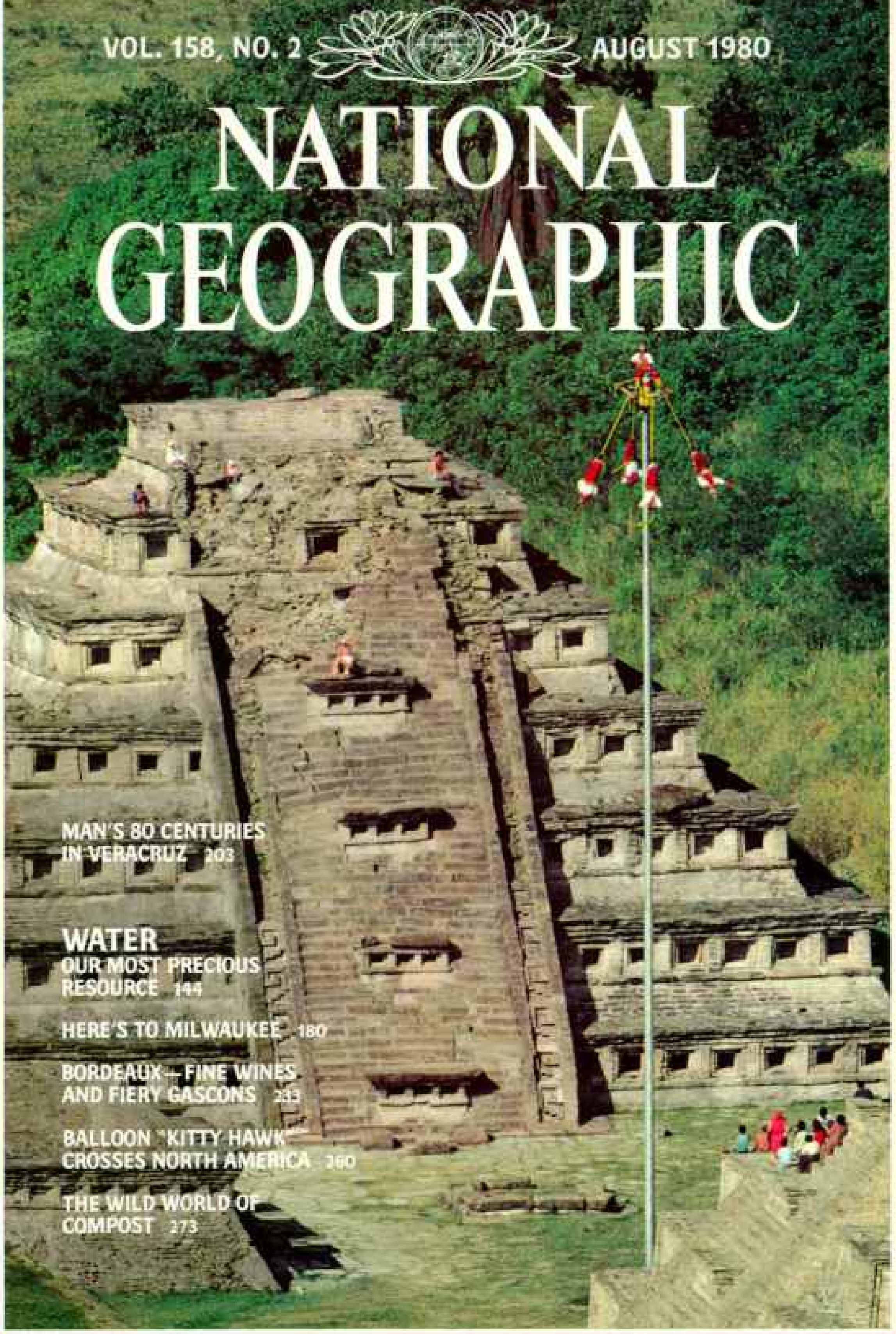
VOL. 158, NO. 2 AUGUST 1980

NATIONAL GEOGRAPHIC



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

A SCIENCE-FICTION WRITER postulating a name for this strange planet earth, as observed by those elsewhere in the cosmos, would not be hard put: Water Planet immediately suggests itself, for this blue-and-white globe on which we live is predominantly and, as far as our solar system is concerned, uniquely covered with H_2O.

There are, to be sure, vast deserts, but none to compare to those of Mars. There is immense desolation, but nothing like the emptiness of the moon. Life as we know it springs, many scientists believe, from water and depends upon water to survive. The human bloodstream's chemical content resembles that of seawater.

The vast engine of heat, air currents, and planetary revolution interacts with the oceans in an unending cycle that also nurtures growth upon the fertile lands. And, since this cycle is so regular and dependable, we have come to take it for granted. The average American's way of life requires 2,000 gallons of water every day—87 gallons of it for personal use, but only two to meet the basic needs of drinking and cooking.

Our agriculture, industry, and urbanized regions could not exist without gulping tremendous quantities of water every minute—befouling a lot of it in the process and, in certain regions, drawing the water table down to precarious levels. While there is plenty of water freely bestowed by nature, it droppeth not as mercy should, in equal measure everywhere.

Over the past decade, though, heartening progress has been made in both the public awareness of just how precious this resource is and in public actions to halt the worst of the abuses. Of the 18,000 cities and towns identified as having severe sewage problems, a full third now meet federal standards. Though still a long way from the goal, that is genuine progress in view of the costs and red tape involved.

The proper management of water, like that of a human life, is a matter of continuous thought and attention, and this may be one national concern that has been attended to in time. At the least, in this age of futilities, there is sound progress to report.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 158, NO. 2

August 1980

COVER: *Indian* voladores—*fliers*—*whirl on steadily lengthening ropes in front of the ancient Temple of the Niches in Mexico's state of Veracruz (page 209). Photograph by David Hiser.*

OUR MOST PRECIOUS RESOURCE

WATER

By THOMAS Y. CANBY
NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by TED SPIEGEL
BLACK STAR

SIX HUNDRED FEET above my hard-batted head, millions of New Yorkers are turning spigots on and off, drawing the one and a half billion gallons of water they will use that day. I am deep in the rock on which the city sits, inspecting its newest and finest piece of plumbing.

Before me stretches City Tunnel No. 3, a dank, dark chamber wide enough for two freight trains to pass. As funding permits in this strapped supercity, crews burrow a few feet a day—beneath the hilly Bronx, beneath Manhattan's angular pinnacles, beneath the chill East River. The job costs dearly in every sense: many millions of dollars a mile, 17 workmen killed so far.

