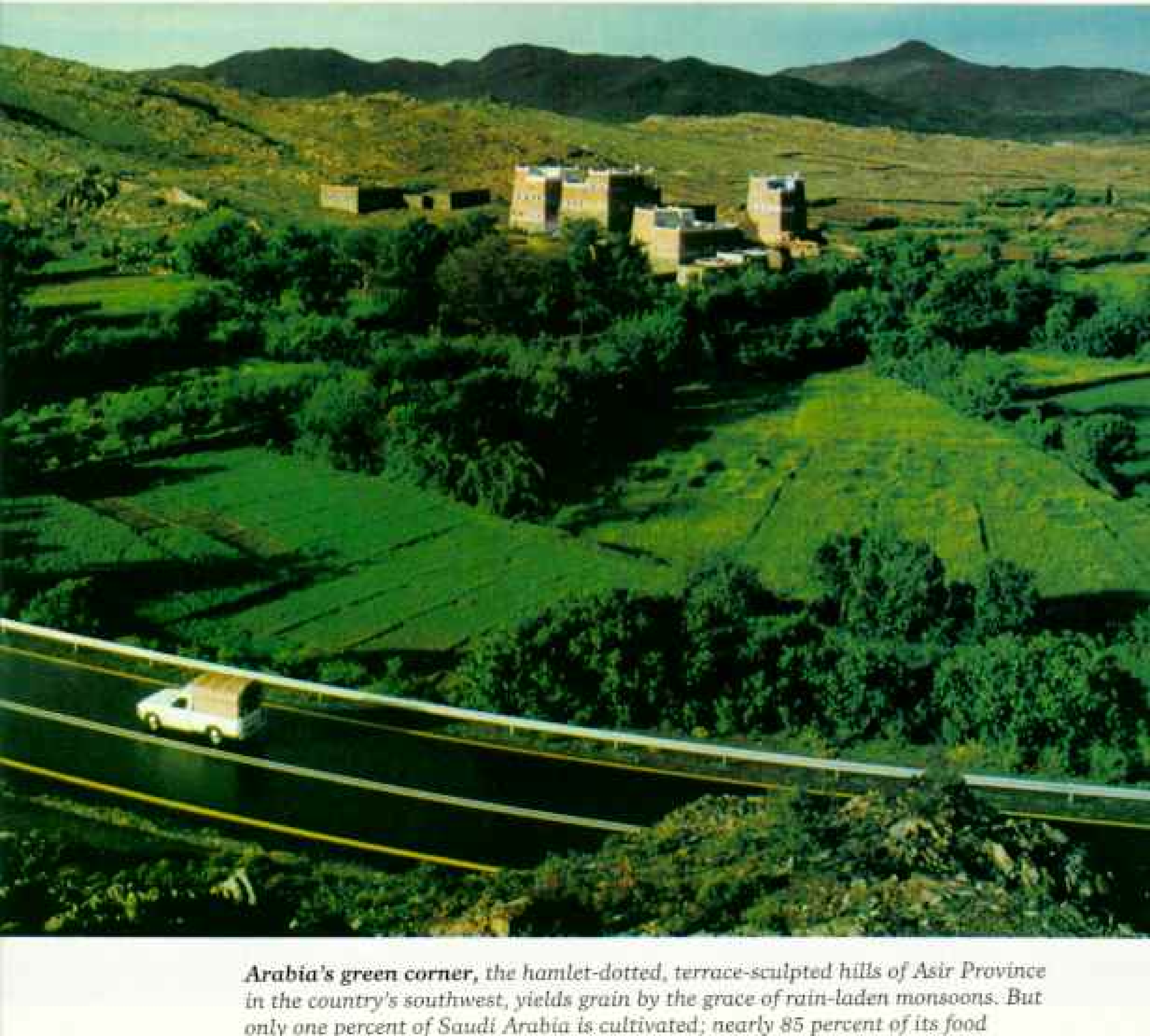
"Oh, no," he laughed. "My wife will make a video recording of it for me."

I couldn't hide my astonished expression; here even drivers have video systems.

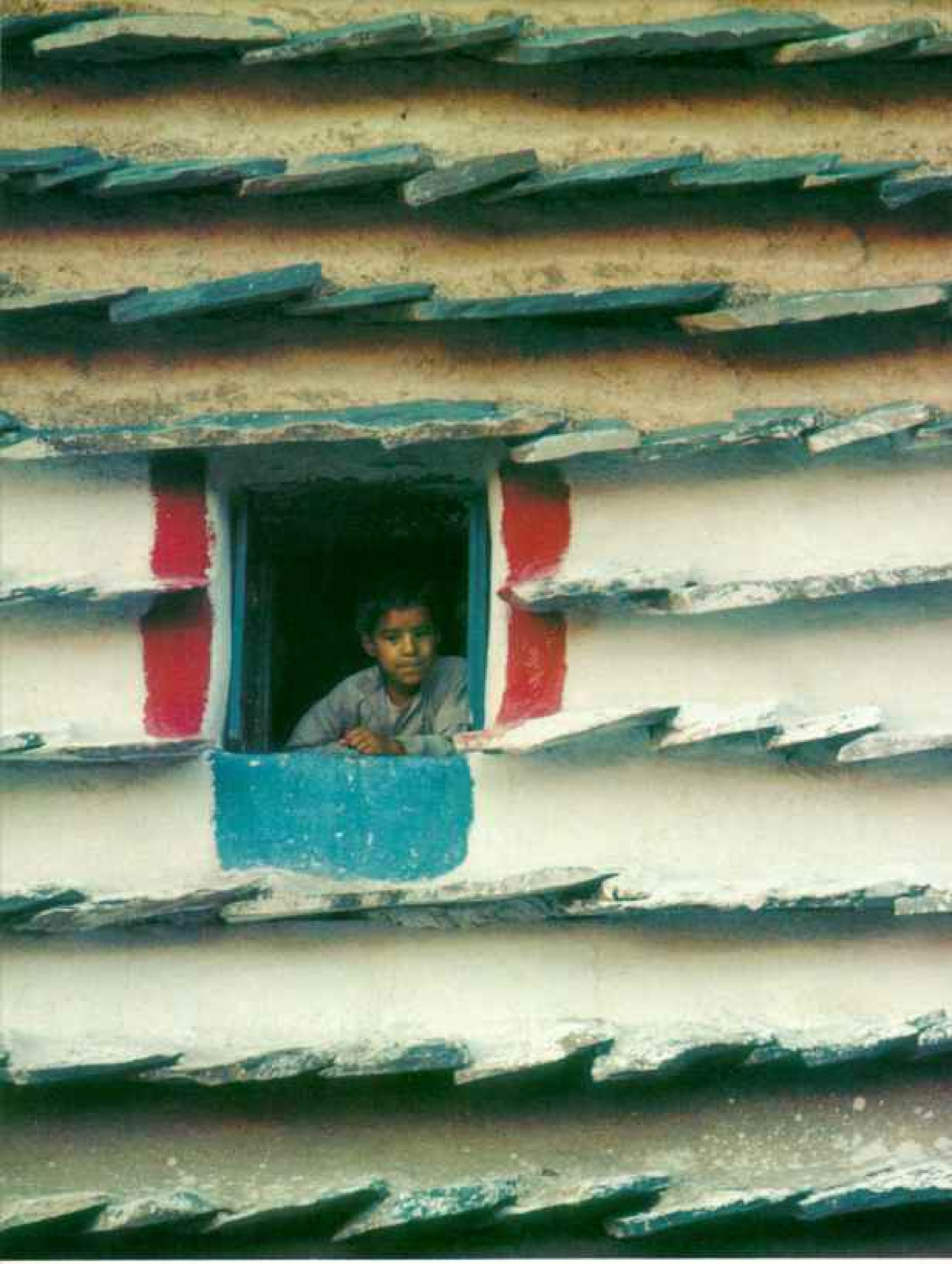
Faraj explained to me, "Nearly everyone who has electricity has a washing machine, air conditioner, television, radio, and in the big cities, video recorders. We are in love with machines."

In a country where video recorders are common, where nearly 20,000 Toyotas, Datsuns, and Mazdas are sold each month, it is obvious that the wealth is filtering through the society.

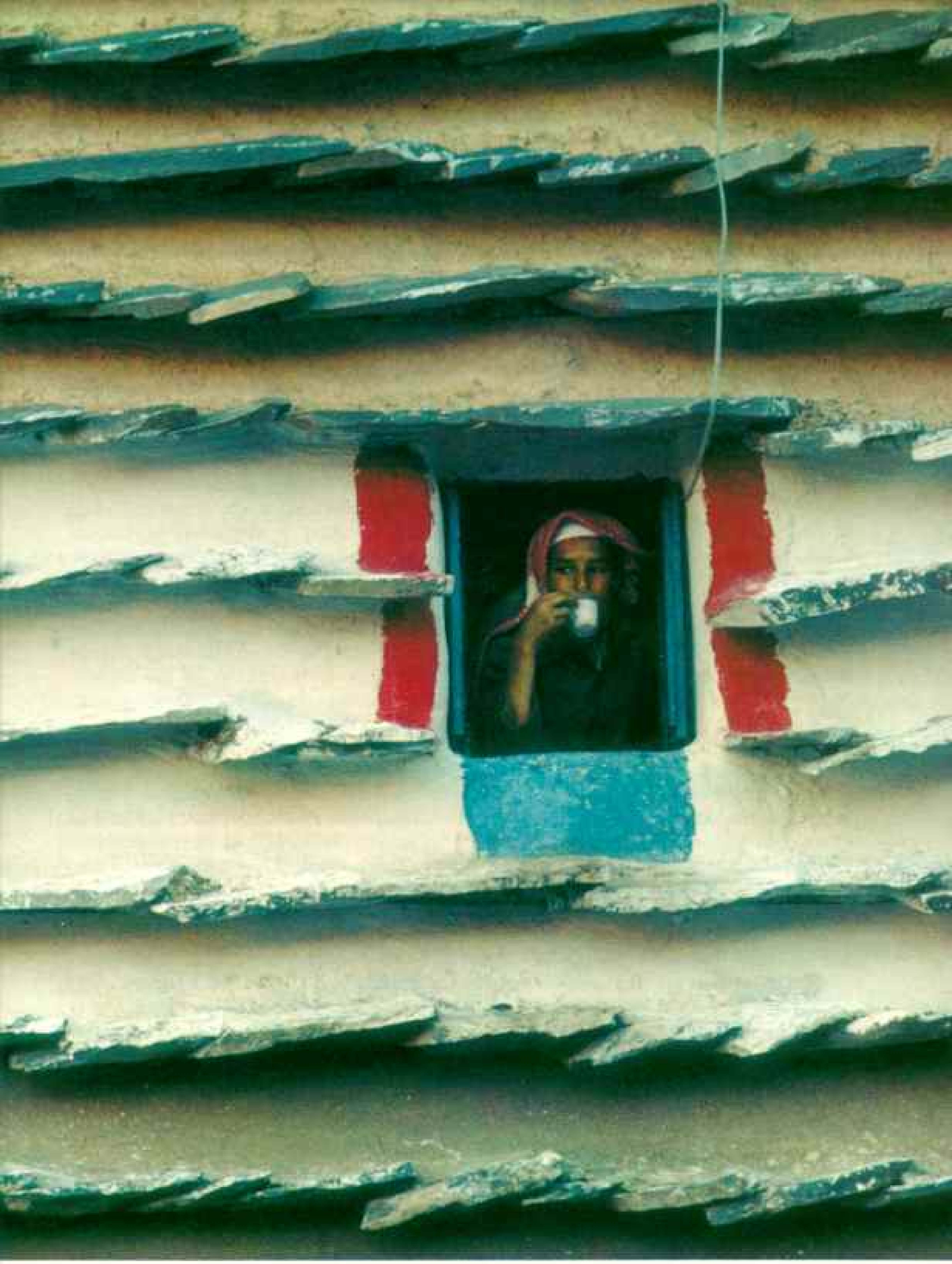
For the millionaires that the oil boom has produced (a tremendous number per capita), the fruits of wealth are abundant. Boutiques of Yves Saint Laurent in Jiddah and Christian Dior in Riyadh sold out their initial high-fashion consignments in a matter of weeks. Architects, interior designers, jewelers, ballet teachers, and backgammon instructors all find the new Saudi Arabia a land of opportunity.



Arabia's green corner, *the hamlet-dotted, terrace-sculpted hills of Asir Province in the country's southwest, yields grain by the grace of rain-laden monsoons. But only one percent of Saudi Arabia is cultivated; nearly 85 percent of its food must be imported. Hopes for the area's development into a prime gulf resort will be bolstered with completion this year of nearby Asir Kingdom Park facilities.*



Time-honored and practical, *the layered architecture typical of Asir Province is counterpointed by a television antenna wire. Slate shelves deflect rain from the*



adobe walls. This is wet country by Saudi standards. Rainfall averages about 20 inches a year, compared to a nationwide average of four inches.

THOUGH WOMEN SHARE in Saudi Arabia's economic gains primarily through their husbands, they still live in a world apart. When Sheikh Saleh Kamel recently started Arabia's first mass-transit system, he installed partitions in his buses to create separate seating areas for women. "Out of the first 230,000 passengers in Riyadh we had 2,000 women," Sheikh Saleh said. "It was strange for women to use buses, stranger for men to think that their wives or daughters could take buses. We ran advertisements warning women that if they didn't use this privilege, we'd convert the space for men. Now, out of nine million passengers we've carried so far, 500,000 have been women."

The dilemma of working women is a major one. A potential 50 percent of the native work force is barely utilized, while foreign workers fill even sensitive government positions. Saudi women are not allowed to work where they might come into contact with strange men. Universities graduate thousands of women with skills that go unused. Officially, women may work only in education, nursing, and welfare.

The recent opening of women's banks caused much controversy, as well as a deluge of work applications from Saudi women. "We will take only Saudi women," said Madawi al-Hassoun, the manager of the women's branch of Al Rajhi Company for Currency, Exchange and Commerce, exclusively run for women by women. "They've waited too long for this opportunity," she explained. "If this venture works, perhaps other fields can be entered.

"Islam has always held that a woman controls her own wealth, even after marriage, though there was no way for her to exercise this freedom. Now there's no excuse."

In marriage, women are already finding ways to exercise their freedom. Increasingly, wives leave husbands if they feel they are being treated poorly or without respect. Some women even choose not to marry.

"It used to be that almost any amount of suffering was preferable to being a divorced or unmarried woman," Jawhara al-Ankari, director of Jamia al-Faisaliya, a women's welfare society in Jiddah, said. "A new wife now often demands a separate residence for herself and her husband, rather than living, as couples did in the past, with the husband's family."

Women are also coming to expect education. Educator Fatma Mandily told me: "I was the first woman in Saudi Arabia to graduate from the University of Riyadh. I had married at 16 and had children. I was graduated as a married woman. Imagine that, in Saudi Arabia!"

Dr. Mandily went on to get her master's and Ph.D. degrees abroad and today is a prime example of what can be achieved within the system. "Women expect things today that their mothers didn't expect; but many men still expect to be treated the way their fathers were treated by their mothers. Real change will come when both men and women have adjusted to the new realities."

Cecile Rouchdy is the American- and French-educated headmistress of Dar-el-Hanan, the first and best girls' school in the kingdom (page 326), started 24 years ago by Queen Iffat, King Faisal's wife. "Perhaps we're not able to do all we would like, but we're producing young, thinking women who will be ready to work for the country when the time comes," Mme Rouchdy said. "You can't imagine how far we've come.

"What a change! Before, these girls would have learned mostly through memorization and rote, and studied only religion. Today, with emphasis on contemporary subjects as well as on religion, we find the change here is not generational, but exponential. These girls are being taught to think, analyze."

Princess Sara al-Faisal, daughter of King Faisal and Queen Iffat, has worked quietly but strongly for women. "When I asked my father if I could start the first welfare society for women, an-Nahda al-Khayriyah, nearly 20 years ago, one of the conditions was that I do it without any attention or publicity. I think, after all these years, I can speak out now," she told me, in granting her first-ever interview.

"The society was formed to improve the quality of life for our women by changing age-old habits and customs—changes that would not conflict with Islam, such as adult literacy classes, vocational skills, day-care centers, and hygiene clinics.

"The biggest step here was education. All other steps are smaller now. Don't ask me about veils. To veil or not to veil is not the question. It's a matter of tradition and priorities. Is it so worth fighting for that we risk losing the gains already made?"

Saudi women undoubtedly still have a way to go, but their gains in the last two decades are impressive.

I WAS IMPRESSED with gains being made in other directions when I flew to the Asir, the mountainous southwest province of the kingdom. The Asir is practically a garden (page 315). Rising from the Tihamah, the narrow coastal plain along the Red Sea coast, it is affected by southern tropical zones and has refreshing rains year round—a sharp contrast to the interior, especially to the Rub al-Khali, where several years may pass without rainfall.

"I bet you didn't expect to see 10,000-foot mountains, green plains, and baboons in Saudi Arabia," Prince Khalid al-Faisal, Governor of Asir Province, said as he greeted me laughingly.

The tall, Oxford-educated prince, son of the late King Faisal, is also a noted Arab poet and head of the 500-million-dollar philanthropic King Faisal Foundation. "Our problems here are unique," he told me. "The question is not money—it's how to spend it. The people of the Asir hesitated at first; they didn't understand what kind of change was possible. Now we have jobs, schools, hospitals, roads, color television—we're even building a national park. We are trying to compress into a generation or two the gains that have been made in the West since the industrial revolution."

These projects are nurtured by the money from oil sales. Muhammad Aba al-Khail, the Minister of Finance and National Economy, told me, "All the money comes to the government, and the government decides how to spend it on the basis of the social needs of the kingdom."

Minister of Planning Hisham Nazer, in consultation with other members of the government, is trying to decide how to spend 236 billion dollars over the next five years—an amount that excludes defense expenditures. "The people receive roads, schools, free health care; domestic telephone, electricity, water, gasoline, and domestic air travel are subsidized. As long as you are a Saudi, you get free land to build on, and, to build, you can borrow at no interest up to $90,000 and pay back only 80 percent. More than 140,000 of these loans have been granted. A special fund even exists for distress cases—medical bills, wedding costs, and things of that nature.

"However," Sheikh Hisham said, "we shouldn't give people the impression that they will always get handouts. The government will provide the essentials. Beyond that, the good life must be the prize that the individual's own work generates."

Many of the individuals trying to generate the good life through work are foreigners, who are eligible for some, but not all, Saudi social benefits. There are perhaps a million and a half foreigners in Saudi Arabia: approximately a million Arabs, 400,000 Asians, and 100,000 Westerners. This is a serious burden on an underpopulated country concerned about security and trying to maintain the traditions of a small, insular society. Construction sites are often literally Towers of Babel, and sometimes jobs have come to a standstill when essential workers have been unable to communicate.

THERE ARE 35,000 Americans in Saudi Arabia, 13,000 at Aramco alone—4,000 employees and 9,000 dependents. Aramco, the Arabian American Oil Company, initially a consortium of American oil companies, is now controlled, and its oil assets 60 percent owned, by the Saudi Government. Full Saudi ownership is expected in the future.

Aramco arranged for me to travel to the Empty Quarter—empty still except for drillers and seismic crews looking for yet more oil wealth. I landed there with Mickey Berry, Aramco's supervisor of drilling in the area, a vast region of shifting sand dunes drifting with the winds across the *sabkhah*, the salt plain (pages 288-9).

At a rig at Ramlah, set up at the base of a 500-foot sand dune, Mickey told me: "We're trying to define the width of a 25-mile-long oil field we've found here. Anywhere else this would be a big field, but in Saudi Arabia it's only normal. The Ghawar field, the largest in the world, would extend from Los Angeles to San Diego, California, from the Pacific coast inland for 15 miles."

Besides

(Continued on page 327)

كرتسوك ايبليو ١٩٧٩
كانو - ايطاليا

A gift of falcons *to King Khalid, left, seated next to Prince Sultan, the nation's minister of defense and aviation, marked the visit of the United Arab Emirates' oil*

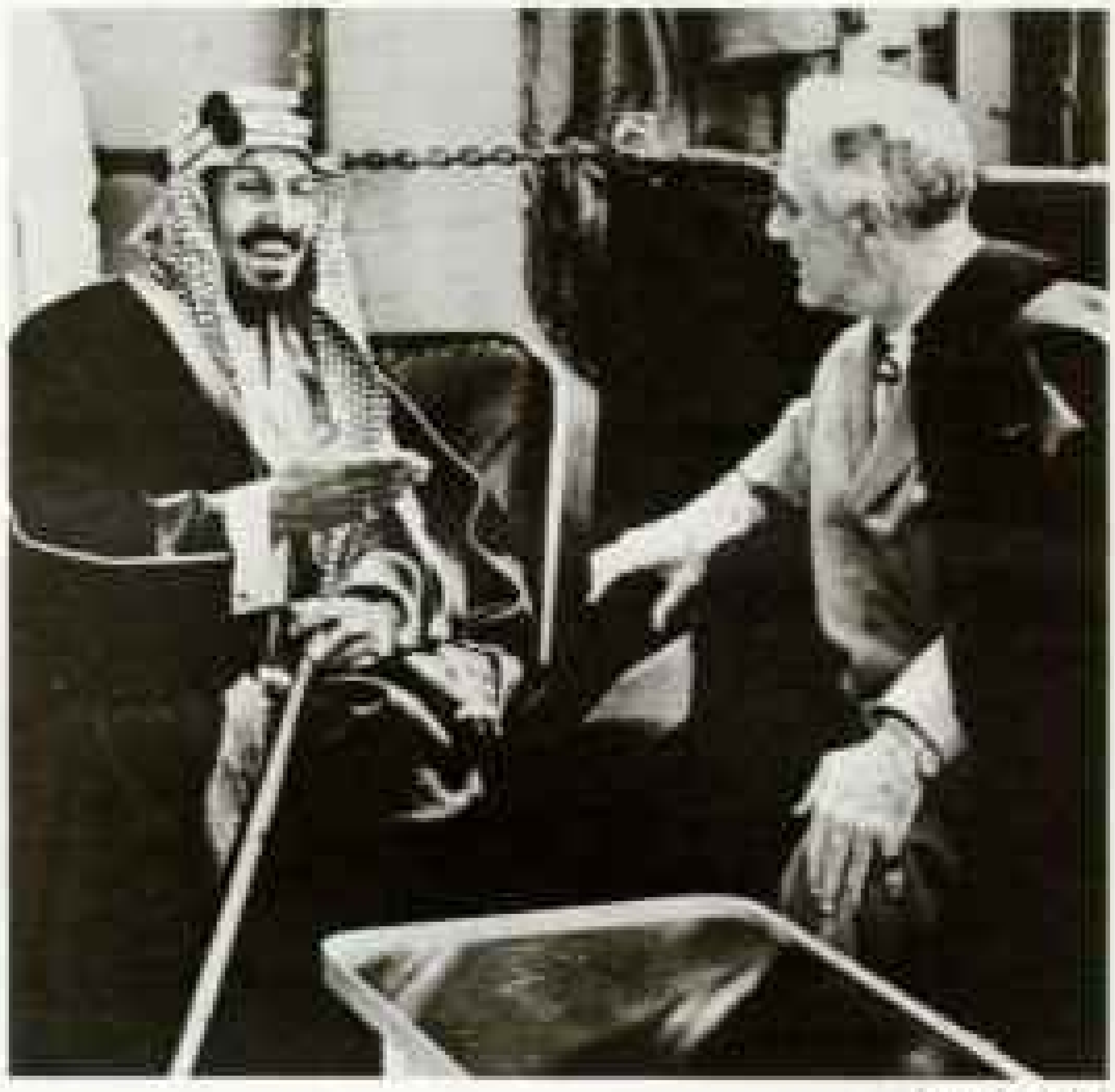
minister. Though the king rules by consensus with almost absolute authority, day-to-day administration rests with Crown Prince Fahd, his half brother.

KING ABDULAZIZ AL SAUD

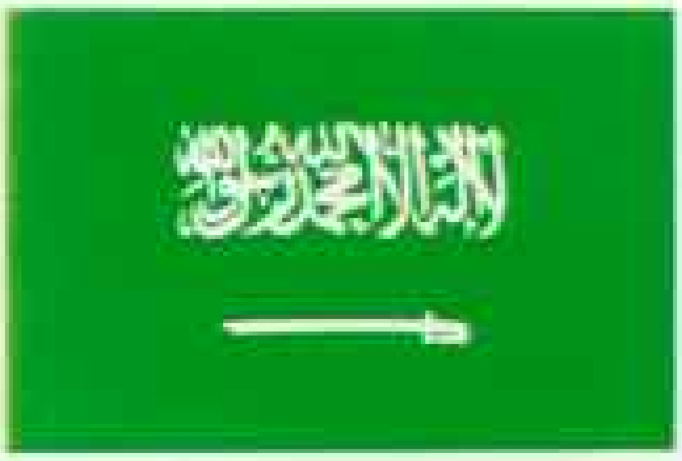
BORN 1880; REIGNED 1932–53; DIED 1953

***The royal family tree** of modern Saudi Arabia is rooted in the legacy of King Abdulaziz Al Saud, who won the allegiance of rival desert tribes, married into them to reinforce the bond, and founded the Kingdom of Saudi Arabia in 1932. His numerous wives produced a procession of kings and princes, many of whom rose high in government service (**below**). In 1945, on President Franklin D. Roosevelt's return from Yalta, the two met aboard the U.S.S.* Augusta *(**right**).*

Born 1902; reigned 1953–64; died 1969	**KING SAUD**
Born 1906; reigned 1964–75; assassinated 1975; father of SAUD, Foreign Minister; KHALID, Governor of Asir; BANDER, Air Force major	**KING FAISAL**
Oldest living son; b. 1910	MUHAMMAD
King since 1975; b. 1912	**KING KHALID**
Crown Prince, First Deputy Prime Minister; b. 1920	FAHD
Second Deputy Prime Minister, Commander of National Guard; b. 1923	ABDULLAH
Minister of Defense and Aviation; b. 1924	SULTAN
Governor of Medina; b. 1925	ABDULMUHSIN
Minister of Public Works and Housing; b. 1928	MITIB
Deputy Commander of National Guard; b. 1933	BADR
Minister of Interior; b. 1933	NAIF
Governor of Qasim; b. 1935	ABDULELLAH
Governor of Mecca; b. 1935	MAJID
Governor of Riyadh; b. 1936	SALMAN
Vice Minister of Interior; b. 1937	AHMED
Governor of Tabuk; b. 1940	ABDULMUJEED
Vice Governor of Riyadh; b. 1943	SATTAM
Governor of Hail; b. 1943	MUQRIN



NEW YORK TIMES


لا إله إلا الله محمد رسول الله

Saudi Arabia

"THERE is no god but God; Muhammad is the messenger of God," proclaims the Saudi flag. A sword of righteousness underscores the Islamic creed as well as the evolution of a country born from the union of ideology and military force. The alliance was forged in the mid-18th century when an emir, Muhammad ibn Saud, joined fundamentalist Muhammad ibn Abdulwahhab and conquered central Arabia. By 1818, the Ottoman Empire halted the expansion . . . temporarily. In 1902 Abdulaziz captured Riyadh, reinstated the Al Sauds to leadership, and paved the way to unification.

The history of Saudi Arabia is thus the history of the House of Saud. If it is acceptable to the family, rule passes to the oldest surviving son of Abdulaziz. Crown Prince Fahd (**below,** with son Abdulaziz) will succeed King Khalid.

Religion and government remain interlocked. The Koran stands as constitution, and the ulama is always consulted about major domestic decisions.

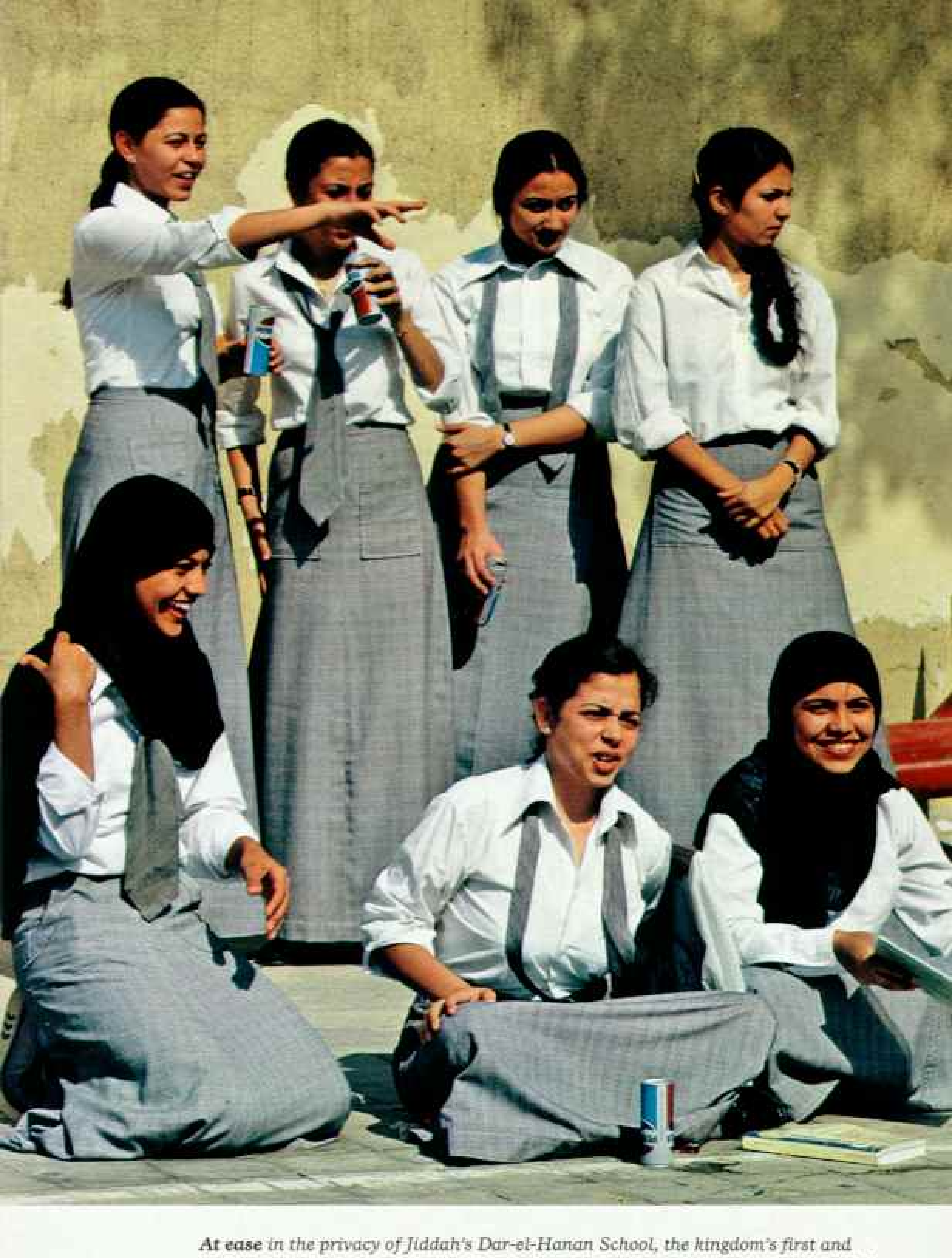
AREA: 830,000 square miles. **POPULATION:** Saudis estimate nearly 8,000,000. **RELIGION:** Muslim. **LANGUAGE:** Arabic. **ECONOMY:** Oil, oil products, gas. **MAJOR CITIES:** Riyadh, capital (pop. 1,000,000); Jiddah (pop. 1,000,000); Mecca (pop. 425,000).

The prince and the people *meet at a majlis, or audience, held here by Prince Salman, Governor of Riyadh. A petitioner whispers a request, while a guard holds a sheaf of written ones.*

All majlises, open to any person, spring from tribal custom and are held several times a week by members of the royal family and their representatives. Complaints, requests for aid, or adjudication may be acted on or referred to proper authorities. Formality bows to the edict that all men are equal under the Koran, and the prince is addressed by his first name.

Such openness spelled tragedy for King Khalid's predecessor, King Faisal, assassinated at a majlis in 1975 when a deranged nephew approached, bent to kiss the king, and drew a gun from his robes.

Yet the tradition continues; petitioners approach unsearched. "It is a system based on trust," says the author.



At ease *in the privacy of Jiddah's Dar-el-Hanan School, the kingdom's first and leading girls' educational institution, students go without the veils worn in public by most women older than 12. Nearly half a million Saudi girls now study in single-sex schools supervised by the ulama. Forty thousand are expected to earn college degrees in the next five years, but employment must still exclude contact with men.*

(Continued from page 319)

exporting oil, Saudi Arabia has now enjoined Aramco to implement a gas-gathering project costing more than 15 billion dollars. The gas, which often comes to the surface with oil, instead of being flared off as in the past, will be piped to new industrial cities at Yanbu and al-Jubayl, being built to accommodate tens of thousands of workers.

There is a feeling in some quarters that Western consultants may have encouraged this project with the thought that the more Saudi Arabia depended on natural gas for domestic use, the more it would need to produce huge amounts of oil to get the associated gas. All that has changed. "The Saudis have instructed us to look for more nonassociated gas—and soon!" an Aramco officer told me. "They don't want to be forced to produce as much oil as the West wants in order to get the gas they need."

One unhappy by-product of oil wealth has been incidences of fast dealing and corruption. In the past it was expected that those negotiating contracts would take a bit off the top. When such commission taking got out of hand, the government limited commissions to 5 percent on all contracts except those involving weaponry; no commission is allowed on arms sales. But 5 percent of billions of dollars is big money. A recent press report alleged that a member of the royal family may have received a commission of 100 million dollars on a single contract.

Reports, widely disseminated in the foreign press, have linked major international corporations with alleged wrongdoing in Saudi Arabia. An employee of a Korean company, Hyundai Construction, was sentenced to 30 months in jail for trying to bribe a Saudi official with eight million dollars *in cash*. The company was fined 90.9 million dollars and suspended from doing new business in Saudi Arabia for two years. Saudi oil shipments of 100,000 barrels a day to ENI, the national Italian oil company, were suspended after allegations that payoffs were being made to Saudi and Italian officials.

But much of the Saudi populace fears that attempts to eliminate corruption will not reach high enough. They ask, can the royal family and officials control themselves? There are signs that the family realizes how demoralizing corruption can be to a developing country. In fact, few in the royal family are ever touched by scandal.

AT 7:30 ONE MORNING I went to the Ministry of Defense to meet Maj. Bander al-Faisal. A son of King Faisal, he is a former fighter pilot who now serves on the Saudi joint commission for services coordination. He arrived promptly, driving a white Volkswagen Rabbit. My image of princely behavior shaken, I joined him in his office for coffee.

"King Faisal taught us to be humble. When I was graduated from our national Air Academy, the other students became first lieutenants. I was a second lieutenant on order from my father!

"There is no long military tradition in Saudi Arabia, but today our military needs are great. We have so much to defend, and so little to do it with. We started with nothing, so perhaps 75 percent of our military spending is on infrastructure: roads, housing, cantonments, airfields."

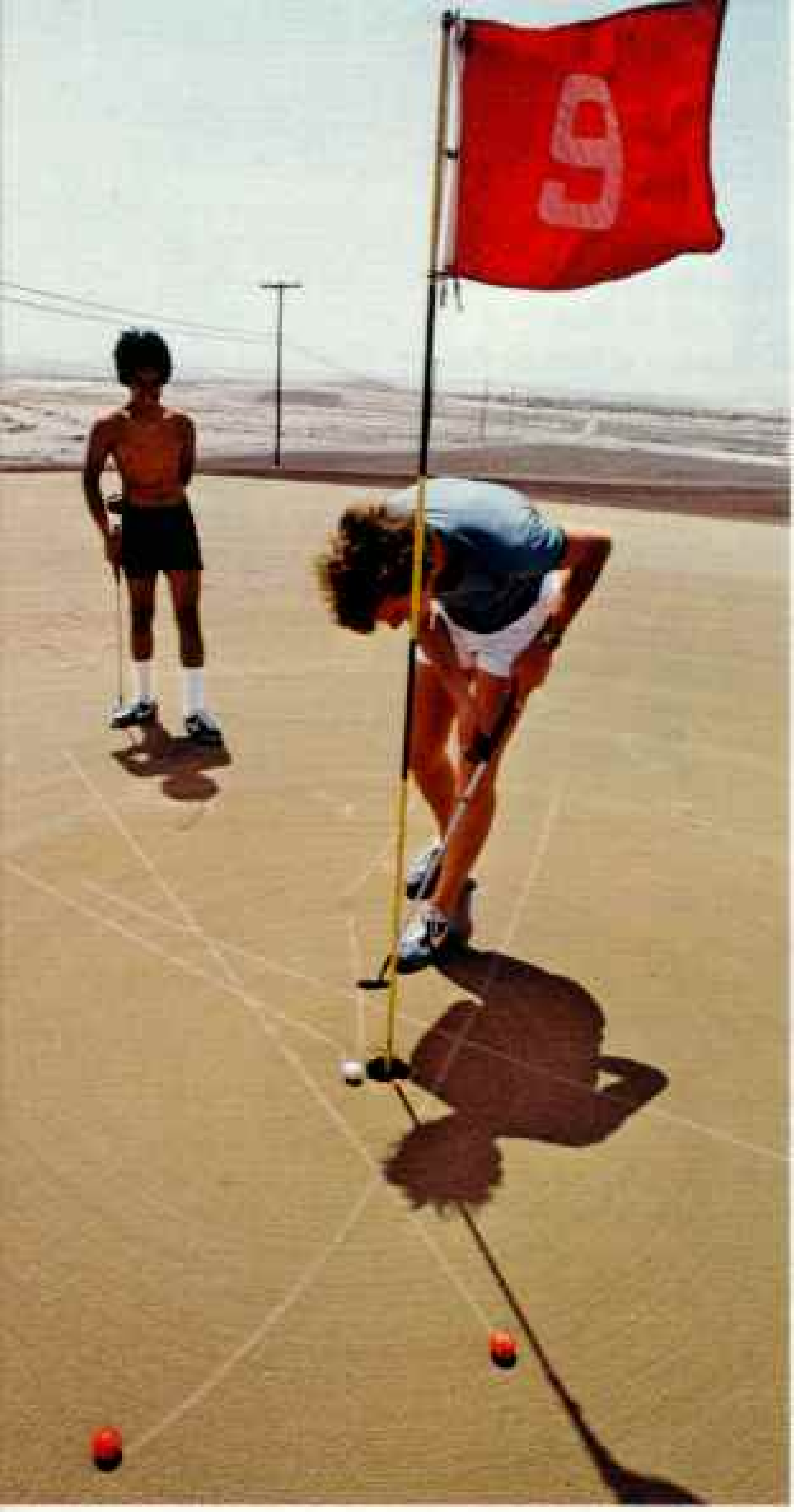
The Saudis are now spending about 15 billion dollars a year on defense, much of it in the U. S. for training and equipment. But the armed forces, with 40,000 men, and the national guard, with 26,000, are shorthanded and poorly equipped to protect the nation's vital pipelines and its 4,400 miles of border if a conflict developed.

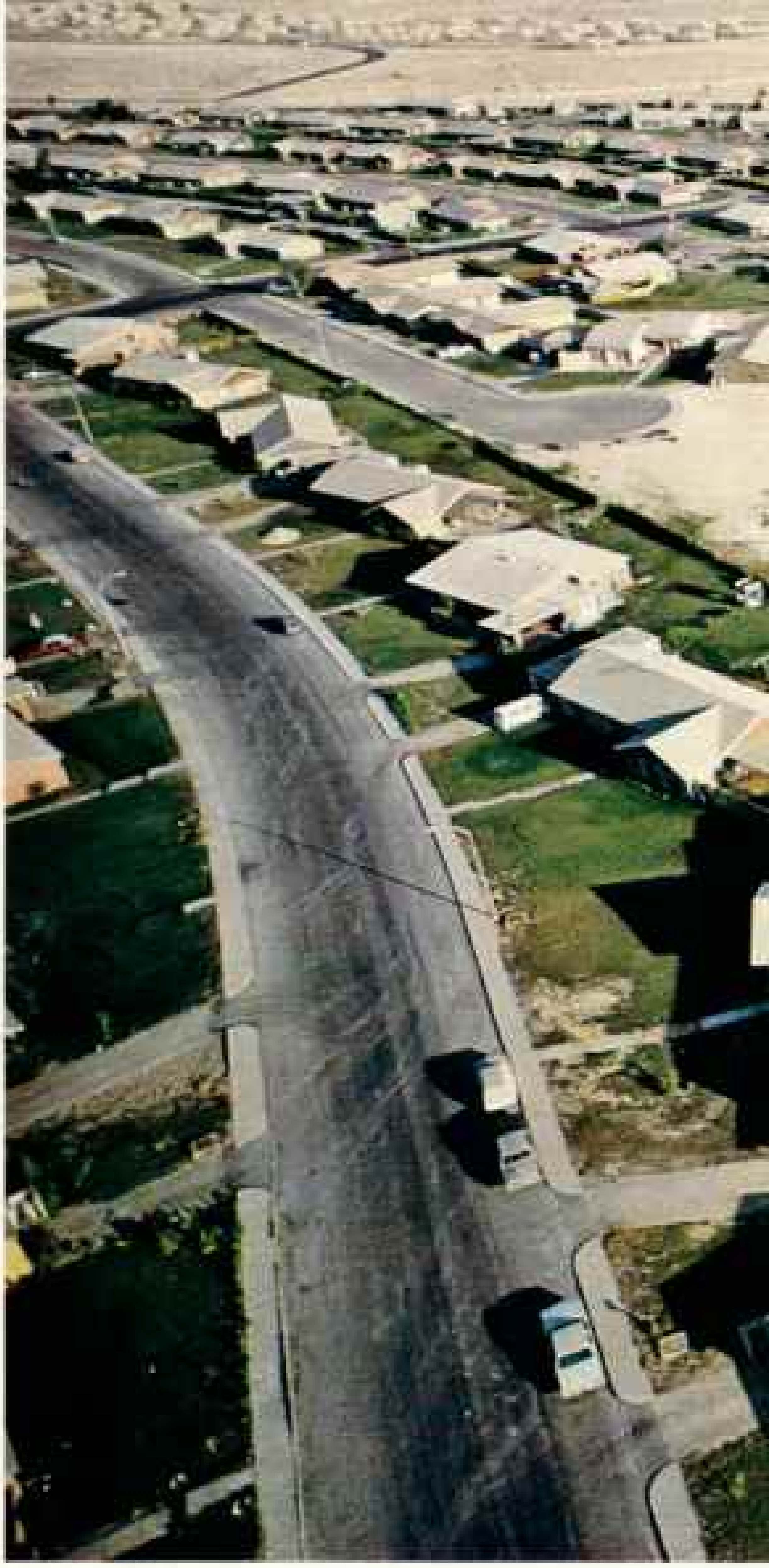
For now, fervor must compensate for capability. During the siege of Mecca, 26 armored national guard personnel carriers were dispatched from Riyadh by airlift. As they left camp, the roads were lined with their compatriots, weeping because they had not been chosen to fight and die in defense of Islam's most holy site.

Within 24 hours of the outbreak of violence in Mecca, thousands of men, some of them octogenarians carrying vintage World War I weapons, reported for duty to various Saudi Arabian national guard bases.

"Laws here against going AWOL—absent without leave—are not always enforced. Guardsmen often just show up when needed," an American officer told me.

A debate on upgrading Saudi Arabia's military capability is presently taking place. Behind all strategic considerations, however, lie the realities that while the kingdom may, in the future, be able to protect itself





Town that oil built, *the Aramco community at Dhahran serves as the company's administrative center and home for the families of many of its 4,000 American and 22,000 Saudi employees. The executive housing district* (**above right**) *breathes an air of suburban America, and staffers can shoot a round on a company golf course where greens are "browns"—smooth-packed oiled-sand surfaces* (**above**). *Employees' children* (**right**) *benefit from Aramco-provided medical care, and many study at company-built elementary and intermediate schools. As the literacy rate increases, so too do the numbers of educated Saudis who fill the nation's growing bureaucracy.*

American involvement began in 1933, when King Abdulaziz signed the first oil concession with Socal, Standard Oil Company of California. In 1938 a major strike near present-day Dhahran presaged a string of discoveries, including the world's largest onshore and offshore oil fields. The Aramco consortium, owned by Socal, Exxon, Texaco, and Mobil, grew into the world's leading oil-producing company. The Saudi Government has moved toward ownership of Aramco's producing facilities since 1973, but the American connection will continue with Aramco participation in operations.

against internal unrest and small external conflicts, it will be unable to defend itself against powers such as the Soviet Union or a potentially dangerous united Yemen.

The Saudis, who by the nature of their religion are conservative and deeply anti-Communist, have traditionally based the security of their country on two factors: the support of the United States and the belief that the United States would come to their aid if they were threatened, and support within the Arab world.

RAYMOND CLOSE, the U. S. Central Intelligence Agency's station chief in Saudi Arabia from 1970 to 1977 and now an independent commercial consultant, told me: "In the mid-1970s there was a mood here of excitement and anticipation as the Saudis, aware of their new power, prepared themselves to be full partners of the free world against Communism. That mood has now faded, largely because the United States has been seen to pursue its own objectives without sensitivity to the vital interests of its friends. In Saudi eyes, America still seems blind to the absolute necessity of achieving justice for Palestinians, not just 'Middle East peace,' if it expects Arab cooperation on the strategic level. Many American officials realize this, but until discreet private convictions become forthright public policies, hopes for a Saudi-American partnership, as originally conceived, will never materialize."

The Camp David accords, which shattered the unity of the Arab states confronting Israel, were a real blow to Saudi Arabia, forcing it to move closer to the radical Arab states. To do otherwise would have exposed its vulnerable flanks to its radical neighbors, and it could not support an agreement that it felt would not lead to the Saudi version of a comprehensive Middle East settlement.

Given such skepticism, the military keeps on building—infrastructure first. The new King Khalid Military City is going up at Hafar al-Batin near the Iraqi border, with a projected population of 70,000. This will not only be a powerful military base in a vulnerable region, but also is expected to create a nucleus around which civilians, even the Bedouin, will eventually settle.

One recently arrived resident is Saffooq

Cross-cultural encounter *introduces Donald Duck, a walking advertisement for a toy store, to visitors at a new*

shopping center in Jiddah. Foreign businessmen, operating within laws designed to keep businesses under Saudi control, have struck bonanzas in the suddenly affluent markets of a nation with a long have-not history.

al-Bashir, father of Dr. Faisal al-Bashir, Deputy Minister of Planning, and a leading member of the Sabaa tribe. "I've folded my tent. I never thought I would see the day, but I am an old man now, and life is not as it was. My sons are being well educated—even now two more of them have gone to America to study. Bedouin life is disappearing, and I prefer to be here, with people around me, than to be alone, the last man in the desert. But I still have my sheep, thank God, and a shepherd who tends them. When I miss the desert, I get into my pickup and go out and visit. But I have a home now. I am no longer a Bedouin."

NO ONE KNOWS how many of the Saudi Bedouin still remain—those desert-roaming, camel-riding shepherds who, till a few decades ago, *were* Arabia. Guesses range anywhere from 250,000 to 500,000.

But it is the devout fundamentalism of the Bedouin that pervades the psyche of the Saudis. Development must take into account what they and their children, even though now urbanized, will accept.

Years ago, King Abdulaziz, to convince the ulama that automatic telephones would be desirable in Riyadh, had a prearranged call made to the learned teachers; it began with a recitation from the Koran. "You cannot tell me," the king said to the august body, "that any instrument that can carry the word of God is an evil instrument." The telephones were installed.

They are still being installed all over the country, but not without respect to the old Islamic values. When a village in the Asir got its first telephone service recently, the traditional sacrifice of a lamb was made as a gesture of thanksgiving.

Television came harder. When King Faisal inaugurated it, there was opposition, despite the ulama's agreement that it could be a useful instrument for the propagation of the faith. Finally accepted, it remained suspect. After the attack on Mecca, when many Saudis felt obliged to reassert their moral rectitude, one result was that women were forbidden to appear on local television.

The most sensational television presentation involving Saudi womanhood was a British production, "Death of a Princess." A mix of fact and fiction, the "docu-drama" was based on a real-life occurrence. In 1977 Princess Mishaal and her lover were executed for adultery. She was shot; he, beheaded. This implementation of Islamic law and tribal justice shocked Saudis as well as Westerners, and many hoped that the outcry would temper justice in the future.

The film added fuel to the debate, and outraged many Saudis. "The royal family was personally slandered," one Saudi official told me. "The kingdom was defamed and Islam attacked in such a base manner that we had no choice but to react."

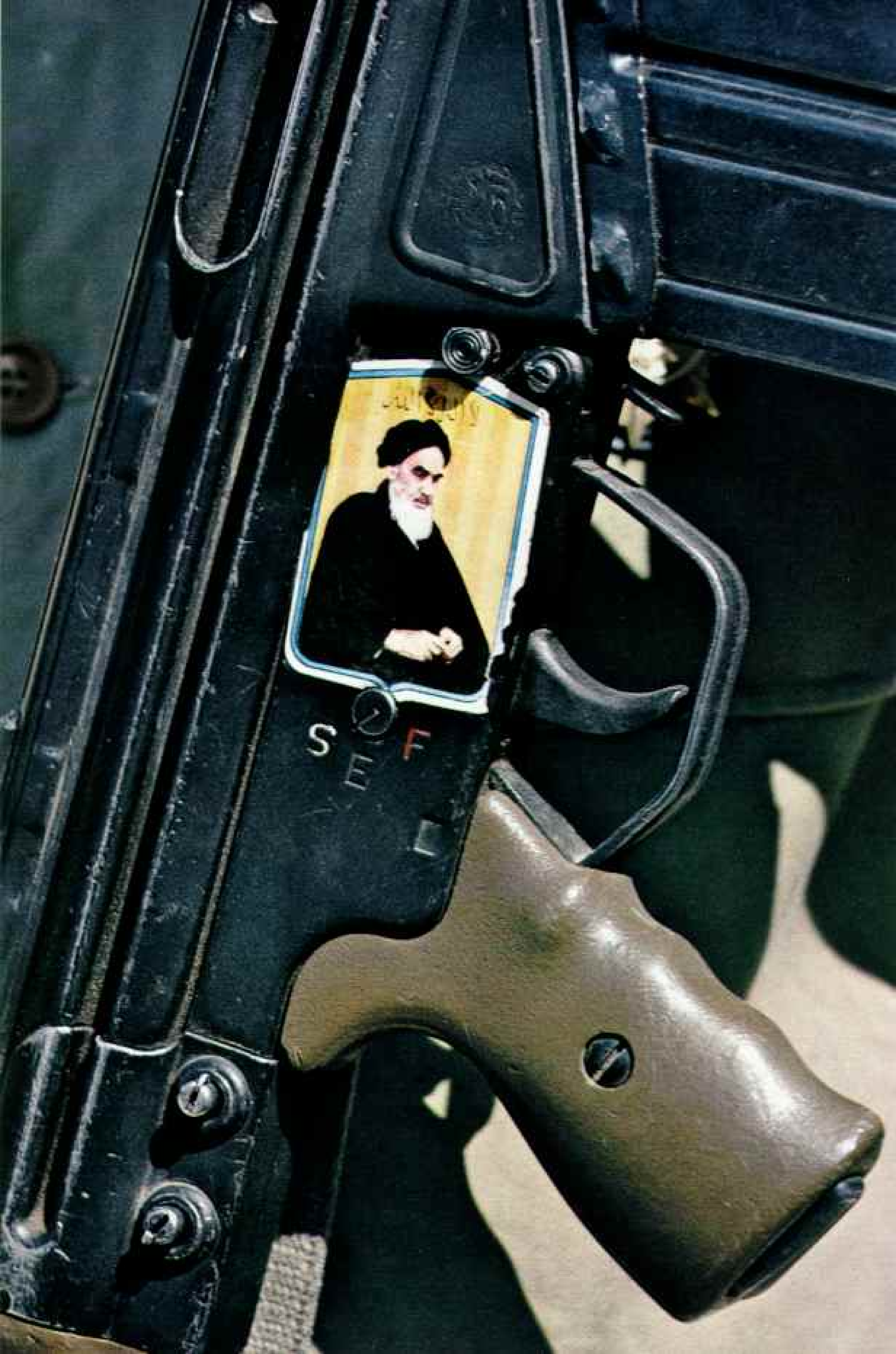
Dr. Mujahid Al Sawwaf, professor of comparative religion and Islamic law at the University of Mecca, told me: "The strongest force in Sharia law—the law of Islam—is God. Unlike some of your Western systems, there is no immunity for certain individuals. Sharia is the law of God, and no man is immune."