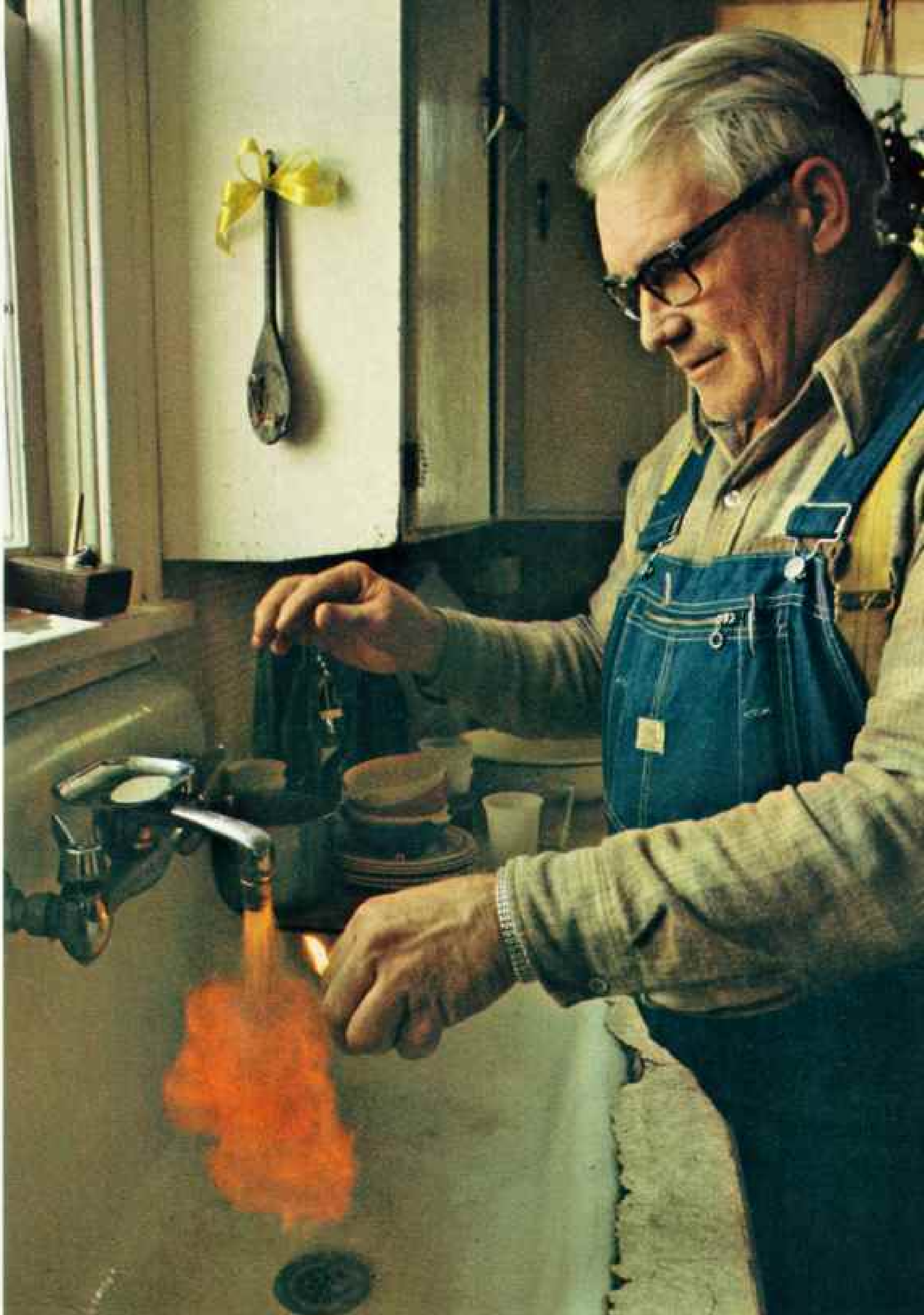
When the task is completed, 34 ponderous valves will open, and a mighty river of pure water will surge unseen beneath the city. That day the engineering feat will draw rave reviews. The next it will be forgotten, and once again a marvel of our age—the blessing of safe, abundant water to be had at the turn of a tap—will be taken for granted.

New York's water supply, collected upstate from pristine streams and piped by gravity flow through a sprawling aqueduct system, enjoys high esteem among connoisseurs of "Adam's ale." Happily, most United States cities and towns serve their citizens good drinking water, an achievement rivaled in Canada, much of Europe, but in few other places on earth. In the 75 percent of the world where such sanitation is lacking, an estimated ten million people will die this year of waterborne diseases.

Partly because we can take water for granted, partly because it's cheaper than dirt (in most cities 15 cents will get you a ton delivered in your kitchen), we use it lavishly. On an average day you and I each draw about 87 gallons: 24 for flushing, 32 for bathing, laundry, and dishwashing, and 25 for swimming pools and watering the lawn. We use a mere two gallons for drinking and cooking—the only water we actually require to survive.

But this is just a start; now we add the immense amount that irrigates our food and fiber and feeds our industry. Traced back through their creation, the eggs you ate for breakfast required 120 gallons of water each; the steak you'd like for dinner, 3,500

The miracle of clean water *at the turn of a tap is taken for granted by most Americans, but not by Lee Hattenberger of Kettle River, Minnesota. Until he was forced to drill a new well thousands of feet deep, natural gas from his old well had to be flamed off every three days, or his tank would have exploded. Though blessed with an abundance of* H_2O*, Americans spend billions of dollars and suffer untold problems to manage its quality and distribution.*



Subsidence is a household word *in Baytown, Texas, where property values have plummeted because of sinking ground. Here, one of a dozen abandoned homes is seen behind a 1968 snapshot taken before the pumping of groundwater caused the*

earth to subside and tidewater from Galveston Bay to invade; hundreds more are in danger. Fresh underground water far exceeds that on the surface. If withdrawn faster than rainfall can replenish it, however, subsidence may occur.

Water, the wonder fluid

***FOR A BREW** that's colorless, tasteless, odorless, and calorie free, water packs a punch.*

It is the only substance necessary to all life; many organisms can live without oxygen, but none can live without water.

It comes closest to being the universal solvent; while you drink from a tumbler, the water is busily dissolving molecules from your glass.

It travels upward in defiance of gravity. So strongly do water molecules adhere to one another that when one evaporates from the leaf of a tree, it pulls up those behind like links of a chain. This molecular attraction forms the surface film on which water bugs race without wetting their feet, and which permits you to float a darning needle atop a glass of water.

gallons; the ton of steel in your car, about 60,000 gallons. With these indirect uses our daily need soars to some 2,000 gallons each.

Considering this staggering use of water, are we running out?

The answer, most experts agree, is a resounding "no," at least in a general sense. Four trillion gallons of precipitation falls on the United States each day, and we use a mere tenth of it. Most of this fraction returns to its source, though often dirtied by the detour. The rest escapes into the atmosphere, but only briefly. None is lost; the water that John used for baptizing Jesus still exists, its billions of molecules now dispersed around the world.

This endless renewal is performed by an immense solar engine called the hydrologic cycle. Each day the sun evaporates a trillion tons of water from the oceans and continents and pumps it as vapor into the atmosphere —the greatest physical force at work on earth. Each day the same amount of vapor condenses and falls as rain, snow, sleet, and hail, replenishing its sources.

Yet the United States faces serious water problems, of both quantity and quality.

Rain and snow do not fall evenly across the land; the West, with 60 percent of the nation's real estate, receives only 25 percent of its moisture. The Water Resources Council, a federal research and coordinating agency, finds water shortage imminent in the Rio Grande and lower Colorado River Basins and looming in other western regions, particularly in the Missouri Basin.

The rain-rich East faces water challenges equally severe, some of quantity and more of quality. The immense populations of metropolitan Boston, New York, and Washington, D. C., will face rationing if nature repeats the drought that struck in the 1960s. Pollution plagues waterways that we use as both fountains and sewers.

To manage water, we have rearranged our landscape on a colossal scale: built two million dams, irrigated sixty million acres, carved barge canals that carry a fifth of intercity freight, created 50,000 public and private water utilities, drained a hundred million acres of wetlands, and drilled millions upon millions of wells. Billions of dollars have been spent.

In these manipulations, we create situations both extraordinary and bizarre:

- So thoroughly have dams tamed the Tennessee, the nation's ninth largest river, that its flow can be turned off like a spigot.
- The Chicago River runs backward, its flow reversed to carry Chicago sewage away from Lake Michigan.
- Texans have pumped so much water from the ground beneath Houston—a process partially stabilized—that the city has subsided several feet and some homes have been abandoned to invading seawater from Galveston Bay (preceding pages).
- One of our longest rivers—the rushing

***Beyond the reach of city water,** the John Cusack family of Evergreen, Colorado, decided against traditional well and septic tank for a revolutionary, self-contained system. Computer controlled, it continuously cleans and recycles the same 1,500 gallons back into the home and costs little more than conventional systems.*

Managing the

UNDER THE NATION'S SKIN, reservoirs of groundwater, called aquifers, range from small, low-yield deposits found nearly everywhere (tan areas) to the vast 156,000-square-mile Ogallala aquifer that supports life and agriculture on the High Plains.

A nation divided

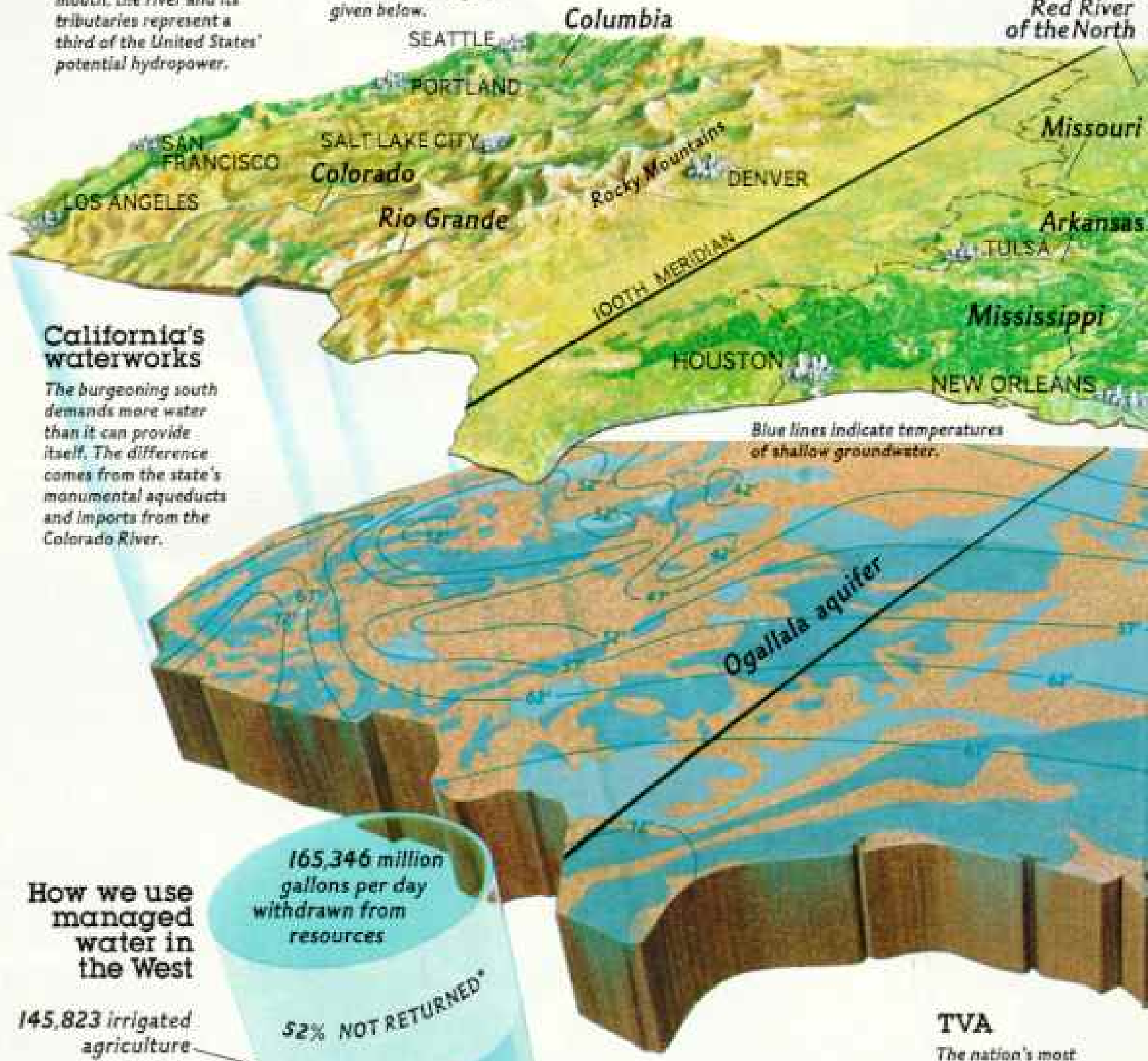
The 100th meridian has historically been the boundary between wet and dry America. The jagged line, dividing the nation by water regions, provides the basis for the West and East water-use figures given below.

Columbia River

A staircase of reservoirs from Canada to its mouth, the river and its tributaries represent a third of the United States' potential hydropower.

California's waterworks

The burgeoning south demands more water than it can provide itself. The difference comes from the state's monumental aqueducts and imports from the Colorado River.



How we use managed water in the West

Arkansas River

This 450-mile thoroughly engineered waterway has made a prairie port of Tulsa, Oklahoma, spurred industrial development, and provided recreation.

TVA

The nation's most integrated river-management system, the Tennessee Valley Authority brought navigation, flood control, recreation, hydroelectric power, and jobs to a depressed region.