NEAR THE END of my travels I visited Abdullah, a young friend in Jiddah. We discussed my findings and fears for Saudi Arabia's future. After listening for some time, he exploded.

"Who are you to judge us? *Your* history is riddled with scandals: political, economic, moral, reaching into the highest levels of your government. If we didn't have the oil, you wouldn't give a damn about us, and when it's gone, you expect us to fade back into the desert.

"Forget it. We're not going back. We survived for hundreds of years with nothing but faith in God, a belief in His generosity and mercy, and with the strength of families and tribes united by those beliefs. We'll survive, with or without you, and with or without oil, as Saudis, as Muslims, as Arabs." □

Leaping a gulf of distance, *a solar-powered radiophone provides linkage with emergency service on a lonely stretch of road. In a land of vast spaces and few people, technology knits isolated oases of life. But beyond the din of the electronic age, the desert's children strain to catch the echo of ancestral voices.*


S
E
F

ISLAM'S HEARTLAND UP IN ARMS

By THOMAS J. ABERCROMBIE

NATIONAL GEOGRAPHIC SENIOR WRITER

KABUL, AUGUST 1967. Music blares, bright lights and fireworks flare as Afghanistan celebrates 48 years of peaceful independence. Yet the winds of cold war already blow from the north: Soviet-made tanks and rocket launchers rumble along Akbar Khan Street, and MIGs scream overhead to highlight the military parade.

To an army brigadier I express my surprise. How could his nation, traditionally neutral, trust its colossal northern neighbor to train and equip its armed forces? His reply is beautifully Afghan:

"When you ride a good horse, do you care in which country it was born?"

Qandahar, March 1980. Aloft somewhere over Afghanistan's Dasht-e Margow, the Desert of Death, we throttled back and buckled up for the descent into Qandahar, the southern Afghan city where I would spend the night.

Authorities at Tehran's airport had refused to let the plane wait there any longer, and our destination, Kabul, on the edge of the Hindu Kush, was still closed by blizzards. We looked like a flying rerun of the *Orient Express:* the Turk with a diplomatic passport, the striking lady from Lisbon, two Pushtun tribesmen in robes and turbans, a strung-out German hippie, the bald Lebanese always taking notes, and an American reporter revisiting a dozen familiar cities caught up in the wrenching turmoil of 1980.

I had earlier inquired of our pilot, sipping coffee at the galley, after an old friend who also flew for the Afghan airline. "He's dead," he said sadly. "They shot him in front of his house."

"They," of course, meant the Soviet-supported regimes that have ruled the country since 1978. Among the thousands who died in the ensuing tumult was U. S. Ambassador Adolph Dubs. Last December Afghanistan's revolutionary president Hafizullah Amin, suspected of making overtures to the West, was assassinated, and the Red Army, 80,000 strong, poured across the border.

Armies and borders are the oldest of all stories in the Middle East, that crossroads where three continents meet. The region, when I first visited it, was relatively peaceful, with big-power attention focused on Southeast Asia and later Africa. Now the nations between Morocco and Pakistan provided a new chessboard

ABBAS, GAMMA/LIAISON (FACING PAGE) AND WILLIAM KAREL, SYGMA

Peace Now *urges a hand-held flag* (**above**) *at a demonstration in Jerusalem. The small but vocal peace movement opposes Israel's policy of West Bank settlement.*

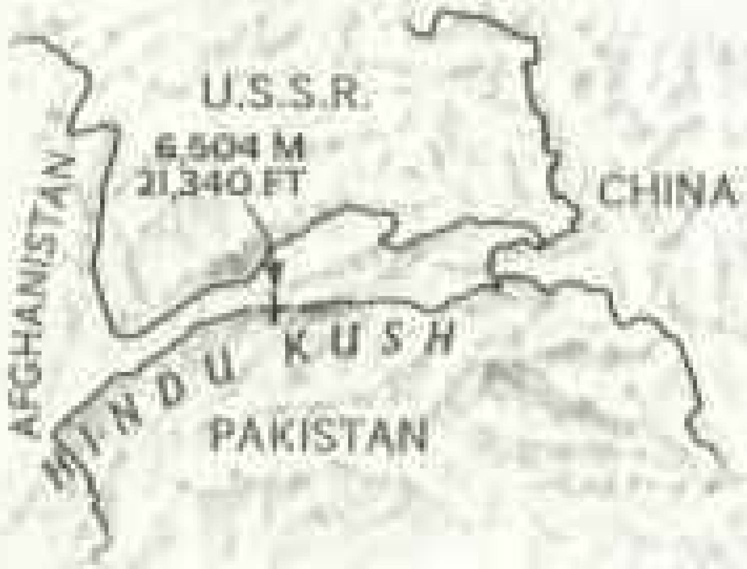
*A portrait of Ayatollah Ruhollah Khomeini (**facing page**) turns an automatic rifle into a symbol of Muslim militancy in Iran.*

In the Mideast, now as ever, religion and politics form a volatile mixture.

Rugged *as the mountains that conceal him, an Afghan guerrilla* **(below)** *looks down on a government fort in a valley of Nangarhar Province. The* mujahidin, *or Muslim freedom fighters, have fought Kabul's Communist regimes since they first took power in 1978. Now the rebels snipe at Soviet troops, tanks, and armored helicopters that entered the country in force in December 1979. More than a million refugees have fled into Pakistan.*

In Badakhshan Province to the north, yak herdsmen **(right)** *climb a trail to summer pastures in the Hindu Kush. Towering above them, the frozen peak of an unnamed 21,000-foot mountain overlooks three other nations: the Soviet Union, Pakistan, and China*

THOMAS J. ABERCROMBIE (RIGHT)
© 1988 STEVE McCURRY/LAUREN STOCKBOWER


U.S.S.R.
6,504 M
21,340 FT
CHINA
AFGHANISTAN
HINDU KUSH
PAKISTAN

on a grand scale. And again the lives of the people across a vast area were being influenced by decisions made elsewhere.

We touched down on a long runway built with U. S. aid but now guarded by Soviet tanks and antiaircraft missiles. We taxied to the terminal past rows of dartlike MIG-19s and MIG-23s slung with rockets—64 jets in all, poised only 650 miles from Persian Gulf shipping lanes.

Bused from the airstrip into Qandahar, I found only a handful of greengrocers half-heartedly selling tangerines and apples from pushcarts. A few local taxis, three-wheeled Vespa scooters embellished with mottoes from the Koran, huddled near the hotel. Otherwise, merchants protesting the Soviet occupation had shuttered the city tight.

"It is a tragedy. Afghanistan will never be the same," one of my fellow passengers, a Kabul man in a business suit, volunteered in a guarded voice as we warmed our hands over the fire in the lobby. "Praise God, I got my family out. As soon as I settle my affairs, I will leave too."

When our flight finally reached Kabul next day, turbaned street crews were digging out from under two feet of snow with crude wooden shovels. Wraiths of steam billowed from trucks and armored cars marshaling along the road to Charikar.

I looked up a high official in the Foreign Ministry, a longtime friend who had spent 20 months in prison following the 1978 coup. "These are difficult times, even painful, and they will not end soon," he said. "But this is not the first crisis wished on our nation by outside forces. We must persevere. Afghanistan will survive."

My driver, a rough-hewn Hazara from the rugged Hindu Kush, best summed up the fears of his deeply religious countrymen. "Look what happened to our brothers north of the border. Their mothers were Muslims, their fathers were Muslims—but the young men have all been brought up *kafirs* [nonbelievers]. Is that the fate of Afghanistan?"

Here I found another major change between the Middle East I had known and the one that now confronted me. (See the special supplement map of the Middle East distributed with this issue.) As the Western powers lost first their colonies, then their influence in the area, Muslim leaders moved gradually to fill power vacuums, sparking an international resurgence of Islam. Only under the Russians and the Israelis has Islam waned. Now one of these religious leaders—Ayatollah Ruhollah Khomeini—has overturned a government, and others exert potent political influence in places like Saudi Arabia, Egypt, and Libya.

TASHKENT, SOVIET CENTRAL ASIA, 1971. I am impressed by the many ambitious Soviet development projects: electric buses, the large university, parks, a building boom. Still, many of life's basics are missing. Shoppers wait in long lines, only to find store shelves nearly bare; travel requires a government permit; bookstores are stocked mainly with bound volumes of Lenin's speeches. And the faces in the street—those same Tajik, Turkoman, and Uzbek faces one met in the Kabul bazaar—never smile.

Despite the U.S.S.R.'s official atheist policies, I found many there seeking comfort in their Islamic culture and religion. In Samarkand, 14th-century capital of the conqueror Tamerlane, I joined crowds at the splendid azure-tiled shrines of Shah-i-Zinda. Trees were festooned with strips of white cloth, prayer offerings left by the faithful visiting a tomb believed to hold a cousin of the Prophet. Such local pilgrimages are popular. Last year, of the Soviet Union's 40 million Muslims, only 25 were allowed to visit distant Mecca.

At one mausoleum a long-robed Uzbek villager and his son watched me with curiosity while I copied an elegant Arabic inscription into my notebook.

"Tarif al-lughah al-arabiyah?" the old man ventured in the Arabic of the Koran. "Do you know the Arabic language?"

"Yes, a little," I answered in kind, then added the universal *"as-Salaam alaykum."*

"And upon you, peace," he replied. From him I gleaned glimpses of a hard life on the steppes: three bad harvests and a collective-farm committee that put too much land in cotton, too little in grain; religion discouraged by the government but still observed at home; six sons, two in the army.

The soaring birthrate of Soviet Central Asia's Muslims—their numbers grow some 3 percent a year, or five times faster than the Russians themselves—may well be viewed with misgivings in the Kremlin. Indeed, some observers conclude that one of the main reasons for the massive march into Afghanistan was to stifle, by unmistakable example, any thought of unrest among the growing Muslim population in Central Asia.

BEIRUT, LEBANON, 1972. I savor a stroll through the Paris of the Middle East. The neighborhood along Avenue des Français seems a second home to me. I return the wave of Chartouni, the shirtmaker; browse among the Roman coins at Petit Musée antiques; pick up a Herald Tribune *at Antoine's book shop. Over arrack at the sleek Hotel St. Georges, I watch water-skiers cut slaloms on the glinting blue Mediterranean.*

But now the St. Georges was a blackened shell. It stared emptily at a cannon-pocked Holiday Inn a quarter of a mile inland.

"Opposing factions fought for months for these two hotels," said my escort from the National Movement, a leftist coalition. "Cannon and rockets. You see the results."

The herds of tourists were gone from Beirut, and many students, bankers, businessmen, artists, and writers. They began to flee in 1975, when civil war ravaged the city.

The delicate Christian-Muslim balance, with political powers apportioned by the constitution, had long guaranteed tiny Lebanon a genuine, if fragile, republic, but the balance was upset by the half million refugees driven from Palestine. Denied repatriation, confined to crowded camps, they grew more militant and allied themselves with Lebanese leftists challenging the Christian-dominated power structure. Beginning in the late 1960s, the Israeli Army, battling Palestinian commandos, made spasmodic, sometimes extended, incursions into southern Lebanon, exposing the impotence of the small Lebanese Army and sending more waves of refugees north to Beirut.

Throughout the country dozens of political factions—Christians, Druzes, Socialists, Muslims, Palestinians, Falangists, Nasserites—armed themselves. In Beirut sniper attacks escalated into full-scale war—a war that, so far, has claimed 60,000 lives and left the city in shambles.

Halfway along the no-man's-land of Rue Allenby, a squad of battle-ready Syrian soldiers from the Arab peacekeeping force screeched up behind us in a bullet-riddled Mazda station wagon.

"Get out of here, you fools! This area is dangerous," one shouted, then began arguing with my escort. A block away children were playing. Two blocks east I heard the crack of rifle fire and a round of artillery.

In the bullet-scarred Minet el-Hosn quarter I was invited in by the remarkable Mardinian family. Head of the house was a tough 75-year-old Armenian, Ohannes Mardinian. During the fighting he had sent his family to safety but refused to go himself.

"Those who left came back to find everything looted by the soldiers, their homes occupied by refugees from the south," he said. Wearing robe and slippers, still recovering from a stray bullet in the hip, he pointed his cane to a large oil painting of a bygone hero wearing medals and a handlebar mustache.

"One night a band of leftist soldiers broke in," he said. "But they noticed the painting first thing. 'Stalin!' they exclaimed. 'This old man is one of us!' I poured them coffee; they left me some oranges.

"Of course," he chuckled, "I never told them the portrait was Gen. Antranig Pasha, our great Armenian hero."

Life in the city goes on, especially in fashionable Ras Beirut, still largely unscathed. On every wall, posters of Gamal Abdel Nasser, Yasir Arafat, Ayatollah Khomeini, and Palestinian martyrs compete for space with spray-can graffiti in Arabic: "The Land Belongs to the Steadfast"; "Revolution Is the Road to Liberation"; "No U. S. Bases in the Middle East." Yet American and Egyptian films pack theaters along Rue Hamra. Supermarkets are well stocked. Nearby, one still finds Paris couture at Milady, works in English at Uncle Sam's Bookstore, fast food at Kentucky Fried Chicken, and fast ladies at the Dolce Vita or the No Name Bar.

What chilled me was how many in Beirut had adapted to the anarchy. At a friend's apartment on Rue Madame Curie I heard horror stories: a cousin cut down stepping out of her car; the small grocery on the first floor bombed, smashing most of the building's windows. To get home that night, my host had to detour around a shoot-out.

A machine gun crackled outside. I jumped. "Take it easy." My friend smiled. "It's probably just a wedding celebration."

Jerusalem: reunited or occupied? *The question has divided the city's 400,000 Jews and 100,000 Arabs since Israel annexed East Jerusalem in 1967. Dominating*

BEIRUT, JANUARY 1975. Armed soldiers lead me through labyrinthine back streets, up a dark stairway to a midnight rendezvous. Only a bare bulb lights the temporary command post; Yasir Arafat, chairman of the Palestine Liberation Organization, seldom dares spend two days in the same place.

"Our argument is not with the Jews," he tells me. "We are both Semites. They have lived with us for centuries. Our enemies are the Zionist colonizers and their backers who insist Palestine belongs to them exclusively. We Arabs claim deep roots there too."

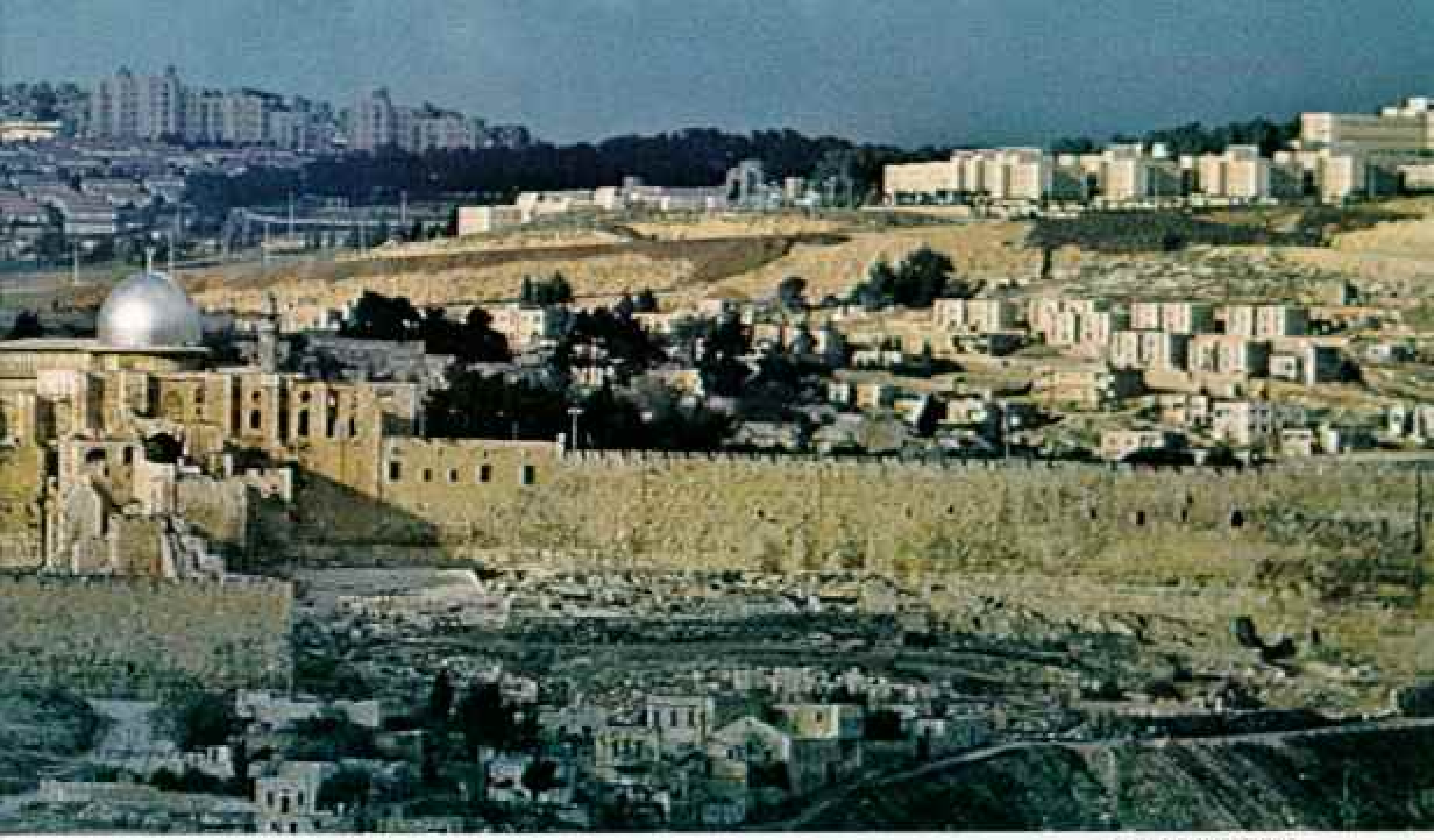
Two decades ago Palestinians were to be found in United Nations Relief Agency camps at places like Gaza and Jericho, in a forlorn and pitiable state. While Palestinian spokesmen pressed their case in world capitals, the loudest voice the world heard was that of terrorists, with whom the word Palestinian came to be associated. Jordan fought a war to curb them. The disintegration of Lebanon was due in part to the thousands of refugees within its borders.

Prospects for peace brightened, however, when President Anwar Sadat of Egypt, most powerful of the Arab countries, made his historic trip to Israel in November 1977. A year later Sadat and Israeli Prime Minister Menachem Begin signed the Camp David accords, a framework for the return of the occupied Sinai Peninsula to Egypt. The former enemies established diplomatic relations and opened mail, telephone, and airline communications.

The Camp David accords also addressed the all-important Palestinian question but left it vague. Sadat insists that any lasting peace depends on an eventual Palestinian homeland in the Israeli-occupied West Bank and Gaza. Israel agrees to limited autonomy for those regions, but, fearful of a new and hostile Palestinian state suddenly planted on its borders, insists that Israeli troops must maintain security there.

Crowded Rashidiyah refugee camp, set among orange groves south of the ancient Phoenician port of Tyre in Lebanon, lies on the front lines. Frequent pounding by Israeli military jets and warships seeking PLO targets has war-hardened its population, some 13,700 Palestinians.

At the schoolyard I watched a solemn flag raising. Uniformed *ashbal,* or lion cubs, stood rigid as color guards briskly ran up the green-white-and-black Palestinian flag. Ranging in age from 8 to 12, they might have been Cub Scouts—except for the loaded



THOMAS J. ABERCROMBIE

the city skyline, Israeli-built apartments rise beyond Arab suburbs and the golden Dome of the Rock shrine, where Muslims believe Muhammad ascended to heaven.

rifles they held at present arms. Behind them stood two rows of girls, *zaharat*, or little flowers. Same age, same weapons.

Over lunch of flat bread, *hummus*, yogurt, and chicken I commented to my hosts, a group of combat-ready fedayeen, that 30 years of bitter war had settled nothing nor gained the Palestinians one inch of their homeland. Was there no peaceful way to press their cause?

"Yes, and we are doing it. Finally, after 30 years, most countries in the United Nations recognize that we too have rights in Palestine. But we feel that until your country stops its unconditional aid to Israel, we have two choices: to fight, or to face an unmarked grave in exile."

AFTER CROSSING the Allenby Bridge from Amman, I drove across the fertile Jordan Valley through Arab Jericho and past some of the controversial new Jewish settlements: Mitzpe Jericho, Tomer, Maale Adumim, Shilat. Then as I climbed through the steep stony hills to Jerusalem, I saw that it too had changed. A ring of high-rise apartments and offices was growing inexorably around the occupied Arab side of the walled town. Within the wall, too, scores of Arab houses had been leveled during extensive reconstruction.

"Already 64 settlements have been built on the West Bank," said a Christian Palestinian agriculturist working for an American church group in Jerusalem. "And another 10 are planned," he said. Unfolding a copy of the master plan prepared in 1978 by the World Zionist Organization, he read: "Realizing our right to Eretz-Israel. . . . with or without peace, we will have to learn to live *with* the minorities. . . ."

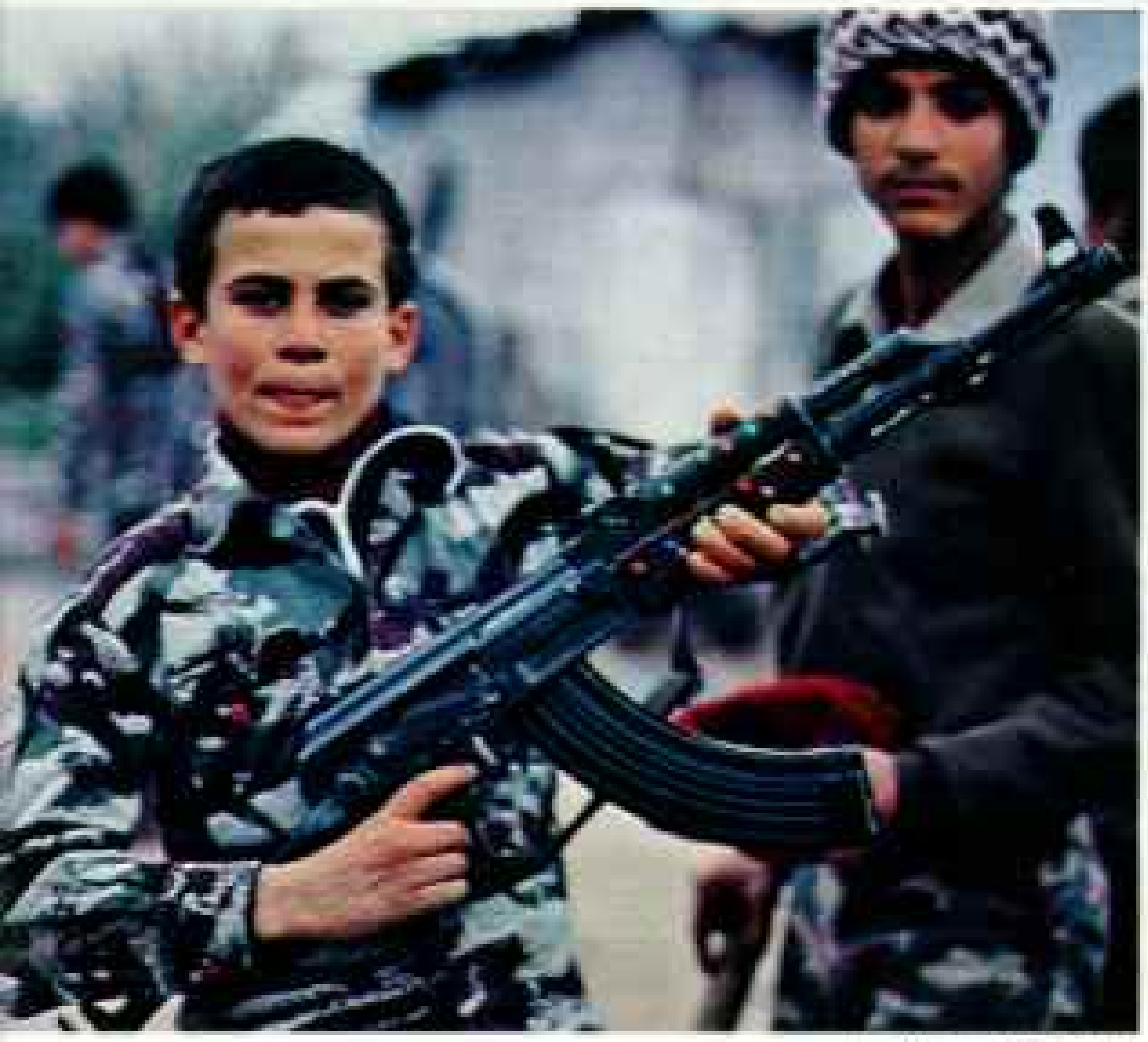
The Israeli Government has reaffirmed the policy. In Prime Minister Menachem Begin's words: "Settlement is an inherent and inalienable right. It is an integral part of our national security."

"Security" is a word deeply etched into the Israeli psyche. The country has lived for 30 years as an armed camp, always on guard against PLO raids and terrorist bombings. Whenever such incidents occur, the response is quick: even greater retaliation.

In Jerusalem I met with David Eppel, an English-language broadcaster for the Voice of Israel. "We must continue to build this country. Israel is our lawful home, our destiny. We have the determination, and an immense pool of talent, to see it through."

Combat ready at 13, *a Palestinian lion cub, or commando trainee* (**below**), *shows off a rifle decorated with glass buttons. At refugee camps scattered through southern Lebanon, hundreds of boys and girls from 8 to 14 learn the skills of guerrilla warfare at Palestine Liberation Organization schools.*

In a section of Beirut (**right**) *all that remains after the devastating 1975-76 civil war is the rubble of once fashionable shops.*



THOMAS J. ABERCROMBIE

His cosmopolitan friends—a city planner, a psychology professor, an author—gathered for coffee and conversation at David's modern apartment on Jerusalem's Leib Yaffe Road.

Amia Lieblich's book, *Tin Soldiers on Jerusalem Beach*, studies the debilitating effects almost constant war has had on life in the Jewish state, a nation still surrounded by enemies. As she and her husband kindly drove me to my hotel in Arab Jerusalem afterward, some of that national apprehension surfaced in the writer herself.

"We don't often come over to this part of town," she said. "Especially at night."

I DROVE OUT of the Old City in the dark of morning and arrived a few hours later at the nearly finished Israeli frontier post, whence a shuttle bus bounced me through no-man's-land to the Egyptian terminal. As a result of the Egyptian-Israeli treaty, it was possible for the first time since 1948 to travel overland from Jerusalem to Cairo. An Egyptian customs man opened my bags on a card table set up in the sand. I took a battered taxi into nearby El Arish, to a sleepy bank that took 45 minutes to convert dollars into Egyptian pounds. Then I hired a Mercedes for the 200-mile run across the northern Sinai desert, the Suez Canal, and the Nile Delta. By sundown Cairo was mine.

Despite official government optimism, I found many in Cairo worried that President Sadat's bold diplomatic gestures might fail. The city was noticeably tense as Israel officially opened its new embassy on Mohi el-Din Abu el-Ez Street in Cairo's Dukki quarter. Black-uniformed Egyptian troops guarded the chancery and nearby intersections as the Star of David flew for the first time in an Arab capital. Across town, police with fixed bayonets were posted every ten feet around the American Embassy. Others were posted at the TV station and the larger hotels. Protests were scattered, mostly peaceful. None disturbed the cadence of the city.

Welcoming ever larger delegations of tourists and businessmen from Europe and the U. S., Cairo was busier than ever—and more crowded. Despite a building boom, many Egyptians migrating from the countryside, perhaps 10,000 a month, still find housing only by squatting among tombs at the City of the Dead, the huge old cemetery on the southeast side of the capital.

Even with the new elevated highway and wider bridge across the Nile, half-hour traffic standstills are common. Commuters arrive at Ramses Station riding even the roofs of trains, then cram buses until axles break. Cairo smog, a corrosive blend of diesel fumes and hot dust from surrounding deserts, rivals tear gas.

Despite the rampant blessings of progress, Cairo can still charm. In the medieval Khan el-Khalili bazaar near Cairo's thousand-year-old Al-Azhar University, I sought out Ahmad Saadullah's sidewalk café. I found that 30 piasters (45 cents) still brings hot tea, a tall water pipe primed with tobacco and glowing charcoal, and the latest

HARRY KALTCHAYAN

gossip. The turbaned gentleman on the carpeted bench opposite was unusually talkative; we dispensed with weather and the high cost of living and got right to politics:

"Of course I am behind President Sadat, but he is taking a great risk. The Israelis have not fully responded. If Sadat fails, no other Arab leader will dare try for peace again for a generation."

Across town at the weekly *Akhbar El-Yom* newspaper, one of the largest and most widely read in the Middle East, chief editor Abdel-Hamid Abdel-Ghani drove home that same point.

"What worries me most is that President Sadat's agreement with Israel has isolated Egypt from our brother nations," he told me. "When Saudi Arabia broke with us, it was a heavy loss. The Saudis are our close neighbors. Now they have canceled pledges for hundreds of millions in development aid to Egypt. Some 200,000 Egyptians—teachers, doctors, engineers—live and work in the kingdom.

"And Saudi Arabia, guardian of the holy cities of Mecca and Medina, remains for Muslim Egypt a spiritual homeland."

MECCA, FEBRUARY 1965. Across the rooftops from the highest minarets peal the calls to early morning prayer: "Come to salvation. Prayer is better than sleep. . . ."

I am swept up in the largest religious gathering on earth, the annual pilgrimage to Mecca. Pious crowds surge through narrow streets and covered markets to the great Sacred Mosque, heart and focus of the holy city. We come from a score of nations and cultures, but each of us now wears the humble ihram, *the simple pilgrim costume of white cotton. Inside the shrine, blacksmith, banker, Bedouin—prime minister or pauper—all bow in unison, all equal in the eyes of the Almighty.*

Those narrow streets seemed unusually quiet this time. Around Islam's holiest shrine hundreds of masons and carpenters labored, repairing the heavy doors, filling gaping shell holes in the minarets, replacing scarred marble panels.

A few weeks earlier an armed band, led by a radically fundamentalist Muslim from Saudi Arabia's hinterland, had seized the Sacred Mosque, protesting the moral corruption and modernization efforts of Saudi

NATIONAL GEOGRAPHIC PHOTOGRAPHER GORDON W. GAHAN (ABOVE) AND MEHMET BIBER

Sky-blue tiles *on a Samarkand mosque preserve the flavor of Islam in Soviet Central Asia, where 30 million people keep Muslim traditions.*

In Karbala, Iraq, fluorescent lights and mosaics of mirrors (**facing page**) *reflect the gold- and silver-decorated shrine of Imam Husain, grandson of the Prophet Muhammad. The pilgrims are of the Shia sect, whose split with orthodox, Sunni Islam more than a thousand years ago still fuels rivalries in the Middle East.*

leaders. Outrage swept the Muslim world. In Libya and Pakistan, fired by false rumors that the United States was involved in this sacrilege, mobs attacked U. S. embassies.

In Mecca the forces that had profoundly changed the Middle East I knew became clearer in the face of the most profound force of all—the largest transfer of wealth in human history. Industrialized nations poured untold billions in oil payments into the coffers of governments that ruled populations whose values sprang from relative poverty, simplicity, and faith.

To protect those societies from moral crumbling under the assault of wealth, fundamentalist religious leaders had risen—with potent political impact.

Jiddah, the kingdom's commercial capital, a small desert seaport when I first landed there 19 years ago, had swelled to a metropolis of perhaps a million people. Overwhelmed by oil prosperity, it has become, according to a recent survey by the Union Bank of Switzerland, the most expensive city in the world.

With students of King Abdulaziz University in Jiddah, I attended a lecture by Dr. Ghazi Algosaibi, the Saudi Minister of Industry and Electricity.

"We must not depend on foreigners to run the machinery of our country," Dr. Algosaibi warned. "They neither understand nor care about our culture.

"We are blessed with revenue," he continued, "but unless we develop skills, money will not solve our problems."

All across the Middle East I saw this clash between Western-style modernization and traditional values. Now new external pressures build as the oil-seeking superpowers maneuver for position around the wells.

Encircled by events beyond their control, the Muslim nations fear that the Soviet Union will maintain its hold on Afghanistan, and that United States countermoves will make pawns of the region's nations. Internal strife gnaws away at Iran, Iraq, Lebanon, and other nations with strident minority groups. Continued Israeli settlement on the West Bank, over official United States objections, threatens Sadat's peace initiatives, as do continuing PLO raids.

In Islam's anguished heartland, some fear, lie the bitter seeds of global war. ☐

September, remember... Atlantic waters spawn the deadly, unpredictable

HURRICANE!

By BEN FUNK

Photographs by ROBERT W. MADDEN

NATIONAL GEOGRAPHIC PHOTOGRAPHER

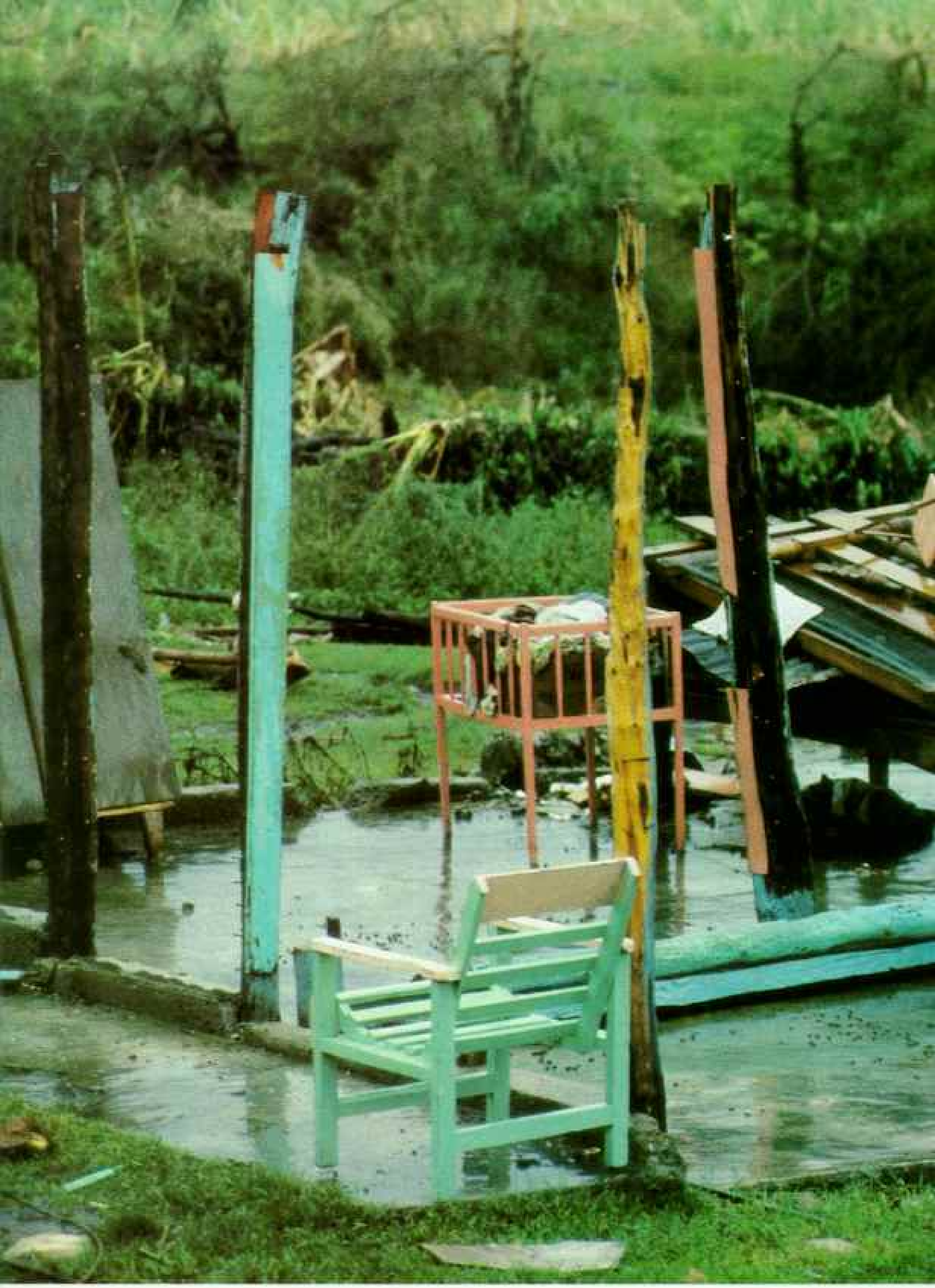
HURRICANE FREDERIC was far from its peak of fury as I drove through the deserted streets of Mobile, Alabama, for a last look. But already roaring winds loaded with rain funneled between buildings. Traffic lights danced crazily on their wire strings, then crashed into the streets. Signs, tree limbs, garbage cans, and sheet metal hurtled through the air. Windows popped; glass sprayed like shrapnel.

I retreated to my hotel about 8:30 p.m., as the center, or eye, of Frederic neared western Mobile. Eventually the city was enveloped in the most violent sector of the storm: the "eyewall," a maelstrom of wind and rain raging around the hurricane's calm core. Wind spiraled in bands toward the eye, signaled by a banshee wail that rent the night. Lightning flashed down the wall of the sky; thunder shook the hotel, and once a dread hurricane-spawned tornado rumbled past in the darkness. More than a few who have heard these horrendous noises of a hurricane have died of heart attacks.

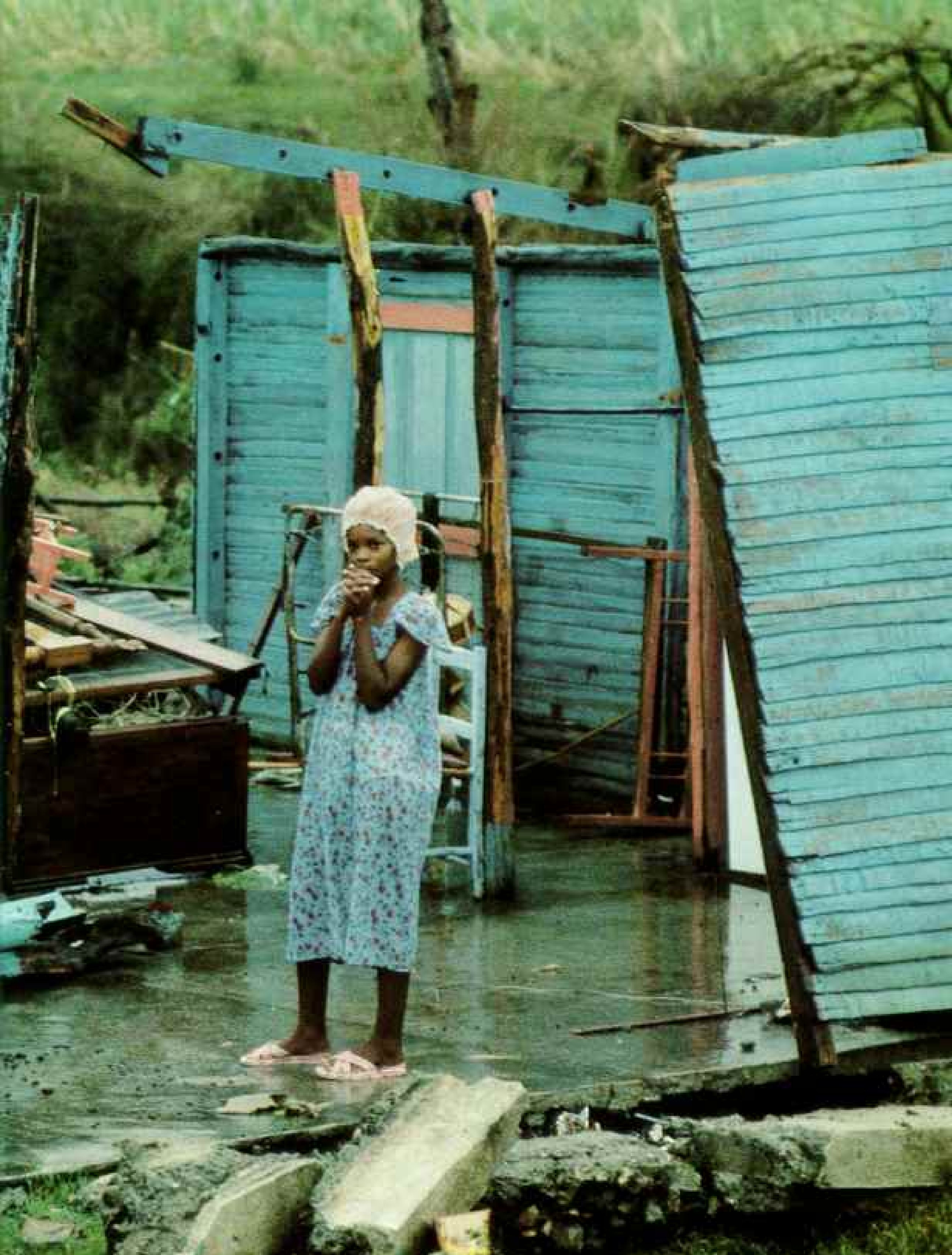
The wind strengthened steadily until, in the fiercest assault of the century on Mobile Bay, Frederic lashed the coast with sustained winds of 133 miles per hour. The maximum gusts of history's great hurricanes have rarely been clocked, because most wind gauges cannot stand before them. (In August 1980, Hurricane Allen would sweep the Caribbean with record force; aircraft-measured gusts topped 215 mph.) Now, at the mouth of Mobile Bay, gauges on Dauphin Island recorded gusts of 145 mph before Frederic blew them away.

Hurricanes and their western Pacific and Indian Ocean counterparts—typhoons and cyclones—may grow to be more than 500 miles in diameter, earth's greatest storms. Enormous heat engines, they feed on the ocean's warmth. Evaporated seawater

Labor Day scare, 1979: *Hurricane David gives Miami Beach a close shave, passing just offshore after devastating the Caribbean. In Miami and other research centers, scientists continue to probe earth's most dangerous and destructive storms by tracking such monsters as Hurricane Allen, which in August 1980 flailed Jamaica with 170-mph winds, ending on the south Texas coast.* J. SCOTT APPLEWHITE, MIAMI HERALD



The poor got poorer in the Dominican Republic. In David's aftermath a



NATIONAL GEOGRAPHIC PHOTOGRAPHER JAMES P. BLAIR

sugarcane cutter stands in shock amid the ruins of her modest home.

Storm after the storm: *In the wake of Hurricane Frederic, Mobile, Alabama, lay prostrate, and a dusk-to-dawn curfew was imposed. Authorities frequently face urban*

condenses into rain, converting thermal energy into wind power in awesome amounts. The heat energy released by one hurricane in a single day, if converted to electrical energy, would supply the entire United States with power for three years.

As a veteran Florida reporter, I have had an intimate acquaintance with hurricanes, and I realized that air pressure inside the hotel was now greater than the low barometric pressure of the storm, putting explosive stresses on the building.

I propped my door open, hoping to vent air into the corridor. I can only assume that it helped. My window held while, all around, others cracked and shattered.

The thudding strikes of wind came harder and more often as the night wore on. Gusts slammed through gaping windows and knocked the inner walls of some rooms out into the hallways. Sometime near midnight Frederic jolted the entire hotel, cutting off electric power and plunging the building into darkness.

With other guests I groped down emergency stairs to the lobby. Water streamed from the cracked ceiling. Broken glass crunched under our feet. Hours later I went

SHELLY KATZ, BLACK STAR

problems in the aftermath of such natural disasters. News photographs of storm damage are often followed by those of looting as the damaged civil fabric temporarily unravels.

out into a gray, gusty dawn to walk the streets of a brutally beaten city.

MOBILE WAS A SHAMBLES. Roofs were torn off, glass and even brick walls caved in, church steeples toppled, debris piled high. At Bellingrath Gardens, a luxuriantly landscaped estate, tornadoes like artillery fire had topped and uprooted oaks, pines, and other trees. Throughout Mobile, giant live oaks that had stood for two centuries now lay blocking avenues and flattening houses.

In only a few hours Hurricane Frederic had swept Mobile back to an earlier era. Gone were air conditioning, ice, television, telephones, and, in many areas, drinking water. Gasoline could not be pumped, newspaper presses were silent, and only candles and lanterns dispelled nighttime darkness.

Although people in many neighborhoods drew together in a spirit of cooperation during the chaos, other parts of town found the veneer of civilization wearing thin. Wide-open storefronts invited looters, and National Guard troops rushed in to help police combat them.

Preying on desperate people, profiteers demanded thirty dollars for a block of ice, four dollars for a sandwich, and exorbitant prices for chain saws to clear fallen trees. As days passed and most neighborhoods remained without electricity, tensions grew. Five thousand refugees lined up at a distribution center for food stamps.

From eastern Mississippi through Alabama to the western Florida Panhandle, Frederic left similar scenes of ruin and strife. But for lessons learned from Hurricane Camille in 1969, Frederic might have killed many more than five people in the U. S.

Camille had struck the Gulf coast with almost unimaginable fury. Sustained winds had reached 155 miles per hour as hurricane-hunter planes pierced the storm and clocked gusts to 215 mph. After a tour of the mangled Mississippi shore, the director of the National Hurricane Center in Miami, Florida, had told colleagues, "It looked as if a row of midwestern tornadoes had gone ashore shoulder to shoulder." By the time the hurricane blew itself out in Virginia, more than 300 people had died.

Camille hit no heavily developed areas, and property destruction was far less than Frederic's toll of more than two billion dollars. But memories of Camille spurred half a million Gulf coast residents to flee oncoming Frederic. Many seaside communities were virtually ghost towns when Frederic ripped ashore last September.

IN THE 20TH CENTURY, hurricanes prowling the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico have killed an estimated 45,000 persons, including more than 13,000 in the United States. Nine out of ten victims drowned in the storm tides, or storm surge, walls of water that swept ashore with the high winds.

Low air pressure in a hurricane eye allows the ocean surface to rise near the center of the storm, forming a bulge one or two feet high. Wind-driven water piles onto the bulge as the hurricane rushes to landfall. Where it is driven against a sloping shoreline, the combination can tower as high as 25 feet above normal tide, pounding miles of beaches with devastating force. This storm surge can be augmented by other waves eight to ten feet tall that slam ashore before, during, and after the surge itself.

Ignorance of these storm tides cost thousands of lives when the worst killer hurricane ever to strike the United States mainland arrived in the first year of this century.

On September 2, 1900, a weather station in Cuba advised mainland forecasters of a Caribbean hurricane. Ship reports placed the storm 1,500 miles southeast of Galveston, a booming port of 38,000 people on an island off the south Texas coast.

Weather forecasters then could do little more than watch and wait. Not until September 8, when the barometer fell sharply and tides swelled, did the threat to Galveston become apparent.

Drawn by the roar of crashing storm surf, spectators flocked to the shore, blind to danger. A forecaster, Dr. Isaac M. Cline, raced along the beaches by horsecart crying warnings into the rising wind. Three thousand people heeded the call, but when a 20-foot-high storm tide rolled down the streets of Galveston, 6,000 people were lost, many mired in a graveyard of briny mud.

WIND AND RAIN play dramatic supporting roles in hurricane disasters. For several hours before arrival of the storm surge, brawling winds maim and kill, cut off bridges, roads, and communications, and weaken or destroy buildings. Tornadoes often swirl out of a hurricane's black clouds, and torrential rains loose floods that add to death and destruction.

Hurricanes are classified by the Saffir-Simpson scale, devised by consulting engineer Herbert Saffir and Dr. Robert H. Simpson, former director of the National Hurricane Center. A storm ranked number 1 is minimal; 2, moderate; 3, extensive; 4, extreme; and 5, catastrophic. Only three hurricanes in this century have been classed as number 5: the 1935 Labor Day storm that ravaged the Florida Keys, Camille in 1969, and Allen, 1980's first great storm.