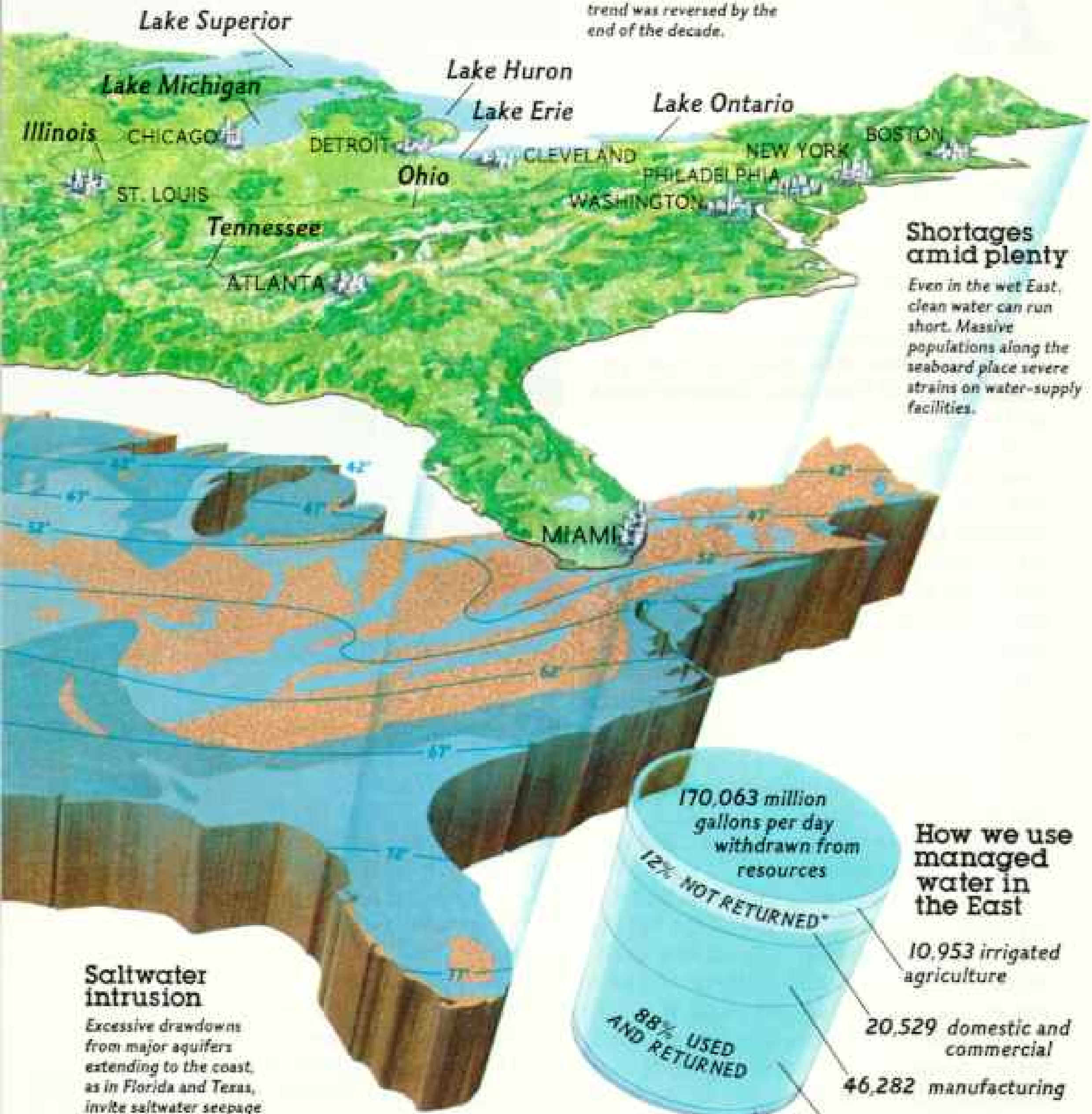
PAINTED BY WILLIAM H. BOND
COMPILED BY JOHN B. THEBER
NATIONAL GEOGRAPHIC ART DIVISION

nation's water wealth

Stored in porous rock (light blue) or loose sands and gravels (dark blue), the most water-abundant of these aquifers could also yield clean energy, since they maintain constant temperatures year round. The statistics cited below are for both ground- and surface-water usage.

Great Lakes cleanup

Before the Water Pollution Control Act was amended in 1972, Lake Erie was already a graveyard for many fish species. Though much remains to be done, the trend was reversed by the end of the decade.



Shortages amid plenty

Even in the wet East, clean water can run short. Massive populations along the seaboard place severe strains on water-supply facilities.

How we use managed water in the East

Saltwater intrusion

Excessive drawdowns from major aquifers extending to the coast, as in Florida and Texas, invite saltwater seepage from the ocean and contamination of wells.

**Lost in evaporation, transpiration, incorporation into products or crops, or consumed by humans and livestock.*

Colorado—surrenders such quantities of water to farmers and cities along its parched banks that it almost vanishes into Mexican sands before reaching the sea.

• Every day six new lakes glint on the landscape of the United States, largely municipal reservoirs and centerpieces for subdivisions. About 50,000 small farm ponds also blossom each year.

AMONG THESE, none rivals in importance the mundane miracle of safe drinking water. I heard the story from Abel Wolman, professor of sanitary engineering at Baltimore's Johns Hopkins University and one of the nation's leading water consultants.

"In the year 1900," he explained, "an estimated 27,000 Americans died of typhoid fever, most virulent of the waterborne diseases. Thirty years later, with our population half again as large, the toll had dropped to one-eighth of the 1900 level. In this period came the 'great sanitary awakening'—recognition that these terrible epidemics stemmed from water that was fouled by human wastes.

"Cities reached out beyond their polluted rivers and tapped remote, pure sources. They introduced filtration and added coagulants to settle out sediments. In 1913 they began disinfecting water with chlorine—one of the greatest breakthroughs in human health. These techniques, plus a dash of fluoride to curb tooth decay, still form the basic steps of water treatment."

In a nation where residents of the poorest ghetto usually can afford ample water, at least four million Americans lack this amenity. Most live in small towns or rural regions that municipal systems do not reach. The problem is acute in many of West Virginia's coal-mine communities.

"Oh, I've got running water," a hospitable mother of six assured me as she led the way to her tidy kitchen. "But it's no good. Stinks the house right up." She turned on a faucet, and a tan stream did just that.

She studied it. "Better than usual, much better. Sometimes it comes out so thick it won't flow down the drain—just piles up in the sink. We get our drinking water from a roadside pipe a mile down the hill."

She produced a health-department report

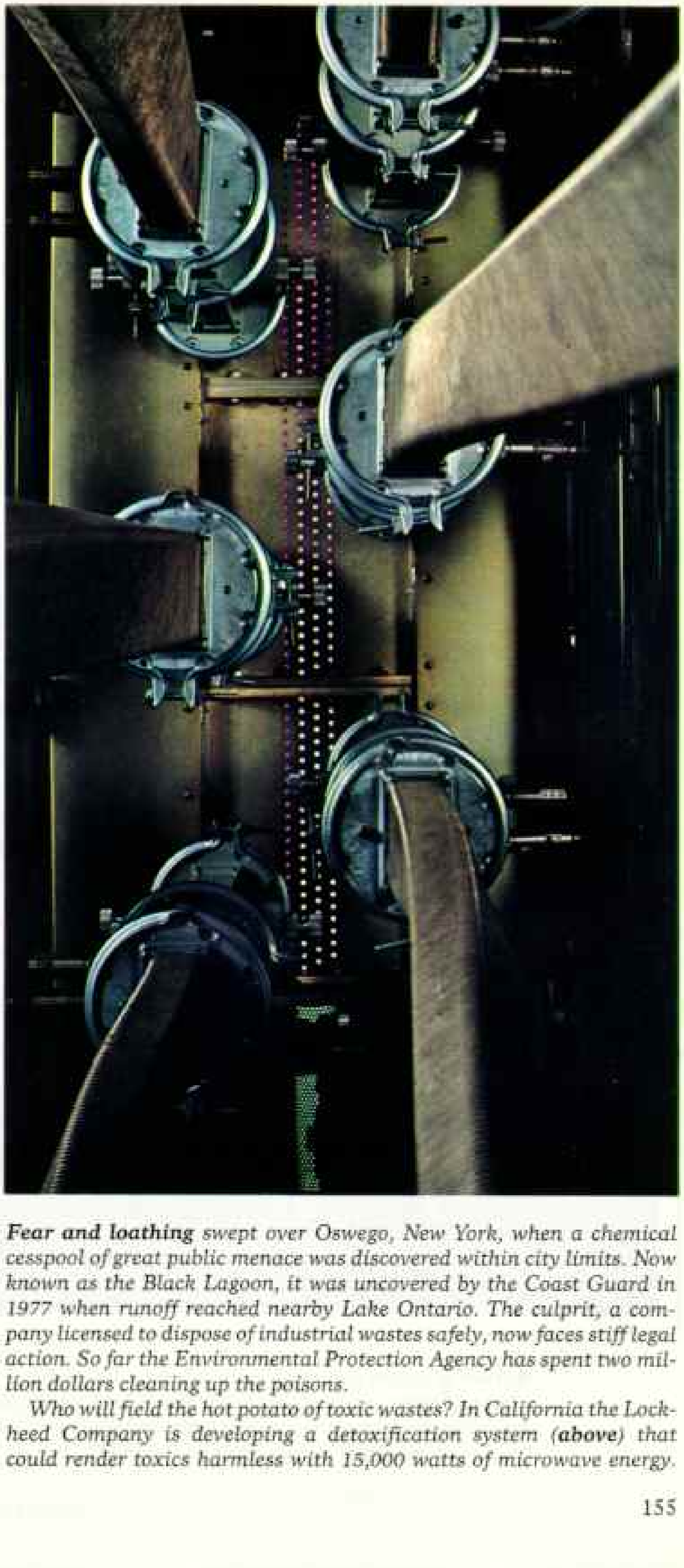
of the substances congealing her water—iron, manganese, chlorides, sulfates—and a newsclip that told how the local utility had been convicted of 93 health and sanitation violations. One was for piping impure water into the little schoolhouse across the road, where her daughter contracted hepatitis.

"Those convictions don't provide her a drop of good water," observed Ervin Queen, a local lawyer who had taken the utility to court. "The water company owns no assets to pay damages."

Mr. Queen and I drove down the Guyandotte River and veered left up Rocky Branch, a V-shaped valley squeezed between hills. A procession of houses strung along the valley, their wells alternating

Young and beautiful *now, Lake Tahoe will one day become an old bog. Left to nature, that would take millennia. But erosion and air pollutants hasten the aging process of eutrofication, bringing excess nutrients to stimulate oxygen-depleting algae. Here a diver from the University of California at Davis monitors instruments measuring algal growth.*

*An EPA experiment with sibling trout fry in Duluth, Minnesota, shows the harsh results of such pollution (**left**). The stunted fry at left, raised in oxygen-poor water, will die.*



Fear and loathing *swept over Oswego, New York, when a chemical cesspool of great public menace was discovered within city limits. Now known as the Black Lagoon, it was uncovered by the Coast Guard in 1977 when runoff reached nearby Lake Ontario. The culprit, a company licensed to dispose of industrial wastes safely, now faces stiff legal action. So far the Environmental Protection Agency has spent two million dollars cleaning up the poisons.*

Who will field the hot potato of toxic wastes? In California the Lockheed Company is developing a detoxification system ***(above)*** *that could render toxics harmless with 15,000 watts of microwave energy.*

with outhouses along the odorous creek.

"Sewage seeps from the outhouses to the wells and creek," explained the attorney. "We checked, and 31 wells in Rocky Branch were contaminated."

At a home midway up the valley, Mr. Queen opened a small utility room to reveal an assemblage of pumps and pipes. "This little job," he explained with satisfaction, "chlorinates and filters, and it costs only $1,500. If we put in a swimming pool as a reservoir, this unit could treat water for every home on Rocky Branch. It could answer our prayers, if this innovative system could make it through the red tape in Washington, D. C., where it must be approved."

I swung eastward into Virginia, and another kind of rural water problem. The unyielding granite of the eastern Appalachians absorbs little groundwater, and a well can go down 600 feet and find nothing.

Here the chore of obtaining water takes many forms—scooping it from streams that often are contaminated, catching roof water in cisterns that also collect leaves and bird droppings, buying from tank trucks at as much as a dollar a day.

"We have people who stop at a local filling station and buy soda bottles full of water—at the price of the soda," said Roanoke poverty worker Wilma Warren.

"We did a study that showed that half a million Virginians drink polluted water, or haul in water, or both," said Mrs. Warren. "We now realize that it's the greatest single need of the rural poor."

She and a determined little band set up the Virginia Water Project, under the umbrella of the Total Action Against Poverty program in Roanoke. Their work brings help to many, and gives Wilma Warren a philosophy about water and rural society.

"For those who must carry water home and boil it before it's drinkable, there's the terrible amount of simple, repetitive drudgery. Worse, if you are dirty, and you stay dirty because there's no water, it tarnishes the spirit. How do you look for a decent job when you can't clean your own body?"

Half a million wells are sunk each year in rural America, but many people still need help. Assistance with their water systems has long come through the federal Farmers Home Administration. Other agencies now help, and the National Demonstration Water Project fosters efforts such as those of Ervin Queen and Wilma Warren.

WHEN A WELL BIT gnaws into earth's granular flesh, it probes a part of our planet more mysterious than ocean depths or outer space. Yet beneath our feet lies most of the world's fresh water—thirty times as much as is stored in all rivers and lakes combined.

Earth's crust acts as a giant sponge. It

NATIONAL GEOGRAPHIC PHOTOGRAPHER JAMES P. BLAIR

A river of shame *in 1970, the Cuyahoga winds through industrial Cleveland, Ohio, a year after its oily surface caught fire. Those flames helped ignite a decade of remarkable cleanup of the nation's lakes and waterways. Today, at the same location, people are returning to the river's banks* ***(right)****, and fish to its waters.*

soaks up rain and snowmelt as they percolate through grains of soil and rock crevices. Where this water can flow underground, as toward a well, it forms a reservoir known as an aquifer. The aquifer's top, which usually marks the water table, is the goal of the well driller.

Lakes and rivers often represent outcrops of these immense aquifers. Where the water table lies at the surface, it forms a swamp or wetland. Where the table is nicked by an eroding gully, it bleeds to form the springhead of a stream. Where it encounters a dent in the surface, it flows in to form a lake.

When sediments flowed from the Rocky Mountains onto the Great Plains, they trapped water that now forms the Ogallala aquifer. Stretching eight hundred miles from South Dakota to Texas, this immense reservoir holds enough water to fill Lake Huron.

First with windmills, then with power pumps, farmers began tapping the Ogallala for irrigation. Today 150,000 wells pincushion the High Plains, irrigating an empire of more than ten million acres.

With virtually no recharge from the surface, the Ogallala is being drawn down at a rate that causes national concern. Most High Plains irrigators can calculate that in 5 years or 15 or 30 their wells will go dry or reach too deep for economic pumping.

Water reigns as the nation's number one recreation medium, and at Florida's Walt Disney World, with its simulated wild rivers and a host of water-based activities, it couldn't be cleaner fun. Pioneering the use of natural vegetation cover to filter out nutrient wastes, the park returns its water to the fragile Everglades-like ecosystem cleaner than the original.

Experts foresee an economic decline for the area before the turn of the century.

First to falter, they believe, will be the southern High Plains of Texas, around Lubbock. Because limited rainfall and fierce evaporation permit almost no recharge of the aquifer, the Internal Revenue Service grants Texas farmers a depletion allowance for water similar to the tax benefit for oil.

Despite their declining water table, plainsmen regard occasional obituaries about their region as premature.

"I've got 280 acres of irrigated cotton sitting above a real thin piece of that aquifer," explained James P. Mitchell, a canny farmer near Lubbock. "The pumping level is down to within a few feet of the bottom of my 11 wells, and it's been that way for five years.