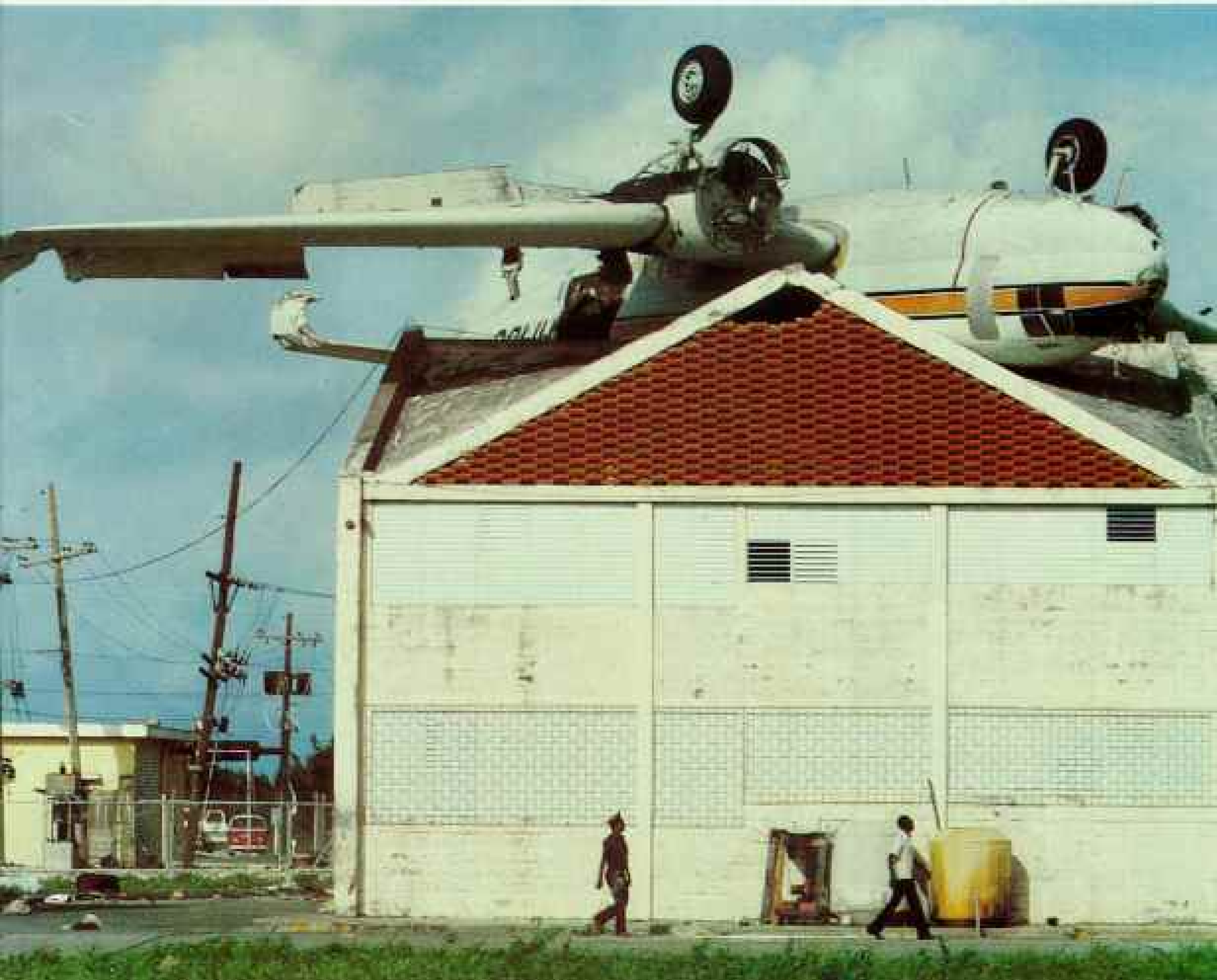
Since 1900, hurricanes have wrought more than 12 billion dollars' damage in the United States. Of the hardest-hit Caribbean nations—Haiti, Cuba, the Dominican Republic, and Honduras—hurricanes have savaged Haiti the worst, killing an estimated 8,400 in this century. In 1963, 5,000 died in Hurricane Flora alone as rain pummeled the island. In August 1980 Haiti was barely spared direct assault by the 170-mph winds of Hurricane Allen, the mightiest Caribbean storm ever recorded. Within days its force was focused on the Gulf Coast of Texas.

FOR FIVE YEARS the Atlantic Ocean off the West African coast had been cool—poor nourishment for tropical storms. But temperatures climbed above normal in 1979, and by June 1, when the six-month hurricane season began, the sun had warmed the ocean around the Cape Verde Islands to 80°F and more.

These waters near the Equator breed most of the hundred disturbances that the National Hurricane Center tracks each year. By late summer, moist air spilling off the African Continent had spawned three tropical storms. The fourth—christened David as it swelled—eventually rated a number 4 on the Saffir-Simpson scale.

At first David was only a mass of air rising from the

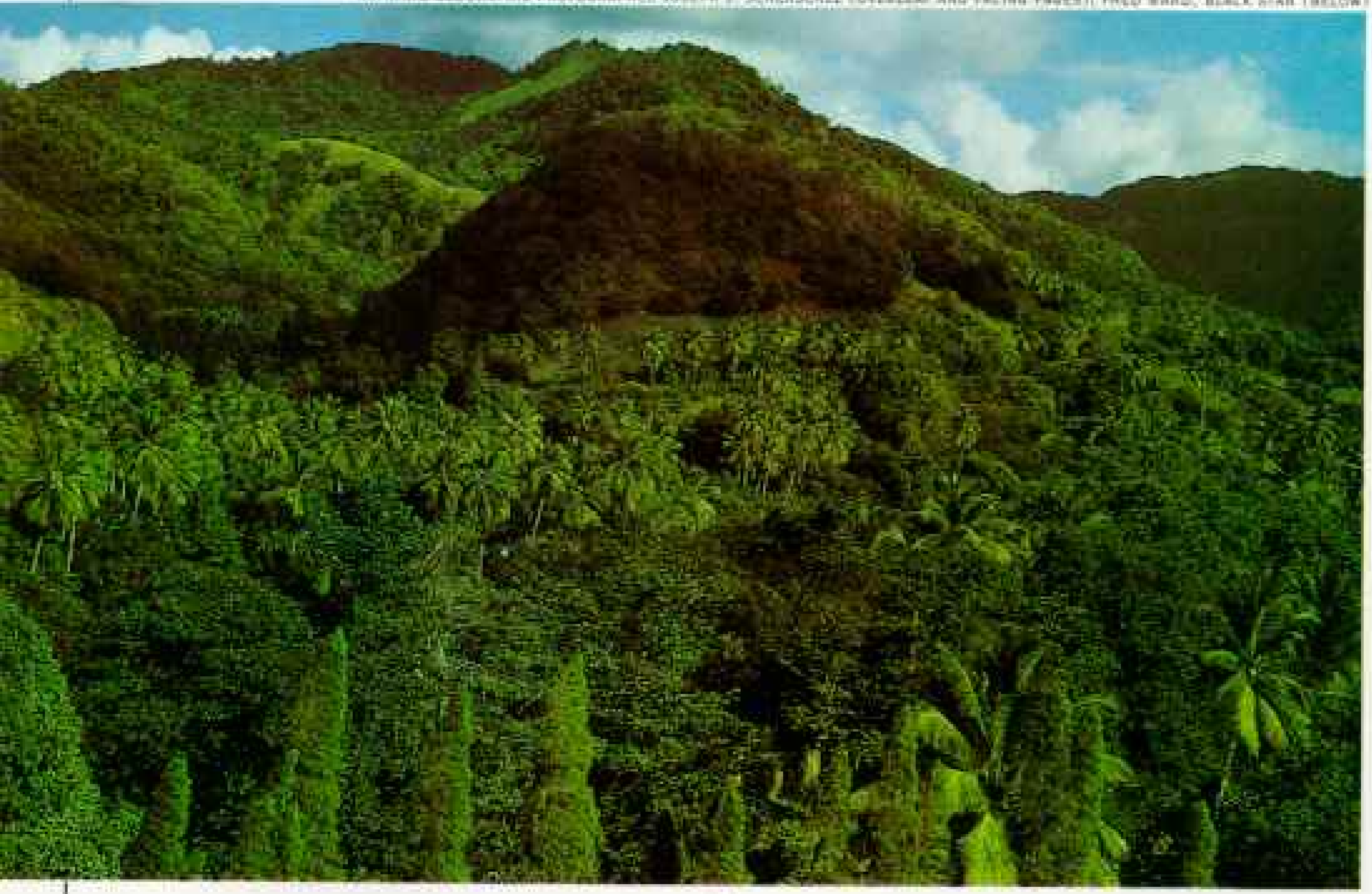
(Continued on page 363)



WIDE WORLD PHOTOS

Like a giant's plaything, *this 15-ton C-46 transport was flipped atop a hangar by 145-mile-an-hour winds at the airport near Santo Domingo, capital of the Dominican Republic. Throughout that nation, David killed some 1,200 people, left more than 200,000 homeless, and cost a billion dollars in damage. Multiplying the tragedy, Frederic dumped two feet of rain on parts of the country six days later.*

NATIONAL GEOGRAPHIC PHOTOGRAPHER JOSEPH J. SCHERSCHEL (OVERLEAF AND FACING PAGES); FRED WARD, BLACK STAR (BELOW)



Before David ↑

← After David

Dominica

By FRED WARD

BLACK STAR

SATELLITE PICTURES do not lie. The evidence was clear that Hurricane David was a monster, and it had turned on a collision course for the Windward Islands. Newly independent Dominica lay directly in its path.

Radio warnings pinpointed the giant's location, but with disbelief born of helplessness and an unrealistic notion that their island's mountains would offer protection, most Dominicans went about business as usual. On August 29, 1979, one of nature's most awesome displays, a fully formed hurricane, churned in from the sea, unleashing its forces of unbearable winds and devastating waves to overpower the lush landscape.

"'Oh, God,' I thought, 'we're done for sure,'" recalled Delia Winston. As the winds grew, she and her husband, Allandale, took refuge in their basement. "We could look out our window over the Roseau Valley. The air had turned into a milky green swirl of mud, water, coconuts, and sheets of galvanized roof, like flying razor blades. Then our own roof went, and I knew we were dead."

Miraculously, on this island of 78,000 people who mainly live in hastily nailed wooden shacks, David claimed only 56 lives. The low toll seems inexplicable, for the storm's eye passed directly across Dominica's southern half, returning to the sea just north of its ramshackle capital, Roseau. David was calculated to have 145-mile-per-hour sustained winds here, with gusts to 175 mph. Surprisingly, although satellite photographs confirm the hurricane was more than 300 miles wide, Dominica's north coast, less than 20 miles away, suffered almost no damage.

For me, Dominica's principal appeal has always been its rugged, unspoiled beauty. Vast interior preserves hold one of the Caribbean's most extensive rain forests. David ravaged this resource, leaving in its wake trunks stripped even of their bark. The fierce winds snapped coconut palms as if they were matchsticks. Hills were raked bare.

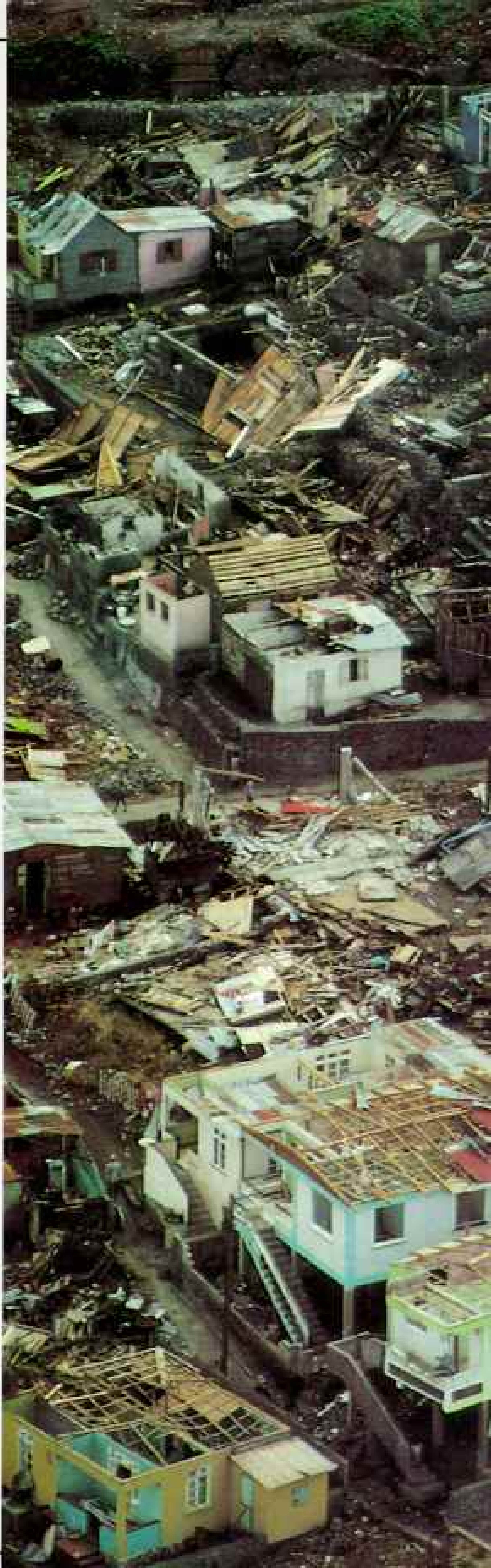
Although the banana crop, providing 85 percent of the island's income, was mostly destroyed, the fast-growing plants came back in time to produce fruit for England in May. Coconut palms, cultivated for oil, were not so heavily damaged, but the seven-year wait for mature nuts means a considerable setback. Roads are badly pitted, and repairing the island's electricity system will take years.

Even before David's winds died, an epidemic of looting virtually paralyzed Dominica, as people took to the streets to steal food, building materials, furniture, clothes, trucks, and cars. On the docks and in customs areas even relief shipments became fair game for thieves.

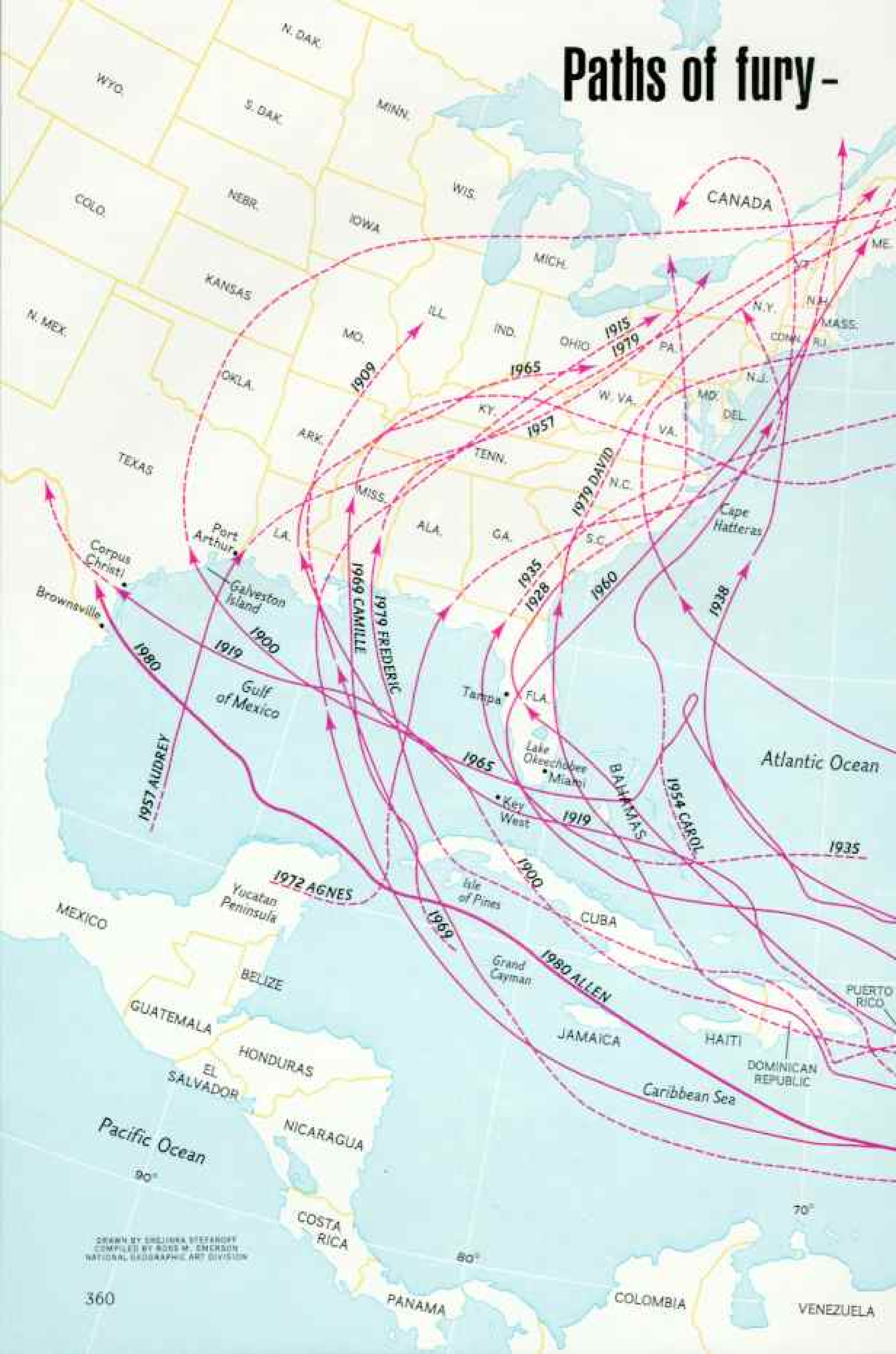
Free food from overseas was a mixed blessing. At the critical moment when Dominicans needed to be rebuilding their island, long lines of hungry people formed, and commerce and construction almost stopped.

David was the crowning disaster of Dominica's recent troubled history. Since gaining independence from England on November 3, 1978, the island nation has spiraled from one political crisis to another, forcing the resignation of the prime minister and his cabinet in June 1979. While still reeling from the effects of self-government gone awry, Dominica fell under David's attack, which terminated any immediate hopes for recovery.

Is there a solution for the small island's plight? Practically the only one heard on Dominica is the plea for more aid. But no country can hope to survive on foreign largess. Said Lennox Honychurch, scion of Dominica's oldest white family: "Dominicans are also going to have to learn how to attract industry and capital and how to work competitively again if we are going to survive as a nation." ★ ★ ★



Paths of fury–


N. DAK.
WYO.
S. DAK.
MINN.
WIS.
CANADA
COLO.
NEBR.
IOWA
MICH.
ME.
VT.
KANSAS
N.H.
N. MEX.
ILL.
MO.
IND.
N.Y.
MASS.
OHIO
1915
1979
PA.
CONN.
R.I.
1909
1965
OKLA.
N.J.
W. VA.
MD.
KY.
DEL.
ARK.
1957
VA.
TEXAS
TENN.
1979 DAVID
N.C.
MISS.
Cape Hatteras
ALA.
GA.
S.C.
Port Arthur
LA.
Corpus Christi
Galveston Island
1935
1928
1960
1938
Brownsville
1969 CAMILLE
1979 FREDERIC
1900
1919
1980
Gulf of Mexico
Tampa
FLA.
Lake Okeechobee
Miami
BAHAMAS
1954 CAROL
Atlantic Ocean
1965
1957 AUDREY
Key West
1919
1935
1972 AGNES
Yucatan Peninsula
1900
Isle of Pines
CUBA
MEXICO
1969
Grand Cayman
1980 ALLEN
PUERTO RICO
BELIZE
GUATEMALA
JAMAICA
HAITI
DOMINICAN REPUBLIC
HONDURAS
EL SALVADOR
Caribbean Sea
Pacific Ocean
NICARAGUA
90°
70°
COSTA RICA
80°
PANAMA
COLOMBIA
VENEZUELA

DRAWN BY SHELINKA STEFANOFF
COMPILED BY ROSS M. EMERSON
NATIONAL GEOGRAPHIC ART DIVISION

this century's worst American storms

MORE THAN 13,000 PEOPLE have been killed since 1900 in the United States alone by the dreaded storms that rage across the Atlantic from the west coast of Africa or spring from the Caribbean or Gulf of Mexico. Maya and Carib Indian roots of the word "hurricane"—meaning "evil spirit," "storm god," or "devil"—reflect an age-old terror. Seafarers have long borne their brunt; During Spain's heyday of conquest in the New World, entire fleets laden with treasure foundered in such tempests.

Cuban scientists studied hurricane dynamics as early as 1857, but not until the advent of wireless telegraphy could vessels help track the storms; 1909 marked the first hurricane report from a ship to the infant United States Hurricane Warning Service. In 1943 a pilot first penetrated a hurricane's center. Today the storms are routinely monitored by radar and satellites.

1900 Six thousand people died on September 8 when a hurricane inundated Galveston Island, Texas, with a 20-foot storm tide.

1909 About 350 died in September when a storm flooded most of the Louisiana coast.

1915 After ignoring repeated warnings to evacuate, 275 people died when a hurricane struck the Mississippi Delta, September 29.

1919 In early September a hurricane struck both Key West, Florida, and Corpus Christi, Texas. At sea more than 500 persons drowned.

1928 In mid-September a storm drove the waters of Lake Okeechobee into populated areas, causing 1,836 deaths.

1935 The infamous Labor Day storm hit the Florida Keys, killing 408 and bringing winds of 150-200 miles per hour.

1938 New England was struck September 21 by a fast-moving hurricane that took 600 lives.

1954 On August 31 New England was again pummeled by the first great named storm, Hurricane Carol.

1955 Diane, the "billion-dollar" hurricane, flooded the entire northeastern U. S. and took 184 lives in mid-August.

1957 Hurricane Audrey hit the Louisiana-Texas coast on June 27. Many people refused to evacuate, and 390 died.

1960 In early September the Lesser Antilles, Florida, the middle Atlantic states, and New England felt the wrath of Donna.

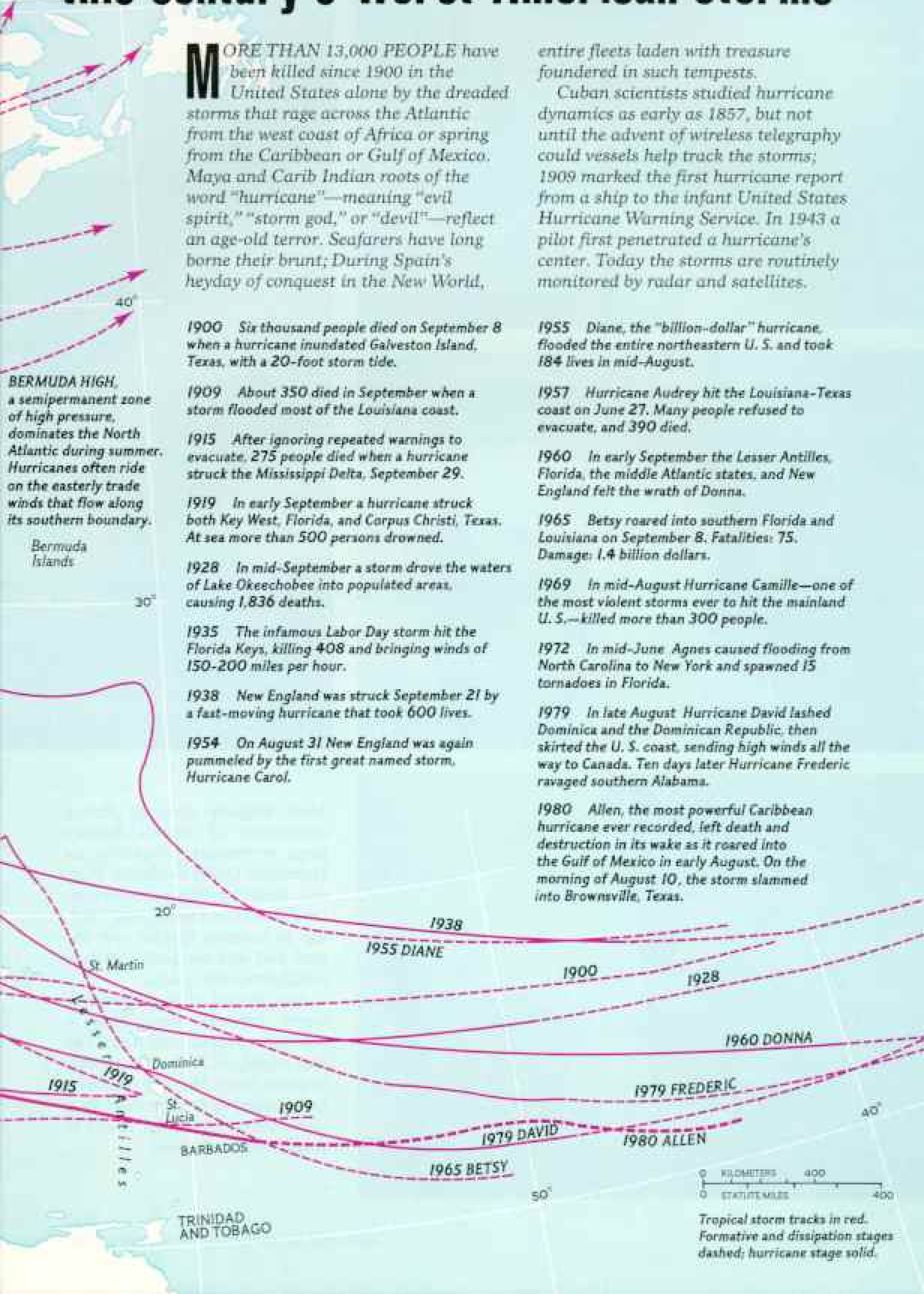
1965 Betsy roared into southern Florida and Louisiana on September 8. Fatalities: 75. Damage: 1.4 billion dollars.

1969 In mid-August Hurricane Camille—one of the most violent storms ever to hit the mainland U. S.—killed more than 300 people.

1972 In mid-June Agnes caused flooding from North Carolina to New York and spawned 15 tornadoes in Florida.

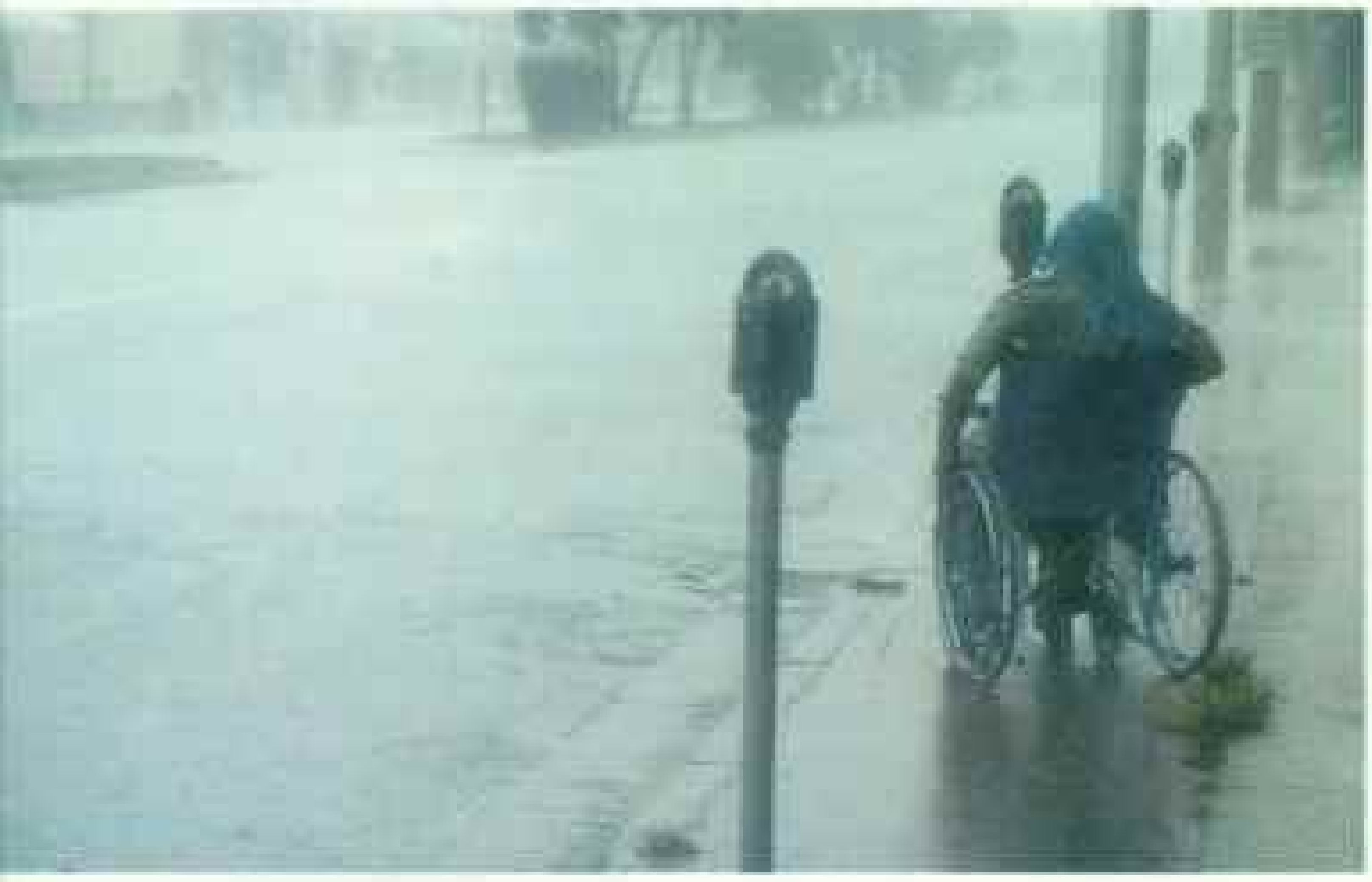
1979 In late August Hurricane David lashed Dominica and the Dominican Republic, then skirted the U. S. coast, sending high winds all the way to Canada. Ten days later Hurricane Frederic ravaged southern Alabama.

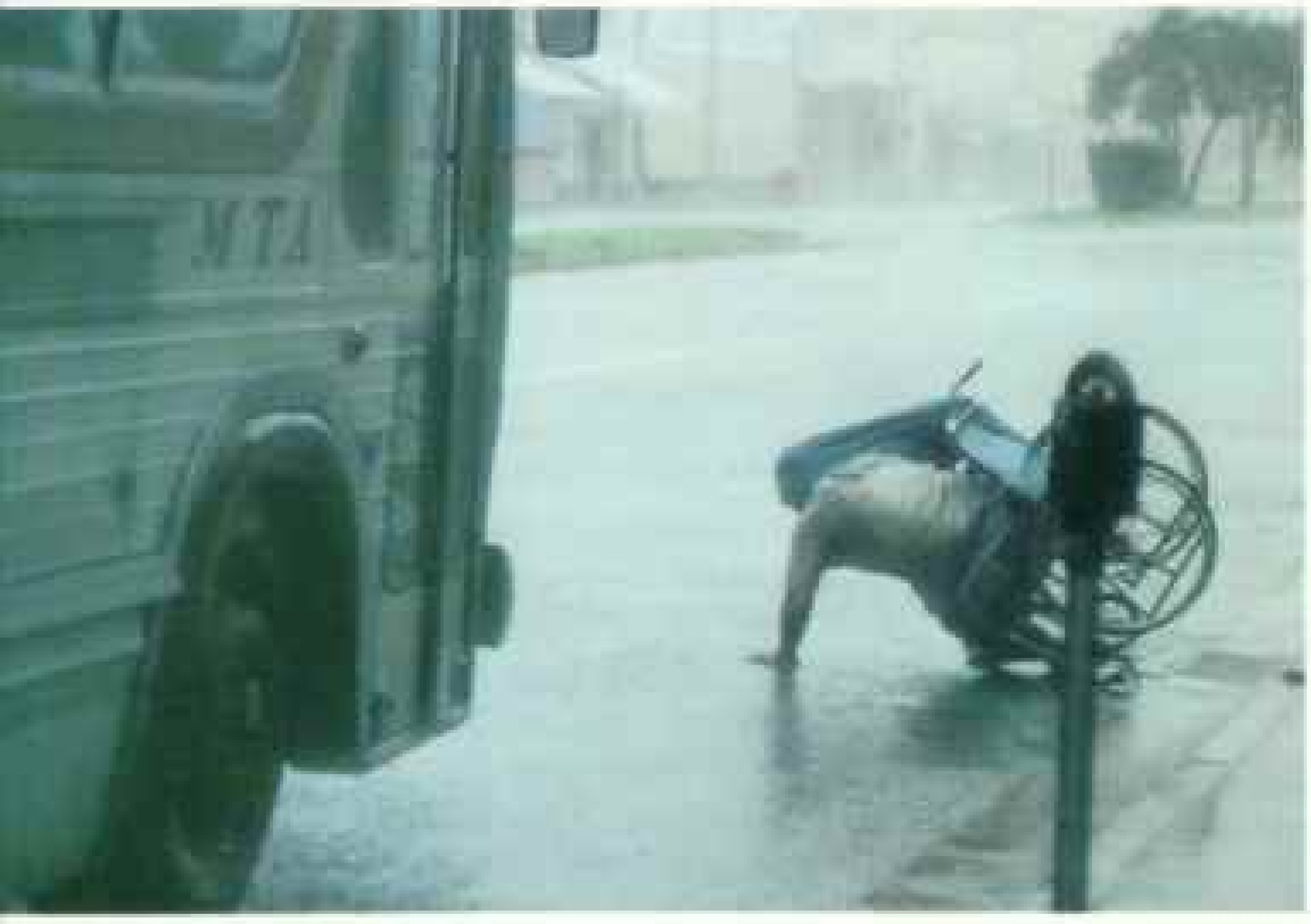
1980 Allen, the most powerful Caribbean hurricane ever recorded, left death and destruction in its wake as it roared into the Gulf of Mexico in early August. On the morning of August 10, the storm slammed into Brownsville, Texas.

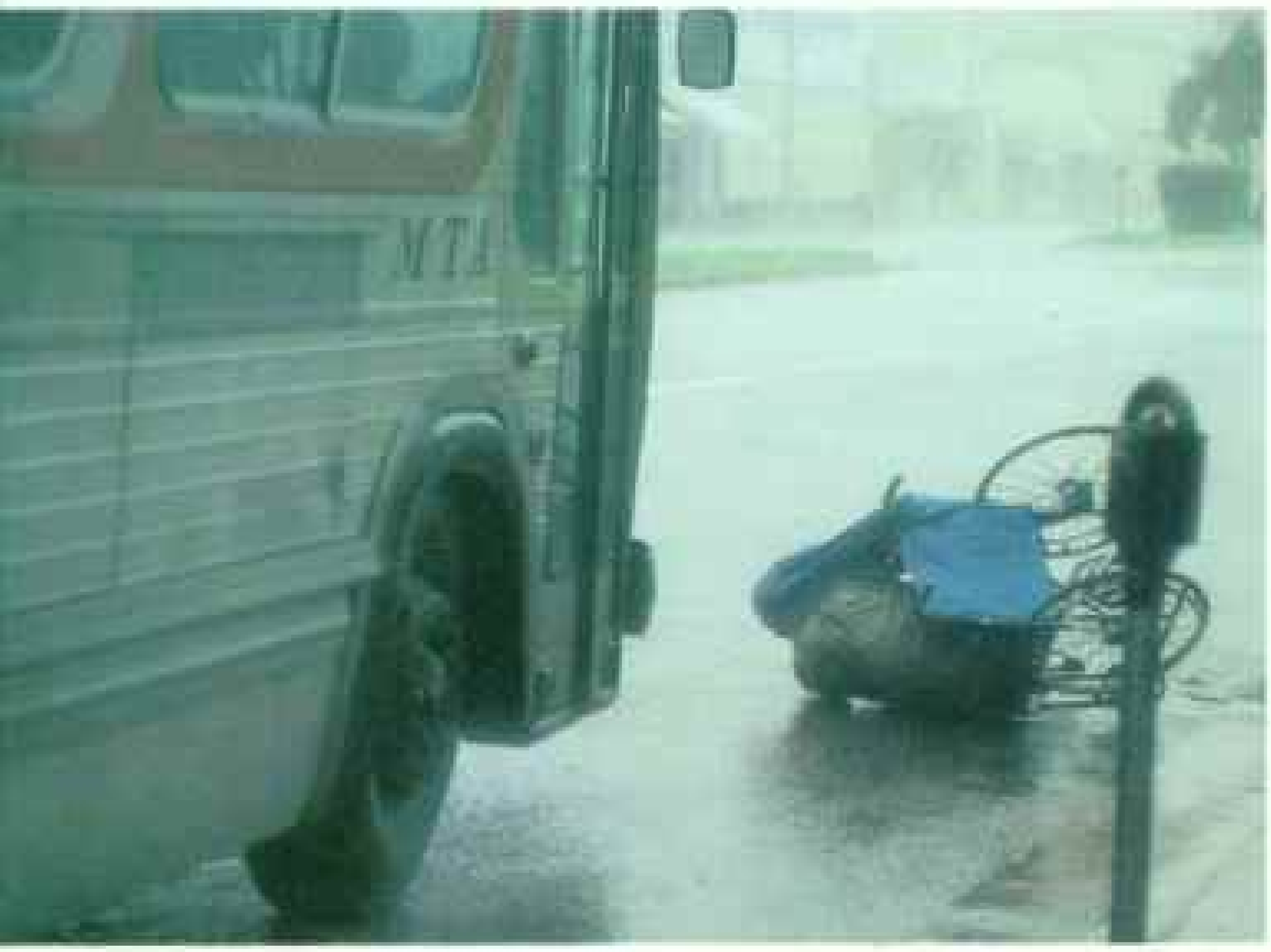


BERMUDA HIGH, a semipermanent zone of high pressure, dominates the North Atlantic during summer. Hurricanes often ride on the easterly trade winds that flow along its southern boundary.

Tropical storm tracks in red. Formative and dissipation stages dashed; hurricane stage solid.







Near tragedy *occurred during evacuation of Miami Beach's large retirement population as Hurricane David headed for Florida. Awaiting transportation inland, a man in a wheelchair (***left, top to bottom***) topples over the curb and into the path of a bus, which screeches to a halt.*

*Eyes fearful of the impending storm (***above***) stare from a boarded-up residential hotel. The real tragedy in Miami Beach may be yet to come. Many of the elderly, outraged at being moved for a storm that missed them, vowed to stay put the next time.*

(Continued from page 353) sun-warmed ocean. As this air ascended, more flowed in from beneath, then rose, expanded, cooled, and formed rain clouds thousands of feet high. Boosted by earth's eastward rotation, the clouds spun counterclockwise around a core of low pressure, picking up speed and sucking more moisture into the vortex, like smoke up a chimney. It was Sunday, August 26; David had been born.

A day later, winds whirling around the center of the storm reached 74 miles per hour, elevating David to hurricane status. In the next 24 hours wind speed doubled, and David became a superstorm that whipped the Atlantic into turmoil over an area 300 miles in diameter. Near the eye, 50-foot waves battered ships at sea.

For all their monstrous power, hurricanes cannot control their direction. From birth as areas of concentrated showers, they are carried along by prevailing air currents, generally easterly trade winds.

Steadily intensifying as they move across warm ocean waters, the showers develop low-pressure troughs and, in the Northern Hemisphere, a counterclockwise air circulation. Should they meet a stronger dry air mass circulating in the other direction, hurricanes can stall and wobble in place, weaken, and break up.

In August and September, hurricanes typically live for two weeks. Hurricanes that form in June, July, October, and November, many of them in the Caribbean and Gulf of Mexico, generally last only seven

EXTRAS -
SUN ROOF
SOLA AIR

Laughing through tears, victims of Frederic made rueful peace with what they

days, because of the shorter distance they travel before landfall.

Only two or three of these erratic storms strike mainland North America each hurricane season. Their early course is set by the trade winds flowing along the southern periphery of the Bermuda high—a mass of warm humid air reaching nearly eight miles up that straddles the North Atlantic and controls its weather in summer and fall. Newly born Hurricane David flowed westward along this atmospheric barrier like a gigantic river of air and swept furiously into the Caribbean Sea.

David severely tortured the northeastern Caribbean with blinding rain and winds gusting to 175 miles per hour, but, colliding with the mountains that separate the Dominican Republic from Haiti, the storm was cut off from its ocean power source and lost most of its strength.

With its wind circulation unbalanced, David weakly drifted past eastern Cuba and within the 250-mile range of United States coastal radar stations.

AS DAVID SWUNG NORTH, another hurricane—Frederic—developed in its wake and followed the first storm into the Caribbean.

Frederic had formed in the open ocean on August 28 and was riding the same air currents that had earlier steered David west. Though roughly equal in power, Frederic was all but snuffed out as it approached the older hurricane.

A hurricane is like a fire in a hearth. To keep the fire burning, air must flow in at the

OR
ALE
CHEAP

STEVE WALL, BLACK STAR

could not change. Trailers, light and often unanchored, were dangerous shelters.

bottom, spiral up the chimney, and spill out over the top (diagram, pages 370-71). If this updraft is stifled, the fire dies. David was, in effect, blocking the flue: pouring air over the top of Frederic and choking off its winds.

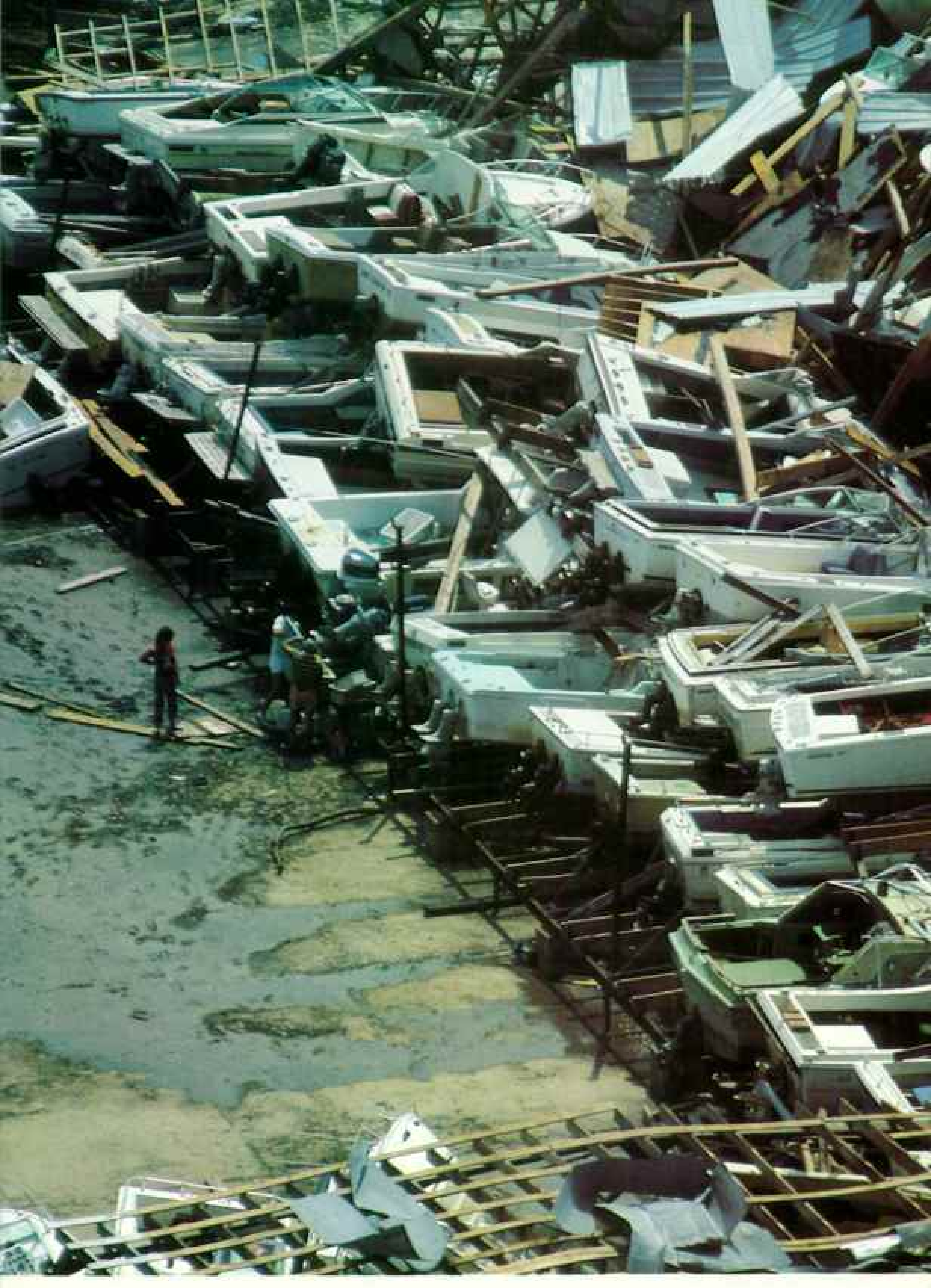
Weakening into little more than sloppy, gusty weather, Frederic seemed about to vanish. Still, the storm sank a fishing boat and its crew off the island of St. Martin, then dumped heavy rains on the Dominican Republic—already battered by David.

That storm, too, had fury left to vent, and threw gusts of 70 miles per hour at Miami Beach. Air Force reconnaissance planes checked wind speed and direction and parachuted instrument capsules into the storm to measure barometric pressure, temperatures, and humidity. Other planes—from NOAA, the National Oceanic and Atmospheric Administration—flew into David around the clock. Computerized weather information they relayed by satellite to the National Hurricane Center described a relentless tropical storm: Over warm water in the Bahama Islands, David had revived. Weather satellites confirmed the recovery, and David began a final long run up the eastern seaboard of the United States, destroying 300 million dollars' worth of property and taking five lives.

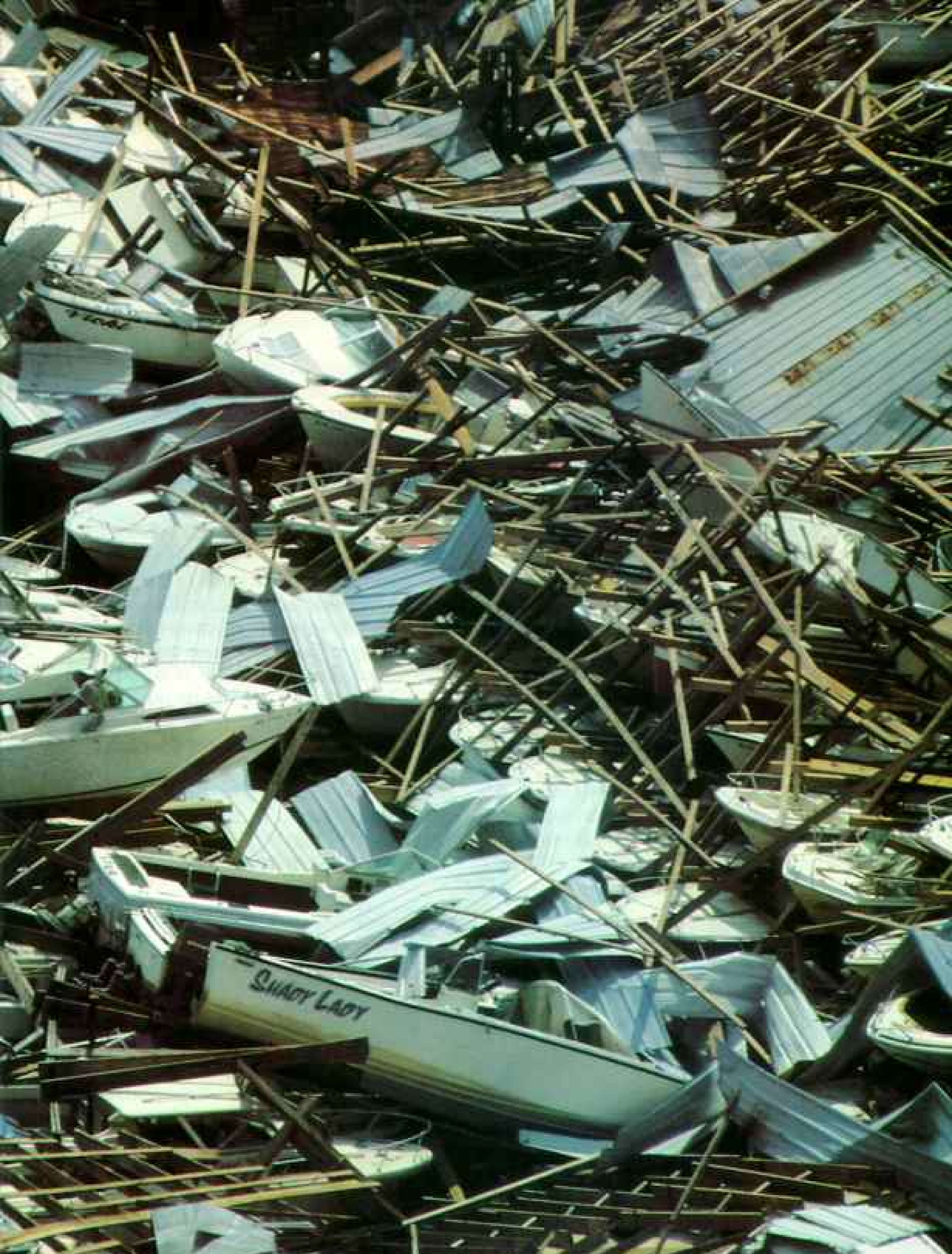
Nor could Frederic be stopped. Breaking free of David's depressing influence over western Cuba, the storm rapidly regained hurricane force and swept north toward the upper coast of the Gulf of Mexico.

At first Frederic defied efforts to predict where it might strike. Radar showed that the hurricane's

(Continued on page 372)



Frederic leveled parts of Dauphin Island, Alabama, where devastating



winds and storm tides smashed boats stacked at a multistory boat shed.

Into the Eye of David

By JOHN L. ELIOT

NATIONAL GEOGRAPHIC EDITORIAL STAFF

SOME AWAIT the winds with a healthy fear, some with feigned indifference or bravado. Others anticipate them as old familiar adversaries that need greater understanding to minimize the loss of life and property.

Such a man is Fred Werley (***below***). It is 9:23 a.m. on Thursday, August 30, 1979. A hundred miles southeast of Puerto Rico he is at the controls of a WP-3D Orion. The blades of its four turboprops are chewing through 140-mile-an-hour winds. In five miles we will penetrate the eye of a hurricane classed 4 on a maximum scale of 5. Its name is David.

NOAA's Research Facilities Center aircraft 42 pitches and yaws and trembles violently. A rush of sunlight floods the cabin. Abruptly the buffeting ceases. Werley's voice crackles over the intercom: "We're in the eye." I crane to gaze eight miles up to the top of the eyewall, the innermost band of clouds that generate the greatest turbulence. It towers like the Roman Colosseum, cyclonic winds howling like lions at us in the tranquil eye.

"Wait a minute," Werley marvels, looking at the radar screen. "It's got a double eyewall. There's a second wall extending partway within the main wall, about seven miles inside it"—an as yet unexplained phenomenon found in intense hurricanes.

To unravel such mysteries, Werley's crew is taking four scientists from the National Hurricane and Experimental Meteorological Laboratory on a study of the storm's complex dynamics. While flying repeatedly in and out of the eye, they will also take fixes on its position and relay them to a satellite that will bounce the data to the National Hurricane Center in Miami.

In the cabin nearly five million dollars' worth of sensitive equipment—including three radar systems and three computers—jounces on shock absorbers of coiled steel cable. In front of me a computer readout terminal flashes second-by-second radar configurations and calculations of wind velocity and direction, vertical wind speed, temperature, barometric pressure—dozens of functions. If David had a voice, we could hear it, and probably talk back.

Through broken clouds below, the sea has

NOAA (FACING PAGE) AND JAMES P. BLAIR

Back-to-back *storms: David bears down on the east coast of Florida, at center, while its "little brother," Frederic, trails behind in the Lesser Antilles in this satellite photograph* (**right**)*. Earlier, the two hurricanes had overlapped, David suppressing outflowing air from Frederic and causing it to weaken. But the storm ultimately reintensified and struck a devastating blow to the Alabama coast.*

gone mad. The waves loom like hulking pyramids that smash into each other to create whitecaps that resemble snow-clad mountains. Like miles-long jellyfish tentacles, sickly greenish threads of air bubbles lace a huge swath of ocean. Werley estimates the waves at 40 feet. "Not a good day for ditching," observes electronics engineer Mike Sims.