"If I pump too fast, I run out. So I tailor my crops, my tillage, and my irrigation equipment to make every drop count. Most other farmers do the same. Nothing like a crisis to bring about improvements."

"Sooner or later," said hydrologist Wayne Wyatt, "we'll get into water harvesting—surrendering part of each farm as a rain catch basin to provide water for the other half. Someday the nation may decide that the food and fiber grown here are vital to feeding ourselves and preserving our balance of payments. Then Congress might vote to import water to the High Plains."

MANY A PLAINSMAN nurtures a hope that someday a giant canal will inch its way from watery eastern Oklahoma or Arkansas to replenish the shrinking Ogallala. The cost of carrying adequate water hundreds of miles westward and a mile upward would be enormous; one study estimated twenty billion dollars at 1972 prices.

"On the other hand," notes Dr. Robert Sweazy of Texas Tech University, "this region's agriculture vitally affects people as distant as shippers in New Orleans and bankers on Wall Street."

What happens to a region whose water fails? An example lies southwest of Lubbock, around the sweltering town of Pecos.

Tumbleweeds piled against abandoned farmsteads when I flew there. Rusting irrigation equipment littered parched fields like bones of a bygone civilization.

"If *ever* there was a Garden of Eden, this was it," said the late Carl Herring, a Pecos irrigation dealer in its heyday. "We had a thousand farmers, bumper crops of cotton and cantaloupes, 15 cotton gins. It was *Eden*. Our water table was dropping, but

Marble martyrs, *statues in a Louisville, Kentucky, cemetery illustrate the effects of acid rain, created by the reaction between atmospheric moisture and fossil-fuel emissions. A black crust forms on the Madonna because it is sheltered, explains University of Louisville geologist K. Lal Gauri, while the angel has no buildup because of the scouring but nonetheless corrosive action of the rain.*

*In New York's Adirondack Mountains, life itself has withered from fallout carried from coal-burning power plants in the Midwest. About 200 lakes here are now devoid of fish life. In a desperate attempt to counteract acid runoff from spring snowmelt, area residents dump tons of neutralizing lime (**right**) over a frozen lake.*

manageably. Then, in 1973 natural-gas prices rose too high to fuel irrigation pumps. They quit, and so did Pecos agriculture."

Of those farmers, only a few dozen still hung on. Three cotton gins limped along, and Pecos imported cantaloupes. Luckily an oil and gas boomlet had ignited as farming fizzled, and the economy was holding.

To hydrologists, pumping out groundwater faster than it recharges is known as "mining." What is the morality of knowingly mining a vital substance such as water? For an answer I sought out one of the West's most respected water authorities, in the New Mexico State Capitol in Santa Fe.

"There's nothing intrinsically evil about mining groundwater," explained State Engineer Steve Reynolds, "as long as everyone understands just what he's doing. It's really

no different from extracting oil or metals.

"With an aquifer like the Ogallala, whose recharge rate is so slow as to be negligible, if you use it at all you are going to mine it. The alternative is to leave it underground and simply enjoy knowing it's there."

Most aquifers, particularly those in the East, recharge regularly from rainfall and snowmelt even when wells place heavy demands. Yet, while we place severe strains on surface-water supplies, we neglect many groundwater sources. Why?

"Part of the problem is lack of understanding," asserts Dr. Jay Lehr, a groundwater hydrologist who serves as executive director of the National Water Well Association. "People don't think in terms of underground water—'out of sight, out of mind.' When they do, it often deals with dowsers who claim they can find water with divining rods.

"And how many people are aware that groundwater is the continents' greatest reservoir of solar energy? Insulated from seasonal changes, it remains year round at the average annual temperature of the air above. In Ohio, where I live, this means 53°F. There's a tremendous amount of solar heat in 53-degree water that can be extracted by an electric heat pump."

SURELY the most overused of waters are our rivers, whose forgiving currents freight so many of our burdens.

Cities and industries settled naturally by these sources of transport and energy; little more than a century ago the waterwheel still provided the nation's

primary power source. From rivers came the solvent for countless chemical processes; into them went industry's effluents.

This role expanded mightily with the spread of indoor plumbing and its reliance on water to remove human wastes. In 1775 the English inventor Alexander Cumming patented a flush mechanism for toilets. A century later Thomas Crapper perfected the flush device, enriching the lexicon and sealing the fate of streams as sewers.

Pollutants poured into rivers in ever increasing loads, until a decade ago a bizarre event symbolized their plight: Smothered with oil and floating debris, Cleveland's Cuyahoga River caught fire.

In 1958 limnologists discovered the astonishing fragility of lakes. Preparing a report on Lake Erie, Alfred Beeton reached a conclusion he could scarcely believe: The 10,000-square-mile lake was dying, through a process known as eutrophication. Vast

Once a wetland, always a wetland? *North of Grand Forks, North Dakota, on the flat floodplain of the Red River of the North, spring thaw periodically defies man's*

influxes of pollutants, primarily nitrogen and phosphorus from sewage and fertilizers, were stimulating the growth of algae, and dying algae were creating oxygen demands that suffocated fish.

Dr. Beeton's discovery helped focus civic and scientific attention on water's woes and spark the environmental movement.

Congress reacted in 1972 with the Federal Water Pollution Control Act Amendments, aimed at making our waters "swimmable and fishable" by 1983. Under its provisions, the Environmental Protection Agency (EPA) has pumped some 25 billion dollars into the construction of municipal sewage plants. So far a third of the 18,000 involved cities and towns have met cleanup requirements, as have 90 percent of major industrial polluters.

Are our waters responding?

A growing roster of rivers makes the comeback trail, among them a rejuvenated

efforts to transform this land of former potholes and marshes. Networks of drainage ditches may bring more runoff to the river than its banks can accommodate.

Condemned by geography *to a lifelong threat of catastrophe, the people of Johnstown, Pennsylvania, pay dearly for dwelling in one of America's most flood-prone valleys. Three times in less than a century, this industrial city of 48,000 has been laid low by floods from the rampaging Conemaugh River. The worst, in 1889, claimed 2,200 lives; the second, in 1936, killed 30. The last, in July 1977, followed 12 inches of rain that burst six earthen dams and sent a 12-foot-high wall of water roaring through the hogback hills. In its wake: memorial services* (**above**) *for 80 victims, 200 million dollars in property damage* (**top left**), *and thousands of displaced families.*

Shoveling mud from his basement, Francis Matten (**far left**) *joined the entire city in a months-long cleanup. Armed against looters* (**left**), *a homeowner carries a precious supply of unpolluted water.*

In the nation some 8,000 dams help protect populated areas against floods. The U. S. Army Corps of Engineers has recently inspected half of these and found a third unsafe.

Cuyahoga (page 157), once again magnet for boaters and fishermen.

The Great Lakes, including Erie's ailing waters, also show signs of recuperation. But pollutants still pour in. A primary offender is agricultural land; runoff of fertilizer nitrogen and phosphorus, and sediment from erosion prove especially difficult to curb.

Chemical spills pose an increasing problem. I caught a glimpse of the challenge in a nightmarish setting in Oswego, New York.