One of our crew's most important tasks is to study cloud particles to determine if severe hurricanes like David can be tamed through cloud seeding. Scientists hope to reduce the intensity of hurricanes by seeding them with silver iodide crystals, causing the storm to spread out into a system of lesser intensity. Yet the theory is a prickly one, because some fear the process could also cause adverse side effects.

Other research flights take expendable bathythermographs to drop into the ocean. Their data have shown that passing hurricanes roil deep colder ocean water and cause internal waves that persist for weeks afterward. So awesome is the power of a hurricane that even the sea remembers.

At 2:17 p.m., a shimmering rainbow splits the clouds as we complete penetration number seven and fly out of the eye heading 270 degrees—into the west wall. The crew moves about, comparing notes, checking equipment. Werley doesn't turn on the seat-belt light until he really means it. He's been flying into these things for 19 years. "After 180 eye penetrations, I quit counting," he says dryly. In front of him a radarscope indicates increasing levels of precipitation (and thus turbulence), with colors ranging from green to yellow to red. As we leave the eye, flecks of crimson appear like wounds.

In my seat I study the computer terminal and make some calculations. Barometric pressure is at rock bottom, 27.46 inches of mercury. Vertical wind indicator twitches convulsively. Horizontal wind 90 miles per hour . . . 110 . . . 140. . . .

Werley hits the seat-belt light.

The wind hits 183 miles per hour.

Something seems to seize the plane and jerk it wildly in all directions at once. "Some of our cockpit's coming apart! The radio console's out of its well!" someone on the intercom yells. Lockers in the galley bang open, spewing salt and sugar packets.

Suddenly my tape recorder, its handle looped around my wrist, jumps three feet into the air. It hangs there for a few seconds, then tries to dive down an opening next to the bulkhead. I glance across at photographer Jim Blair. One of his cameras is floating around his eyebrows. His eyes look like Ping-Pong balls. The computer calculates the downdraft, a stomach-twisting 200 meters (about 650 feet).

An updraft hurls us skyward, and our bodies feel twice the pull of gravity. "Hang on," Werley barks.

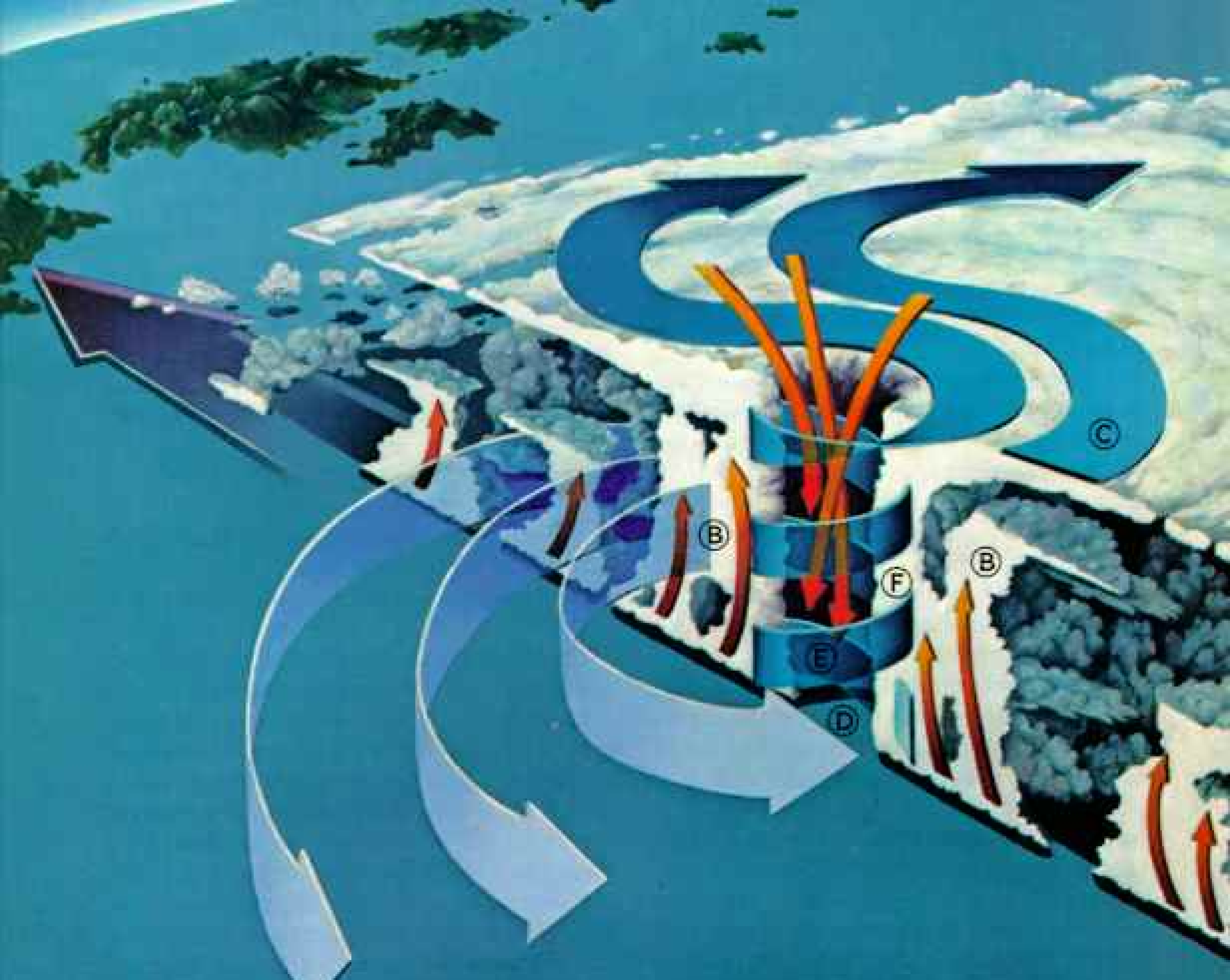
At 5:15 p.m., we complete our eighth pass and head back to Puerto Rico. Half the island looks underwater as Werley sets us down at San Juan in a near-perfect landing. The plane's radar systems are haywire. Computers are down. The air conditioning and a deicer are out. Aircraft 42 will later be X-rayed for structural damage and pass with flying colors. The scientists come away with mountains of data to be analyzed and contributed to a broader picture: the anatomy of a major hurricane (***following pages***).

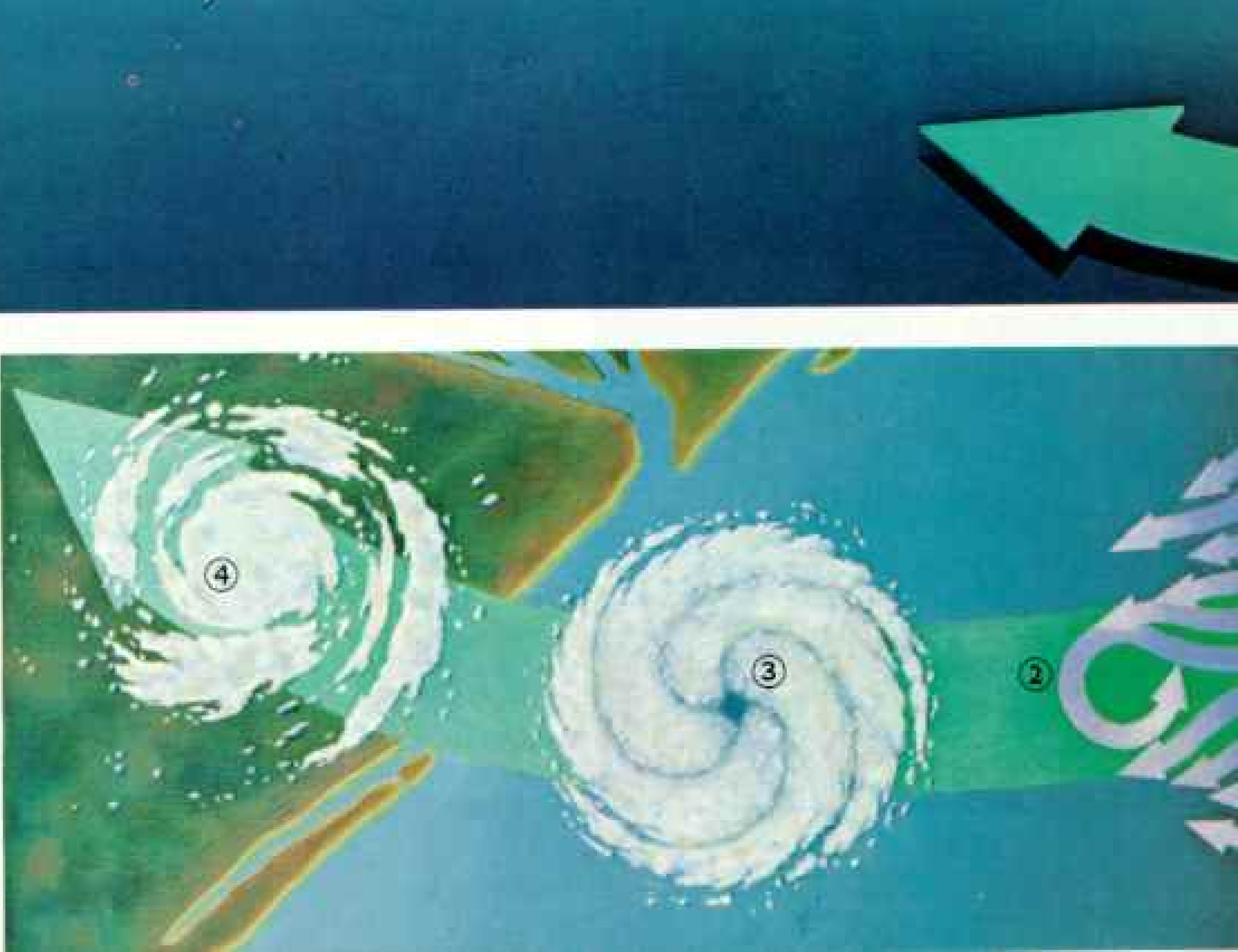
Later, at the hotel bar, the fliers swap stories while David rattles the palm fronds as it lumbers on . . . toward Hispaniola.

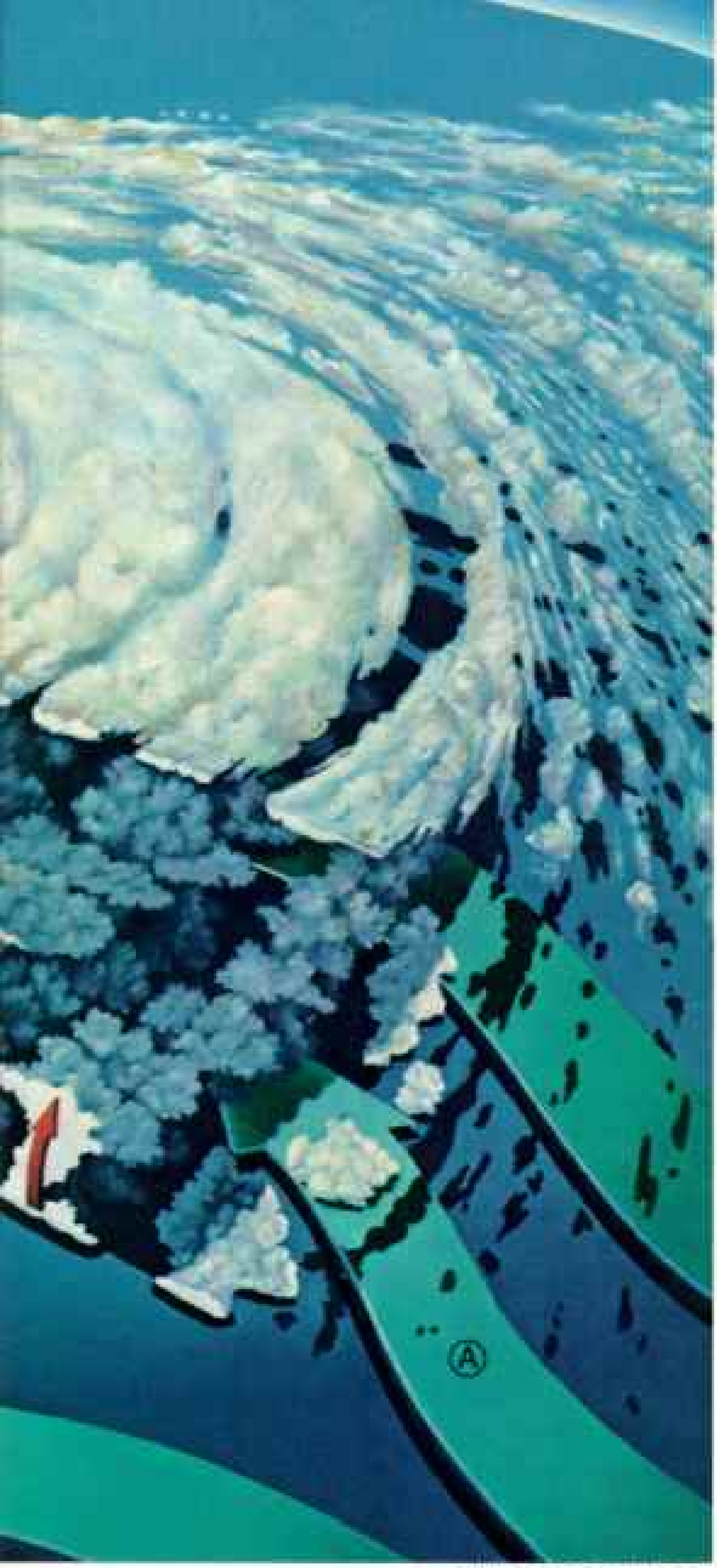
About 1,500 miles east, another hurricane is growling along, but is rapidly weakening. This Thursday, few people are concerned about it. Within 72 hours it will be downgraded from a hurricane to a tropical storm.

Its name is Frederic.

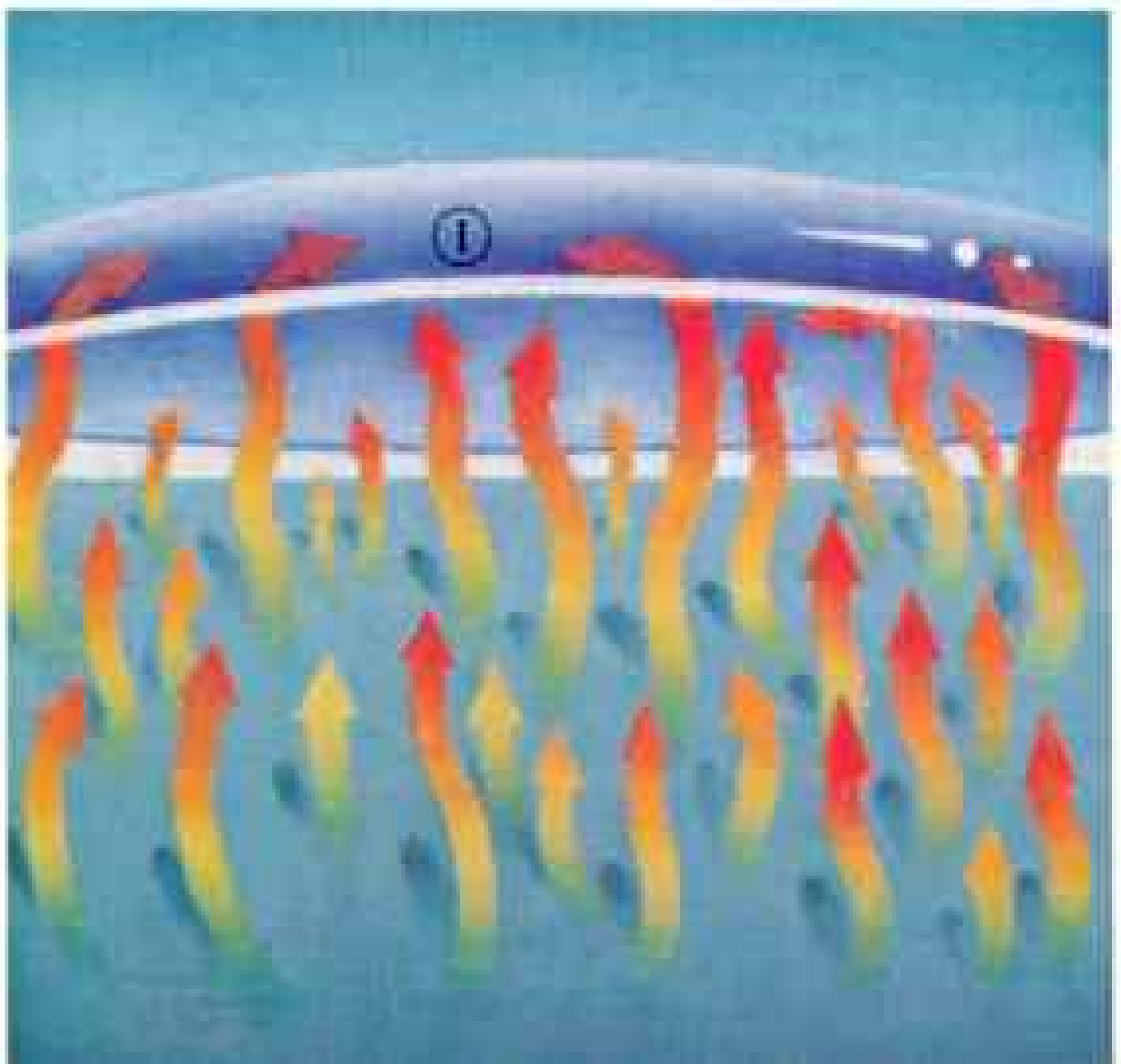
* * *


Ⓒ
Ⓑ
Ⓕ
Ⓑ
Ⓔ
Ⓓ


④
③
②



PAINTINGS BY CHRISTOPHER KLEIN



Dynamics of a hurricane

LIKE HUGE HEAT ENGINES, hurricanes feed on warm moist air and tropical waters. In the North Atlantic from June through November, some 100 disturbances form each year, but only about half a dozen mature into full-blown hurricanes. Roughly 70 percent of these embryonic storms, like David and Frederic, come from the west coast of Africa and are called Cape Verde types.

*In summer, clockwise circulation around the dominant Bermuda high sustains easterly trade winds. Riding the trades are areas of concentrated showers. As air sinks, or subsides, it heats by compression. At the surface, air heated by ocean temperatures to around 26.5°C (80°F) rises but is blocked by this descending warm air, creating an inversion where they meet (***1***). As the showers mature into thunderstorms, they may break through this inversion, lowering the atmospheric pressure at the surface. When pressure drops, the trades are propelled in a spiral pattern by the earth's rotation (***2***). The cycle perpetuates itself, and when sustained winds reach 39 miles per hour, the disturbance is classed as a tropical storm and assigned a name. When the storm becomes organized with winds of 74 miles per hour, it is upgraded to a hurricane (***3***). As it moves north, cooler, drier air penetrates and begins to weaken the system. Once over land, cut off from its ocean power source, the storm rapidly dissipates (***4***).*

*Under optimum conditions, hurricanes grow into howling giants that can span more than 500 miles and orchestrate more than a million cubic miles of atmosphere (***left***). In this cutaway view, trade winds (***A***) govern the storm's track from east to west. Along the contours of its counterclockwise cyclonic flow, bands of dense clouds release torrential rains. Air in these spiral rainbands rises to about 40,000 feet (***B***), where it merges with high-altitude air currents (***C***). Some of the now dry air is forced back down the center of the spiral, creating the relatively calm skies of the eye (***D***), usually about 25 miles across. Outside the eye in lower altitudes, air flows in toward the center and is whirled upward (***E***). Wind velocity increases near the eye, peaking in the innermost band of clouds, or eyewall (***F***).*

Although enormously destructive, hurricanes also bring rain to barren regions and distribute the tremendous heat that builds up in the tropics.

(Continued from page 365)

eye wobbled from side to side over distances of 15 to 20 miles within the storm. When charted from radar fixes on its eye, the hurricane seemed to shift from east to west and back again, yet Frederic was actually following a fairly straight course up the Gulf.

"One wobble to the west made it look as if Frederic were heading for New Orleans," Dr. Neil Frank, director of the National Hurricane Center, told me. "Then the eye drifted east, and the storm seemed bound for Pensacola, Florida.

"Forecasting the wobbles can be difficult, because we don't even know what causes them. They're one reason it's hard to pinpoint a hurricane's landfall."

I wanted to be in the center of Frederic as it came ashore. Dr. Frank predicted the hurricane would barrel into Mobile Bay. He was right on the button.

IT WAS A WHILE before I learned what had happened to Dauphin Island. This fillet of sand lay athwart Frederic's path at the entrance to Mobile Bay, and the hurricane severed the island's telephone lines and breached its causeway to the mainland. Helicoptering in to Dauphin, I saw a crazy quilt of destruction.

The top floors of some houses were gone, the lower stories a soup of debris. Where other houses had stood, only bare pilings remained in gaunt relief against the sky. Battered boats at the Dauphin Island Marina were heaped atop each other or blown completely out of the water (pages 366-7).

Nearby, the Ship and Shore general store had been in a sturdy concrete-block building; there owner Ben Buerger decided to ride out the storm. He sent his family to the mainland but kept his dalmatians, R. J. and Rascal. Friends joined him: Freddie Hoffman; Bobby Taylor; E. B. Quarles, the island's doctor; Mrs. Quarles; retired sheriff's officer Pete Patronas (pages 378-9).

Frederic blew in wild and rough, recalled Pete. "We thought maybe it was the end for all of us. The wind tossed Bobby's camper truck 15 feet and bounced a 400-pound icebox back and forth like a beach ball."

Battening down the Ship and Shore, the little group reeled in all directions when the windows exploded, the roof sailed off, and walls collapsed. Flying glass cut Pete badly; merchandise and debris buried Ben.

Dazed, he dug himself out and discovered the puppy R. J. whimpering beneath a pile of rubble. Above the howling wind he heard shouts from the store's beer cooler; everyone else but Mrs. Quarles was inside.

"I found her in what was left of my office," Ben said later, "and asked if she had seen Rascal. She said she was under my desk. I put Mrs. Quarles under there too and crawled in myself."

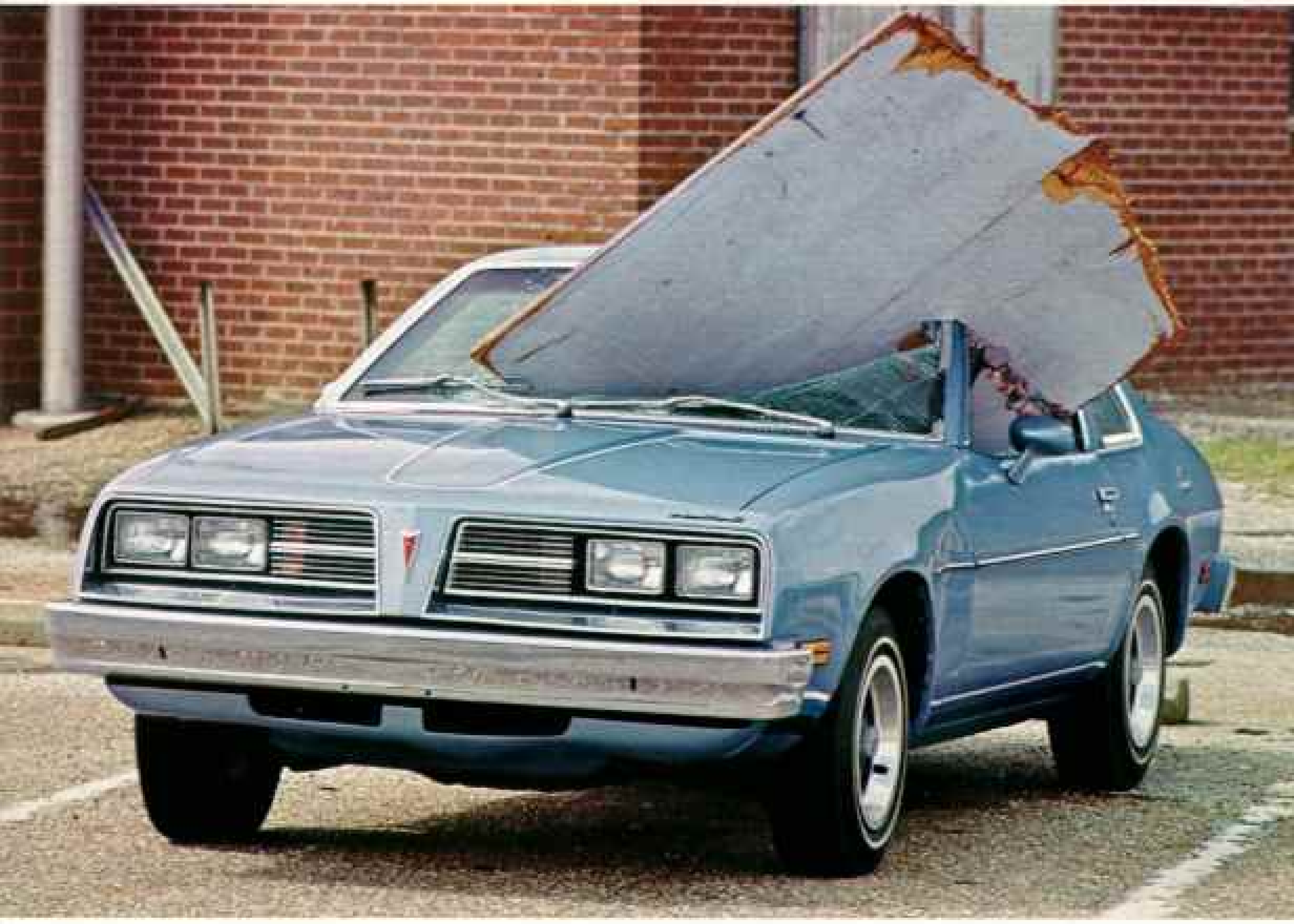
When Frederic's winds slackened at dawn, 24 Dauphin Islanders gathered at the wreckage of the Ship and Shore and counted heads. "It was a miracle we were all still there," Pete Patronas told me in understatement: A 13-foot-high storm surge had breached the island itself in two places.

At Gulf Shores, a vacation colony on a peninsula opposite Dauphin, the surge shattered beachfront homes and deposited them in a pine woods more than a thousand feet from the mainland shore. One man returned after the hurricane to see his splintered house still in place but sandwiched between a motorcycle rental shop and a restaurant that had not been there earlier. Elsewhere, bare foundations outlined a two-story condominium that had simply vanished.

The waterfront home of Alabama Governor Fob James still stood because he had built with reinforcing steel. From the air I saw the Gulf Shores Holiday Inn seemingly intact, but on the ground I found only empty cubicles where rooms had been. The storm surge had ripped out front and back walls, windows, and furniture. The motel resembled an abandoned honeycomb.

INCREDIBLY, NO ONE DIED at Gulf Shores or on Dauphin Island. But never have the southern and Atlantic coasts of the United States been more vulnerable to a deadly hurricane.

For years the National Weather Service, Civil Defense leaders, and seacoast preservationists have feared a natural disaster to dwarf all others in U. S. history. They are certain that a hurricane will someday sweep beaches and isles crowded with people, possibly killing many thousands. Such shock treatment is agonizing to contemplate, but veteran coast dwellers know that beaches



***Airborne guillotines** flew in Frederic's 133-mile-an-hour winds. This one missed any human targets. One of the nation's most destructive hurricanes, Frederic killed five people and caused more than two billion dollars' damage.*

and sandbar-like barrier islands belong to the sea. They do not hope to hold this borrowed land safe from the inexorable wind and tide.

Before the oceanfront building boom of the past three decades, seaside homes were often simple wooden cottages on stilts. Their occupants did not interfere with the natural surroundings, nor attempt to breast the hurricane in its own arena. When a storm approached, they boarded up their cottages and retreated.

UNFORTUNATELY, millions of migrants unfamiliar with coastal life have flocked to the water's edge. Between 1960 and 1970, as the U. S. population grew 12 percent, the number of residents in Atlantic and Gulf coast counties soared more than 40 percent. According to a 1975 National Weather Service survey, almost 80 percent of the 40 million people then living in hurricane-threatened areas had never experienced a direct hit by a major hurricane. This want of experience could be dangerous; Civil Defense studies have indicated that many of these people would refuse to evacuate their homes voluntarily in the face of an oncoming hurricane.

During the hurricane off-season from December through May, Dr. Neil Frank travels regularly to danger areas, trying to persuade otherwise rational people to save their own lives. He lectures, advises, and pleads for recognition of the dangers to life along the razor-edge of land where people and oceans merge. Sometimes he feels he is accomplishing little.

"Human behavior is even more difficult to predict

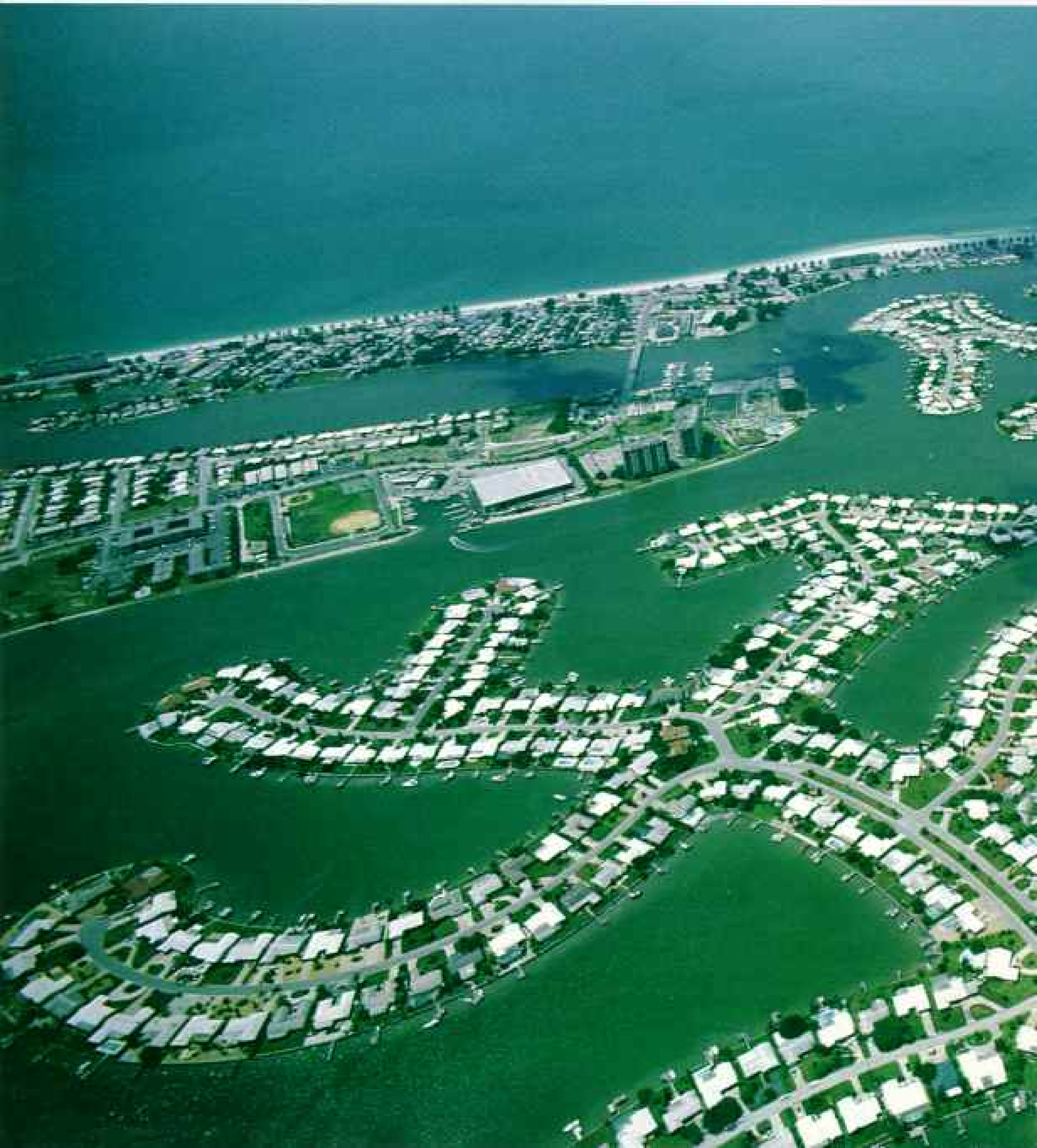
(Continued on page 378)

Sitting ducks: *If a severe hurricane hits the central west coast of Florida, forecasters warn, then heaven help the 65,000 people whose homes dot sandspits like these, dredged from Tampa Bay (**below**).*

*"It's a disaster that's waiting to happen," declares Dr. Neil Frank (**right**), director of the National Hurricane Center. "We have no idea how long it would take to evacuate those people. We try to give 12 daylight hours of warning, but in many cases that's not enough."*

Of 40 million Americans living in areas vulnerable to such storms, four out of five have never had a direct hit by a major hurricane. Dr. Frank travels the Atlantic and Gulf coasts, preaching preservation of beaches, tougher building codes, and better evacuation procedures. As a last resort, he favors "vertical evacuation"—moving people into the tallest, soundest structures that are farthest from the beach, thus escaping storm surges that, coupled with normal tides, can exceed 25 feet.

"People often respond, 'Someday you may be right, but we can't do anything now



because we're so caught up in all our day-to-day problems,' " Dr. Frank says. The last big blow to hit Tampa came in 1921, long before the recent boom of retirement homes and condominiums. Although the population was only about 20,000, the storm still caused a million dollars in damage (in 1921 dollars).

"Some argue that in its entire history Tampa has only experienced three severe hurricanes," Dr. Frank notes. "And they're right.

"But man, it only takes one."

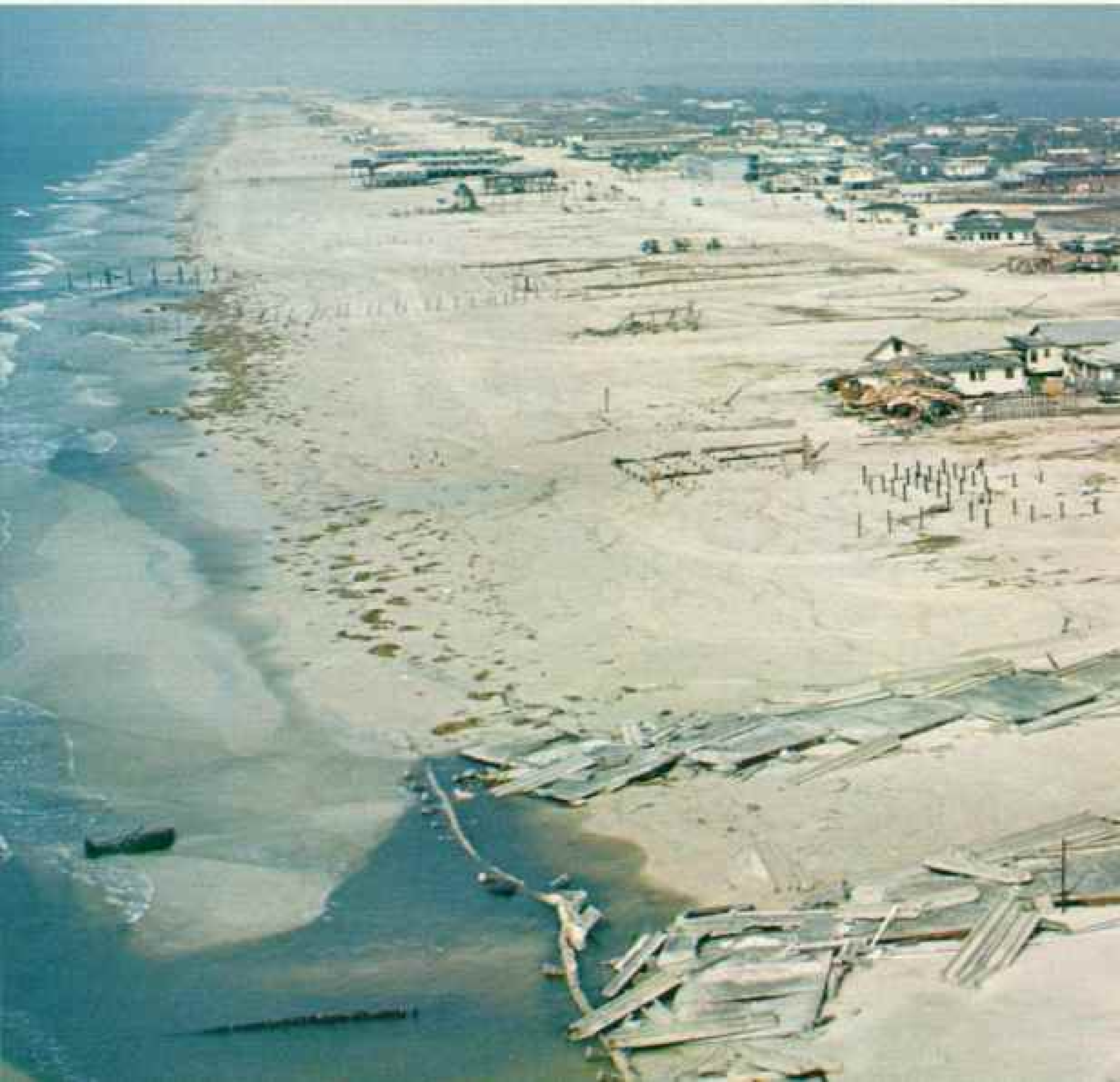
BOTH BY JAMES P. BLAIR

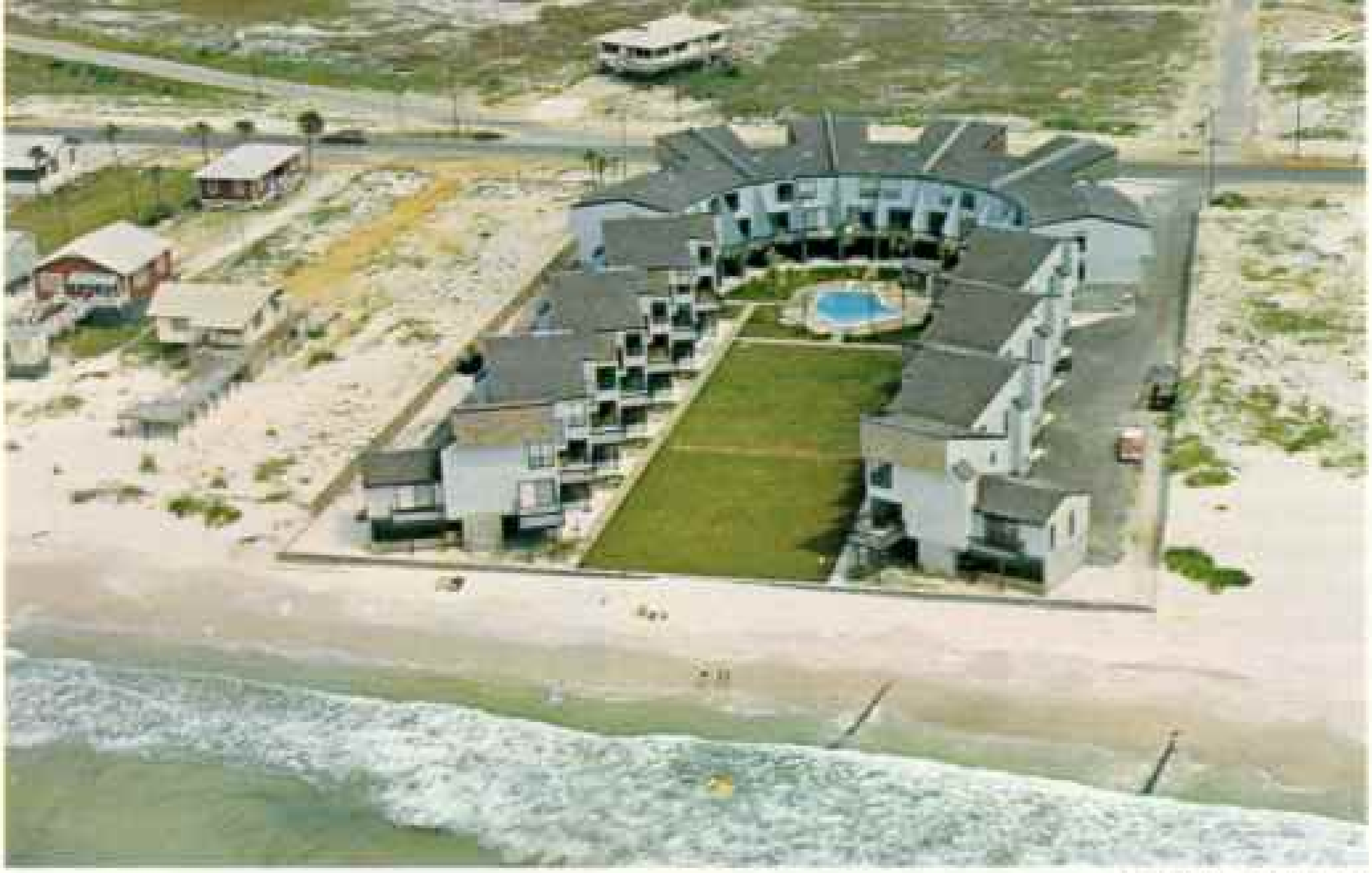
In harm's way: *With gentle surf at their doorsteps, condominium owners at the Beach House (***right***) in Gulf Shores, Alabama, enjoyed ideal beachfront living when this photograph was taken in 1978. Waves raged over their doorsteps on the night of Hurricane Frederic, when a storm tide as high as 15 feet covered the low, sandy peninsula.*

*Of this complex, only a few gutted units survived (***below***). One house formerly alongside the condominium is here visible behind it, shoved across a washed-out road. Others have disappeared.*

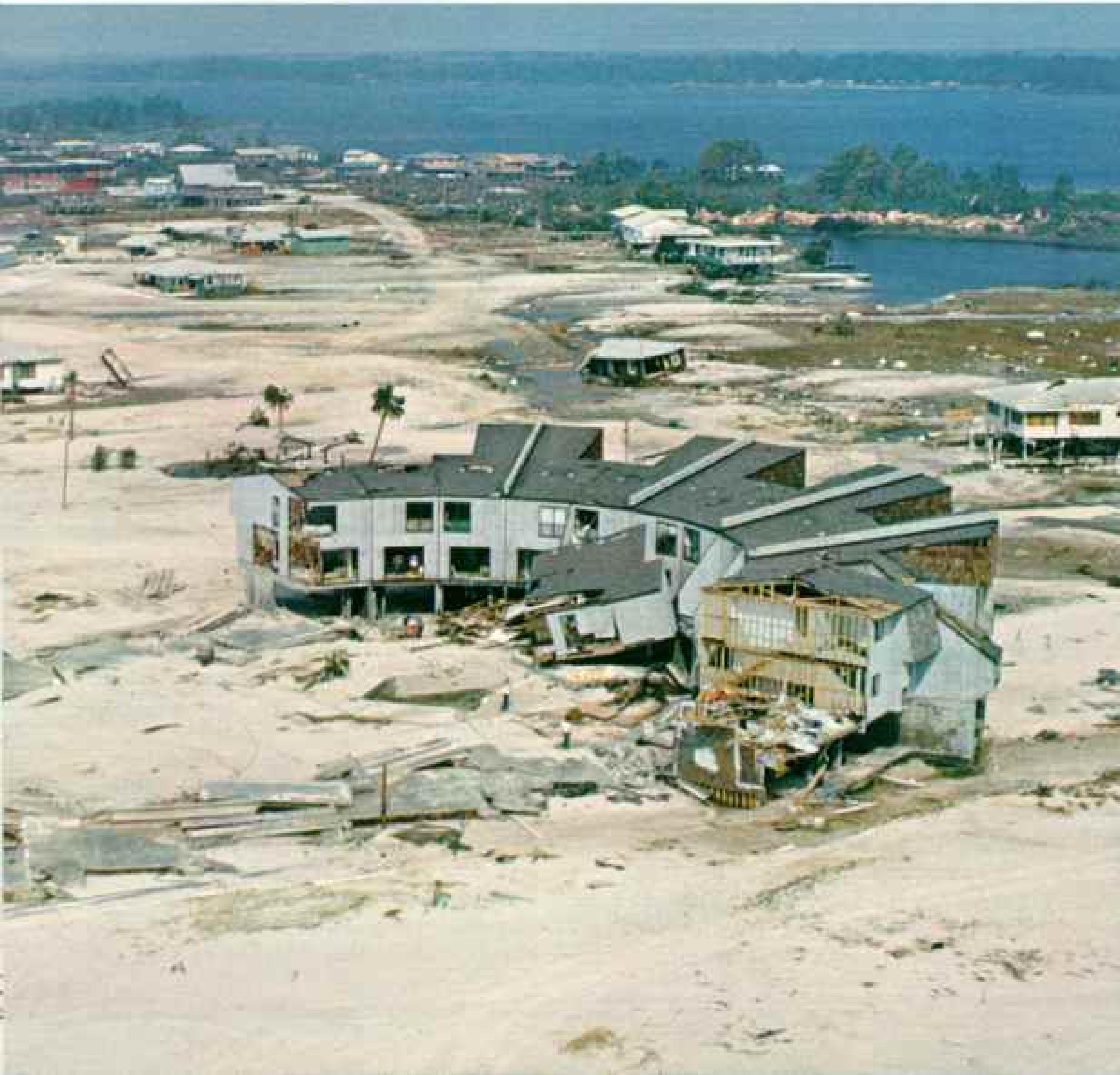
Fortunately, no one attempted to ride out the storm in these buildings. Large-scale evacuation of vulnerable areas in Florida, Alabama, and Mississippi was officially announced the morning before Frederic came ashore. In this case public response kept casualties to a minimum. Hundreds of thousands of coastal residents streamed inland, jamming hotels and shelters over much of the South. Many left even earlier, perhaps mindful of the killing fury visited on Mississippi's coast when Hurricane Camille struck in 1969.

"People seemed to realize, 'This is it,'" says Norman Davis, Mobile Civil Defense director. "And as long as memories of this one remain, I don't think we'll have any trouble convincing people to evacuate. Folks just didn't believe wind could get that strong."





LACEY PHOTOGRAPHY (ABOVE)



than a hurricane," Dr. Frank muses. "There are many coastal areas where I don't think we could get enough people out to forestall tragedy."

Even those willing to flee a hurricane might not get very far, hampered by inadequate escape routes. On the south and central west coast of Florida, 200,000 persons live on offshore islands, each linked to the mainland by a single low bridge. Rising water could block these spans 12 to 24 hours before the advent of hurricane winds. From the Florida Keys, escape to the mainland lies over the two-lane Overseas Highway, and in a panic evacuation this could be closed quickly by auto wrecks or the heavy waves of storm tides.

Along the New Jersey coast, 100,000 or more weekenders jam each of several islands during hurricane season. Even if everyone moved fast at the first hurricane warning, it would require ten hours to clear the islands. Forecasters try to issue warnings that allow 12 daylight hours for evacuation, but under some conditions there might be less than six hours' notice—possibly only three. Hurricanes pick up forward speed as they move north, placing the northeast coast in double jeopardy.

Late hurricane warnings might not save many residents of highly developed areas such as Padre Island off the Texas coast. Hurricane Beulah sliced the 113-mile-long island into 31 segments only 13 years ago, but developers have since built high-rise apartments and condominiums in the washed-over areas.

TAMPA BAY, where thousands of homes perch on islets of dredged-up sand (pages 374-5), is a special danger zone. The tides of a severe hurricane would probably smash all these homes to bits.

Engineer Sebastian D'Alli, executive director of Civil Defense for Sarasota County, calculates the force of hurricane winds and waves and the damage they inflict. I asked him what a storm such as Frederic could do in a direct hit on Tampa Bay. Choosing a condominium as an example, D'Alli produced startling figures.

"A ten-story condominium is about a hundred feet tall and, let's say, a hundred feet wide. That's 10,000 square feet for the wind to work on. A 155-mile-an-hour wind like Frederic would hit the condominium with 300 tons of force. Perhaps the building could survive the wind alone, but we also have a storm surge battering its foundations, and the density and force of water is a thousand times greater than that of air.

"In one blow then," D'Alli reckoned, "the hurricane would ram 8,000 tons of force into the condominium, more than any structure could withstand. Every building on our beaches and islands would be reduced to rubble." Under such an assault, even the geography of Tampa Bay itself might be drastically reshuffled.

Many of today's overbuilt coastal communities first formed while the shifting character of beaches and barrier islands was still poorly understood. Beaches yield to the storm surges that crash over them and, when the surf quiets, rebuild themselves, though not always in the same place. Barrier islands wander too, sculpted by tide and

They lived to tell about it. *Ben Buerger* ***(right)*** *stands amid the ruin of his store, where he and five neighbors rode out Hurricane Frederic on Dauphin Island, Alabama. One, Pete Patronas* ***(below)****, gets a hug from a friend grateful to find him safe.*

wind. Hurricanes may sunder an island or help restore another; some islands simply vanish; others appear where there had been nothing.

Coastal counties seeking more tax dollars often confine and develop migrating beaches and islands. As a first step, sand dunes are bulldozed or dredged to fill in marshes that absorb and disperse hurricane tides. States finance road, bridge, water, and sewer projects. The National Flood Insurance Program reimburses beach dwellers for storm losses private insurers will not cover. As buildings, seawalls, and roads hem them in, beaches and barrier islands disappear, robbed of their ability to recover naturally. Interference intensifies when a hurricane strikes: More sand erodes, and more bulkheads and jetties go up, in ignorance or defiance of the role that hurricanes play in nature.

Hurricanes, like other storms, have their beneficial effects. They douse forest fires, revive drought-stricken wetlands, and stir up nutrients in coastal estuaries, the spawning and nursery grounds for commercial food fish. In the tropical islands, hurricanes provide much needed rainfall.

Moreover, hurricanes are moderators of the atmosphere. They transport heat from the tropics to the north and help balance world temperatures. Cold fronts pour vast amounts of arctic air into the tropics; hurricanes spiral hot air away from the Equator.

THERE IS AWE, respect, and even admiration in the voices of longtime beach dwellers when they talk of hurricanes. They accept it as inescapable that they must accommodate themselves to the waves and the weather. But developers, vacationers, and condominium owners continue to crowd the coast, and often refuse to compromise with the giant storms. Who is right may become clear only when the next great killer hurricane finally comes. ☐

MADAWASKA
DOWN EAST WITH A FRENCH ACCENT

By PERRY GARFINKEL

Photographs by
CARY WOLINSKY
STOCK, BOSTON

GEDEON CORRIVEAU lives on the edge—on the edge of two countries, the edge of two cultures, the edge of past and future. From his century-old mill in Upper Frenchville, Maine, where he runs one of the last buckwheat-grinding operations in the valley, he looks down his long treelined driveway at U. S. Route 1 as it nears the end of its 2,360-mile odyssey from Key West, Florida. Just across the road is the Saint John River and just across the river is the town of St. Hilaire in New Brunswick, Canada.

This is the upper Saint John River Valley, also known as Madawaska. This remote region, where the northernmost stretch of Maine meets the westernmost reach of New Brunswick, lies some 200 miles from either Bangor or Quebec City (map, pages 386-7). It is isolated by the green womblike mountains, the whims of international boundaries, and the quirks of cultural history.

The 60,000 people who live along the hundred miles from Grand Falls, New Brunswick, to Allagash, Maine, think of themselves not so much as Canadians or Americans, but as citizens of a country in between. When

(Continued on page 386)

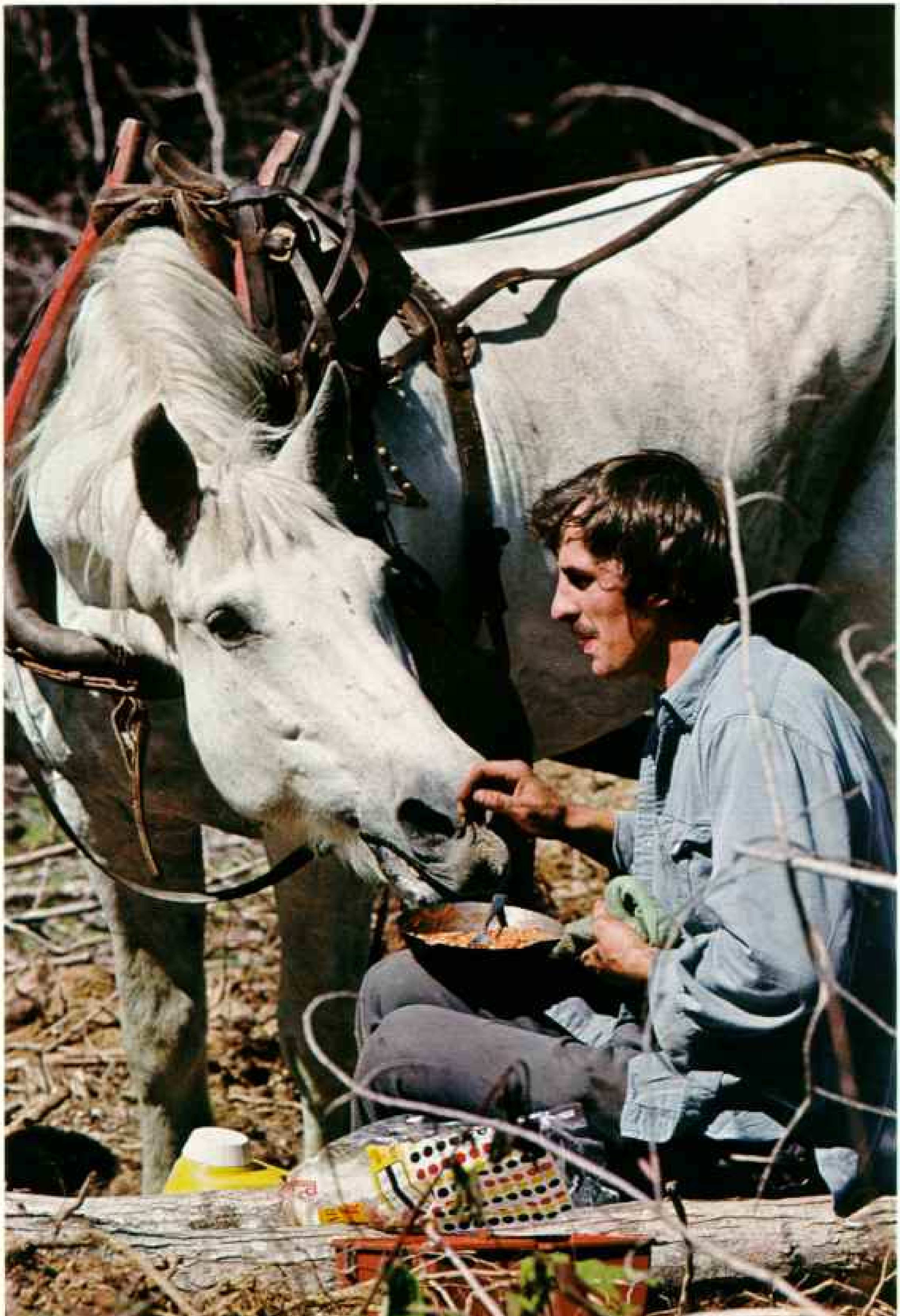
Far from the rush *of world events are the front porches of Madawaska—a quiet valley of French-speaking folk*

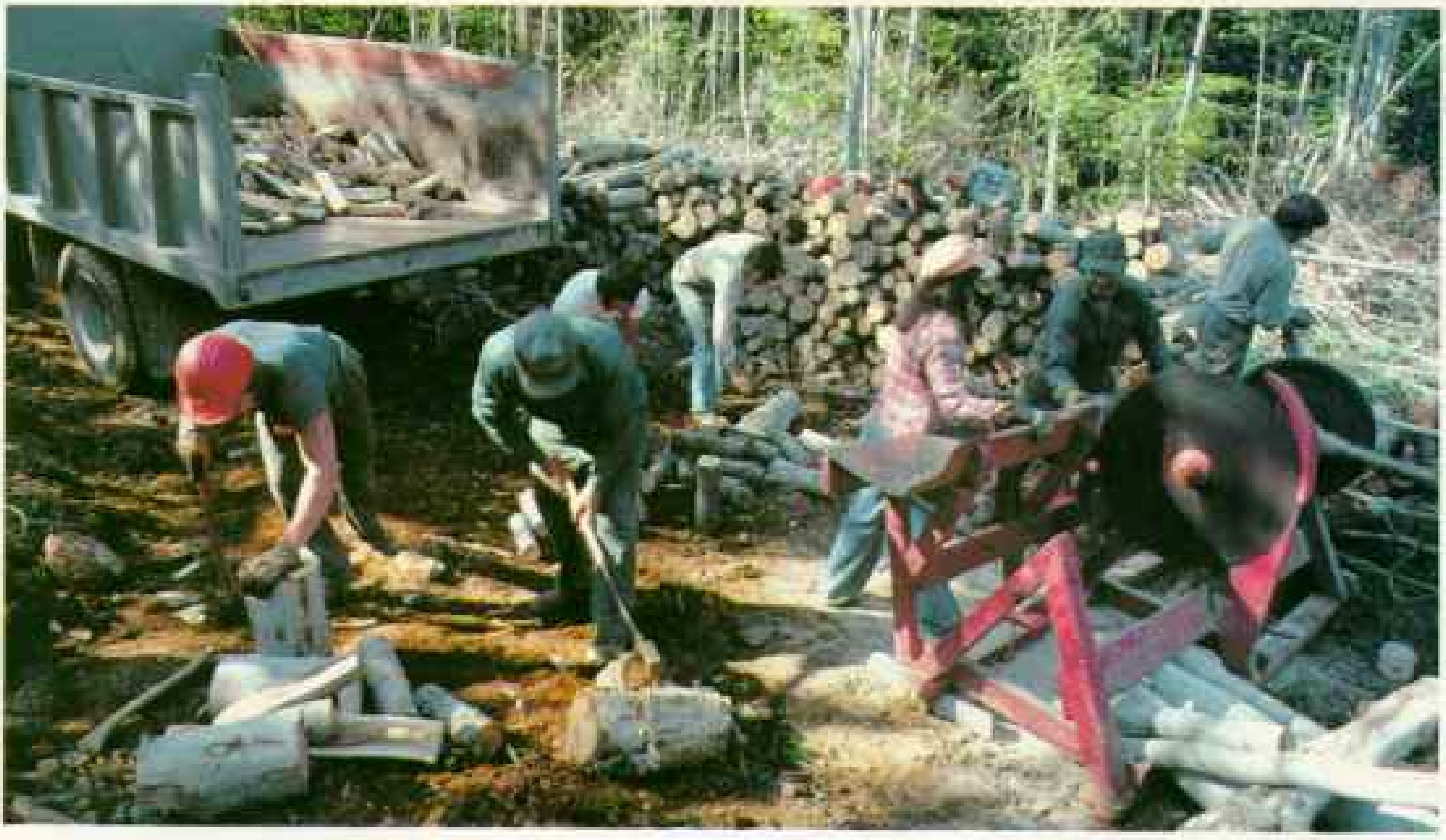
astride the border between New Brunswick and northernmost Maine. Though Canadians by law, the Gerard Durepos family are, like friends and relatives across the boundary, Madawaskans at heart.

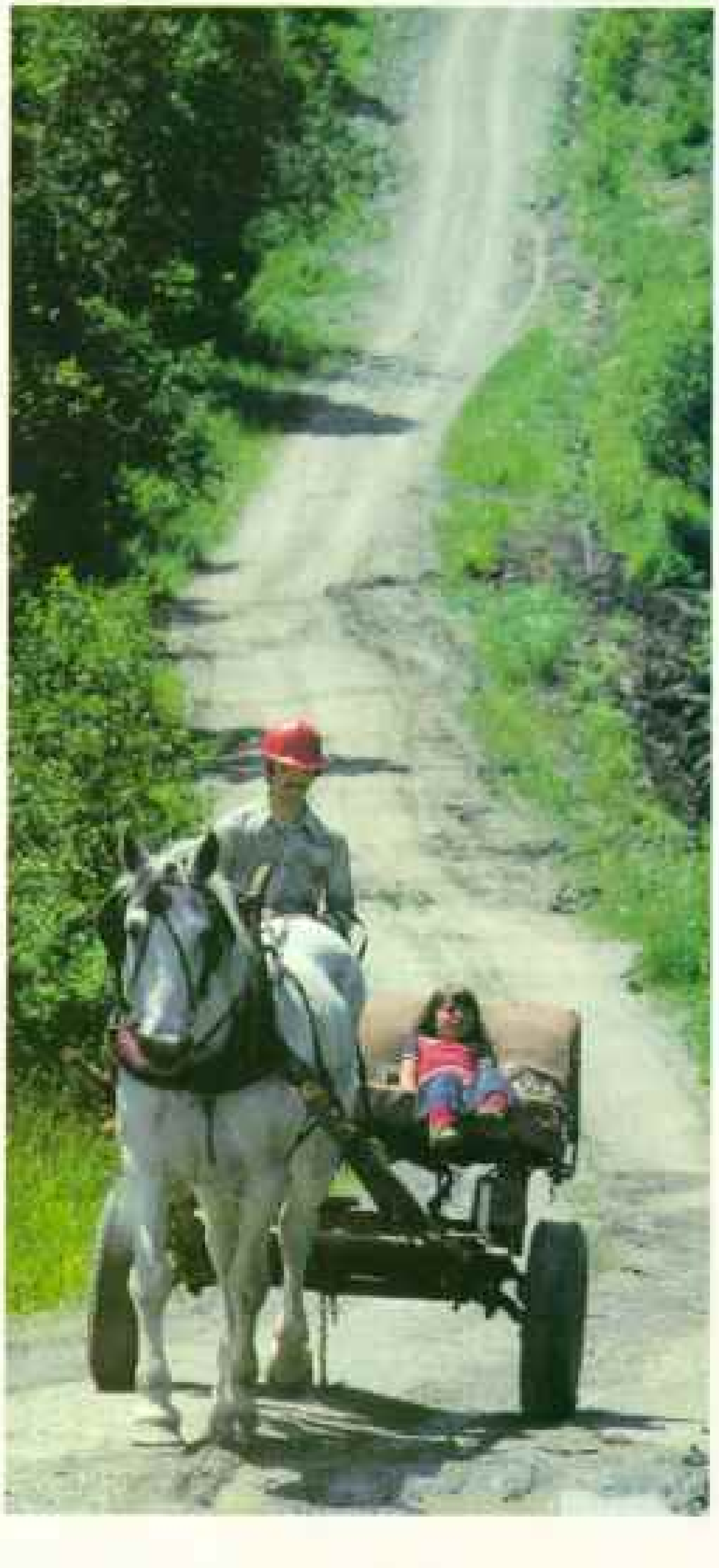
Province of the Maine potato, giant Aroostook County shoulders into the

National Geographic, September 1980

Madawaska region, where corduroy fields signal spring planting.



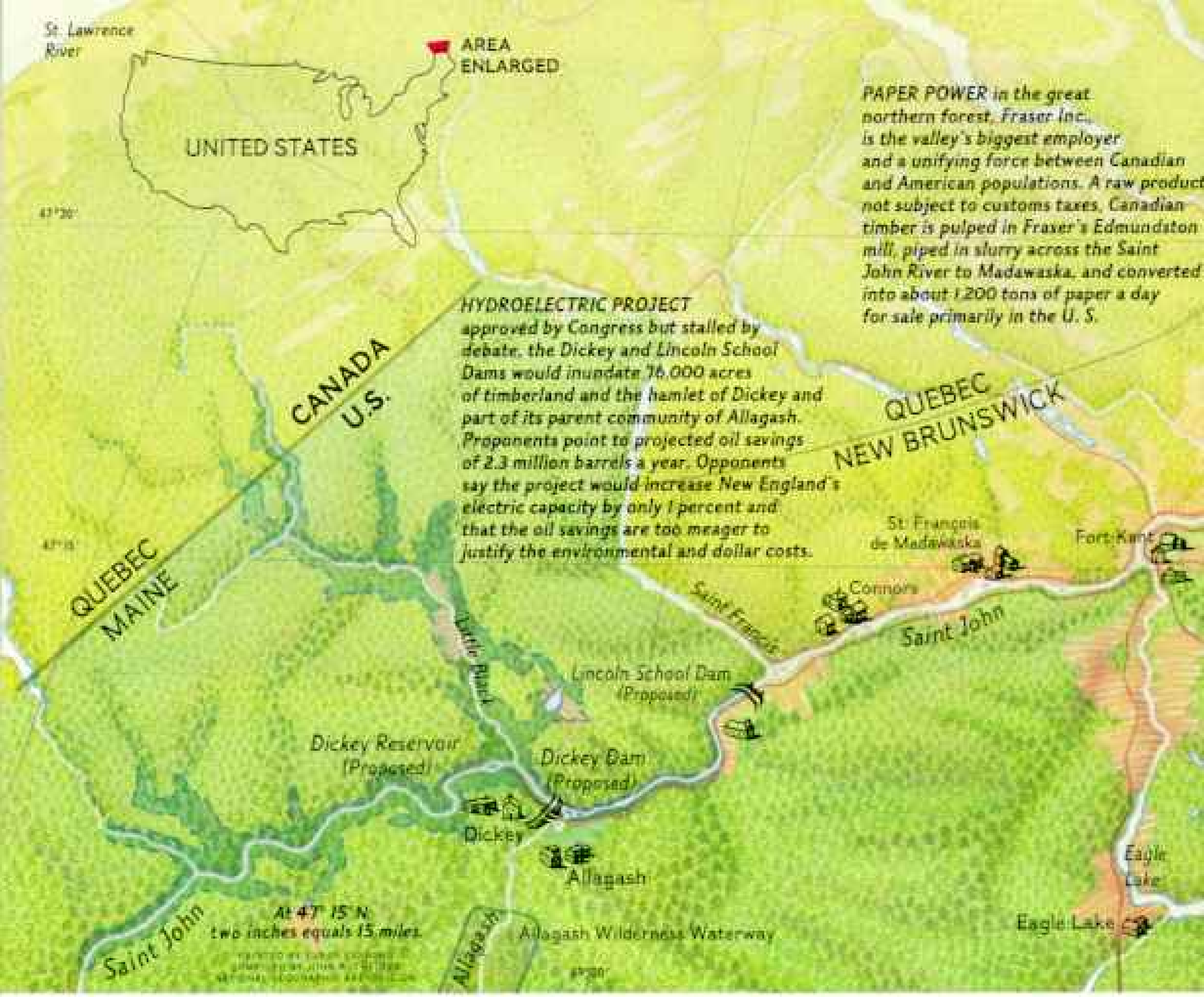




FAMILY TREES are family ties on Elude Landry's timber farm on the Canadian side of the Saint John River, the international boundary that runs through the heart of the Madawaska region.

*While Elude saws with his daughter (**above**), five of his eight sons cut, split, and load firewood for sale on both sides of the river. A nostalgic supplement to their mechanical equipment, the family horse (**left**) sniffs approvingly at Claude Landry's bean lunch, and later provides a slow ride home (**right**).*

The Landrys are among the French-speaking majority in the Madawaska region. Many are descendants of Acadians, the early colonizers of present-day Nova Scotia, who were exiled in 1755 after their land passed from French to British rule. Though many families found refuge in Louisiana, hundreds more resettled in coastal New Brunswick, and a small handful became the first colonizers of the Madawaska region.


St. Lawrence River
AREA ENLARGED
UNITED STATES
CANADA
U.S.
QUEBEC
MAINE
QUEBEC
NEW BRUNSWICK
St. Francois de Madawaska
Fort Kent
Connors
Saint Francis
Saint John
Lincoln School Dam (Proposed)
Little Black
Dickey Reservoir (Proposed)
Dickey Dam (Proposed)
Dickey
Allagash
Eagle Lake
Eagle Lake
Allagash Wilderness Waterway
Allagash
Saint John
At 47° 15' N. two inches equals 15 miles.

PAPER POWER in the great northern forest, Fraser Inc., is the valley's biggest employer and a unifying force between Canadian and American populations. A raw product not subject to customs taxes, Canadian timber is pulped in Fraser's Edmundston mill, piped in slurry across the Saint John River to Madawaska, and converted into about 1,200 tons of paper a day for sale primarily in the U. S.

HYDROELECTRIC PROJECT approved by Congress but stalled by debate, the Dickey and Lincoln School Dams would inundate 76,000 acres of timberland and the hamlet of Dickey and part of its parent community of Allagash. Proponents point to projected oil savings of 2.3 million barrels a year. Opponents say the project would increase New England's electric capacity by only 1 percent and that the oil savings are too meager to justify the environmental and dollar costs.

I asked 19-year-old Patsy Bernier of Fort Kent, Maine, which country she was from, she stated: "The valley is my country."

Life at this border has its idiosyncrasies. A baby born to an American family living in the town of Madawaska, Maine, will most likely enter the world in Edmundston, New Brunswick—since Madawaska has no hospital—and therefore can claim dual citizenship according to both United States and Canadian law. Intermarriage between the valley's Canadians and Americans is so common you need a scorecard to keep track. Money games are even trickier, with exchange rates for Canadian and American dollars fluctuating with the fickleness of the weather. A person who works on one side of the border but lives on the other can make a career of filling out an income tax form. And if he is an American working in Canada, he must get up an hour earlier than his Canadian co-workers, since New Brunswick time is an hour ahead of Maine's.

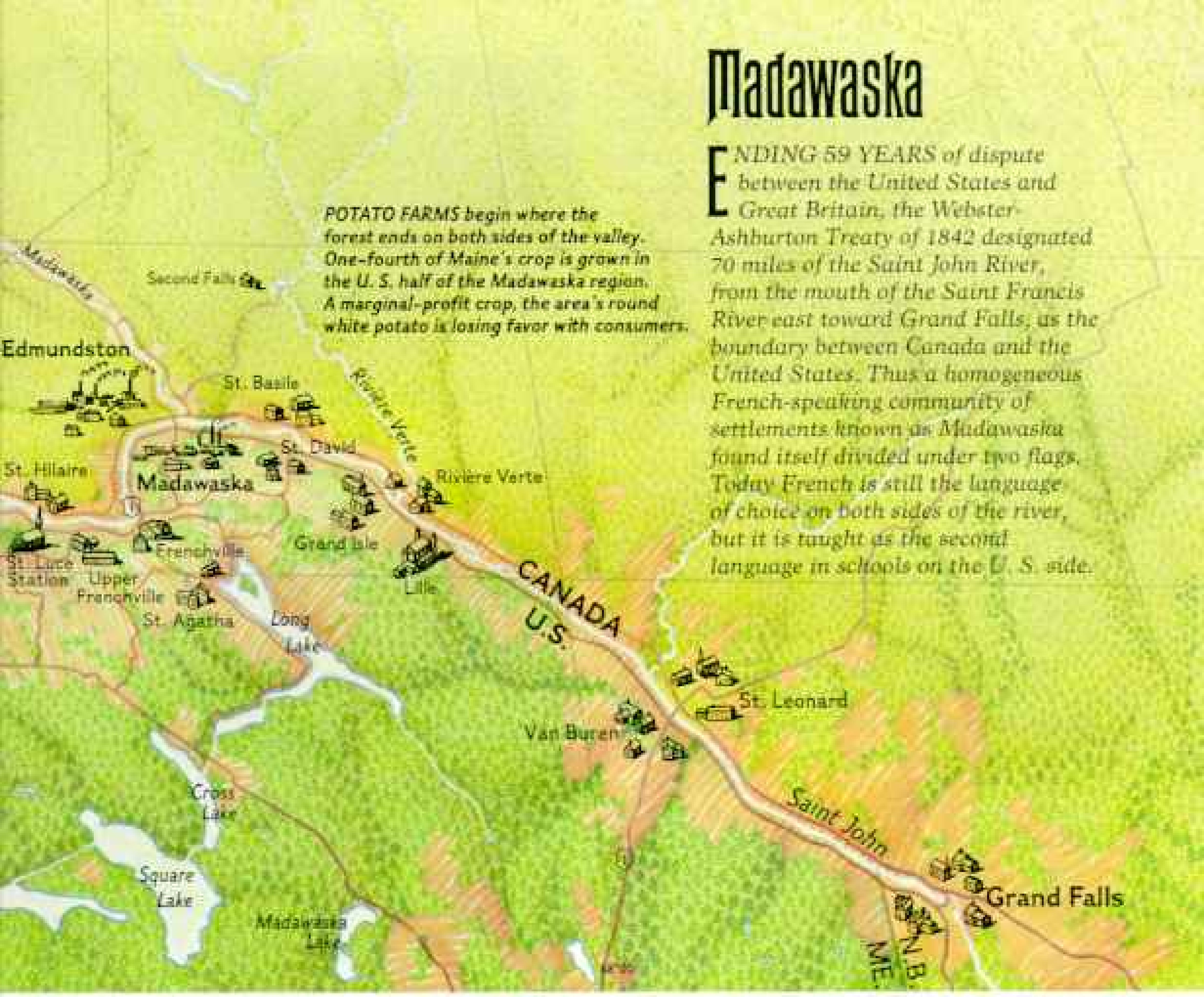
Despite these complications, the three border crossings along the upper Saint John River—at Van Buren, Madawaska, and Fort Kent—are among the busiest along the entire length of the United States–Canada boundary. This may be due, at least in part, to the fact that the blood of family ties runs thicker here than do the international waters of the Saint John.

And, as much as anyone's, the story of the Corriveau family is the story of the valley.

Gedeon Corriveau, born in Upper Frenchville, is a loader for Fraser Paper, Limited, where he has worked 25 of his 53 years. In the valley, if a man isn't growing potatoes, he's likely working for the paper industry. Between the Canadian pulp mill

Madawaska

ENDING 59 YEARS of dispute between the United States and Great Britain, the Webster-Ashburton Treaty of 1842 designated 70 miles of the Saint John River, from the mouth of the Saint Francis River east toward Grand Falls, as the boundary between Canada and the United States. Thus a homogeneous French-speaking community of settlements known as Madawaska found itself divided under two flags. Today French is still the language of choice on both sides of the river, but it is taught as the second language in schools on the U. S. side.



POTATO FARMS begin where the forest ends on both sides of the valley. One-fourth of Maine's crop is grown in the U. S. half of the Madawaska region. A marginal-profit crop, the area's round white potato is losing favor with consumers.

Madawaska
Second Falls
Edmundston
St. Basile
Rivière Verte
St. David
St. Hilaire
Madawaska
Rivière Verte
Grand Isle
Frenchville
St. Luce Station
Upper Frenchville
St. Agatha
Long Lake
Lille
CANADA
U.S.
St. Leonard
Van Buren
Saint John
Cross Lake
Square Lake
Madawaska Lake
Grand Falls
N.B.
ME.

and the U. S. paper mill, Fraser puts something on the table of almost every family.

Gedeon's wife, Aline, was born in St. Hilaire on the other side of the Saint John—"across." She teaches French to second and third graders. Several generations back, both their families emigrated from France to Quebec and then made their way to the valley. They are devout Catholics and attend church regularly, where the Mass is celebrated in French.

"This's gonna be the last year I grind buckwheat," Gedeon told me in a singsongy patois that managed to combine Maine drawl, Canadian twang, and French twist. He wiped his lean, weatherworn face and dumped a barrelful of grain into the antique grinder. "No matter how I figure it, I will come out in the red." His eight-year-old daughter Nicole, a blue-eyed blonde, and dark-haired Susan Thibault, one of Nicole's 42 cousins from across, played on the steps of the mill where buckwheat sprouts peeked through the cracks.

"Buckwheat used to be a major crop in these parts. We used it for everything. The walls of my house are insulated with it. I still heat with buckwheat hulls. But at this point grinding buckwheat is more like a community service for me. Everyone in the valley who makes *ployes* buys their buckwheat from me." Ployes are buckwheat pancakes, and everyone in the valley eats them.

In the kitchen Aline poured buckwheat batter on the top of the wood-burning stove. Four handsome blond Corriveau girls bustled and giggled their way around, preparing mashed potatoes, fiddleheads, brisket, and bread, singing a French song.

"We're probably the only family in town

who still use a wood stove," Aline said apologetically, and didn't seem to believe me when I said many of my urban friends would envy her that. Stoking the stove, she told me: "I don't make ployes much any more. Too much time. And people are very particular about their ployes. Some say you shouldn't flip them. Cook them one side only. Everyone has their own recipe." Steaming hot and buttered, or layered with baked beans and molasses, then rolled up and eaten with the fingers, Aline's ployes were impossible to resist.

Mother Tongue Once Forbidden

Over dinner the conversation was politely in English. If I had not been there, they would be speaking the local French, a combination of Canadian French and an archaic idiom traced to 17th-century France and laced with the nautical terminology of those French ancestors who originally settled and farmed a land that they called l'Acadie—Acadia—along the shores of the Bay of Fundy and its inlets. A majority of the people in the upper Saint John Valley speak this dialect as their mother tongue, but until ten years ago Maine forbade children to speak it in school. Then, in 1970, valley educators designed a bilingual education program with a grant under the Elementary and Secondary Education Act, and it became a model program throughout the U. S.

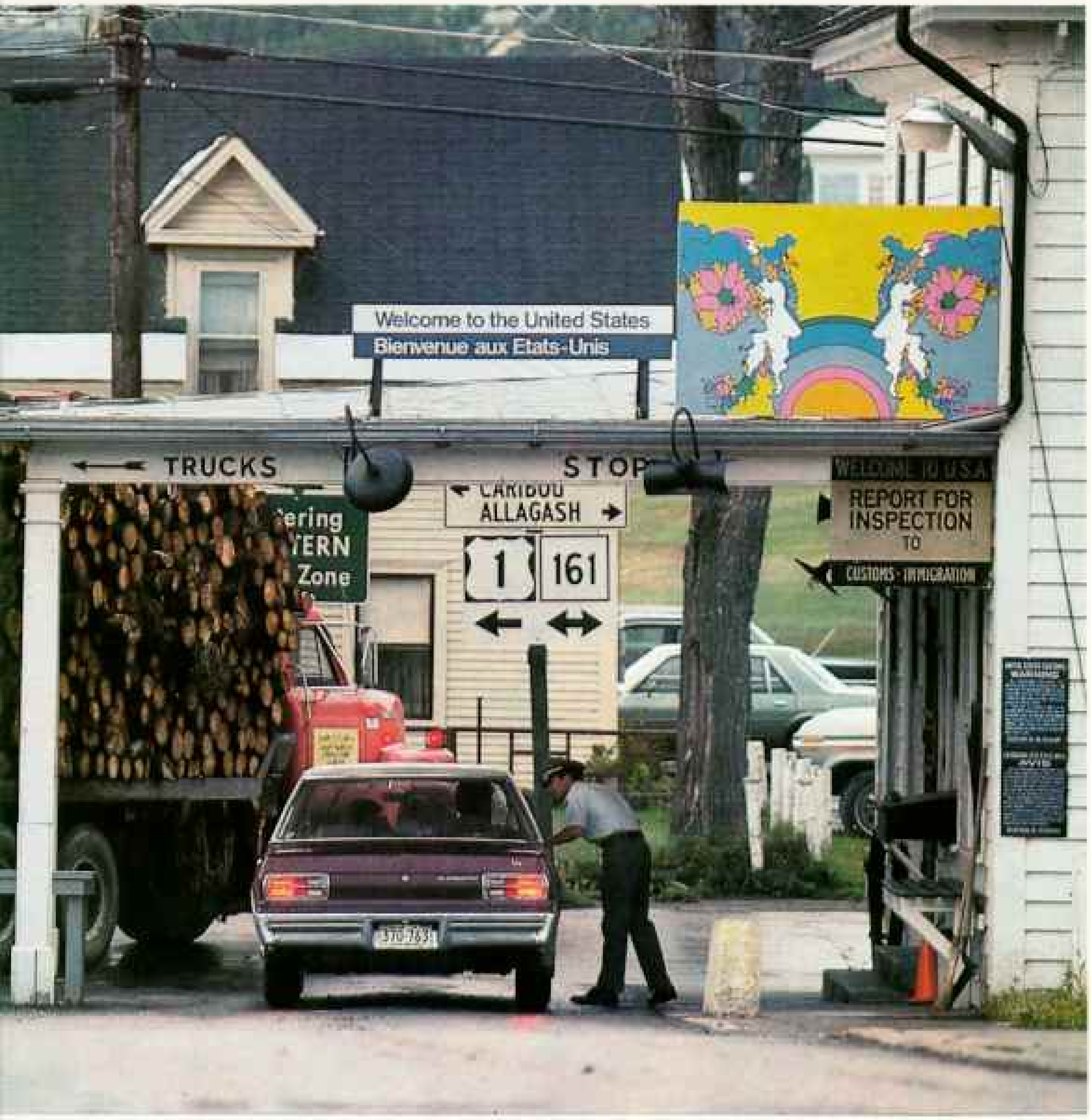
I got a look at the bilingual program when I accompanied Nicole to her second-grade French class at the Dr. Levesque School in Upper Frenchville. The teacher, Claudette Paradis Violette, told me before the class started, "The parents who were denied the right to speak French are delighted their children can speak bilingually now." She knew because she was one of those parents. "Most of these children's great-great-grandfathers were Acadians. But at this age they don't yet grasp the concept of ancestry—though it's never too soon to try."

She opened the lesson with some Acadian history—in French. Turning to the group of young faces, she asked, *"Qui étaient ces Acadiens?* Who were these Acadians?"

"Indians?" tried one youngster.

Nicole raised her hand, pushing it higher, bubbling with enthusiasm. "They were people who came from France," she answered, ironically in English. She was right, of course. French colonists came in the 17th century to what is now coastal Nova Scotia and the Bay of Fundy. They brought their own dialect from the province of Poitou, south of the Loire River—along with their own customs, food, and dress, plus an independent spirit and the farmer's stubborn streak. Alternately controlled by the French and the English, they were finally ordered to take an oath of allegiance in 1755 to George II of England. When they refused, Governor Charles Lawrence of Nova Scotia called all men and boys

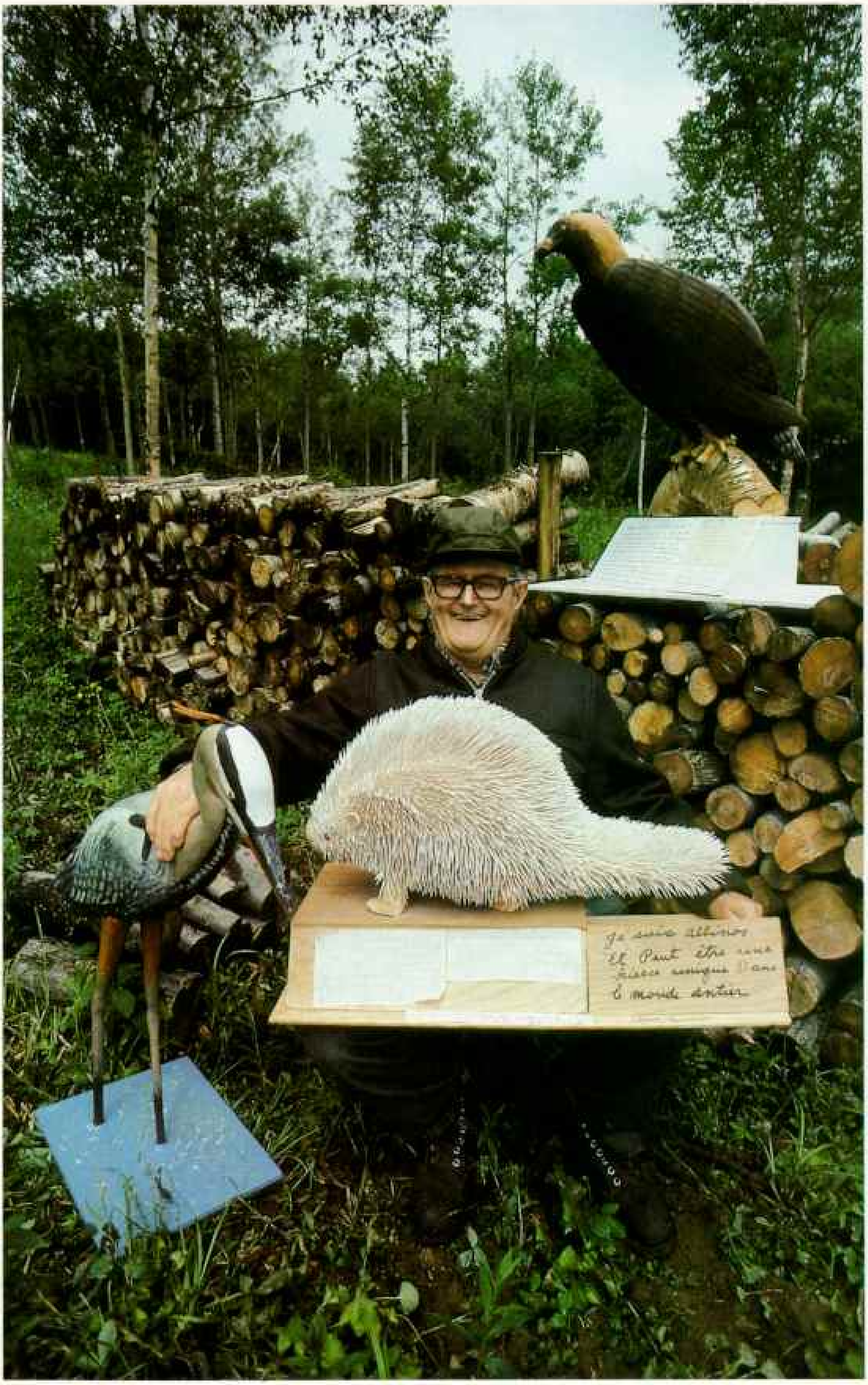
(Continued on page 394)

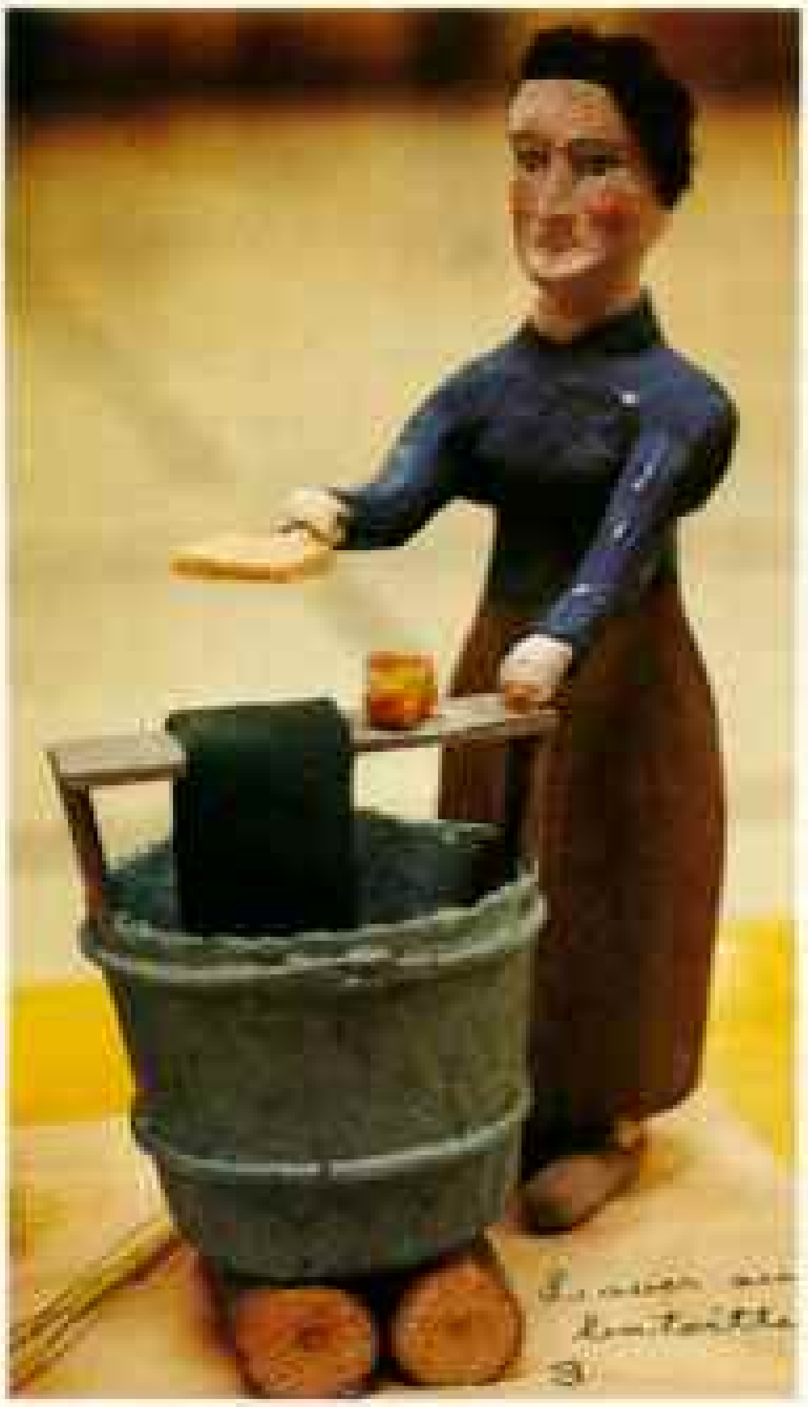

Welcome to the United States
Bienvenue aux Etats-Unis
TRUCKS
STOP
CARIBOU
ALLAGASH
1
161
ering
YERN
Zone
WELCOME TO U.S.A.
REPORT FOR INSPECTION TO
CUSTOMS · IMMIGRATION

*RARE BIRTHRIGHT is claimed by Americans Roland and Helen Michaud for their son, Kris, at U. S. Immigration in Madawaska, Maine (**left**). Born in a hospital across the border, Kris will hold dual citizenship. But like the valley's other residents, he will probably view the border (**above,** at Fort Kent) as a lifelong nuisance.*

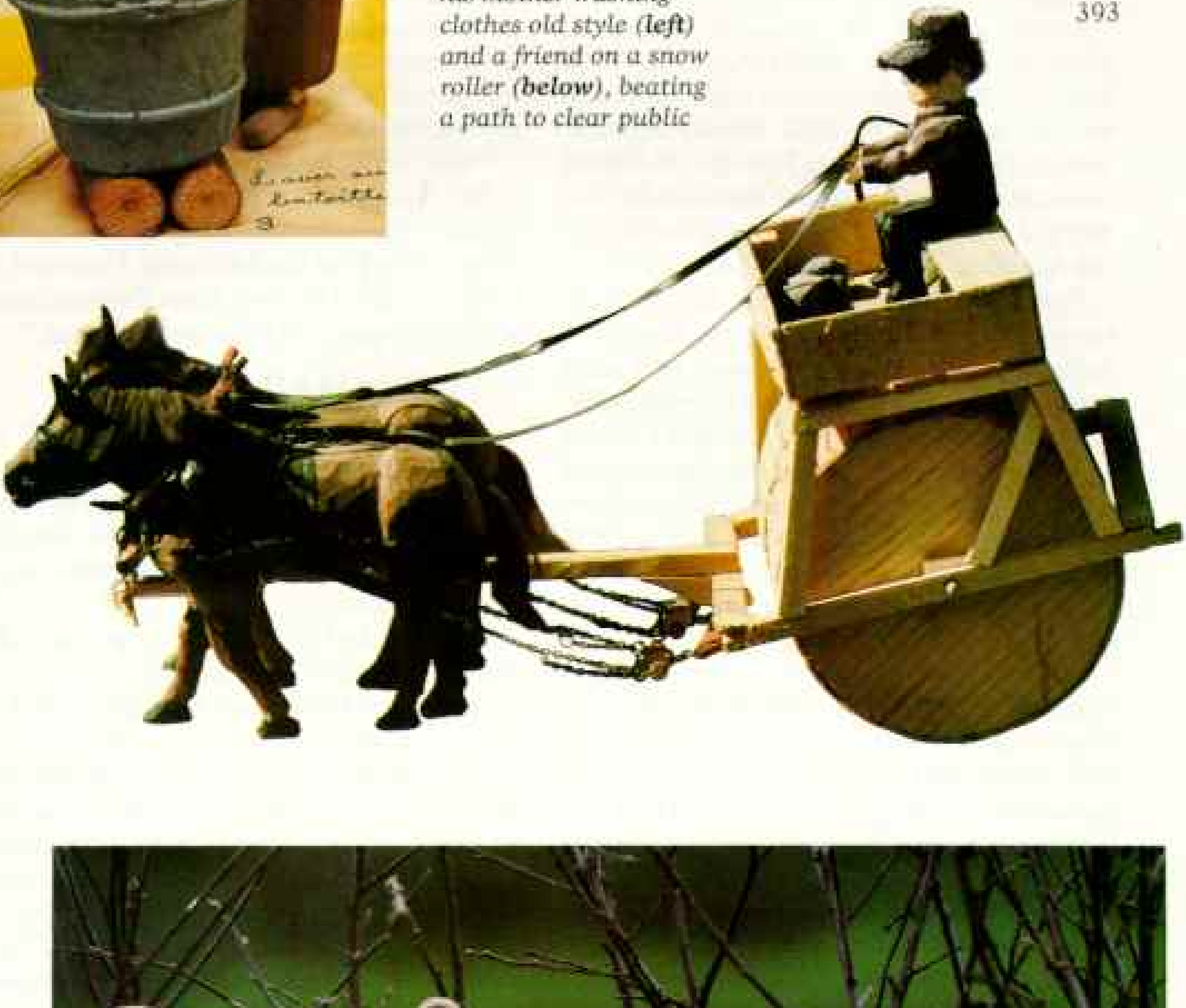
Each passing winter adds creaks and character to an old barn near St.

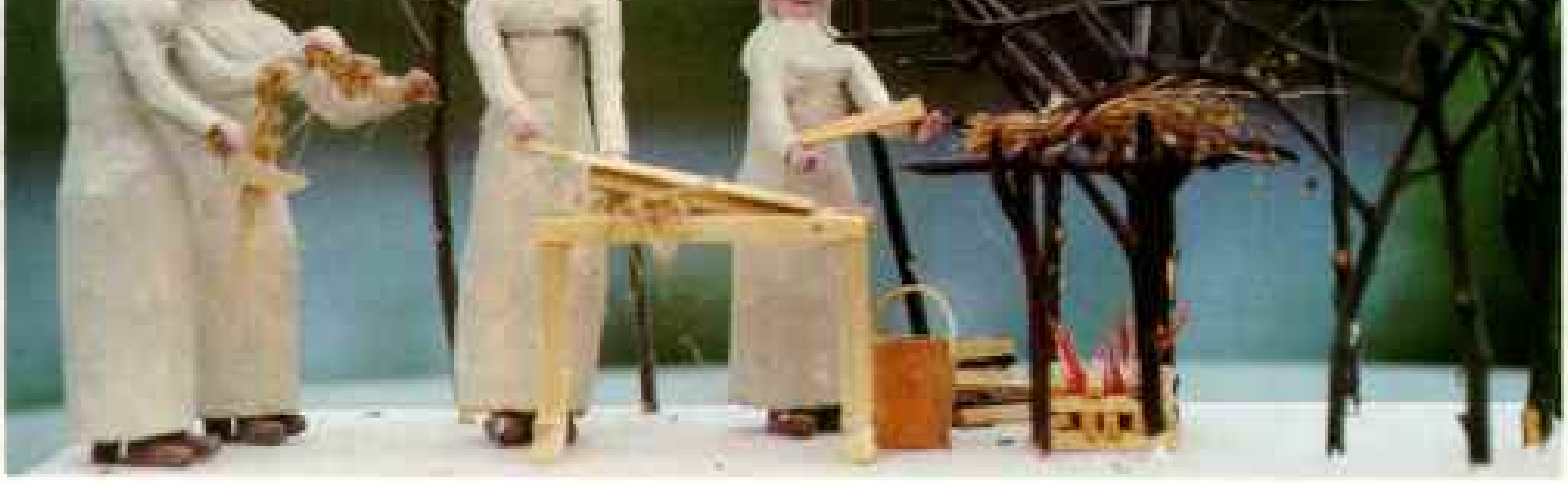
Agatha, Maine, where tire chains await their next bite of New England snow.


Je suis albinos
et Peut être une
pièce unique dans
l monde entier



*LIFE STORY in wood slowly evolves as Alfred Morneault of Edmundston uses his recently discovered talent to depict people, animals, and experiences from his past. Symbol of Madawaska, a life-size porcupine was made with 6,000 toothpicks and is the pride of Alfred's creations. Human portrayals, like those of his mother washing clothes old style (***left***) and a friend on a snow roller (***below***), beating a path to clear public roads, were carved on a scale of one inch to a foot. In Alfred's youth, valley women still removed the fiber from flax by crushing the stalks in brays (***bottom***). According to one local tradition, the term Brayon, which many residents call themselves, was derived from this instrument.*





(Continued from page 388) to the St. Charles Church in Grand Pré and ordered the eviction of all Acadians—*"le grand dérangement."* At gunpoint they were herded onto ships and scattered from Quebec to Louisiana.

Over the years small groups made their way back to resettle along the Saint John River. In June of 1785, a band of perhaps ten families came ashore at St. David on the southern banks, and soon had settled both sides. The names of those first settlers—Duperre, Daigle, Cyr, Fournier—echo today throughout the Madawaska region.

Local interest in Acadian history is growing as fast as fiddleheads. In 1979 Madawaska, Maine, celebrated its second annual Acadian Festival Week, simultaneously commemorating June 28—declared Acadian Day by the state of Maine in 1978—and the 375th anniversary of the landing of the Acadians in North America.

For many residents getting their first accurate view of their own history, Roger Paradis of the University of Maine's Fort Kent branch is the valley's walking encyclopedia. A slight man with a thin mustache and a tired voice, this historian is the impassioned leader of a move to save bits of valley culture before they are homogenized in the 20th-century American mixing bowl. He has put together one of North America's largest collections of Acadian folklore.

One day he took me off to Edmundston to meet Alfred Morneault, who might be called a nouveau folk artist. At 77 Alfréd had a robust laugh and high red cheeks. He welcomed me into his house and with great joie de vivre, though in barely understandable English, he discoursed on his powerful, primitive wood carvings (preceding pages).

"Come," he said. "Look."

In the middle of his living room, next to a life-size wooden blue heron, there reposed a replica of a white porcupine, the largest I had ever seen. On its base, scribbled in Alfred's scratchy hand, was this less than modest description: "I am albino and maybe a unique structure in all the world."

"I whittled maybe 6,000 toothpicks for its spines," Alfred said. "I feel it's my best work. I sold about 50 pieces to the National Museum of Man in Ottawa, though it was hard to separate my collection. If I count my time, materials, and mileage I could get a small fortune for the whole collection."

"What was your inspiration to start all this?" I asked.

"Roger came to me four or five years ago and said, 'If you don't share what you have in your spirit, it will be lost forever.' "

Roger said, "But I didn't think it would come to *this*."

What it had come to was a basement full of small carved wooden figures—people, buildings, horses, logging haulers—all displayed on large sheets of plywood in exacting detail to a scale of one inch to a foot.

"These are scenes from the valley logging life—scenes from my life. *Histoire vécu*—my personal history. Each carved figure represents a real person in my life."

"You were a logger?" I asked.

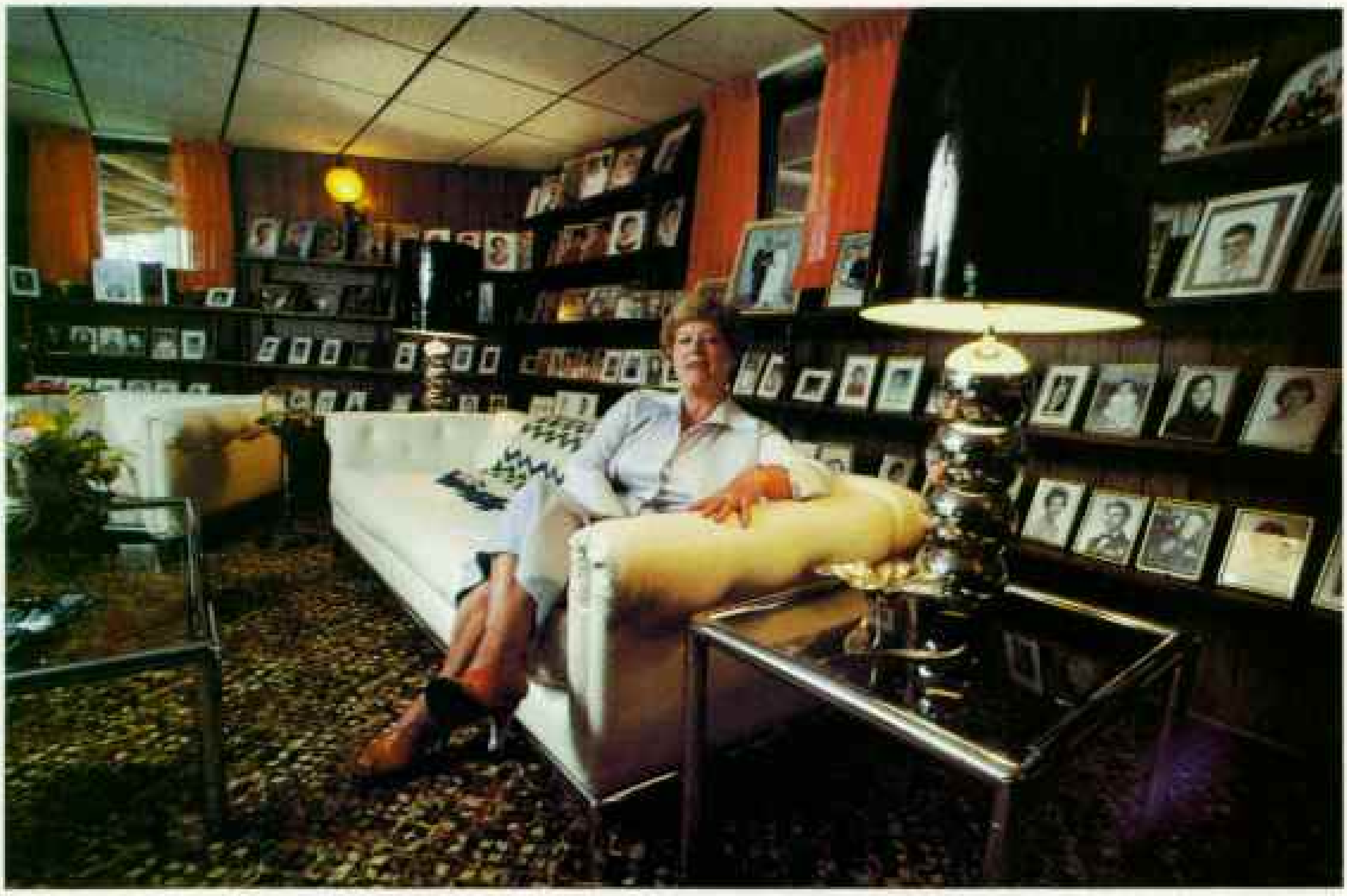
He laughed. "That—and 44 other things." He pointed to a group of figures. "Here's the first lumber camp I worked at, back in 1920. This man turns the grindstone while this man and horse pull the logs."