***Flood of paper** but not a drop of concrete: After forty years of studies analyzing the heavily populated Passaic River Basin of New Jersey and New York, scores of affected communities cannot agree on a flood-control plan. The Corps of Engineers had proposed a dam and 108 miles of levees. At the corps' Waterways Experiment Station in Vicksburg, Mississippi, a rainfall simulator tests vegetation and soil conditioners that could retard erosion (**facing page**).*

"You're looking at a chemical time bomb," said youthful Jim Yezzi as we stood on the brink of a million-gallon witches' cauldron of industrial chemical wastes (page 154). Jim was coordinating EPA's specialized Environmental Emergency Response Unit, which had rushed a mobile chemical laboratory and a treatment facility to the site.

"The owner of this company contracted with major corporations to dispose of industrial wastes. Since the company could not incinerate them all, it resorted to storing the chemicals in the lagoon and in drums." Jim gestured toward irregular ranks of the 55-gallon containers. Fifteen thousand of them littered the site, many holding substances so corrosive they had begun to rupture.

"Eventually the lagoon overflowed into Wine Creek, and finally the toxic chemicals reached Lake Ontario. A local resident noticed the oily slick and contacted the U. S. Coast Guard, which notified the EPA."

I walked skittishly among reeking drums oozing multihued trickles that merged in sinister puddles. Patches of feathers and bones told where birds had alighted and partaken. The cleanup was just beginning. Already it had cost EPA 1.2 million dollars, with little hope of reimbursement.

DDT, DDE, PCBs, PBBs, mirex, Kepone, dieldrin—the list of toxic or suspected toxic chemicals found in water steadily lengthens. Many experts believe that concentrations of toxic heavy metals such as mercury and cadmium are also increasing. Others believe the threat is overstated, partly because scientists can detect materials in increasingly smaller concentrations: parts per billion and even parts per trillion.

Such contention surrounds a discovery that chlorine, the magical water disinfectant, may spawn cancer-causing agents in water drawn from rivers rich in organic matter. As a result, EPA limits the amount of organic material in chlorination. The agency also proposes that cities with populations of more than 75,000 vulnerable to contamination from industrial organics install carbon filtration systems. The water industry deplores this as unnecessary and extremely expensive. Cost estimates of carbon filtration may vary from ten dollars a year

per family to more than a hundred dollars.

In the great distillery of the hydrologic cycle, even the most polluted water is scrubbed clean. But what if the precipitation falls back to earth through dirty air? A dismaying answer haunts New York's Adirondack Mountains, where man's intrusion produces an aberration known as acid rain.

"I'd fished these lakes for twenty years," recalled Dr. Dwight Webster, professor of fishery science at Cornell University. "Native brook trout would jump from the surface like popping corn. Then, in the 1960s, fish in some lakes at higher elevations started to disappear, and we began noticing changes in the water, including rising acidity. Yet no one lived above these lakes to pollute them. It was a real puzzler."

I learned the answer from one of Dr. Webster's former students, Dr. Carl Schofield, whose research has done much to explain the vanishing fish populations.

"We think the source of the problem is coal- and oil-burning electric plants, especially in the Midwest. Over the years these plants have tried to clean up the air for local communities by installing tall stacks that pump pollutants high into the atmosphere. But someone forgot that what goes up must come down. Moist air masses moving from the Midwest carry the stack effluents northeastward. When they hit these mountains, the moisture condenses and falls as dilute sulfuric and nitric acids."

Today the fish are gone from about 200 Adirondack lakes. Measurements show acidities of fifty times the norm, concentrations that affect even the rock surrounding the lakes. "The acidity almost doubles the rate of erosion," says Dr. John Turk, a geologist. Dr. Gene Likens of Cornell believes acid rain may be affecting the growth of northeastern forests.

Water politics: *In Fresno, California, an unenforced law that would limit cheap federal irrigation water to 160 acres per farm family member is hotly contested. While smaller farmers want the law enforced, others want it changed, and argue for the efficiency of larger farms.*

EACH YEAR the acre around my Maryland home receives some forty inches of rain—about a million gallons. This is average for the well-watered part of the nation east of the Mississippi. Except in drought, crops and forests prosper, and streams and aquifers run full.

Farther west, the land's green cloak acquires a tint of tan. Iowa gets 31 inches of rain a year, eastern Nebraska 27. Cross the 100th meridian into western Nebraska, with its 18 inches of rainfall, and the real browning of America begins. Wyoming averages only 14 inches a year and Nevada, the driest state, a mere nine. West of the 100th meridian, the necessity of managing scarce water supplies has shaped a distinctive civilization and bred attitudes toward water that sharply divide the nation.

To an Easterner such as myself, many western water schemes seem like pork-barrel projects (as do some of our eastern water wonders). To many Westerners, this is nonsense; without these projects their homes, their farms, their cities simply would

not exist. In this spirit, Westerners manipulate water on a scale never before seen on earth, a movement that began when weary Mormon pioneers first straggled into Utah.

Entering Salt Lake Valley in 1847, the Mormons encountered parched, alkaline soil that could be farmed only by irrigating. This posed a problem: Though irrigation is older than history, and was used by American Indians, no Anglo-Saxon people had ever attempted it.

Resolutely the settlers dug a ditch from City Creek and diverted it onto their first potato patch. By trial and error they discovered the critical slope for canals, one that would keep water moving, yet not so fast as to erode the ditches. Soon thriving crops splotched their harsh Zion.

Miners swept over the West to sack its mountains of gold and silver, and Mormon farmers followed, transplanting their new technology to feed the mining camps. But other western communities, lacking the Mormons' cohesion, found it difficult to organize complex irrigation works.

To speed this process, Congress in 1902 enacted the Reclamation Act, creating the Bureau of Reclamation. One of its first projects, a dam on the Salt River in Arizona, nurtured the desert oasis of Phoenix. Later Hoover Dam rose athwart the Colorado. It staunched the river's violent floods and helped irrigate the salad empire of the Imperial Valley. Across the West spread the mammoth water systems that today sustain so many millions of Americans.

Almost from the outset, western dam building stirred opposition by those who wished to preserve wildness. In 1913 naturalist John Muir lost a national campaign to halt a dam in California's exquisite Hetch Hetchy Valley. Since that time, several dams have been blocked.

I felt this tension when I called on the head of the water department in Denver, a city renowned for its sweet mountain water.