Logging a Hard Day's Work

At today's lumber camps you will see more giant skidders, mammoth harvesters, and merciless mechanical debranchers than horses and grindstones. But you will still meet families operating in the old ways—like the Landrys, whose 1,900 acres of woodlot sit in the saddle of a green valley township on the Canadian side.

As did his father and his father's father, Elude Landry along with his eight sons and one daughter harvest their own wood, putting strong backs to heavy chains, hauling 50-foot logs with a hefty horse—the whole day laughing, cajoling, cavorting, taunting, and having a grand old time (pages 384-5). They are people whose strength—of back and character—bear out the local boast that Paul Bunyan was born in the valley.

"This land is my life," Elude shouted above the noise of the flatbed truck as we bumped along a dirt lane into the woods for a day's work. Three Landry boys—Luc, 17, Georges, 21, and Claude, 25—horsed around in the back of the truck. "Some guy from Toronto offered me $24,000 for a parcel I paid practically nothing for just after World War II. But I'll never sell. My children will always be able to work this land."



SONS AND DAUGHTERS, nephews and nieces, aunts and uncles: In her home on Eagle Lake, Maine, Juliet Perreault basks under the gaze of 215 family portraits, including 6 children and 22 grandchildren. Such galleries are found where the family is still the warp and woof of society.

It's hard to imagine anyone working the land harder. A well-drilled team, they cut, split, and loaded three cords of hardwood in two hours. They sell 1,000 cords a year.

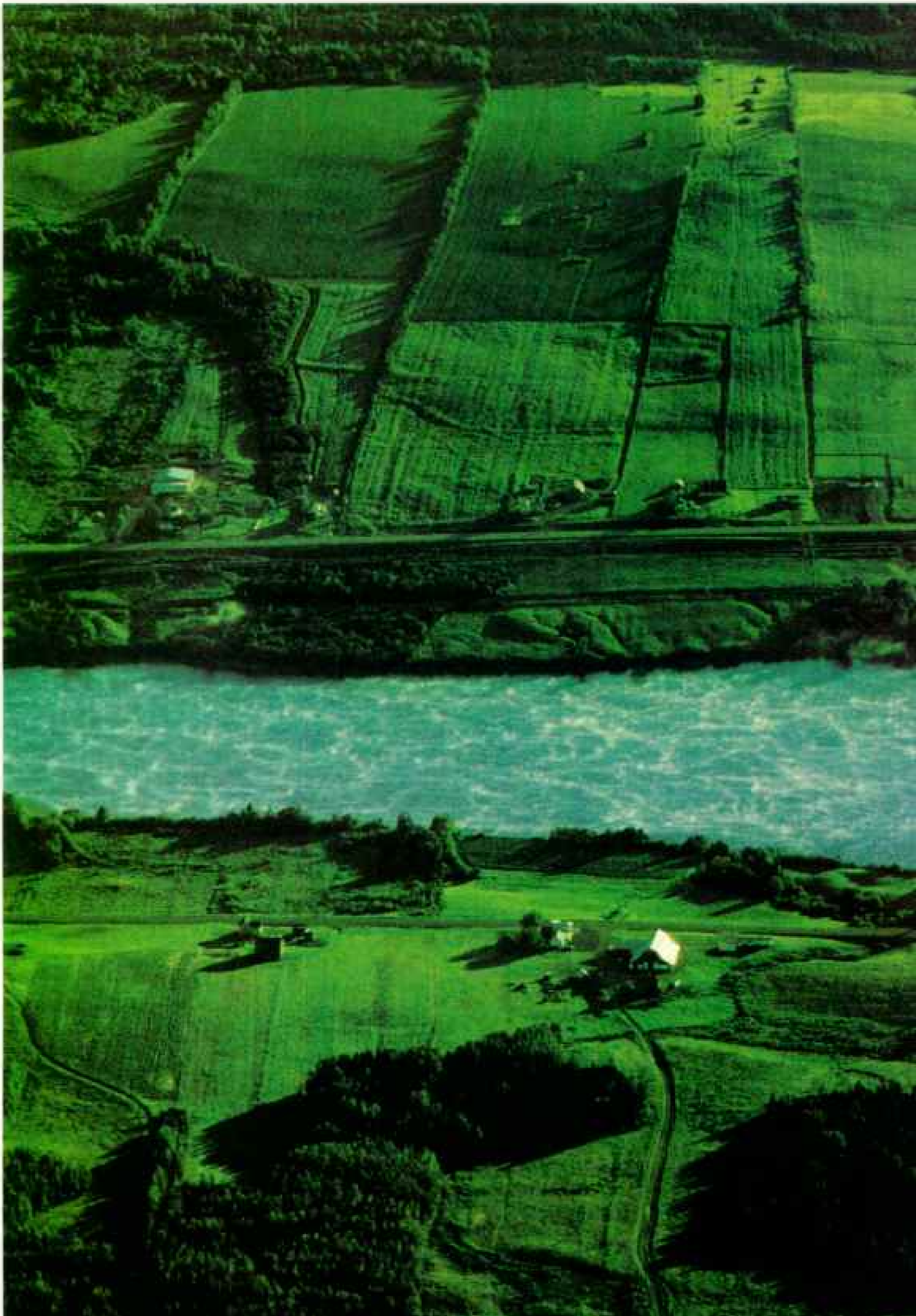
Most of the wood that comes out of the region's rich spruce and fir concentrations is harvested by companies like Fraser, the valley's biggest, founded by a sagacious Scot named Donald Fraser. The company started a sulfite pulp mill in Edmundston in 1918, and in 1925 opened the paper mill in Madawaska. Today Fraser Inc. is managing and harvesting 1.8 million acres of prime timberland (of which it owns more than 40 percent), and it manufactures more than 400,000 tons of fine paper a year. If you have ever read a Sears Roebuck catalog, you have touched Fraser paper.

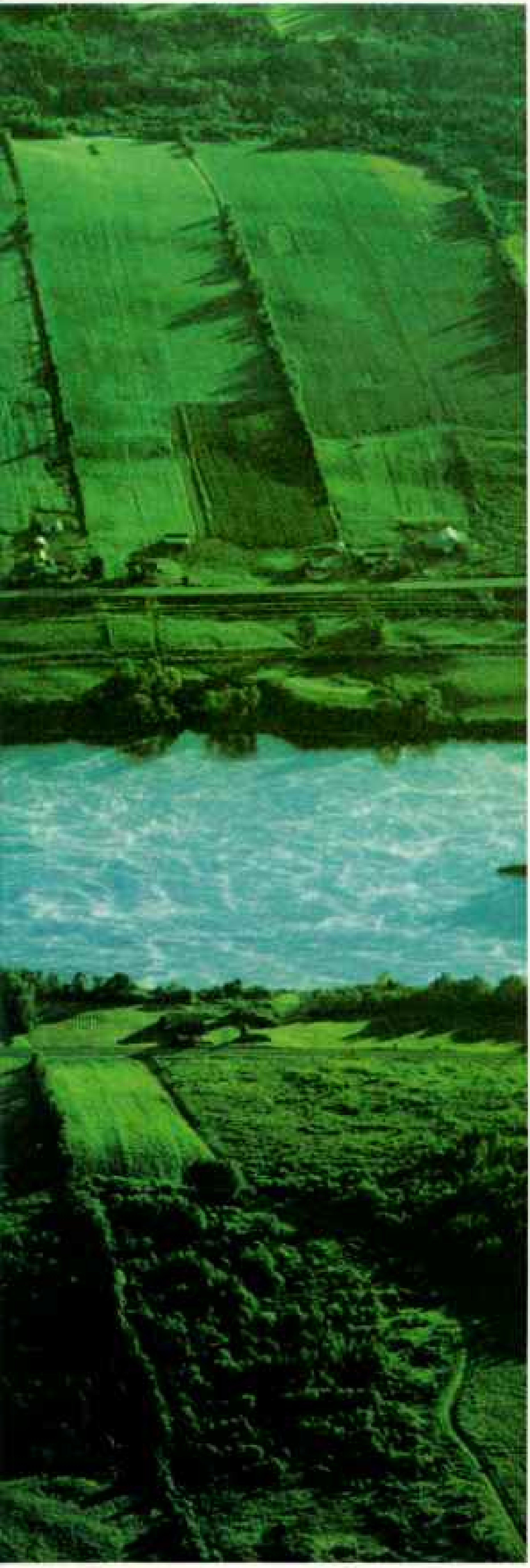
Five-mile-long pipes pump 950 tons of pulp every day under the international bridge from Edmundston to Madawaska, a symbolic umbilical cord of international cooperation. Fraser, a Canadian company, exports pulp duty free to its American paper-producing mill, eliminating the high tariffs levied on Canadian paper imported to the United States. That pipe is the lifeline of the 2,200 valley people employed at the Edmundston and Madawaska mills and offices (pages 402-403).

From Fraser's administrative office in Edmundston I drove 40 miles of unpaved roads with 37-year-old Jeff Leach, a Canadian who oversees close to two million acres as woodlands manager. We were heading north to Camp 69, one of Fraser's typical harvesting operations, driving parallel to the Madawaska River.

"It's hard to believe now, but the Madawaska River was completely covered with wood for 14 miles—you couldn't even see the water, eh?—until 1969 when we stopped using the river as a means of transportation and storage. We found out there was more wood underwater than above. When we cleaned the river out, we pulled 100,000 cords of wood from the bottom."

Camp 69 was buzzing with activity when





we got there—literally buzzing from the deafening sounds of chain saws, tree harvesters, grapple skidders, and house-size slashers. Like an angry, gnawing, single-clawed big yellow monster, a harvester was dropping trees as though they were annoying weeds. Relentlessly closing in on one particularly formidable tree, the monster grabbed it at its base. Two sheets of heavy metal cut through the trunk. The crunching wood sounded like bones being ground. You could almost hear the tree cry out. The brute yanked the tree from its home of 80 years and turned slowly, the tree dangling from its claw until it was dropped onto a pile.

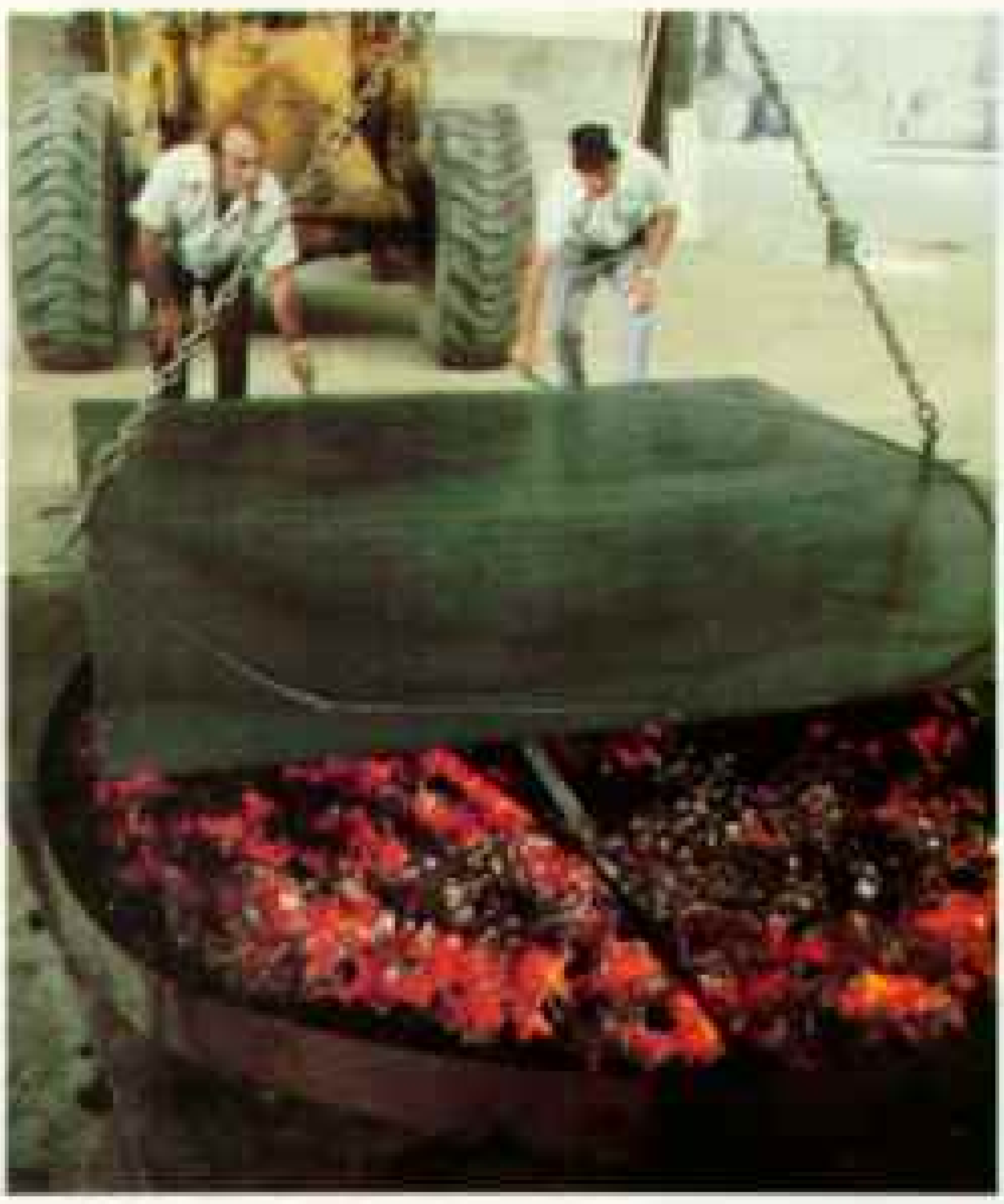
Gerald Quimper supervises the camp of 85 men who produce 58,000 cords of wood a year. It is a life of cold, cut, and splintered hands, unshaven faces, tired eyes, weary bodies. They live in long bare-metal Quonset huts or in newer, sterile five-room trailers, two men to a room. Privacy is minimal.

"Yes, it can get lonely up here for us," Gerald admitted, relaxing by the wood stove. "But the supervisor's salary compensates for the loneliness."

Living Between Two Worlds

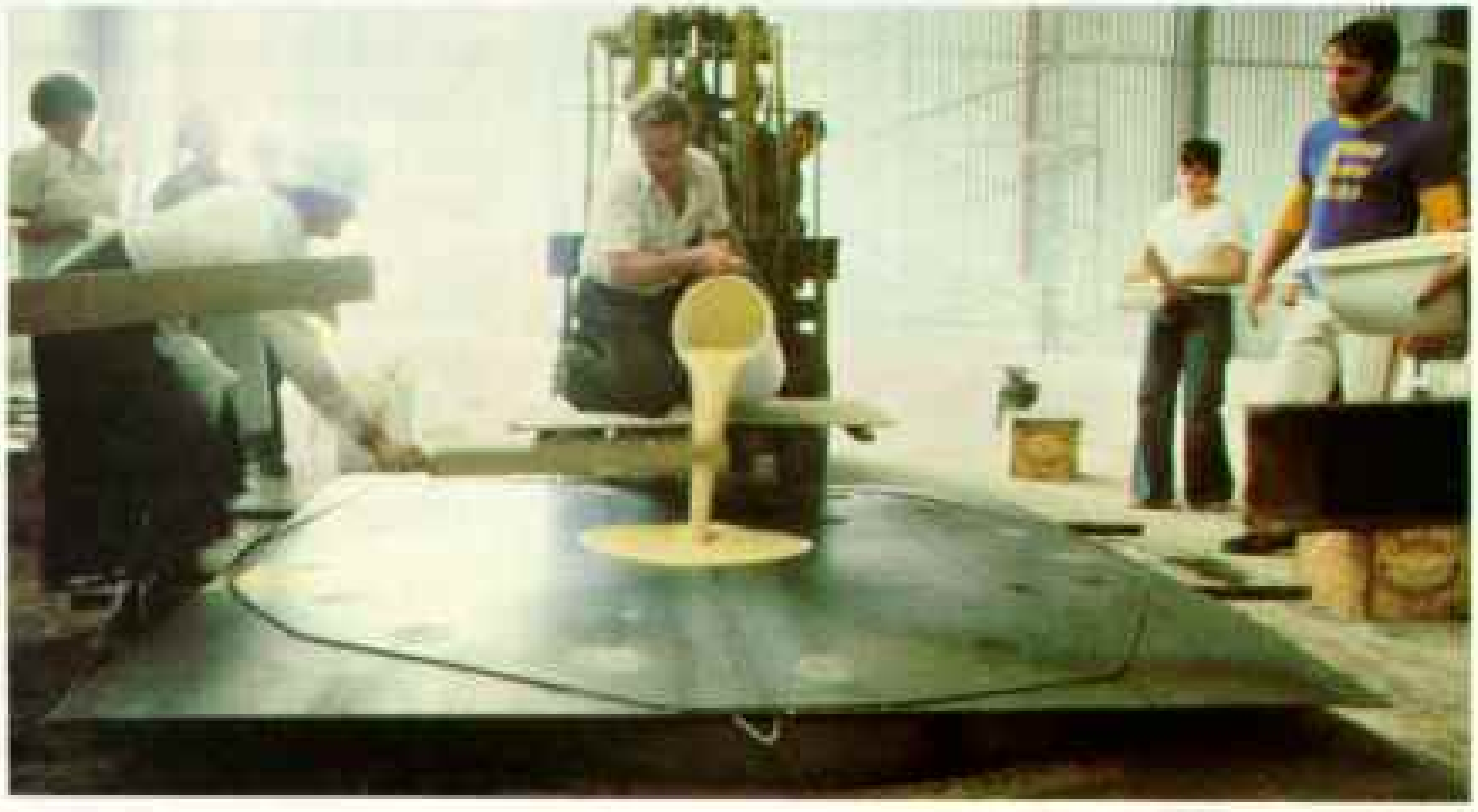
"We were the forgotten territory," said Oneil Clavet of Edmundston, who is doing everything he can to help people remember it. "I would say it has to do with the fact that Madawaskans had to live so long without knowing whether they belonged to the United States or Canada. Look here," he said, pushing a map at me. "For 59 years this area was a bone of border contention because of vagueness in the 1783 Treaty of Versailles. Not until the Webster-Ashburton Treaty of 1842 could the people of the valley claim a country. But by declaring seventy miles of the Saint John River the border, that treaty effectively made an international community of the valley, and in many instances

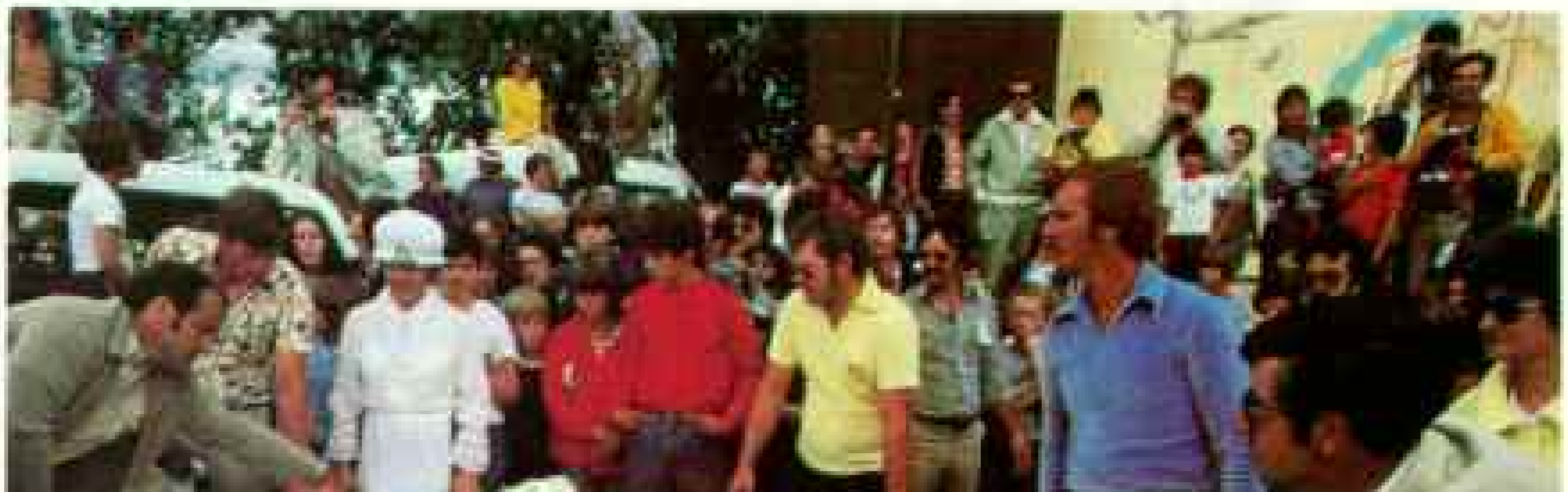
ENDING ITS STINT as an international boundary, the Saint John River flows under a fleecy morning mist toward Grand Falls, New Brunswick. Parceled in narrow strips, farms here offer each family a share of woods, pastures, and fertile bottomlands.



PIÈCE de résistance of 1979's Foire Brayonne, Edmundston's folk festival, was a contest celebrating the valley's buckwheat ploye. Unlike traditional pancakes, ployes are usually cooked on one side only and commonly eaten as a bread substitute.

*The families of Alberic Pelletier and Jeannine Albert welded a griddle of boiler plates (**left**) large enough for 15 gallons of batter (**below**). The cooks cheered their creation (**facing page**), which, measuring eight feet (**bottom**) and declared edible, won hands down.*





SILENT REQUIEM: Oldest parishioner in Lille, Maine, Alma Dube mourns the closing of her church for lack of funds. Now many Lille families worship in Grand Isle, another of the valley's all-Catholic towns.

divided families into two nationalities.

"I prefer to call myself a citizen of La République du Madawaska," Oneil earnestly declared. He was referring to the original name for the territory, borrowed from the Malecite word meaning "land of the porcupines," an apt image for the sometimes prickly valley characters. Now Oneil unfurled a flag of the republic, then pulled out a draft of the republic's constitution.

Wait a second! Is this a real republic? In North America? Or am I cornered with the leader of an international conspiracy?

But before my mind could run wild, Oneil was quick to remind me the republic is a myth. The Republic of Madawaska has no political clout but is playing *The Mouse That Roared* to attract attention to itself.

To that end Edmundston played host last summer to the first annual Foire Brayonne. (A bray, a tool regional farmers used for breaking flax, has become a modern-day symbol for Madawaskans.) If there was not a Mardi Gras of the north before, there is now. The downtown streets were blocked off and jammed for a week with 70,000 people. Their high-spirited French blood ran hot as they celebrated their ancestry in cuisine, dance, dress, parades, and competitions.

The highlight of the occasion was the attempt by Jeannine Albert and Alberic Pelletier and their families and friends to make the world's largest ploye, with bulky and uncooperative pans, poles, paddles, forklifts, and tractors. When they finally poured the batter, it oozed to eight feet in diameter and they gleefully joined hands and broke into spontaneous song and dance around the implausible ploye (preceding pages).

But around here even the largest pancake is humbled by the lowly potato, as this local "Potato Song" laments:

I am a farmer on the Saint John River.
I plant potatoes to pay the income tax.
The collectors have arrived and they are
encamped at St. Agatha.
They've come to take what little money
we've lately saved.

"Baked, mashed, or French fries?" the waitress asked, as all waitresses in the valley automatically inquire.

"No potatoes today, thanks," I deferred, still remembering an overindulgence in oversize ployes. By the look on her face I knew I had committed the ultimate insult here in potato country.

The valley is, and has been for a long time, one of the largest potato-producing regions in the United States. The American side is part of Maine's Aroostook County, which accounts for 90 percent of the state's harvested acreage. In potato production Maine ranks just behind Idaho and Washington.

From the air the valley appears as a patchwork of brown corduroy overalls, held up by long green suspenders leading to the Saint John River—remnants of a centuries-old method of farming which gave every farmer access to the river water. Part of the reason potatoes grow so well here is the valley's natural drainage system plus a good ratio of clay, sand, and organic components.

Potato farming in the valley is a gamble, akin to Russian roulette. Why the average price per barrel for U. S. No. 1 grade potatoes was $16.44 in one year and $2.08 the next keeps brokers at the New York Mercantile Exchange perplexed—and Maine potato farmers poor.

Against such heavy odds, I wondered, why did people choose this way of life.

"We were born in the business," was Adrian Morin's fast reply. Across the kitchen table his wife, Riola, threw up her hands and laughed, "We were born to starve."

Certainly they were not born to get rich. In 1977 the per capita income in Aroostook County was under $4,000. In St. Agatha, not far from the Morins, it was even less.

Adrian said: "My father worked this farm. I was born at my brother Roland's place, up the hill, where grandpa had his farm. For a while I worked construction down in East Hartford—20 years ago there was big money down there in Connecticut. But I didn't like that city life. Then I built the sawmill in 1957. In 1958 it burned—lost all my money. When my father retired, my brothers and I took over the farm.

"Today my sons are planting their own three acres. That's how I started. My father gave me three acres to work. They were shining like gold. I was more proud of those three acres than of what I got today.

"In 1965 there were three and a half million farmers in the nation. Now we're less than two and a half. It gets us to wondering whether our boys should go into another business. But what can we do? Nothin'. It's just somethin' we got in our blood."

The river, like the land, is also in the blood. The valley folk sing of their River Saint John:

Blessed be our heavenly Father
Who placed our cradle upon these shores;
May the pure waters of the river someday
caress my grave.

The Indians called it Oo-las-tuk, the Goodly River. From its source deep in the woods of northern Maine, the Saint John River flows more than 400 miles before emptying into the Bay of Fundy. At the eastern end of the river is Saint John, New Brunswick (population 90,000). Far to the west is Allagash, Maine (population 650). If the valley is a place apart, then Allagash—or Moosetown, as people downriver call the isolated town—is a place beyond that.

"Damn Dam" Threatens Scotch-Irish

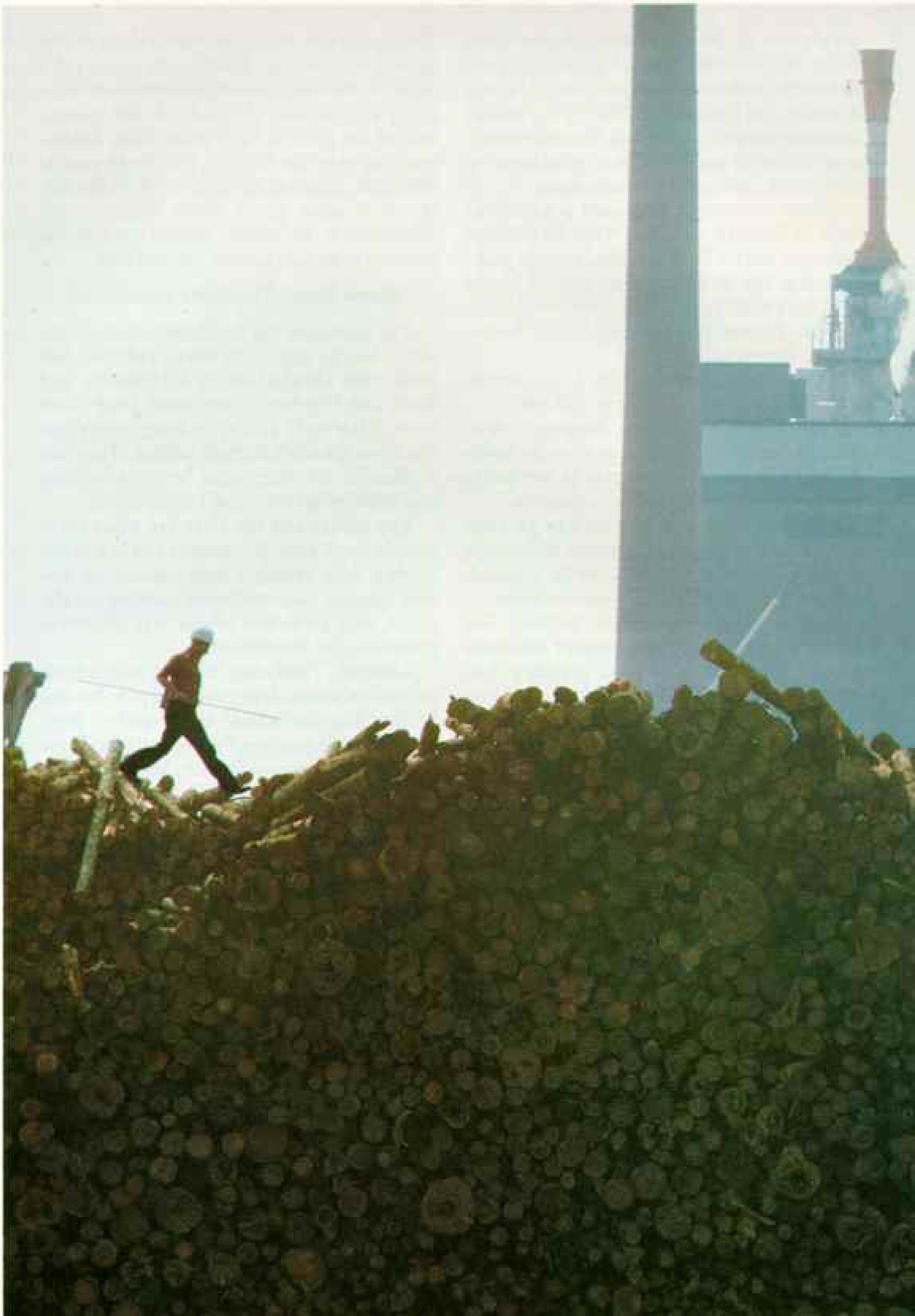
The names on the mailboxes change suddenly as you approach town. Pelletier and Sirois and Daigle turn to McBreairty and Kelly and Gardner. The Scotch-Irish came here in the early 1800s, looking for a place the French hadn't already settled. They are a clannish lot. Marriages between cousins and other relatives are not uncommon.

The woods and the river are what these people know best. Driveways and lawns are strewn with skidders and haulers on one side, canoes and outboard motors on the other. But now this whole way of life is scheduled for demolition.

Allagash, I feel, may become only a footnote in the wake of the proposed two-headed Dickey-Lincoln School hydroelectric project. "That damn dam," as the dual facility is referred to in some valley circles, is the largest public-works project in New England's history and one of the most controversial. Ever since authorized by Congress in 1965, it has pushed emotions to overflowing from Maine to Washington, D. C.

Some chamber of commerce elements, looking toward a boom economy during construction, voted in favor of it. Environmentalists, on the other hand, condemned it for the potential destruction of wilderness, not to mention the rare Furbish lousewort. Still others pointed to it as a nonpolluting renewable source of an even rarer resource—energy—and as a means of controlling the spring flooding that damages urban properties and potato fields.

With construction slated to begin in 1983, the fate of the project is unresolved. But if built, its impact will be tremendous. The 944-megawatt facility will cost about $825,000,000; the larger Dickey Dam will rise 27 stories and stretch two miles across the valley just above the confluence of the



*MIRED in paper work, a trimmer cuts off the wrinkled ends from a 12-ton roll (**below**) at the Fraser Paper, Limited, mill in Madawaska, Maine. In front of the company's mill in Edmundston (**left**), another employee inventories the raw material that will be pulped here in Canada and piped duty free across the river to the plant at Madawaska.*

*Future insurance, six million spruce seedlings are nurtured each year in company greenhouses (**above**) at Second Falls, New Brunswick.*

Saint John and Allagash Rivers. It will flood 278 miles of rivers and streams, 76,000 acres of timberland—and part of Allagash.

That last item irked Allagash teacher Bob O'Leary. "What does the dam mean to me? It means 112 families here in Allagash will be displaced. Mine will be one. I just finished building a $40,000 home along the banks of the Allagash a mile from here. It will be lost if they build the dam. And, you know, those people in Washington can tell us to the penny what the dam will cost, but they still haven't told us what they'll pay us for our homes."

One Family's Most Precious Crop

If you surmise that home and family are important in the valley, you miss the point—they are everything.

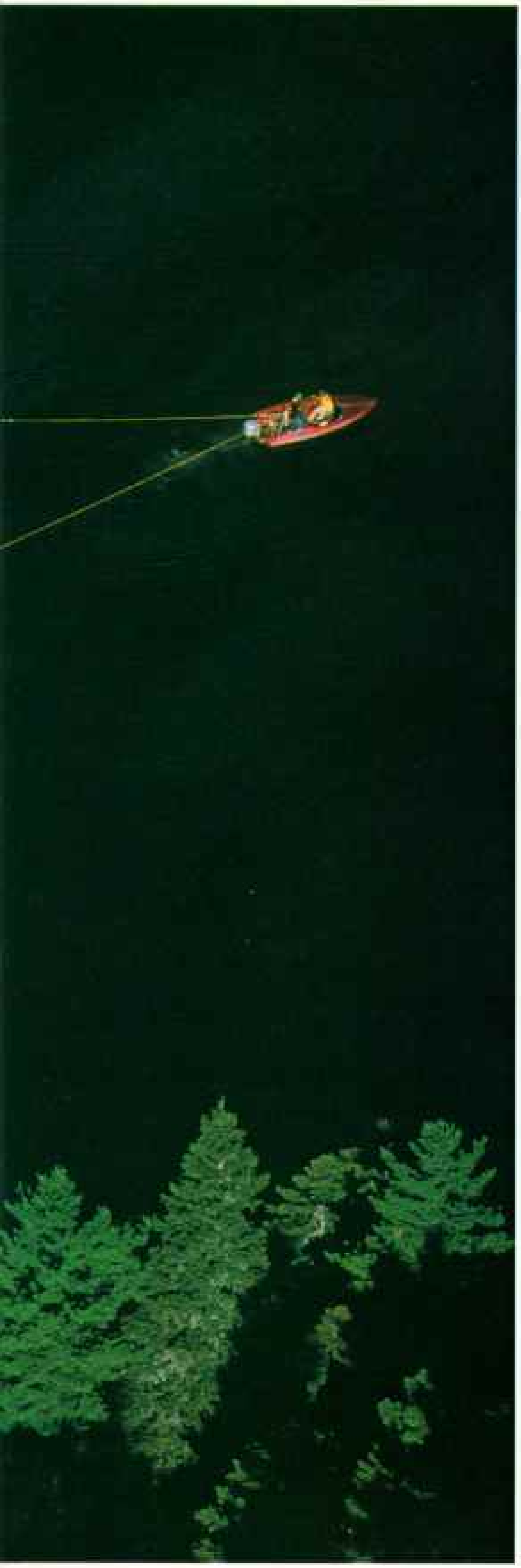
I was introduced to the Minal Caron family of Fort Kent as one of the most successful potato-farming families in the valley. But according to Mrs. Caron, potatoes were not the family's most important product. She pinched my elbow and asked, "Would you like to see our best crop?"

The living room was like a shrine to her family, its walls lined with photographs, portraits, snapshots, cameos, tintypes, degrees, trophies. One by one, I was introduced, by proxy, to her brood of 12 children, 48 grandchildren, and a couple of great-grandchildren. "Some have moved to Connecticut, but we are all very close. Family reunions are very special occasions. The most special is Mother's Day."

Nowadays three to five children in a family are not out of the ordinary. A generation ago it was nine to 13. For sheer numbers the Cyrs of St. François de Madawaska, New Brunswick, must take the cake. Heliodore and Marie Cyr have had 27 children.

Next to family is faith.

"*Qui perd sa langue perd sa foi.* Who loses



ALL WERE LOSERS when a controversial spraying program to combat the spruce budworm was interrupted last spring after a plane was ditched in Maine's Allagash waterway. An electrical fire forced the pilot to dump a hundred gallons of pesticide into the waters of this wilderness sanctuary so loved by Madawaskans.

*THE CLASS OF '79, all five of them (**right**), will not go down on record as the smallest in Allagash, Maine, a Scotch-Irish community at the western end of the valley. In 1969 there were only two graduates. What this town of 650 lacks in size, it makes up for in scrappiness. For two years running, the school garnered state championships in girls' basketball.*

*The small populations of many valley towns owe nothing to small families. Marie and Heliodore Cyr (**above**) of St. François, New Brunswick, parented 27 children in 30 years.*

his language loses his faith." The strength of faith in the valley is visible everywhere. In the schools, children are allowed to leave their classes for "release time," during which they receive religious instruction, otherwise not permitted in Maine schools. In the homes, a picture of the family priest shares the wall with the children's portraits. In the fields each fall, priests go through the valley performing Masses in potato houses where potatoes are stored before shipment.

But it's the church itself that impresses most as you drive through any town: It is invariably the largest, most elaborate edifice, and the focal point of every village. The only traffic jams in town are on Sundays.

A Temptation and a Proposal

Months after leaving the valley—back in my urban environment where I sometimes wonder whether all the amenities are worth the price, where it sometimes seems unnatural to be living 250 miles from my parents, where I sometimes feel anonymous in the city's sea of humanity—I find myself valuing the virtues of these valley people more and more. I am often tempted to trade urban slick for country hick and a warming evening singing old songs with old friends.

But of all my valley memories, it is the face of eight-year-old Nicole Corriveau that keeps coming back to me, circled in gold, angelically pure. Bright eyed, naive, but learning fast, Nicole *is* the upper Saint John River Valley. Child of a mélange of cultures, a child of our times—the valley's most valuable natural resource.

"If I come back in 15 years, will you marry me?" I asked her one day. She smiled coyly but did not answer, later giggling over my proposal with her cousin. It was I who was being naive. In 15 years Nicole would change—as the valley would change. But one could hope. □

PITCHING IN *at an early age, Sharon and David Ouellette of St. David, Maine, help clear their father's farm of rocks, prior to potato planting. Still bound together by family, faith, and language, Madawaskans like the Ouellettes hark back to a simpler time.*

Undersea World of a Kelp Forest

By SYLVIA A. EARLE

Photographs by AL GIDDINGS

SEAFILMS, INC.

AT FIRST I could see nothing but a taut white anchor line and murky green-gray water above and below as I descended hand over hand through increasing gloom. At 120 feet the view became strangely lighter, then white, like a snowfield extending in all directions.

I suddenly realized what the snowfield was—squid eggs, millions of them. Abandoning the anchor line, I finned down into a bank of soft, cylindrical clusters of egg packets, each containing hundreds of developing young. I had landed in a marine nursery of colossal dimensions.

My partner, photographer Al Giddings, and I were delighted. With this dive near California's island of Santa Catalina, we were initiating a seasonal study of marine life associated with offshore forests of kelp, or seaweed.

Catalina, belonging to the southern Channel Island system, is separated by 20 miles of ocean from Los Angeles. For the most part Greater Los Angeles' seven million residents are unaware that within a score of miles to the west of them ancient and beautiful submarine cities teem and pulse with life in response to seasonal changes little felt on land.

Among the marine forests rimming Catalina, literally millions of tiny animal residents may occupy a few strands of kelp, creating an underwater metropolis that rivals a tropical jungle in color, diversity, and sheer abundance of life.

Across the broad white expanse of squid capsules Al beckoned me, pointing to a slender, silvery squid hovering motionless above the nursery. I approached cautiously, holding my breath to avoid emitting a stream of bubbles that might frighten the glistening creature. At length it floated a few inches from my nose. For a moment the squid and I eyed each other, one superbly equipped through millions of years of adaptation to life in cool, dark oceans; the other, a curious visitor on a 15-minute passport provided by an air tank and regulator.

Very slowly the squid glided away, tail first, its eyes fixed on mine until I lost sight of it in the green-gray haze. I wanted to follow, to see if there were others nearby to account for the profusion of squid-in-the-making, but time was short. At this depth, without

A submarine metropolis *thrives off the island of Santa Catalina, California, where kelp beds harbor more than 750 varieties of fish and invertebrates. Exploring this ocean city, the author finds a field of squid egg capsules draped with kelp (**facing page**). Hundreds of eggs fill each capsule, unharmed by young sea urchins (**above**). At the surface (**overleaf**) giant kelp and plumes of Japanese sargassum form huge canopies. The number of tiny animals on a few giant kelp plants may rival the population of Greater Los Angeles.*

decompression, Al and I had scant minutes to record what we could of the undersea forest community.

Two types of kelp are especially conspicuous near Catalina: *Macrocystis pyrifera*, or giant kelp, sometimes known as sequoia of the sea; and a deep-sea relative, *Pelagophycus porra*, nicknamed elk kelp for its antler-like shape.

In clear tropical seas I have found seaweeds living at depths greater than 600 feet, but in less transparent temperate waters most plants grow within 150 feet of the surface. In the environs of Catalina the giant kelp is common in depths to about 60 feet. Below that, plant life becomes increasingly sparse, except for occasional stands of the bizarre-looking elk kelp and other deep-water species.

Elk kelp is well named. A lacy rootlike holdfast supports a main stalk crowned by a single gas-filled sphere that sprouts a pair of antler-like branches. By contrast, giant kelp has a massive holdfast at the seafloor, topped by numerous ribbon-like blades, each supported by a gas-filled sphere.

The squid nursery was lodged in a stand of elk kelp. Arching here and there among the densely packed egg cases, dark streamers of *Pelagophycus* rose toward the surface far above us. As I turned to look for more abundant stands of elk kelp, Al glanced at his watch and pointed skyward. Our passport, for the present, had expired.

Kelp Plants Banded Like Birds

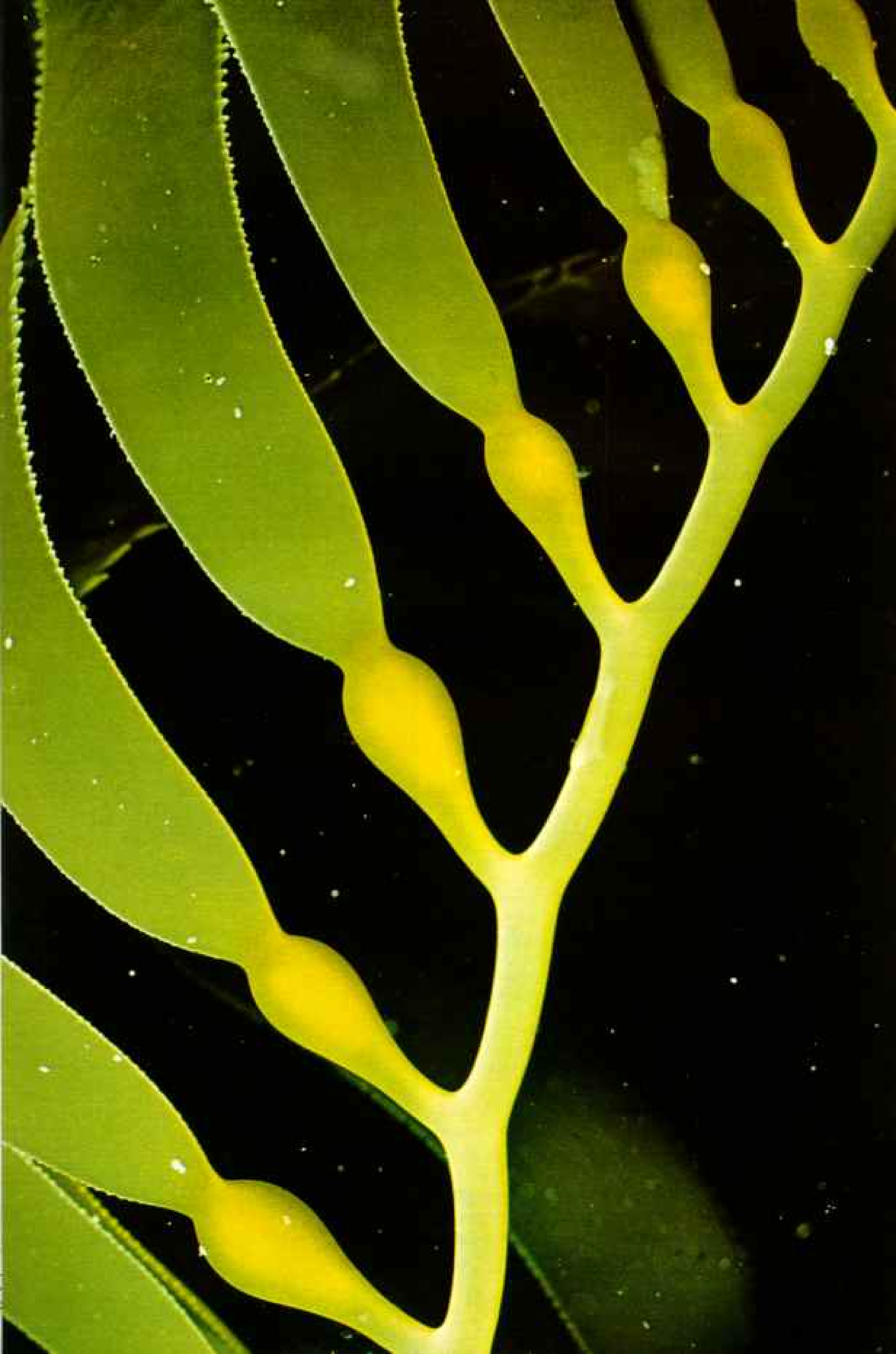
From that initial dive our research into marine life associated with kelp forests proceeded on a year-round basis. With support from the University of Southern California and the California Academy of Sciences, we collaborated with James Coyer, a marine-biology graduate student from USC, and his co-worker Alexandra Zaugg-Haglund.

In cooperation with other scientists at USC's Catalina Marine Science Center, Alexandra and Jim conducted such research as the banding of individual kelp plants and the frequent measurement of growth rates. For our part Al and I dived regularly in Catalina's kelp forests, photographing seasonal changes throughout the year and documenting them.

Our ultimate goal was to develop a better

***Young blades** on a frond of giant kelp (**right**) are buoyed by gas-filled bladders. Tiny animals, like the colony of bryozoans on the third highest blade, attach as blades mature. The anchoring holdfasts of various kelp species (**bottom**) shelter creatures like the brittle stars wrapped around the base.*

*Bands identify elk kelp (**below**), which grows only in southern California and northern Baja waters, during a growth-and-longevity study.*



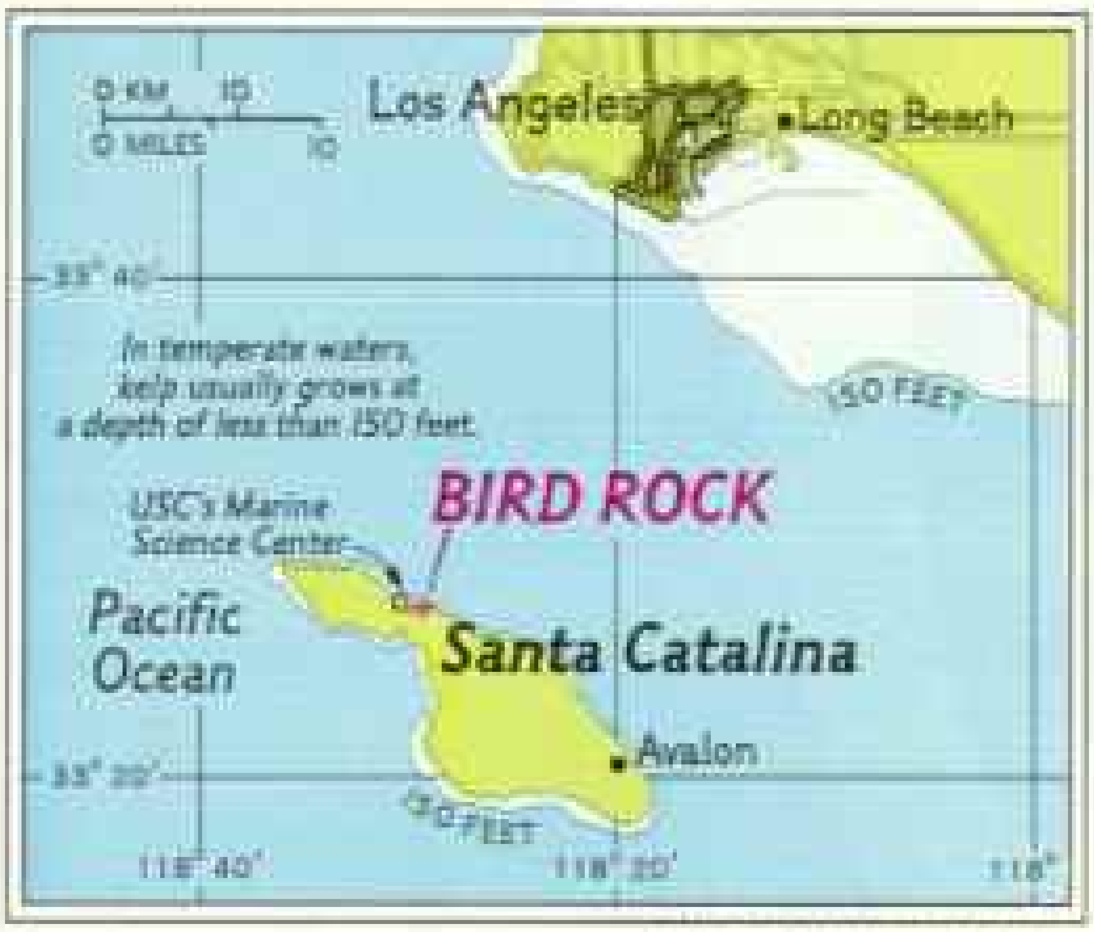
understanding of the marine ecology around Catalina. Elsewhere California's explosive growth has altered the coastal environment, and there is much to be learned from those undersea areas that have so far escaped major damage.

Al and I chose the dead of winter for our next dive, along the submerged cliffs of Catalina's tiny neighboring islet, Bird Rock.

Above water, brown pelicans and black cormorants vied with assorted gulls for choice perches on dark, craggy points. Thirty feet below, energy-giving sunlight shafted through a canopy of golden brown blades, where schools of fish called blacksmiths swept among a tangle of fronds (pages 420-21). In tropical waters I have studied relatives of these small damselfish and compared their omnivorous habits with those of whole families of coral-reef fish that are adapted primarily as herbivores—parrot fish, surgeonfish, rabbitfish.

At Catalina, as in cold waters around the world, there are only a few kinds of plant-eating fish. Plant food enters the ecosystem via numerous small beings, thousands of invertebrate animals. I wanted to see these minute creatures and to trace the chain of events that followed. Who ate *them?*

Almost immediately I found a voracious grazer on algae—a sea hare, relative of


0 KM 10
0 MILES 10
Los Angeles
Long Beach
33° 40'
In temperate waters, kelp usually grows at a depth of less than 150 feet.
150 FEET
BIRD ROCK
USC's Marine Science Center
Pacific Ocean
Santa Catalina
Avalon
33° 20'
150 FEET
118° 40'
118° 20'
118°

NATIONAL GEOGRAPHIC ART DIVISION

"Marine botanist's heaven," *says the author about Santa Catalina's life-supporting kelp forests, where optimum sun and cold, nutrient-rich water can support frond growth of two feet a day.*

snails and slugs, with a physique suggesting a plump, soft-skinned dragon. Sea hares at Catalina associate with their favorite food, certain red algae. Where the red plants were, so were there sea hares, like rabbits in a cabbage patch.

Al engaged a well-known California vegetarian, an abalone, moving literally at a snail's pace along a rock surface. The rock was overgrown with a stubble of small algae, and the abalone was busily chewing as it went. A community in its own right, the abalone unwittingly served as host for many other plants and animals. The hitchhikers included fourteen feathery sprouts of hydroid (a type of marine polyp), three small anemones, nine miniature cup-shaped corals, a patch of reddish sponge, a cluster of barnacles, at least seven species of algae, and amid this diminutive shrubbery numerous slim, pale crustaceans grazed on the algae. In return for the space it provided its entourage of guests, the abalone received a superb natural camouflage. When I glanced away, I had to look twice to rediscover this mobile microcosm.

Probably the most significant kelp grazer, in terms of quantity consumed, is the sea urchin. Within a few minutes, I found four varieties of urchins, each resembling a small explosion of spines, each with a prodigious appetite for seaweed. Some were in crevices, some on patches of open sand, some crawling on kelp blades.

Within the tangled mass of a giant kelp's holdfast I could see that the many little creatures living there had weakened the plant's grasp on its rocky basement. This plant would soon be cast ashore by winter storm waves—a banquet for multitudes of

small crustaceans inhabiting the beach.

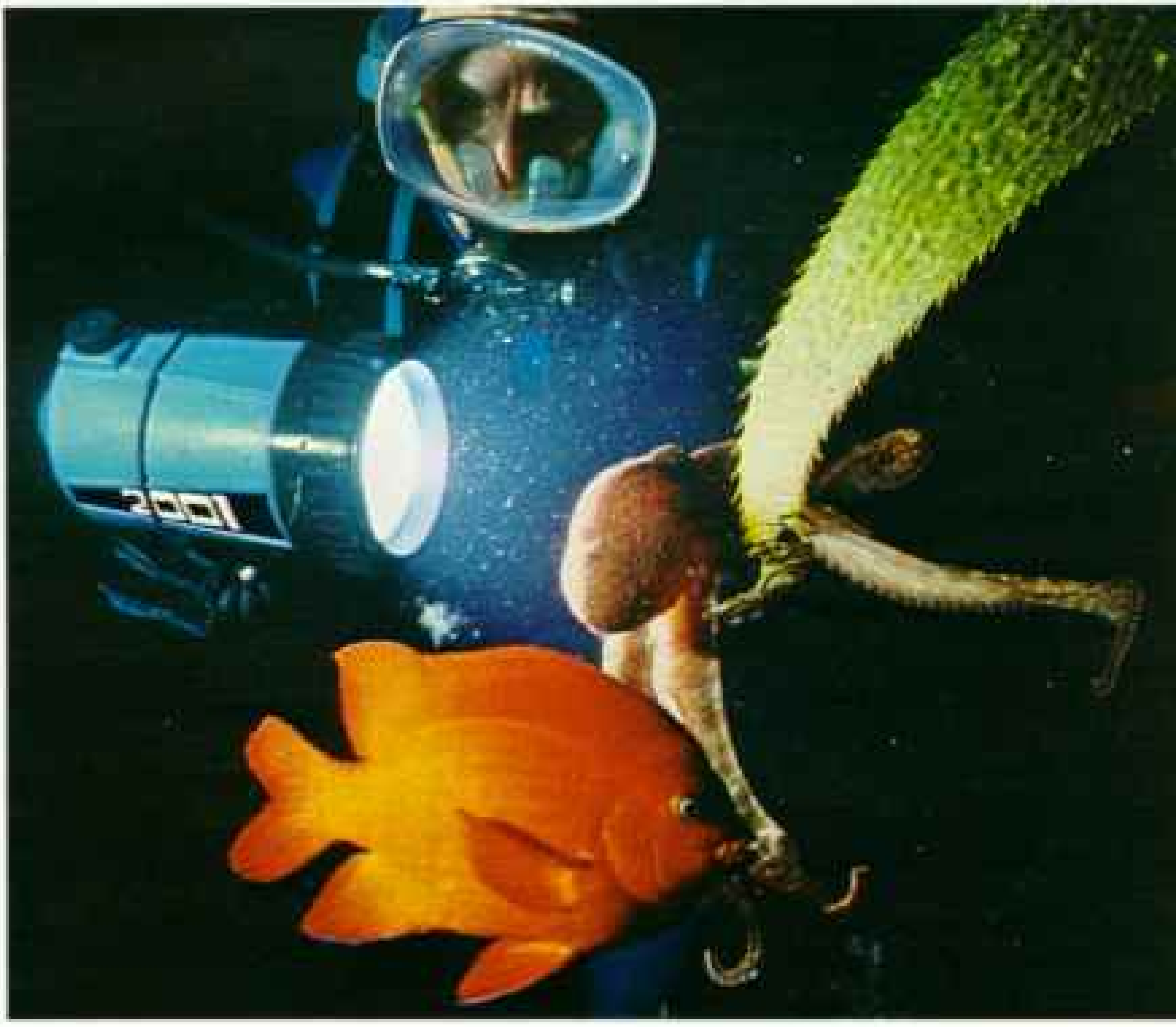
Watching predators and prey in action in the sea gives me great respect for seafood. Carnivores, such as tuna and cod, require the conversion of thousands of pounds of minute plants through a complex chain to make a pound of fish. Herbivores, such as the highly prized species of abalone, require far fewer plants to yield a pound of protein.

In general it is more efficient in terms of energy to eat abalone rather than tuna. But it takes at least eight years for most abalone to reach market size, and overexploitation has drastically reduced their numbers along the California coast. We have thoughtlessly taken more from the undersea community than the system can give back.

After the Bird Rock dive, Al and I made several other winter sorties underwater and then suspended operations until spring. By May we found a cycle under way beneath the sea that would determine the destiny of millions of aquatic lives during the year ahead. At depths ranging from 30 to 60 feet, rock surfaces were carpeted with newly sprouted *Macrocystis* blades. Soon a new forest would appear, with plants sometimes growing as much as two feet a day.

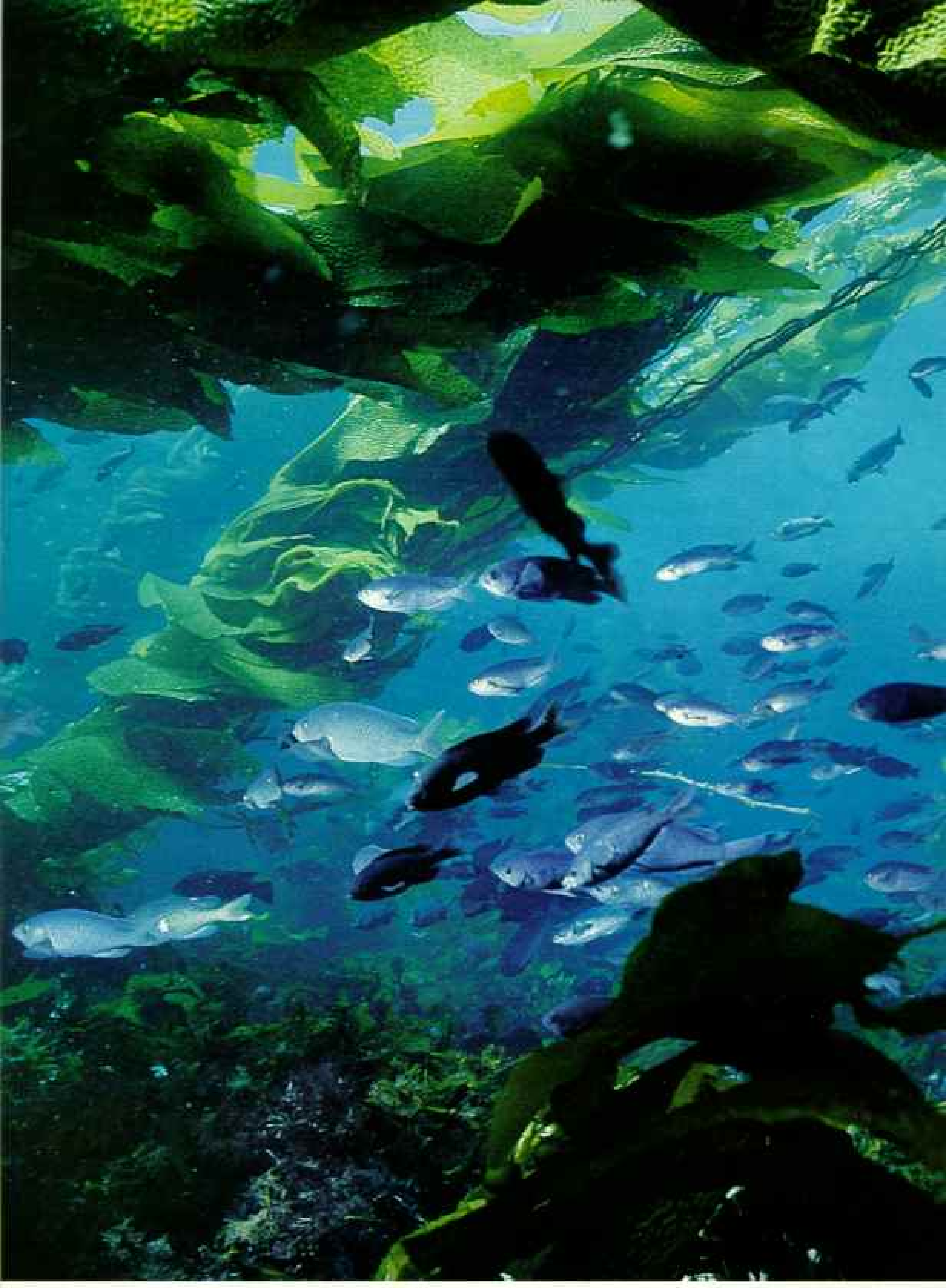
In deeper water, 60 to 120 feet down, widely spaced young elk kelp plants were already beginning to thrust skyward from the area that had been blanketed with squid egg cases a few months before.

On one dive, I cruised the vertical outer face of Bird Rock, following a deep crack in the rock some 30 feet underwater. Something stirred slightly in a shadowed crevice, and I turned my diver's light to see what it was. Pressing my face against the crack, I maneuvered the light from below and only



OCTOPUS, OCTOPUS BIMACULATUS, UP TO TWO FEET ACROSS; GARIBALDI, HYPSYPOPS RUBICUNDA

Shy contortionist, *an octopus becomes its own security blanket as it rests in a narrow crevice* (**left**). *Seawater drawn into a funnel beneath the eye can be quickly flushed to propel the mollusk. The small docile creature rests on the author's hand as she encounters a flashy garibaldi* (**above**). *Once a target for collectors, the brilliant swimmer is now protected as California's state marine fish.*



School of blacksmiths snaps into formation, facing the current to catch

food carried through a giant kelp bed by the rushing change of tide.

then recognized the eyes of an octopus, peering intently into mine, less than two inches from my chin.

The mottled-brown creature seemed to regard me with serene indifference. I turned to leave and nearly bumped into another octopus that was inconspicuously flattened on a ledge near the opening. I followed the outline of the body of the second animal and discovered that the tip of one slender tentacle entwined an arm of the other.

"Ah, spring!" I thought, and left them to whatever it was that they were about.

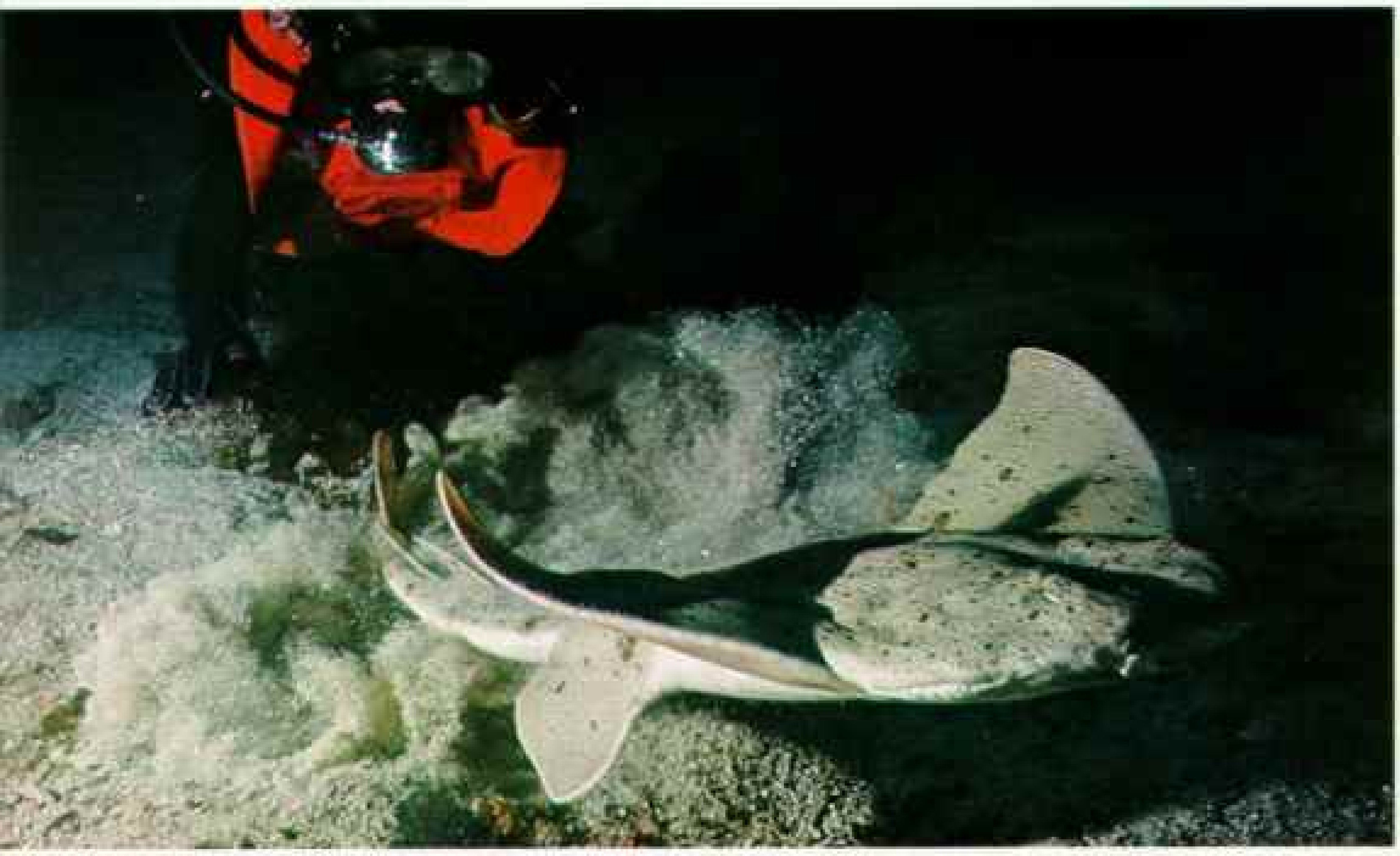
Eggs and young of infinite variety were evident at every turn. Sea hare miniatures prowled the leafy ocean floor, and leathery egg cases of the small prehistoric-looking swell sharks and horn sharks were tangled among the vegetation. A brilliant orange garibaldi (page 419), blissfully unaware of its status as California's state marine fish, hovered over a well-groomed lawn of soft, threadlike red algae tended by the fish as a nursery ground.

Amid the fine red filaments lay hundreds of glistening spheres, each containing the ingredients necessary to form a creature with blazing silver-rimmed eyes and a gracefully flattened body sheathed with scales of gold. Each embryo contained the makings of a bold disposition, a brain, and sensory system designed to ensure its owner's survival.

Not all would make it. My presence distracted the parent enough to allow a small predatory fish to dart in and eat several of the garibaldies-to-be. Aware that I was an intruder, I backed away and presently headed for the surface.

Fourth of July Fireworks—Underwater

Holiday fireworks illuminated the night skies of Los Angeles, while underwater I observed a galaxy of minute flashes of living light, sparked by my motion in the water. Some bioluminescence is evident in most seas year round. But the warming of surface waters around Catalina Island characteristically yields a conspicuous increase of sea fire, brilliantly heralding the arrival of the summer season.



SQUATINA CALIFORNICA

Startled by human presence, *a Pacific angel shark takes flight. Exposing only eyes and upper portions, large numbers of the raylike sharks nestle in sandy stretches around Catalina's kelp beds, emerging at night to stalk fish.*

My arms were clothed with silver as I swept forward; behind me a glowing wake marked my passage. Explosions of light bombarded my face mask, and I felt as a space traveler might—weightless, gliding among countless constellations through black infinity. A bold streak of light ahead disrupted my momentary reverie; something large, startled by my approach, streaked away, creating a sparkling trail: a living comet.

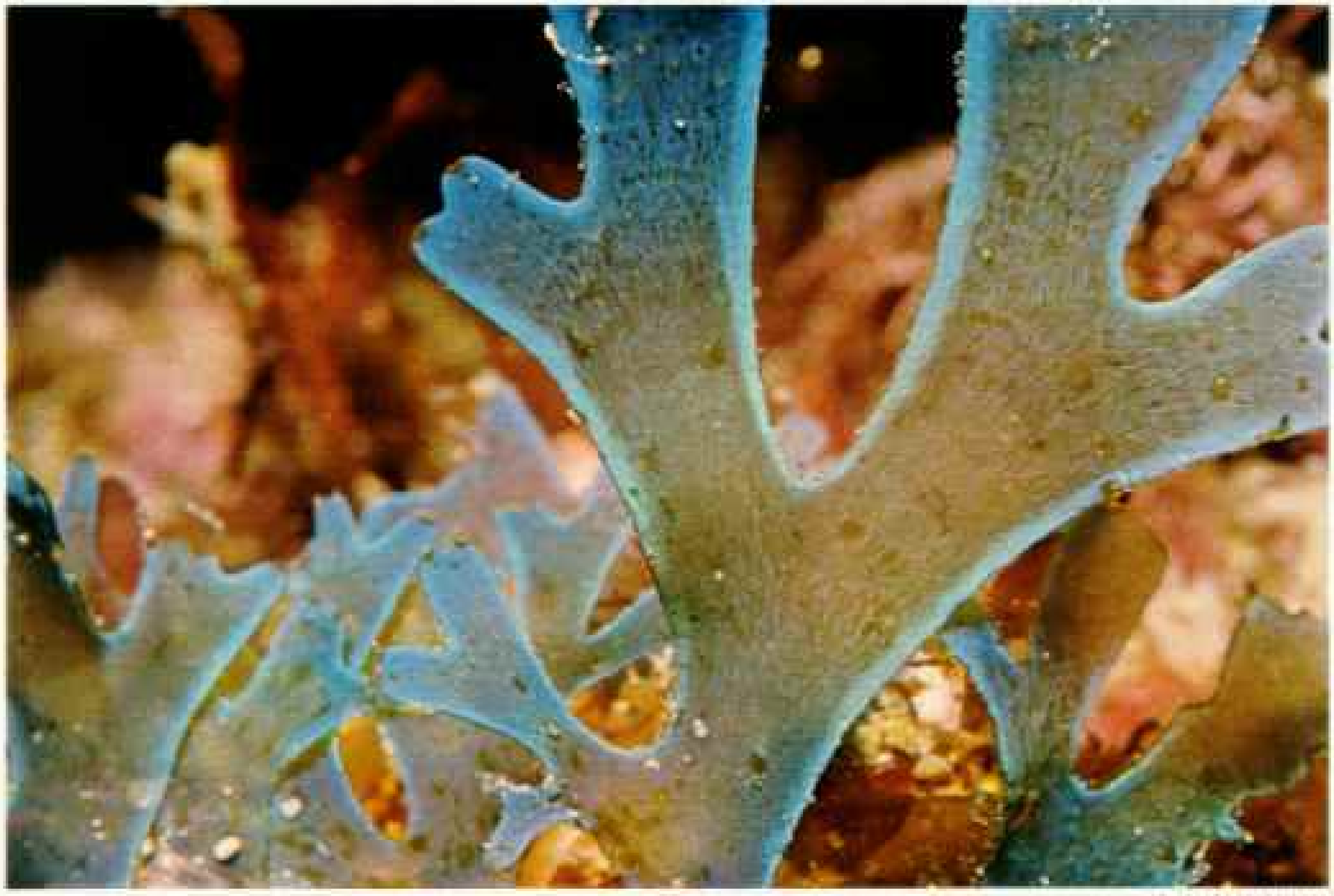
As I watched the creatures of the night in action, I was keenly aware that I too might be watched. It had happened earlier. While swimming along the shore of Bird Rock, I became aware that I was being scrutinized by an inquisitive harbor seal. A fish predator, this bewhiskered sea mammal with its catlike expression is itself on the menu of at least one now-and-then visitor to these waters, the great white shark.

Although I admire these sleek, giant carnivores and urge their protection as valuable members of the ocean's ecosystem, I am not greatly disappointed that I have yet to meet one face-to-face while diving at Catalina, or anywhere else during thousands of underwater hours. Encounters with some of their relatives, however, are common—and can be a source of distinct pleasure.

The air and sea temperatures were both above 70°F one fine day in summer when Al and I set off to observe some of Catalina's large sharks. We swam down the seaward side of Bird Rock through a startlingly abrupt thermocline. "Who needs air conditioning?" I thought, shivering as we entered the cold water that flows near the base of the tiny islet.

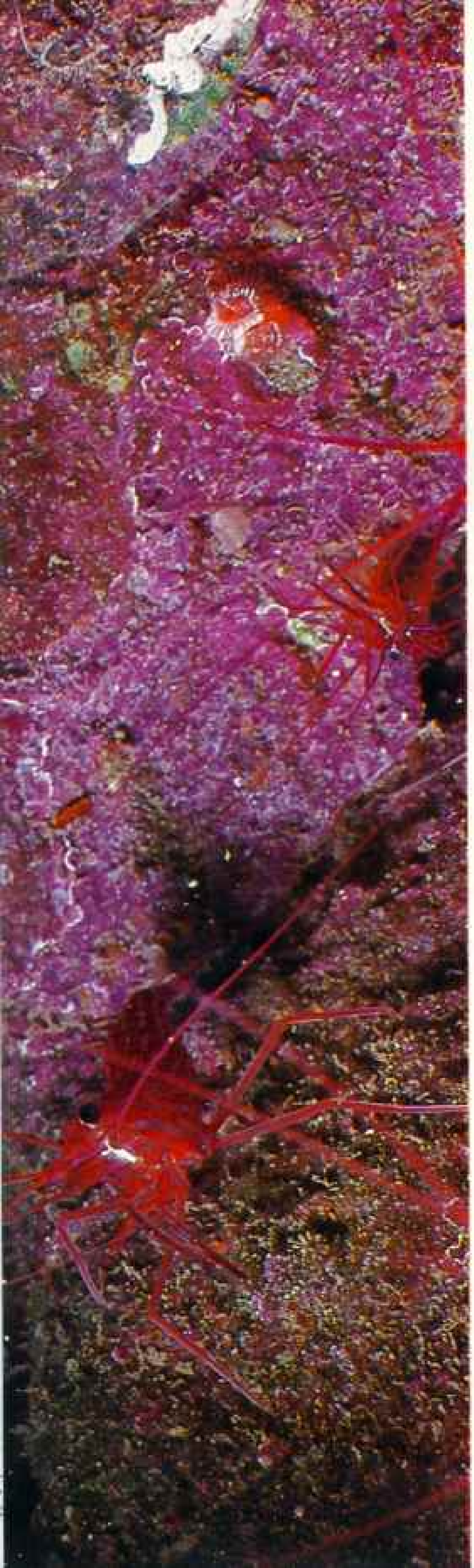
Ninety feet from the surface, we approached the gradually sloping seafloor. Golden eyes with fixed expression stared from a brown-gray form resting on brown-gray sand. I focused on the body of an angel shark, superficially resembling a great lobed and elongated pancake, nearly as long as I. As I reached to touch a sprig of pink algae that grew on its back, I brushed its rough-textured skin with my elbow.

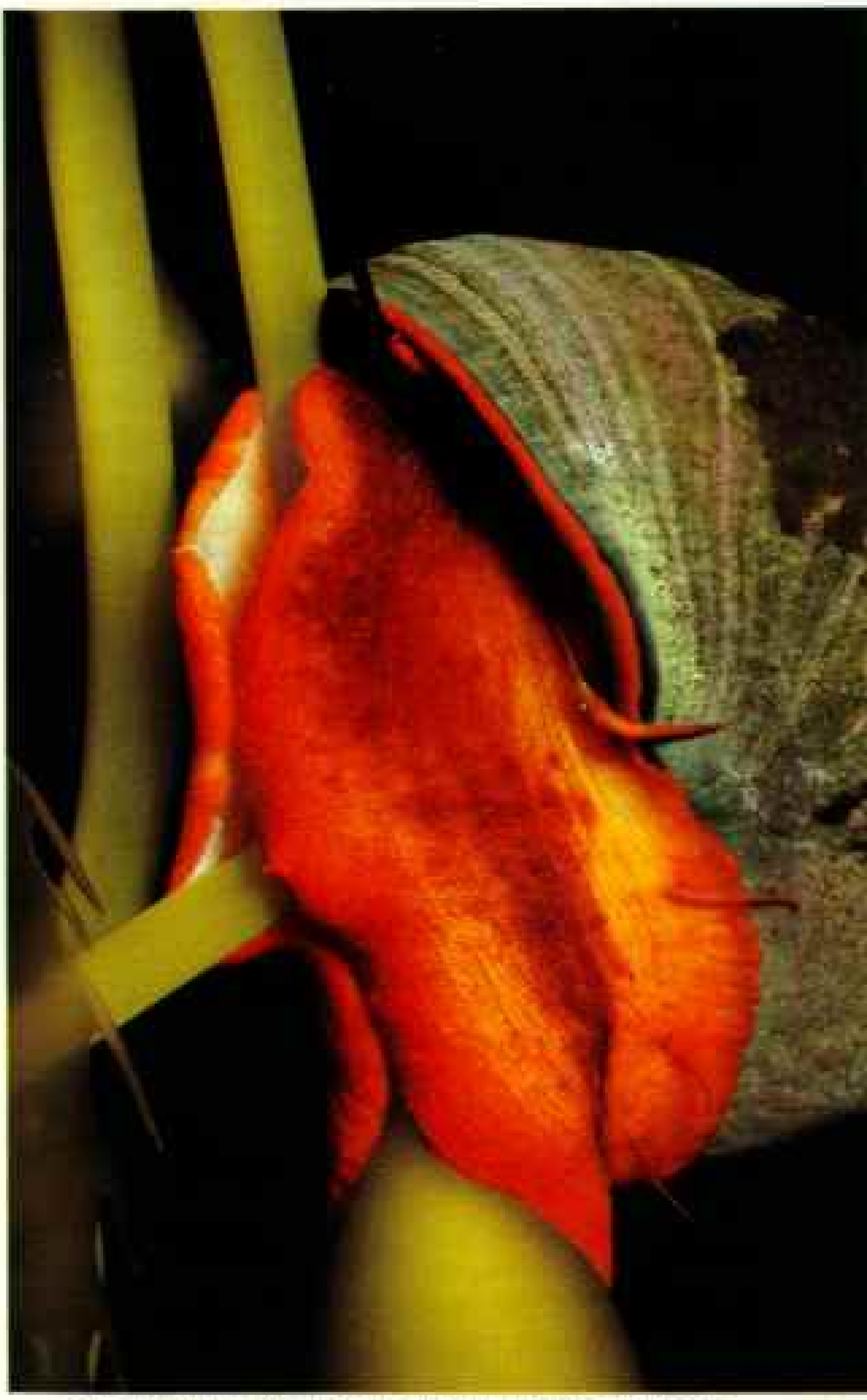
The shark quivered slightly, then "flew"



DICTYOTA FLABELLATA

Azure halo *on brown algae shines only underwater, where light refraction creates the soft iridescence. The low-lying species, less than a foot at maturity, grows outside the shadow of giant kelp to capture sunlight.*





SNAIL, NORRISIA NORRISI, 2 INCHES LONG; CALIFORNIA MORAY, GYMNOTHORAX MORDAX; RED ROCK SHRIMP, LYSMATA CALIFORNICA, 2 TO 3 INCHES LONG

Fearless crew *of cleaner shrimp scours parasites and dead tissue from a moray eel* (**left**)*, though ventures into the mouth can be fatal. Even in the act of breathing, a moray appears threatening, rhythmically closing its razor-toothed maw to pump water across the gills.*

For the eye-catching kelp snail (**above**) *eating is a one-way journey. Starting at the holdfast, the tiny grazer ascends a kelp frond, removing a layer of surface cells. When it reaches the end of a blade, the snail drops to the seafloor and, undaunted, begins another ambulatory feast.*

with a slow-motion burst of energy and glided like a limp handkerchief to a landing, on top of another angel shark. Both then exploded into momentary action, moving in separate directions, and each landing on other sharks that in turn disturbed others as they settled back on the seafloor. More than 40 of these gentle carnivores occupied an area less than 60 yards square—amid a scattering of orange and red bat stars.

In a nearby stand of elk kelp, angel sharks shared floor space with relatives of ancient lineage, the equally benign horn sharks. "Benign unless you happen to be two inches long," I thought, considering the varied diet of small fish, mollusks, and other animals that nourish these small-mouthed sharks. Horn sharks, in turn, are sometimes on the menu of their larger relatives.

As in human society, the question of who's boss under the sea tends to vary, depending on one's point of view. Sharks may be regarded as formidable neighbors by some members of the community, but to a delicate pink plant the nose of an angel shark may simply be a fortuitous parking place.

Sea Storms Uproot Seaweed

In October word came from Jim Coyer and Alexandra Zaugg-Haglund: "Somebody has found one of our tagged kelps on a beach two miles from the study plot."

By that time Alexandra and Jim were well along in their studies of growth rates and longevity of kelp. Each elk kelp plant in several scattered areas 12 yards square had been banded around the stalk, a procedure reminiscent of birdbanding by ornithologists. We hadn't expected any of our plants to be migratory, but nearly all of those marked early in the season were uprooted by storms before year's end and had drifted to unknown destinations. At least we now knew the fate of one.

By autumn Jim and Alexandra were able to plot the rate of growth and determined that young elk kelp settling early in the spring grows more rapidly and attains greater size than plants that begin life later in the season. Although not as luxuriant as giant kelp, *Pelagophycus* nonetheless grows as much as 25 feet in a year's time, one of the world's fastest-growing plants.

Around Bird Rock the kelp and more than 130 species of attached and planktonic plants had—through the magic of photosynthesis—generated in a single year hundreds of tons of material from available ingredients: sunlight, water, minerals, carbon dioxide. The plants in turn had directly or indirectly yielded food and shelter for an abundant and diverse assemblage of animals. More than 750 kinds of fish and invertebrates live in or near southern California kelp forests. A single plant sometimes supports more than 500,000 small animals.

A summing up of our findings brought to mind remarks by biologist Charles Darwin in 1834: "The number of living creatures of all Orders, whose existence intimately depends on the kelp [*Macrocystis pyrifera*], is wonderful. A great volume might be written, describing the inhabitants of one of these beds of sea-weed."

Darwin's further comment about kelp communities was hauntingly prophetic: "Yet if in any country a forest was destroyed, I do not believe nearly so many species of animals would perish as would here, from the destruction of the kelp."

Sadly, much of the kelp bordering southern California's coastline *has* been destroyed by pollution in recent decades. Ironically this has paralleled a growing awareness of the significance of these ancient and complex ocean systems.

Dr. Wheeler J. North, who pioneered in partially successful efforts to restore coastal kelp communities, estimates that each square mile of *Macrocystis* is worth about a million dollars a year. The figure is based on fish and shellfish production, plus the extraction of a substance called algin from kelp for a multitude of industrial applications.*

But my year-end accounting added more to the balance sheet. Knowing that millions of years' worth of revolving seasons—of life and death and life anew—are so readily and instantly vulnerable to our unconscious actions, should we not take notice?

The microcosm off Catalina Island offers insights into submarine ecosystems elsewhere. To understand one such magnificent subsea city is a step toward understanding others, and toward relating their survival and well-being to our own. ☐

---

*The August 1972 GEOGRAPHIC carried a report by Dr. North on his study of California kelp.

NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D.C.

Organized "for the increase and diffusion of geographic knowledge"

GILBERT HOVEY GROSVENOR

Editor, 1899-1954; President, 1920-1954
Chairman of the Board, 1954-1966

THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D.C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization. Since 1890 the Society has supported 1,865 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; its books, globes, atlases, filmstrips, and educational films; *National Geographic WORLD*, a magazine for children age 8 and older; information services; technical reports; exhibits in Explorers Hall; and television.

ROBERT E. DOYLE, President
GILBERT M. GROSVENOR, Vice President
OWEN R. ANDERSON, Vice President and Secretary
HILLEARY F. HOSKINSON, Vice President and Treasurer
C. VERNON SANDERS, Vice President
WILLIAM T. BELL, LEONARD J. GRANT,
JOSEPH B. HOGAN, ADRIAN L. LOFTIN, JR.,
LEWIS P. LOWE, RAYMOND T. McELLIGOTT, JR.,
EDWIN W. SNIDER, Associate Secretaries

BOARD OF TRUSTEES

MELVIN M. PAYNE, Chairman of the Board

LLOYD H. ELLIOTT, Vice Chairman
President, George Washington University

MELVILLE BELL GROSVENOR, Chairman Emeritus

THOMAS W. McKNEW, Advisory Chairman

THOMAS E. BOLGER
Executive Vice President, American Telephone & Telegraph Company

FRANK BORMAN, Chairman of the Board and President, Eastern Airlines

J. CARTER BROWN, Director, National Gallery of Art

WARREN E. BURGER
Chief Justice of the United States

ROBERT E. DOYLE, President, National Geographic Society

GEORGE M. ELSEY, President, American Red Cross

GILBERT M. GROSVENOR
Editor, National Geographic

ARTHUR B. HANSON, General Counsel, National Geographic Society

CARYL P. HASKINS, Former President, Carnegie Institution of Washington

JEROME H. HOLLAND
Former U. S. Ambassador to Sweden

CARLISLE H. HUMELSINE
Chairman of the Board,
The Colonial Williamsburg Foundation

MRS. LYNDON B. JOHNSON

CURTIS E. LeMAY, Former Chief of Staff, U. S. Air Force

WM. McCHESNEY MARTIN, JR.
Former Chairman, Board of Governors, Federal Reserve System

LAURANCE S. ROCKEFELLER
President, Rockefeller Brothers Fund

ROBERT C. SEAMANS, JR.
Dean of the School of Engineering, Massachusetts Institute of Technology

JAMES H. WAKELIN, JR., Former Assistant Secretary of Commerce for Science and Technology

JAMES E. WEBB, Former Administrator, National Aeronautics and Space Administration

CONRAD L. WIRTH, Former Director, National Park Service

Trustees Emeritus
CRAWFORD H. GREENEWALT
JUAN T. TRIPPE
FREDERICK G. VOSBURGH
LOUIS B. WRIGHT

COMMITTEE FOR RESEARCH AND EXPLORATION

MELVIN M. PAYNE, Chairman
T. DALE STEWART, Vice Chairman
EDWIN W. SNIDER, Secretary

BARRY C. BISHOP, ROBERT E. DOYLE, GILBERT M. GROSVENOR, MELVILLE BELL GROSVENOR, CARYL P. HASKINS, STERLING B. HENDRICKS, Scientist Emeritus, U. S. Department of Agriculture, THOMAS W. McKNEW, BETTY J. MEGGERS, Research Associate-Anthropology, Smithsonian Institution, CHARLES H. SOUTHWICK, Professor of Biology, University of Colorado, GEORGE E. STUART, JAMES H. WAKELIN, JR., GEORGE E. WATSON, Curator of Birds, Smithsonian Institution, FRANK C. WHITMORE, JR., Research Geologist, U. S. Geological Survey, CONRAD L. WIRTH, LOUIS B. WRIGHT, and PAUL A. ZAHL

ASSISTANT SECRETARIES OF THE SOCIETY: Frederick C. Gale, James P. Kelly, Ward S. Phelps, Cletis Pride. **ASSISTANT TREASURER:** Alfred J. Hayre. *Assistants to the President:* Earl Corliss, Jr., Thomas E. Kulikosky, Richard E. Pearson. *Administrative:* D. Evelyn Carnahan, Janet C. Soper

SECRETARY'S STAFF: *Accounting:* Dorothy L. Dameron, Jay H. Givans, Laura L. Leight, William G. McGhee, George E. Newstedt, David H. Peters. *Administration:* Ruth E. Clark, Robert V. Koenig, Zbigniew Jan Lutyk, Myra A. McLellan, Ross L. Mulford, Jimmie D. Pridemore, Joyce S. Sanford, Karen F. Shrewsberry, Nell G. Snow, Frank M. Twigger. *Computer:* James G. Schmelzer, William L. Chewning, Ronald C. Kline, Richard A. Mechler. *Educational Services:* Wendy G. Rogers, Dean R. Gage, Carl W. Harmon, Jr. *Employee Benefits:* Howard R. Hudson, Mary L. Whitmore. *Explorers Hall:* Peter Purpura. *Membership Services:* Margaret L. Bassford, Robert C. Dove, Erma T. Goetzinger, William T. McDonnell, Charles P. Thomas, Paul B. Tylor, Dorothy M. Wagner, Marguerite M. Wise, Peter F. Woods. *Personnel:* Thomas L. Hartman, M.D., Robert E. Howell, Glenn G. Pepperman, Shirley N. Wilson. *Printing:* Joe M. Barlett, Frank S. Oliverio, Margaret A. Slifer, Hans H. Wegner. *Promotion:* Charles T. Kneeland, Robert J. Warfel, Eileen W. Bowering, James R. Dimond, Jr., Robert L. Feige, Joseph S. Fowler, Thomas M. Kent, Mary M. Mosser, F. William Rath, Towne Windom. *Purchasing:* Robert G. Corey, Thomas L. Fletcher, Sheila H. Immel

ADVERTISING: *Director:* James L. Till, 1251 Avenue of the Americas, New York 10020. *Asst. to Dir.:* Blanche Coffey. *Assoc. Sales Director:* George W. Kellner. *Managers—East:* Bart W. McDonnell, New York. *Midwest:* Robert R. Henn, Chicago. *San Francisco:* Cecil H. London. *Los Angeles:* Richard H. Lehman. *Detroit:* George E. Moffat. *International Editions:* Robert W. Horan, New York. *Travel:* Gerald A. Van Splinter, New York. *Europe:* Michel A. Boutin, Paris. *Business Manager:* Peter W. Michaels. *Production Manager:* G. Sarita Lapham

---

COPYRIGHT © 1980 National Geographic Society, 17th and M Sts. N.W., Washington, D. C. 20036. Second-class postage paid at Washington, D. C., and elsewhere. Cover design and title protected by U. S. and foreign trademark registrations. $13 a year, $1.45 a copy. **POSTMASTER:** Send address changes to National Geographic (ISSN 0027-9358), P. O. Box 2174, Washington, D. C. 20013.

MELVIN M. PAYNE *Chairman of the Board*
ROBERT E. DOYLE *President of the Society*
MELVILLE BELL GROSVENOR *Editor Emeritus*

NATIONAL GEOGRAPHIC MAGAZINE

GILBERT M. GROSVENOR *Editor*

W. E. GARRETT *Associate Editor, Illustrations*
JOSEPH JUDGE *Associate Editor, Text*

SENIOR ASSISTANT EDITORS

James Cerruti, *Contract Writers* Richard J. Darley, *Cartography*
Robert E. Gilka, *Photography* William Graves, *Expeditions*
Robert P. Jordan, *Special Projects* Edward J. Linehan, *Manuscripts*
Samuel W. Matthews, *Production* O. Louis Mazzatenta, *Layout*
Howard E. Paine, *Art* Carolyn Bennett Patterson, *Legends*
Mary G. Smith, *Research Grant Projects* Thomas R. Smith, *Illustrations*
Kenneth F. Weaver, *Science* Ann K. Wendt, *Research*

TEXT

ASSISTANT EDITORS: Rowe Findley, Allan C. Fisher, Jr., Bart McDowell, Elizabeth A. Moize, Merle Severy

SENIOR WRITERS: Thomas J. Abercrombie, David S. Boyer, Thomas Y. Canby, Mike Edwards, William S. Ellis, Howard La Fay, John J. Putman, Peter T. White

SENIOR EDITORIAL STAFF: Harvey Arden, Kent Britt, Boyd Gibbons, Rick Gore, Noel Grove, Alice J. Hall, Bryan Hodgson, David Jeffery, Michael E. Long, Ethel A. Starbird, Priit J. Vesilind, Gordon Young

EDITORIAL STAFF: Robert Booth, Allen A. Boraiko, John L. Eliot, Larry Kohl, John L. McIntosh, George E. Stuart

RESEARCH: Frances H. Parker (Associate Chief); Carolyn H. Anderson, Susan L. Anderson, Judith Brown, Susan Day Fuller, Ann B. Henry, Jan Holderness, Patricia B. Kellogg, Kathy B. Maher, Jean B. McConville, Jeanne E. Peters, Lesley B. Rogers, Frances W. Shaffer. *Style:* Michaeline A. Sweeney. *Geographic Information:* Bette Joan Goss. *Legends:* Abigail A. Tipton

ILLUSTRATIONS

PHOTOGRAPHERS: Dean Conger, Joseph J. Scherschel (Assistant Directors); James L. Amos, Joseph H. Bailey, James P. Blair, Victor R. Boswell, Jr., Jodi Cobb, Bruce Dale, Gordon W. Gahan, David Alan Harvey, Otis Imboden, Emory Kristof, Joseph D. Lavenburg, Bianca Lavies, Bates Littlehales, Robert W. Madden, George F. Mobley, Robert S. Oakes, Steve Raymer, Robert F. Sisson (*Natural Science*), James L. Stanfield, Volkmar Wentzel (*Archivist*). *Administration:* Claude E. Petrone, Susan A. Smith

ILLUSTRATIONS EDITORS: W. Allan Royce (Assistant Director); David L. Arnold, Taylor Gregg, Declan Haun, Bruce A. McElfresh, Charlene Murphy, Robert S. Patton, Elie S. Rogers, Jon Schneeberger

LAYOUT: Constance H. Phelps

ART: William N. Palmstrom, J. Robert Teringo (Associate Directors); Walter Q. Crowe, John D. Garst, Jr. (Assistant Directors); Elie Sabban (Production). *Artists:* Lisa Biganzoli, William H. Bond, John W. Lothers, Ned M. Seidler. *Map Editors:* John T. Blozis, Gus Platis. *Research:* Virginia L. Baza, Harold A. Hanson (Supervisors); Ross M. Emerson, Margaret Deane Gray, Dorothy A. Nicholson. *Map Artists:* Isaac Ortiz, Leo B. Zebarth (Supervisors); Iskandar Baday, Peter J. Balch, Snejinka Stefanoff, Alfred L. Zebarth

DESIGN: Charles C. Uhl, Betty A. Clayman, Diana L. Pabst, Robert E. Pullman

ENGRAVING AND PRINTING: William W. Smith (Director); James R. Whitney (Associate Director); Bill M. Aldridge, John T. Dunn, John R. Metcalfe

CARTOGRAPHY

John F. Shupe (Associate Chief); Ted Dachtera, Richard K. Rogers (Assistant Chiefs); John F. Dorr (Art Director); Margery K. Barkdull, Charles F. Case, Henri A. Delanghe, Russel G. Fritz, Charles W. Gotthardt, Jr., Thomas L. Gray, Catherine M. Hart, Harry D. Kauhane, Mary C. Latham, Mary Anne McAleer, Charles L. Miller, Roland R. Nichols, Robert W. Northrop, Charles L. Stern, Douglas A. Strobel, Tibor G. Toth, Thomas A. Wall, Thomas A. Walsh

EDITORIAL SERVICES

ADMINISTRATION: *Joyce W. Graves (Assistant to the Editor)*, Elaine Rice Ames, Marie L. Barnes, G. Merrill Clift, Neva M. Collins, Lilian Davidson, Virginia H. Finnegan, Eleanor W. Hahne, Mary F. Klemann, Lucille L. McInerney, Shirley Neff, Patricia M. Oakes, Barbara A. Shattuck, M. Jean Vile, Barbara L. Wyckoff. *Correspondence:* Carolyn F. Clewell, Clifford R. DuBois. *Indexes:* Jolene M. Blozis. *Travel:* Virginia A. Bachant

PHOTOGRAPHIC LABORATORIES AND TYPESETTING: Carl M. Shrader (Chief); Milton A. Ford (Associate Chief); Lawrence F. Ludwig (Assistant Chief); Herbert Altemus, Jr., Billy R. Barnett, Richard A. Bredeck, David H. Chisman, Ellwood M. Kohler, Jr., Geoffrey T. McConnell, Arletta M. Molinari, William S. Petrini, Bernard G. Quarrick, Joan S. Simms, James H. Trott, Alfred M. Yee

LIBRARIES: *Publications:* Virginia Carter Hills (Librarian); Patricia Murphy Smith, Carolyn Locke, Louise A. Robinson, Susan Fifer Schutt, Marta Strada. *Illustrations:* L. Fern Dame, Carolyn J. Harrison. *Records:* Lorie Northrop, Mary Anne McMillen. *Films:* Betty G. Kotcher

RELATED EDUCATIONAL SERVICES OF THE SOCIETY

SENIOR ASSISTANT EDITORS

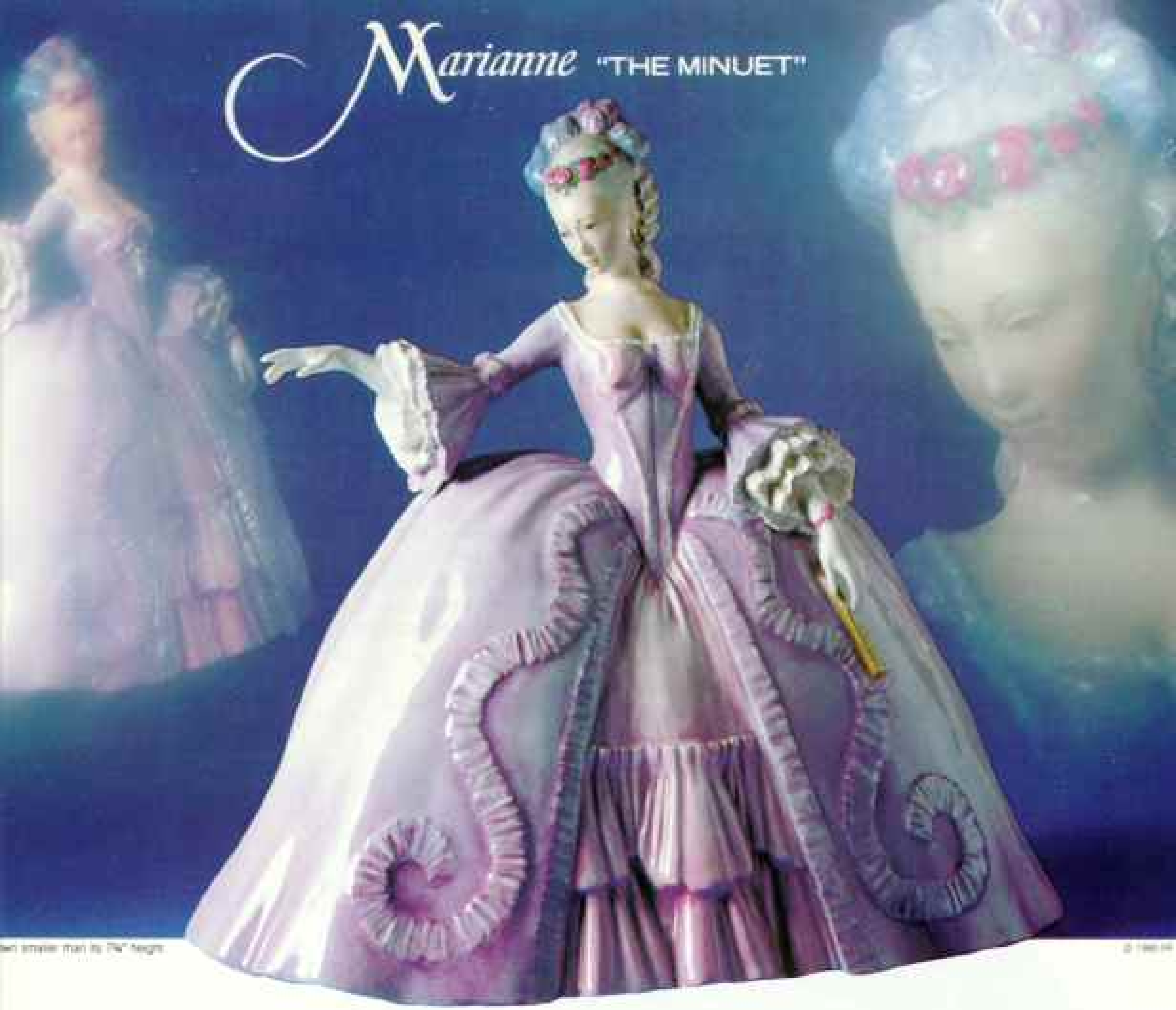
Robert L. Breeden, *Special Publications and School Services*
Charles O. Hyman, *Book Service*

BOOK SERVICE: Thomas B. Allen, Ross Bennett, Constance Brown Boltz, Mary H. Dickinson, Karen F. Edwards, Robert C. Firestone, Seymour L. Fishbein, Anne Dirkes Kobor, J. Edward Lanouette, Carol Bittig Lutyk, Linda B. Meyerriecks, David F. Robinson, Shirley Scott, Margaret Sedeen, Verla Lee Smith

SPECIAL PUBLICATIONS AND SCHOOL SERVICES: Donald J. Crump (Associate Chief); Philip B. Silcott (Assistant Chief); William L. Allen, Josie Bolt, Toni Eugene, Ron Fisher, William R. Gray, Barbara Grazzini, Sallie M. Greenwood, Mary Ann Harrell, Suzanne J. Jacobson, Bonnie S. Lawrence, Geraldine Linder, Tee Loftin, Louisa V. Magzanian, Tom Melham, Robert Messer, H. Robert Morrison, Cynthia Ramsay, Jennifer C. Urquhart, George V. White, Merrill Windsor. *National Geographic WORLD:* Ralph Gray (Editor); Ellen Joan Hurst, Margaret McKelway, Pat Robbins, Eleanor Shannahan, Veronica Smith, Ursula Perrin Vosseler. *Educational Media:* George Peterson (Editor); Jimmie Abercrombie, James B. Caffrey, Margery G. Dunn, Jacqueline Geschickter, Jane R. McCauley, Judith E. Rinard

NEWS SERVICE: Paul Sampson (Chief); Donald J. Frederick, Ellen E. Kohlberg, Barbara S. Moffet, William J. O'Neill, Robert C. Radcliffe. **TELEVISION AND EDUCATIONAL FILMS:** Dennis B. Kane (Chief); Marjorie M. Moomey (*Research*); Patricia F. Northrop (*Promotion*); Sidney Platt (*Educational Projects*); Donald M. Cooper, Anne B. K. Krumbhaar, Yeorgos N. Lampathakis, Louise C. Millikan, Nola L. Shrewsberry, Carl E. Ziebe. **LECTURES:** Joanne M. Hess (Chief); Ronald S. Altemus, Robert G. Fleegal, Mary W. McKinney, Gerald L. Wiley. **AUDIOVISUAL:** Jon H. Larimore

Marianne "THE MINUET"



wn smaller than its 7¾" height

© 1980 FM

The premier figure in "*The Belles of the Ball*,"
an outstanding new collection of hand-painted costume figurines in fine porcelain.
A limited edition issue of The Museum of Costume, Bath, England.

An original porcelain sculpture of exceptional beauty by a distinguished artist at the very attractive price of $90.

Available for a limited time only.

Reservation valid only if mailed by September 30, 1980.

The figure of an 18th-century woman—beautiful and full of grace. Pausing in mid-step as she dances the favorite dance of the time: the minuet. Clad in a ravishing ball gown of the early 1770s—the kind every woman would love to wear—all ruffles and lace.

The figure? A remarkable work of art in fine porcelain. Elegantly sculptured. Hand-painted in exquisite colors, and glazed with a rich sheen that seems almost to give it a life of its own. Superbly detailed—even down to the fan and tiny pendant earrings picked out in *pure 24 karat gold*.

This is *Marianne*—*"The Minuet"*. Commissioned by The Museum of Costume, Bath, England, from the distinguished costume artist Steven Gregory. To be crafted for the Museum by Franklin Porcelain in Japan—home of some of the world's most gifted and experienced porcelain craftsmen.

In keeping with established collecting tradition, *Marianne* will be available during the issue year of 1980 only. Affording the exclusivity of a limited edition—at a price designed to place the figure within reach of all who love beauty... art... and the romance of the past. Just $90, payable in three installments. *When all valid orders are filled, the original molds and designs will be destroyed, so the work may never be issued again.*

Marianne is the first in a new series, "The Belles of the Ball." Owners will be notified of future issues in the series—and may acquire them if they wish. There is no obligation.

Each figure will be crafted to order. To take advantage of this exceptional opportunity, return the reservation form at right to Franklin Porcelain, Franklin Center, Pennsylvania 19091, no later than September 30, 1980.

RESERVATION FORM

MARIANNE "THE MINUET"

Valid only if postmarked by
September 30, 1980. Limit: One per person.

The Museum of Costume
c/o Franklin Porcelain
Franklin Center, Pennsylvania 19091

Please accept my reservation for *Marianne*—*"The Minuet"* by Steven Gregory in the finest hand-painted porcelain, at just $90.* I shall also receive a Certificate of Authenticity and specially written reference material.

I need send no money now. Bill me for my first payment of $30.* prior to shipment, then for two subsequent monthly payments of $30.* each.

**Plus my state sales tax and a total of $3. for shipping and handling.*

Signature ____________________
RESERVATIONS ARE SUBJECT TO ACCEPTANCE

Mr.
Mrs.
Ms. ____________________
PLEASE PRINT CLEARLY

Address ____________________

City ____________________

State, Zip ____________________

Canadian residents will be billed $135. plus $3. shipping and handling. ($CDN)

"The more you learn about our DC-10, the more you know how great it really is."

Pete Conrad
Former Astronaut
Division Vice President, McDonnell Douglas

"I've watched airplanes and spacecraft take shape for much of my adult life. I'm certain that nothing made to fly has ever been built to more exacting standards than our DC-10.

"Eighteen million engineering man-hours were invested in this plane's development. That includes 14,000 hours of wind tunnel testing, as well as full-scale 'fatigue testing' for the equivalent of 40 years of airline service.

"I'm convinced that the DC-10 is the most thoroughly tested jetliner ever built. Along with U.S. Government certification, the DC-10 has passed structures tests just as demanding, in their own way, as those required of U.S. Air Force fighter planes.

"The DC-10 fleet demonstrates its dependability flying more than a million miles a day and serving 170 cities in 90 countries around the globe."

To learn more about the DC-10, write: "DC-10 Report," McDonnell Douglas, Box 14526, St. Louis, MO 63178.

MCDONNELL DOUGLAS

IAIN DOUGLAS-HAMILTON

A swinging trunk stops the shooting

A PLAYFUL CUFF from a baby is all in a day's work for Oria Douglas-Hamilton, whose article on elephants will appear in November. In Kenya, as elsewhere in Africa, elephants face an uncertain future, victims of civilization's crowding edge and ivory-hungry poachers. The animals' struggle for existence is dramatized by a recently completed continent-wide survey of their dwindling numbers by her husband, Iain. Share involvement in such studies. Nominate friends for membership in the Society.

NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

$11.50 **CALENDAR YEAR 1981 MEMBERSHIP DUES INCLUDE SUBSCRIPTION TO THE NATIONAL GEOGRAPHIC**

ANNUAL DUES in the United States and throughout the world are $11.50 U.S. funds or equivalent. To compensate for additional postage and handling for mailing magazine outside the U.S.A. and its outlying areas, please remit: for Canada, $17.87 Canadian or $14.65 U.S.; for all other countries, $18.40 if paid in U.S. currency by U.S. bank draft or international money order. Eighty percent of dues is designated for magazine subscription. Annual membership begins with the January issue.

EIGHTEEN-MONTH MEMBERSHIP: Applicants who prefer delivery of their NATIONAL GEOGRAPHIC to start with the July 1980 instead of the January 1981 issue may upon request become members and receive the magazine for 18 months from July 1, 1980, through December 1981. Upon expiration, such memberships will be renewable annually on a calendar-year basis. For 18-month membership check here ☐ and remit: for U.S. and its outlying areas, $16.25 U.S. funds or equivalent; for Canada, $25.57 Canadian or $20.97 U.S.; for all other countries, $25.47 if paid in U.S. currency by U.S. bank draft or international money order.

NEW MEMBER ______________________________
PRINT NAME OF AN INDIVIDUAL ONLY (MR., MRS., MISS, MS.)

____
STREET

____
CITY, STATE/PROVINCE, COUNTRY, ZIP/POSTAL CODE

Mail to: The Secretary
National Geographic Society
Post Office Box 2895
Washington, D.C. 20013

CHECK ONE

I WISH TO JOIN the NATIONAL GEOGRAPHIC SOCIETY and enclose my dues $__________ ☐
(FILL IN NAME AT LEFT.)

(GIFT MEMBERSHIP) I nominate and enclose $__________ for dues of the person named at left. ☐

Send gift card signed: ______________________________

I NOMINATE for Society membership the person named at left. (Use separate sheet for additional nominations.) ☐

MY NAME ______________________________
PLEASE PRINT (MR., MRS., MISS, MS.)

____
STREET

____
CITY, STATE/PROVINCE, COUNTRY, ZIP/POSTAL CODE

[illegible]

REGIS HALL

Protect your investment with a Smith-Corona.

You can't believe your child is finally off to college. But she is. And you can't believe how much the cost of college has gone up since you were there. But it has. And how!

Now, more than ever before, it makes all kinds of sense to invest in a Smith-Corona® electric portable.

First, because you want her to make it. And while a Smith-Corona isn't going to make anyone into a genius, it *is* going to make papers look more impressive and easier to read.

It will also make your student *feel* better about her work.

And it's one more way of showing how much confidence you have in her. And those things mean a lot.

On the more practical side, a Smith-Corona is a solid investment in the future. It is made to last. (Even *we're* amazed by the testimonials we get.)

And Smith-Corona is the only electric portable that is still actually manufactured by an American company. (No one else makes our machines for us.)

And they're built with the same quality standards that made Smith-Corona the household word for "typewriter."

We really want you to compare it with any other portable.

First, *listen.* A Smith-Corona sounds solid and professional, because it is.

Now, type on both machines, and compare results. Smith-Corona type is smooth, even, precise.

No other portable offers you our unique cartridge ribbon system.

You can use regular fabric ribbon, or the carbon film ribbon, in a variety of colors, like the big office machines use to produce extra-crisp, sharp type. And there's a cartridge correction ribbon, which lets you correct mistakes in a snap, literally.

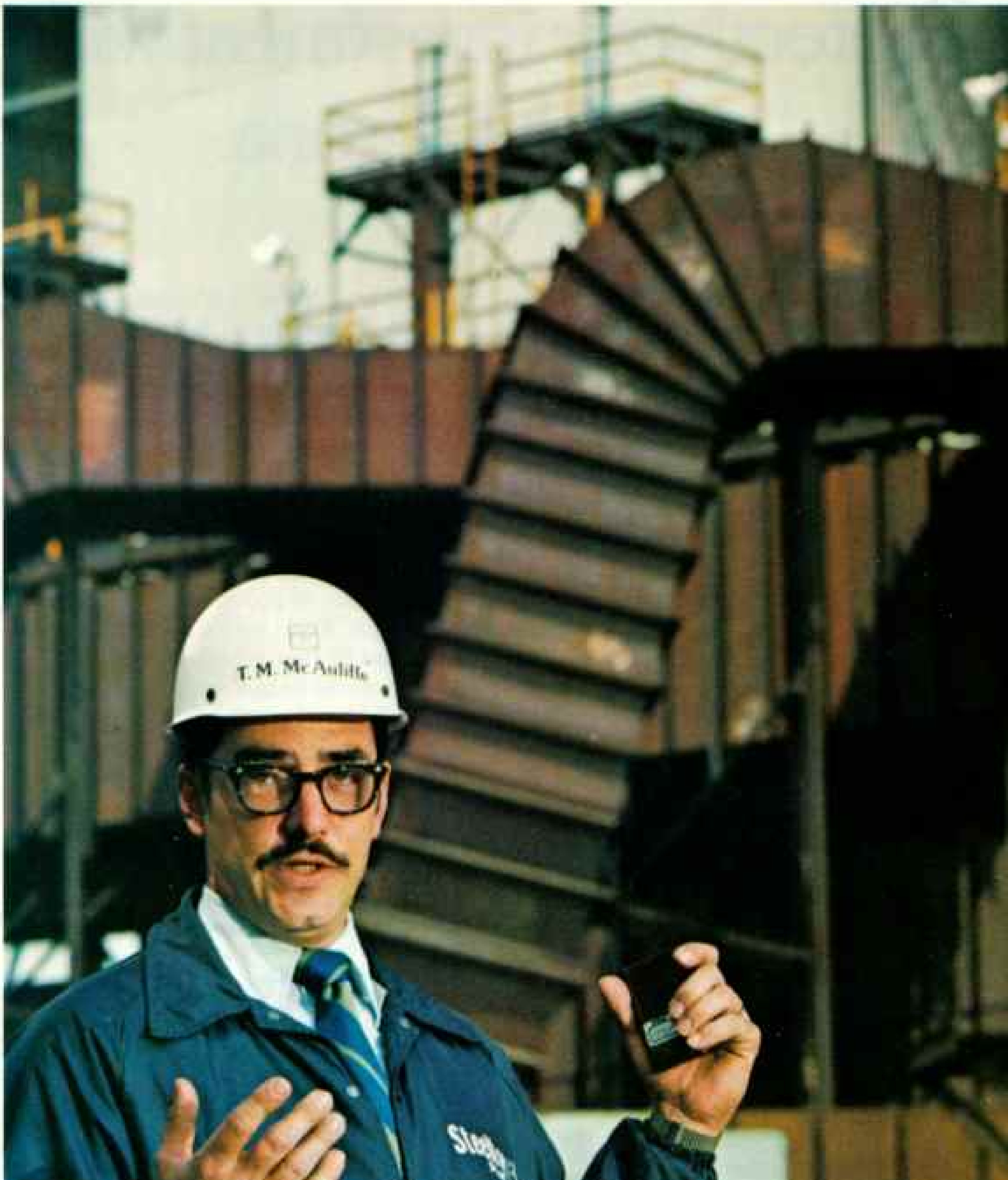
It makes all kinds of sense to send a Smith-Corona off to college.

When you consider what four years of college costs, a Smith-Corona is one of the least expensive forms of insurance you can buy.

Smith-Corona. It will make her words sing.

Patented Correction Cartridge

Smith-Corona


T. M. McAuliffe

Environmental activist Tom McAuliffe:

"When it comes to cleaning air, I'll match this Bethlehem 'dust catcher' against any in the steel industry."

Tom McAuliffe, a combustion engineer at Bethlehem's Steelton, Pa., plant, "just grew" into his environmentalist role... as did many of the thousand other people whose jobs keep them active in Bethlehem Steel's environmental control program.

As Tom explains it: "The fuel department has always been involved with water mains and air ducts. So it was only natural for our department to take over the plant's efforts to control air and water pollution.

"Back in the sixties, the plant changed over to electric furnaces and immediately installed its first baghouse. That $2½ million system still collects about 85 percent of the emissions generated by the steelmaking operation."

Baghouses operate like giant vacuum cleaners. Huge fans pull the dust-laden air through filter bags. The 5,000 bags hanging in No. 2 baghouse, each a foot in diameter and 33 feet long, filter 1,600,000 cubic feet of air every minute. The bags are shaken periodically, causing the particles trapped in the bags to fall into bins. The particles are then collected, pelletized, and disposed of on a plant-site landfill.

But in the early seventies, the EPA came up with tougher clean-air targets. And that's when Tom "really got involved."

"From day one," he remembers, "I lived with the No. 2 baghouse project. I was involved in everything... design, engineering, construction, start-up, everything. We built it 'top of the line,' and it shows.

"The original baghouse collects the particles in the air that's pulled out of the furnaces. What it doesn't get are the particles that escape when the furnace cover is off, or that leak out through the cover from the spaces around the electrodes. That's the job of baghouse No. 2. When those particles rise with the hot air to the peak of the roof, they're drawn into No. 2 baghouse where they're filtered out of the air and collected.

Five times as much money (and a lot more energy) to collect one-sixth as much dust

"No. 2 baghouse cost about five times what No. 1 cost—$13 million versus $2½ million. It's six times larger and pulls six times more air through its bags every minute. But in all that air there's only one-sixth the amount of dust that's in the air cleaned by No. 1.

"Both baghouses run all the time the furnaces are working and together pick up better than 98 percent of the emissions."

Bethlehem's commitment: to do what is necessary to protect public health

Tremendous improvements have already been made in the environmental area, but at tremendous cost. At Bethlehem, for example, we've already spent $700 million for pollution control equipment at our various operations.

We're committed to continue with programs that will control approximately 95 percent of our pollutant emissions and discharges. But we also believe there's a limit. To require industry *to remove the last traces of pollution,* to "purify" the air and water beyond what is necessary to protect public health, does not make good economic or energy sense.

Our position is clearly explained in our booklet *Steelmaking and the Environment,* which includes our *Statement on Environmental Quality Control.* If you would like a copy, write:
Public Affairs Dept., 476 Martin Tower, Bethlehem Steel Corporation, Bethlehem, PA 18016.

Bethlehem

Sony Introduces The Whole Earth Radio.

Imagine a radio with the whole earth on one set of pushbuttons.

Push a button, hear the English-language news from Moscow. Touch another button and check the Voice of America, currently offering world news, U.S. news, U.S. government criticism and discussion, in your choice of thirty-eight languages.

What's the price of oil in the Mideast? Would broadcasts from Spain help you learn Spanish? And how about music from all over the whole earth, in everybody's second language?

With the touch of a fingertip you can change stations all over the FM and AM bands, shortwave, mediumwave, and longwave. You can even listen to amateur SSB and CW Morse code.

You can do it all with The Whole Earth Radio. On AC or DC or even car-battery power, it couldn't be easier.

In fact, that's one of the nicest things about getting so much out of this little radio.

A child can do it.

SONY

THE ONE AND ONLY

© 1980 Sony Corporation of America. Sony is a trademark of Sony Corporation. Model shown: ICF-2001

NIKKOR 50mm 1:1.4 4320665
Nikon
Nikon

NIKON FE
A CAMERA TO STIR YOUR EMOTIONS

A favorite of professionals, the FE is the creative camera par excellence – the embodiment of Nikon sophistication.

Its precise meter system sets correct exposures with uncanny accuracy, automatically. Or, simply turn a dial for complete manual control. Either way, the pictures are razor sharp…

Offering combined capabilities found in no other automatic, it accepts Nikon's extraordinary lenses, accessories and a true 3.5 fps motor drive.

A modern 35mm classic, the FE is the finest compact automatic in its class. Priced to make it an irresistible value too! Why settle for anything less.

©Nikon Incorporated 1980
Garden City, New York 11530

With 40 days' paid vacation every 12½ months, Aramco people can see the heart of Asia, from Delhi to Bangkok to Hong Kong, and still have time for an African game park, Paris in the spring, or ski trips in the Alps.

The money isn't the only reason so many top people are going to Saudi Arabia with ARAMCO

As great as the money is, it's the travel opportunities, the challenge, and casual living in American-style hometowns that make Aramco people stay on.

Aramco employees in Saudi Arabia have travel opportunities that most people only see in daydreams. They get *40 days'* paid vacation every 12½ months. And in Saudi Arabia they are already halfway to wonderful places in Europe, Asia and Africa.

Equally as important as money and travel are the challenging jobs and secure, comfortable living conditions.

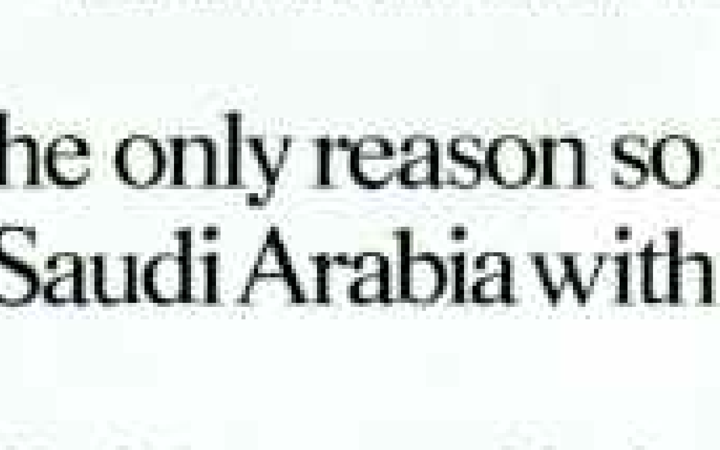
Aramco is the world's largest oil-producing company. Our projects and operations are huge, complex and professionally rewarding. Many are the largest of their kind ever undertaken.

We need more first-rate people to join the 4,000 North Americans who are already working for us. We have openings for qualified engineers, technicians and professionals of all types.

North Americans and Saudi Arabs have worked together for over 40 years

Since the early 1930's, North Americans have worked very closely and successfully with their Saudi hosts in developing the energy resources and infrastructure of this friendly, conservative nation.

These North Americans live in a foreign country, yet they still find it a very comfortable place to live and work. American-style communities, housing, schools, medical services and recreation facilities have prompted a long line of Aramco professionals to stay on and on.



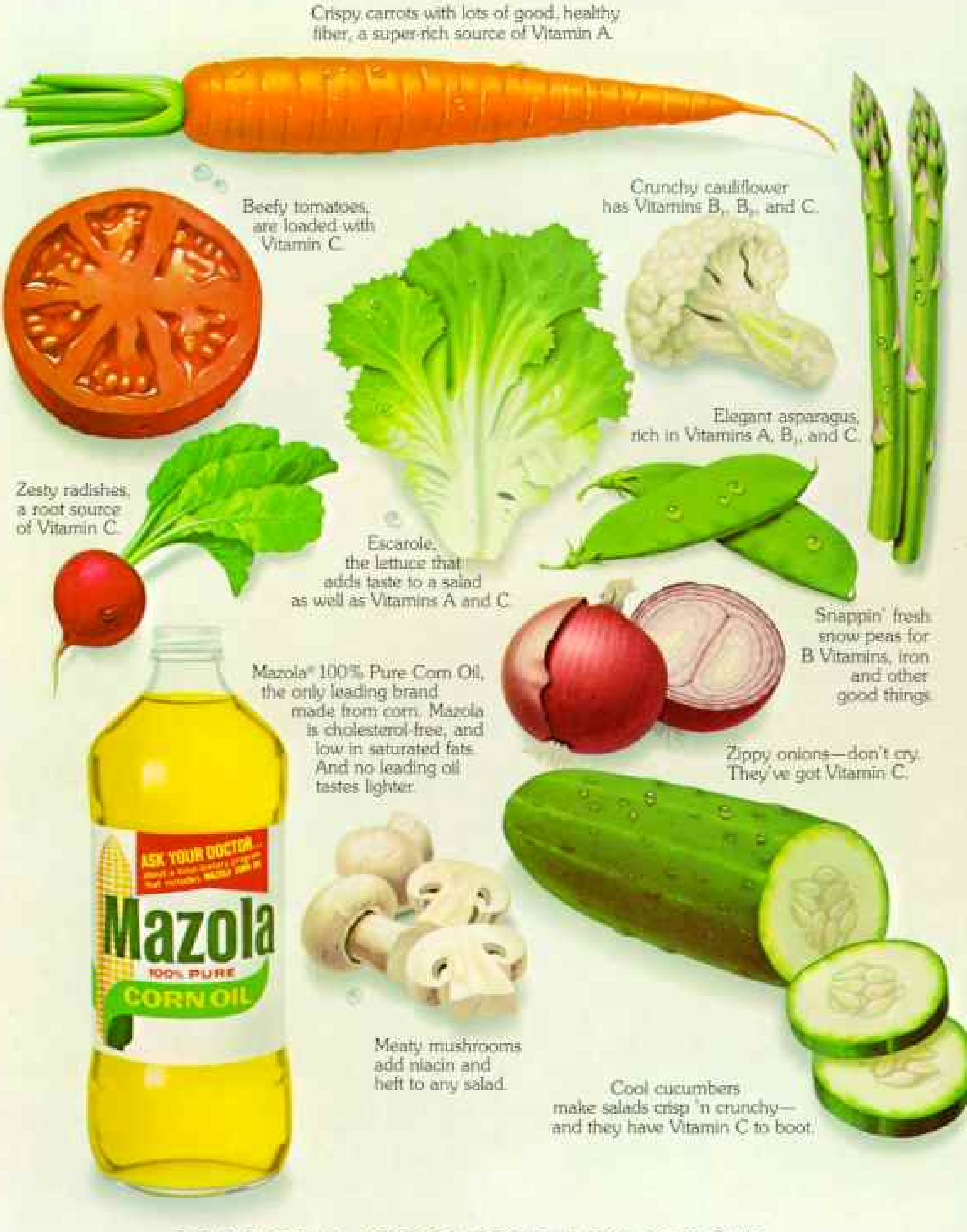
4,000 North Americans work for Aramco in Saudi Arabia. They're helping the Kingdom develop energy resources that are being used all over the world.

What kind of compensation package accompanies all this? Aramco employees earn a competitive base salary, plus a cost-of-living differential. They also get a tax-protected premium for overseas work of up to 40 percent of the base salary, and a one-time bonus of up to $5,000 for signing up for overseas work.

Interested in more information about Aramco and Saudi Arabia; or in a job with us? Write: Aramco Services Company, Dept. NG-090180MLCA, 1100 Milam Building, Houston, Texas 77002.

ARAMCO
SERVICES COMPANY

ELEVEN NATURALS FOR GOOD EATING.



Crispy carrots with lots of good, healthy fiber, a super-rich source of Vitamin A.

Beefy tomatoes are loaded with Vitamin C.

Crunchy cauliflower has Vitamins B_1, B_2, and C.

Elegant asparagus, rich in Vitamins A, B_1, and C.

Zesty radishes, a root source of Vitamin C.

Escarole, the lettuce that adds taste to a salad as well as Vitamins A and C.

Snappin' fresh snow peas for B Vitamins, iron and other good things.

Mazola® 100% Pure Corn Oil, the only leading brand made from corn. Mazola is cholesterol-free, and low in saturated fats. And no leading oil tastes lighter.

Zippy onions—don't cry. They've got Vitamin C.

Meaty mushrooms add niacin and heft to any salad.

Cool cucumbers make salads crisp 'n crunchy—and they have Vitamin C to boot.

MAZOLA 100% PURE CORN OIL.

LETS THE NATURAL FLAVORS OF FRESH FOODS COME THROUGH.

© 1980 Best Foods, CPC International Inc.

OLYMPUS
OM-1
OM-2
OLYMPUS

THE CAMERAS OF MAITANI. THEY'RE MORE THAN CAMERAS. THEY'RE INVENTIONS.

By 1966, the press had already dubbed him "the camera magician." His technical acrobatics and engineering guts had amazed the camera world.

The remaining challenge for Maitani was to take on the oversized, overweight, noisy 35mm SLR.

Thus began a 5-year development program that would produce the OM-1 and, later, the remarkable OM-2.

Olympus OM-1. To create a compact SLR, Maitani had to do more than simply shrink the boxy SLRs that were then the vogue.

He had to build a camera up from scratch.

Maitani started by relocating the shutter speed mechanism to below the mirror. And he shifted the exposure meter to the left of the pentaprism. This opened up more internal room.

What about noise and vibration? To smooth the ride of the OM-1, Maitani designed lightweight curtain drums, ball bearing shutter trains, twenty special shock absorbers and a unique mirror air damper.

It's the same story for every aspect of this camera. The innovation just doesn't quit. And remarkably, while reducing the overall camera, Maitani was able to actually increase the size of critical components. So the viewfinder has an extra large mirror for a big, bright image.

The shutter speed dial is larger. The rewind knob, oversized. The shutter release button fits the finger comfortably.

Thus you can imagine the glee with which the OM-1 was greeted. A light, compact 35mm SLR with speed and stamina. And an entire system of compatible components—all equally compact, light and tough.

Olympus OM-2. The OM-2 goes beyond the full exposure control of the OM-1. Because it's also a fully automatic SLR.

In fact, so automatic is the OM-2 that it actually measures the light *during* exposure. Even during its motor drive's blazing five frames-per-second! How? Two sensors read the light that reflects off the film the instant the shutter opens.

And with the OM-2 the shutter remains open until the film has received precisely the proper amount of light for perfect exposure—then it automatically closes.

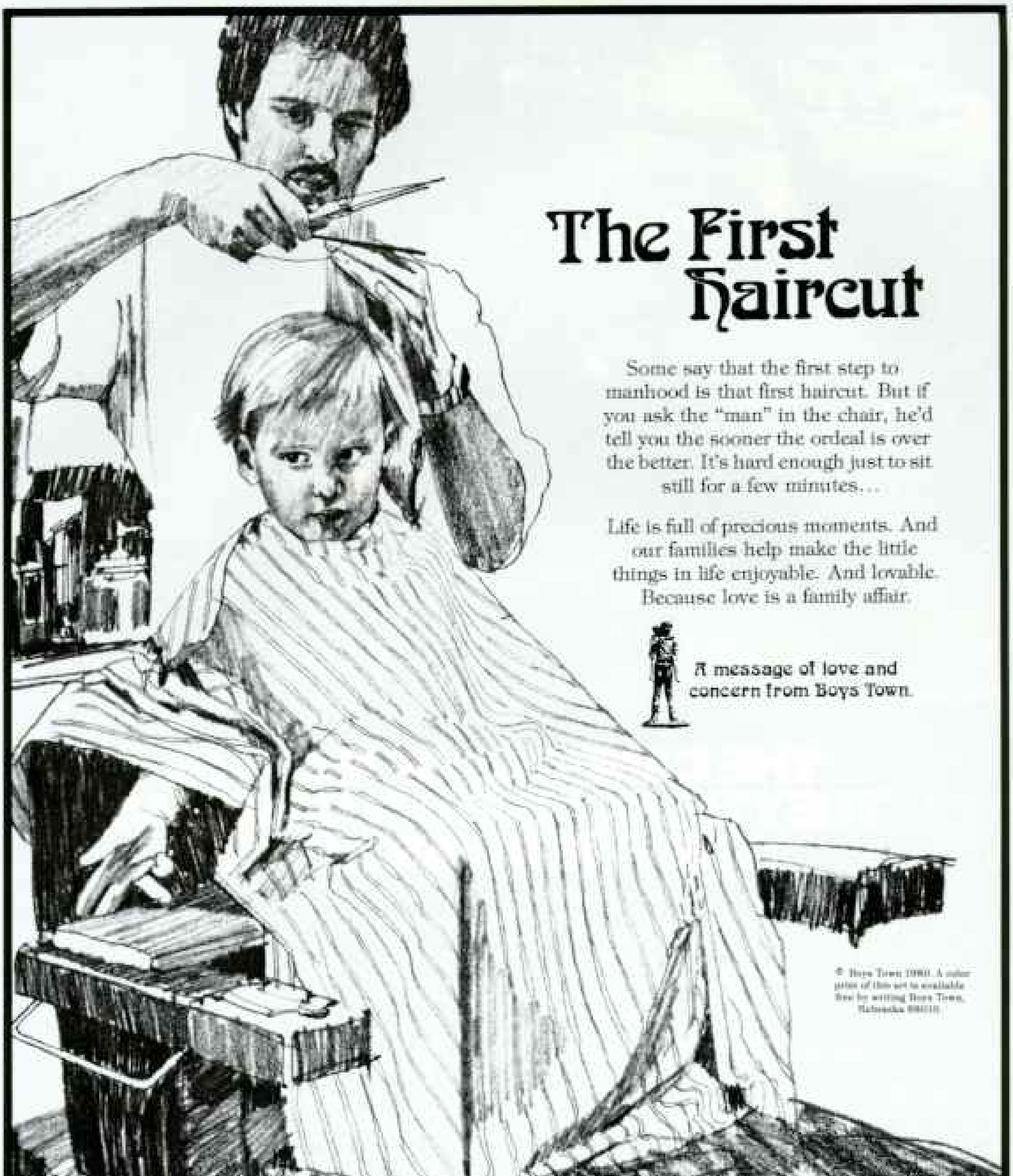
Between the OM-1 and OM-2, virtually all photographic needs are met. Met with a startling array of components for medical, macro, scientific, technical and other specialized applications. Met with system components that are added continually.

So even though each year dozens of new cameras are hustled to market, glittering with the gimmick of the moment, these classy Olympus cameras remain in a class by themselves.

Along with the man who designed them.

For information write Olympus, Woodbury, NY 11797. In Canada contact W. Carsen Co., Ltd., Toronto.

OLYMPUS®



The First Haircut

Some say that the first step to manhood is that first haircut. But if you ask the "man" in the chair, he'd tell you the sooner the ordeal is over the better. It's hard enough just to sit still for a few minutes…

Life is full of precious moments. And our families help make the little things in life enjoyable. And lovable. Because love is a family affair.

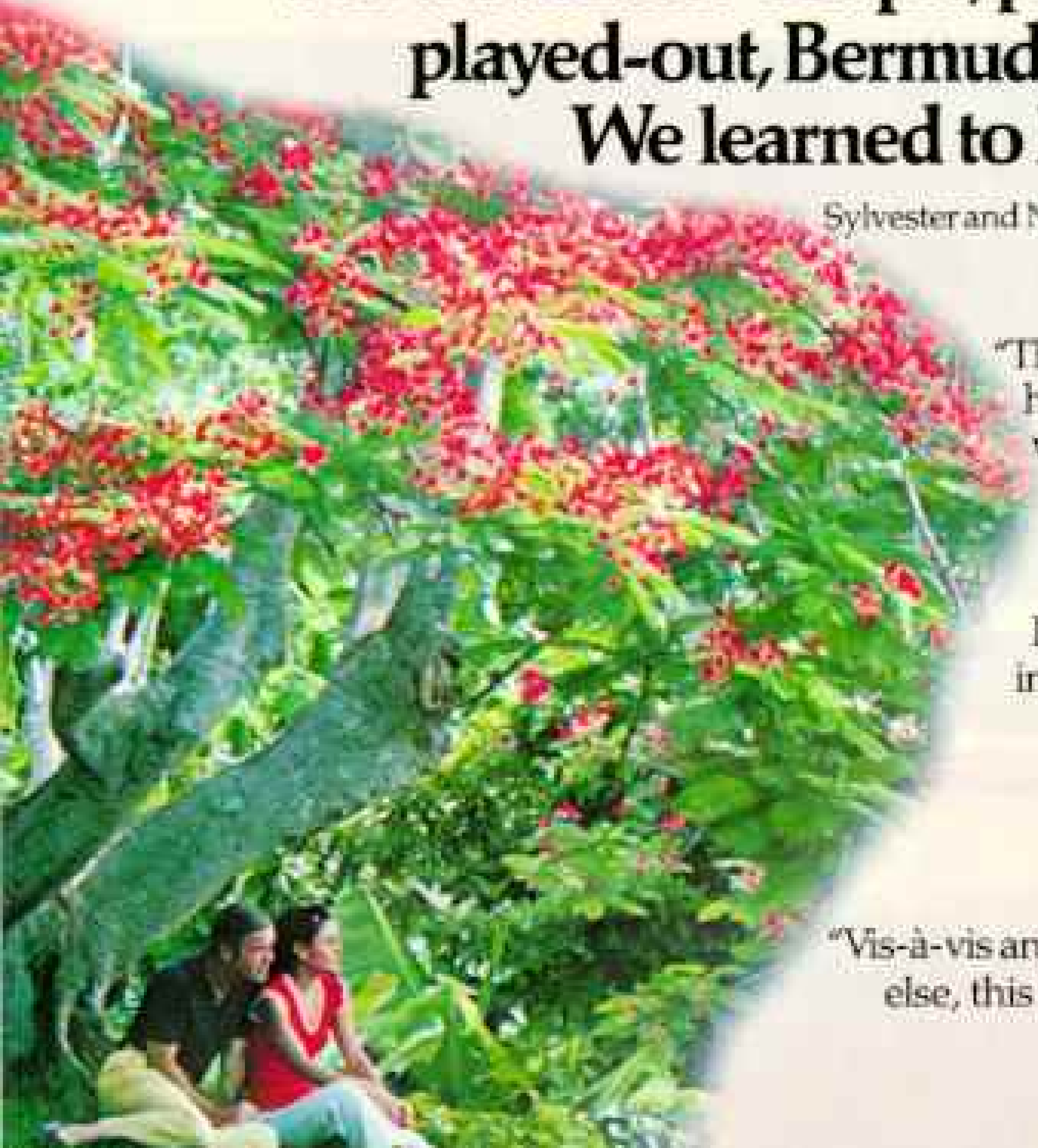
A message of love and
concern from Boys Town.

© Boys Town 1980. A color print of this art is available free by writing Boys Town, Nebraska 68010.

Bermuda. Get away to it all!

"For a business couple, pressured and played-out, Bermuda is very, very special. We learned to have fun again."

Sylvester and Nancy Gardiner talk about their second visit to Bermuda.


"There's incredible beauty here. We relax, we're restored, we find time for one another."

"A leisurely, luxurious breakfast. It's the one thing we don't have in our lives back home."

"Vis-à-vis any place else, this is paradise."

See your travel agent or write Bermuda, Dept. 000, 630 Fifth Ave., New York, N.Y. 10020
or Suite 1010, 44 School St., Boston, Mass. 02108 or 300 North State St., Chicago, Ill. 60610

How to cover more territory by covering less ground.

A salesman on the road is likely to see more road than sales.

So it stands to reason that the best way to get your sales off the ground is to get your salesmen off the ground.

In a Beechcraft business airplane.

Beech has put together a packet of information that tells you not only how you can get into business aviation, but why you should.

It isn't glowing rhetoric, but honest, objective facts and figures, including case histories that let you see how other companies, large and small, have successfully solved the same problems you're facing now.

A Capital Recovery Guide, for example, shows how the net capital cost of a Beechcraft can be a lot less than you might think. And how operating costs can actually be less than you're paying now for travel.

At the same time you're increasing both the range and frequency of your sales calls.

Covering more territory becomes less of a problem when you don't have to contend with highways and the high cost of commercial travel.

Send for your free Management Guide to Business Aviation in the '80's and get your company off the ground.

Write us on your company letterhead, and we'll send you everything you need to decide whether your company can profitably use a Beechcraft. And which Beechcraft suits you best. Write to: Beech Aircraft Corporation, Dept. A 20, Wichita, Kansas 67201, and please mention if you're a pilot. If you'd rather call, call collect and ask for Dick Schowalter, Jr., (316) 681-7072.

Member of General Aviation Manufacturers Association

The Beechcraft Bonanza A36 carries up to 6 people at a top speed of over 200 mph.

hexa·photo·cybernetic
The Possibilities are Endless.

**Six-mode exposure control.
System versatility.
Newer electronics for
wider applications.**

SHUTTER PRIORITY AE
PROGRAMMED AE
ELECTRONIC FLASH AE
MANUAL
STOPPED-DOWN AE
APERTURE PRIORITY AE

The Canon A-1 is one of the world's most advanced automatic SLR cameras. Combining the finest in optical and mechanical engineering with the most sophisticated electronics, it's technology applied to give you the ultimate in creative control. At the touch of a button.

Depending on your subject, you can choose from six independent exposure modes to achieve the results you want:

1 Shutter-Priority: You select the shutter speed, to freeze the action and prevent camera shake or create an intentional blur. The A-1 automatically selects the appropriate lens opening.

2 Aperture-Priority: Control the area in focus by selecting the lens opening for the effect you want. The A-1 matches with the right speed.

3 Programmed: When you need to shoot fast, just focus. The A-1 will select *both speed and aperture* for great results.

4 Stopped-Down: For extreme close-up or specialized photography, a bellows, a microscope or almost anything can be attached to the A-1. It's still automatic.

5 Flash: Totally automatic flash photography, of course, with a wide variety of Canon Speedlites to choose from.

6 Manual: Yes. For those times when you absolutely want to do it all yourself. To experiment. To explore the possibilities.

Shutter-Priority 1000 5.6

There are over forty fine Canon lenses ranging from Fish Eye to Super Telephoto, plus accessories to meet every need. If you can't photograph your subject with a Canon A-1, it probably can't be photographed.

From the sophistication of its LED viewfinder display, to a ruggedness that allows up to five-frame-per-second motor drive, the Canon A-1 represents an incredible technology. At a price that makes owning one a definite possibility.

Canon
A-1
CANON LENS FD 50mm 1:1.8
LENS MADE IN JAPAN

Canon A-1

Canon USA, Inc., 10 Nevada Drive, Lake Success, New York 11042 · 140 Industrial Drive, Elmhurst, Illinois 60126 · 6380 Peachtree Industrial Blvd., Norcross, Georgia 30071 · 123 Paularino Avenue East, Costa Mesa, California 92626 · Bldg. B-2, 1050 Ala Moana Blvd., Honolulu, Hawaii 96814 · Canon Optics & Business Machines Canada, Ltd., Ontario

© 1980 Canon U.S.A., Inc.

TABASCO
BRAND
PEPPER SAUCE
McILHENNY CO.
NEW IBERIA
LA.

Special peppers are aged in oak barrels until the passing of years mellows them to the savory aroma and flavor of TABASCO® sauce.

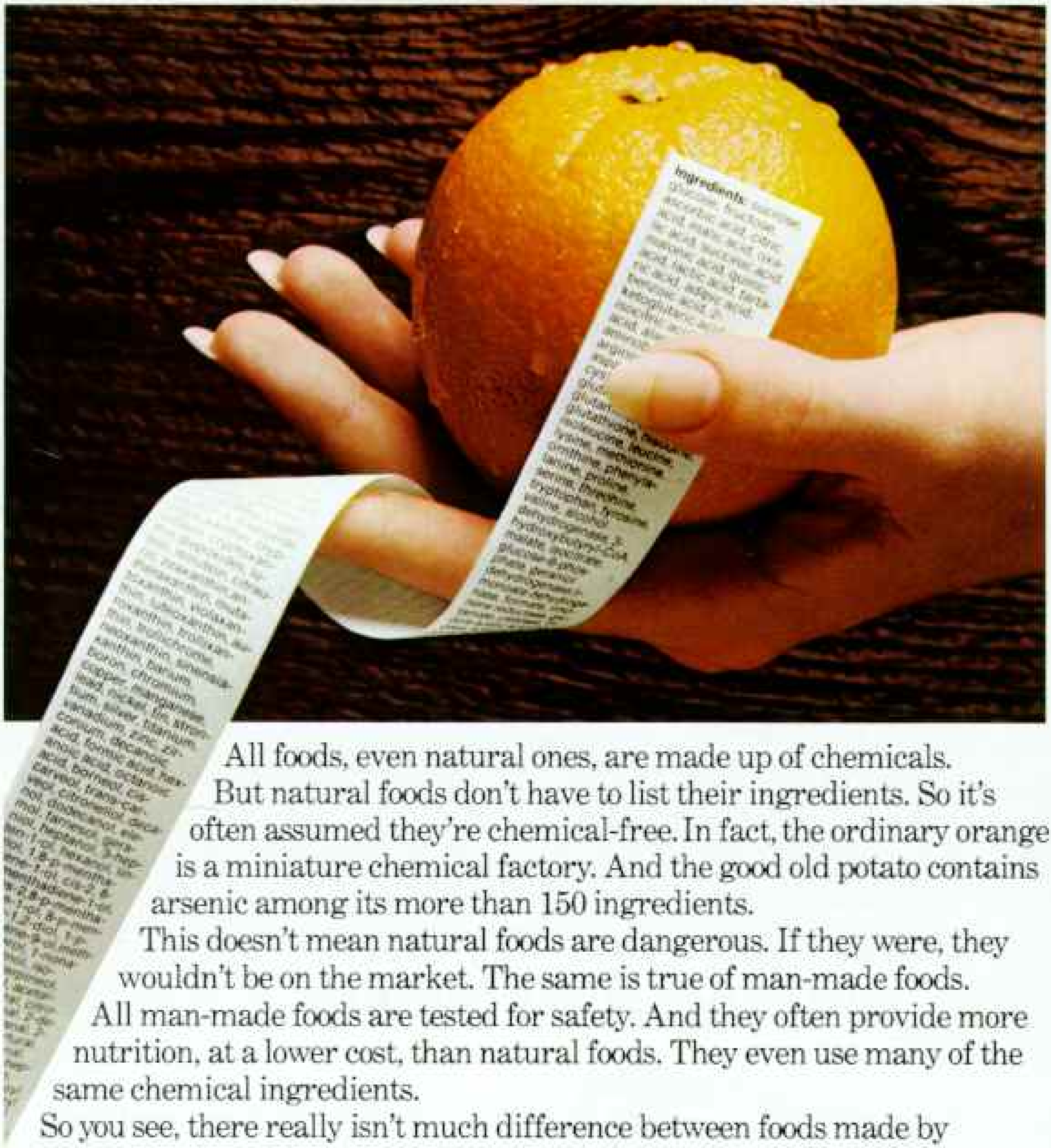
© 1978, TABASCO is a registered trademark of McIlhenny Company, Avery Island, Louisiana 70513

VISIT
EXPLORERS
HALL
NATIONAL GEOGRAPHIC SOCIETY

You and your family are the explorers here. Discover exciting, one-of-a-kind exhibits that talk, move, light up. See your Society's treasures of discovery, records of scientific achievement, and relics of ages past. Watch educational films. Only six blocks from the White House. Open daily.

NATIONAL GEOGRAPHIC SOCIETY
17th & M Streets N.W., Washington, D.C.

Mother Nature is lucky her products don't need labels.



All foods, even natural ones, are made up of chemicals. But natural foods don't have to list their ingredients. So it's often assumed they're chemical-free. In fact, the ordinary orange is a miniature chemical factory. And the good old potato contains arsenic among its more than 150 ingredients.

This doesn't mean natural foods are dangerous. If they were, they wouldn't be on the market. The same is true of man-made foods. All man-made foods are tested for safety. And they often provide more nutrition, at a lower cost, than natural foods. They even use many of the same chemical ingredients.

So you see, there really isn't much difference between foods made by Mother Nature and those made by man. What's artificial is the line drawn between them.

© Monsanto Company 1980

For a free booklet explaining the risks and benefits of chemicals, mail to:
Monsanto, 800 Lindbergh Blvd., St. Louis, Mo. 63166. Dept. [illegible]

Name ______________________________

Address ______________________________

City & state ______________________ Zip ________

Monsanto

Without chemicals,
life itself would be impossible.

© American Express Company, 1980

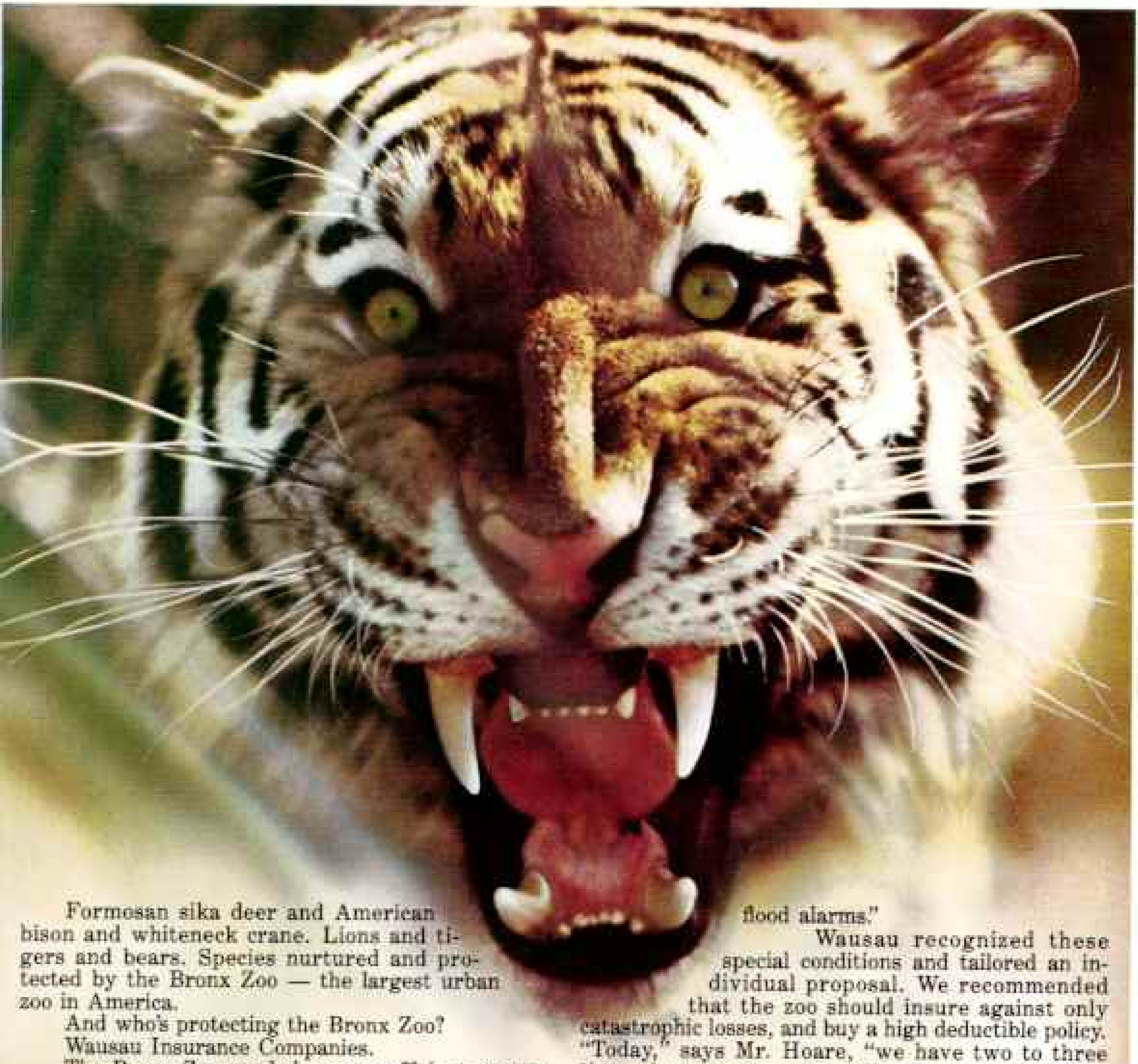
All you need to get $75,000 travel accident insurance automatically.

AMERICAN EXPRESS
3712 345678 95006
C E FROST

Pass the lines at the insurance counter, skip filling out forms, just go to the gate. You're already protected. Every time you put your tickets (plane, train or ship tickets) on the Card you are automatically covered with $75,000 in Travel Accident Insurance. One ticket or a family's worth, they're all covered. The cost is included in your Cardmembership fee.* Charge your tickets in advance and you're covered on your way to and from the airport in a taxi, bus or airport limo. One more reason to carry the American Express® Card. **Don't leave home without it.**®

*Underwritten by Fireman's Fund American Life Insurance Company.

How the Bronx Zoo tamed an insurance problem by teaming up with Wausau.



Formosan sika deer and American bison and whiteneck crane. Lions and tigers and bears. Species nurtured and protected by the Bronx Zoo — the largest urban zoo in America.

And who's protecting the Bronx Zoo?

Wausau Insurance Companies.

The Bronx Zoo needed a more efficient way to protect its property.

John G. Hoare, Comptroller of the New York Zoological Society, explains: "Our zoo buildings are far more secure than those of most businesses. They were designed with safety foremost in mind and are equipped with sophisticated fire and flood alarms."

Wausau recognized these special conditions and tailored an individual proposal. We recommended that the zoo should insure against only catastrophic losses, and buy a high deductible policy. "Today," says Mr. Hoare, "we have two to three times the coverage — in terms of numbers of buildings — at a 30% savings over our previous cost."

Together, the New York Zoological Society and Wausau work as partners to manage risk at the Bronx Zoo.

The partnership works effectively to make business insurance earn its keep. That's the Wausau Story.

WAUSAU
INSURANCE
COMPANIES
Employers Insurance of Wausau

WAUSAU WORKS.℠