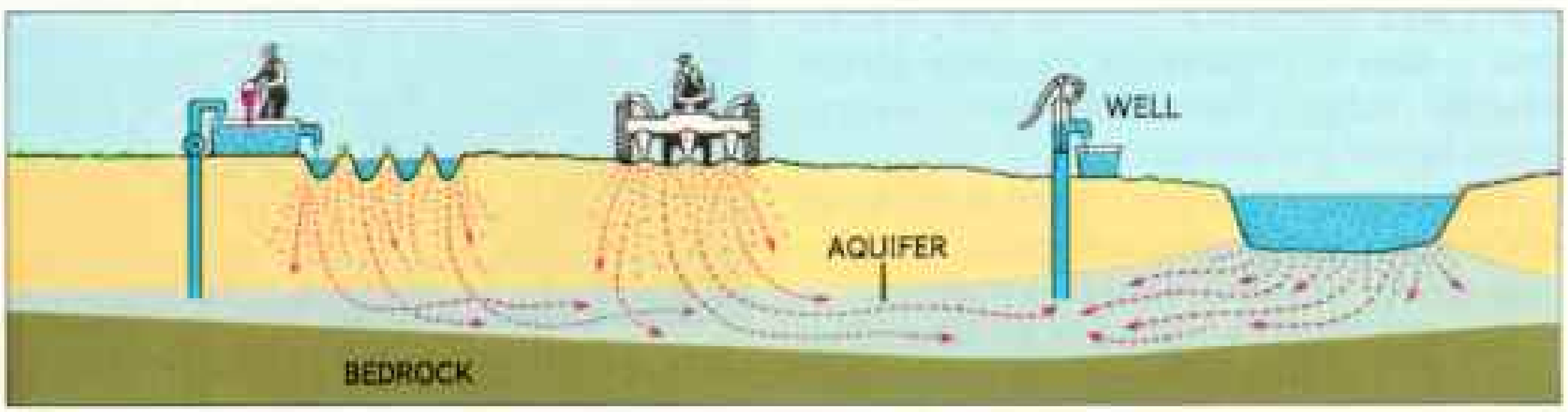
James L. Ogilvie pulled no punches. For nearly five years environmental groups had held up construction of a proposed water plant. Mr. Ogilvie had watched helplessly as costs had risen from an initial 65 million to 135 million and still moved upward.

"The main objectors—the Sierra Club, Trout Unlimited, Friends of the Earth, and such—claim to be big on the environment. They're concerned about a few backpackers up in the hills. Here in the city I'm trying to provide a better environment for a million people. Those groups forget that downtown residents who water their lawns and gardens create their own little environment. We've got to respect their needs too."

I called at the downtown office of water lawyer Glenn Saunders, an eminent member of a legal breed peculiar to the West. His office window framed the gold dome of the State Capitol, where he has helped write much of Colorado's water law; on his wall hung a rock from a Roman aqueduct.

"If you build your waterworks right,"

Water ethics: *Memories of the 1977 drought still vivid, residents of California's San Francisco Bay area have cut down substantially on water waste. With a caped crusader as their model, children in Oakland's Hawthorne School learn the ABC's of water conservation.*



NATIONAL GEOGRAPHIC ART DIVISION

Pesticides in water: how great a hazard?

Spurred by recent findings, the Environmental Protection Agency, which in the past concentrated on surface-water quality, has begun investigations to determine the broad-scale impact of pesticides on groundwater. Many of these chemicals remain suspended in the soil, or otherwise pose no threats to underlying aquifers. But some chemicals that are mixed with irrigation water, added directly into the soil, or sprayed on foliage either wash directly down to the aquifer or run off to streams for transport to wider areas where they could contaminate wells or reservoirs.

Afloat on a hidden sea, *the nation draws about half its drinking water from underground. Each year nearly a million new wells puncture the landscape, drilled with rigs such as these on display at a National Water Well Association convention in Reno, Nevada (**above**).*

*Though groundwater is indispensable to the country's water budget, land-level markers on a telephone pole in California's San Joaquin Valley (**right**) illustrate a danger of overexploitation. So much has been pumped to support the valley's immense irrigation needs that the land has subsided as much as thirty feet.*

Our Most Precious Resource: Water

***Only memories** and photographs can recall the cotton fields on Jack Duke's farm (**right**) near Pecos, Texas, before soaring natural-gas prices made it too expensive to fuel irrigation pumps. Cotton farmers in the San Joaquin Valley (**below**) fight a buildup of crop-destroying salts, a result of irrigation without proper drainage.*

began Mr. Saunders, eyeing the ancient stone, "they'll last for thousands of years.

"Water possesses a marvelous quality. Because of its extreme fluidity, it will flow along the slightest grade by the pull of gravity. If you go to a river's high reaches for your water, you can move it great distances free of charge. We have a rule: Hold water high.

"Colorado has enough water to sustain a far larger population—maybe twenty million. But new population centers, which will be able to pay much more for water, will force agriculture to shift location. We have a saying: Water runs uphill to money."

Across the Rockies, I took up company with the boisterous Colorado River. Scan a list of the nation's 25 largest rivers by volume, and the Colorado trails last, far smaller than Indiana's Wabash or Florida's Apalachicola. But by almost any other comparison—wildness of waters, grandeur of setting, embroilment in controversy—the Colorado flows without peer.

In its 1,450-mile cascade from birth in the Rockies to feeble trickle in Mexican sands (pages 176-7), the Colorado brings life to three million acres of irrigated desert and to burgeoning Sunbelt cities. In transit it

acquires an outsize assortment of legal credentials: court decrees, state regulations, interstate compacts, treaties, congressional acts. One of their effects is to allocate more water than the river holds. Fortunately, states along the upper Colorado do not withdraw their legal share, and many Indian tribes have not exercised their rights. So far, the river still delivers enough water.

This could change in about a decade. Then the vast Central Arizona Project will begin operating full tilt, pumping ninety tons of water a second 815 feet high, carrying it by tunnel through the Buckskin Mountains, channeling it 310 miles eastward to bolster the plunging groundwater supplies of Phoenix and Tucson. At this point, many experts believe, demand for Colorado water will begin to exceed supply.

What of Indian rights? The question raises much uncertainty. Numerous treaties mention Indian water entitlements, and federal courts grant them legal priority. A mammoth federal project will bring more than 110,000 acres of the Navajo Reservation under irrigation, a venture that could suddenly propel a largely pastoral people into the world of agribusiness.

Soon after the Colorado enters Utah, it picks up a consort in the winsome Dolores River. But the relationship is not entirely desirable. In its rush to this rendezvous, the Dolores flows over the Paradox Valley salt beds. Each day they feed the equivalent of eleven railroad cars of salt into the Dolores.

Other tributaries pour in salts, and so does man. Irrigation water trained onto desert fields dissolves about two tons an acre a year and bears it back to the river.

Between contributions of man and nature, the Colorado freights ten million tons of salt a year. Along lower reaches, crops wither, land must be abandoned, and losses climb above fifty million dollars a year.

Nearly a decade ago, Mexico sharply protested this contamination, and today the U. S. is building a 260-million-dollar desalting plant at Yuma, Arizona. Using a process known as reverse osmosis, it will be the world's largest desalination operation.

NO WATER FLOWS out of arid southern California into the Colorado. But, like tributaries in reverse, two man-made rivers carry Colorado water into California. One of these giant aqueducts irrigates the Imperial Valley. The other flows 242 miles to the Los Angeles area, where it helps Californians enjoy the blessings of water without the inconvenience of rain.

When the state's worst drought struck in 1976 and '77, Californians responded by corralling well drillers from across the West and sinking 28,000 holes in a single year. The torrent of groundwater they pumped helped pull them through. It also pulled down the water table, alarming officials in Sacramento.

When torrential rains abruptly broke the drought, these officials watched anxiously for the water table's response. To their relief, in many areas it rebounded to pre-drought levels and beyond. One area registered a recovery of seventy feet.

Some areas, such as the broad San Joaquin Valley, where pumping has been heavy and prolonged, no longer recharge well. Here 50 years of drawing down groundwater has caused an area the size of Connecticut to subside, in places as much as 30 feet.

This was part of the problem in the besieged town of Mendota when I splashed in at dusk of a scented spring day. Mountain snows had just melted, and now the waters were draining toward Mendota, which sits in the vast saucer of subsidence.

Mendotans had thrown up a rampart of sandbags. But the home of Joseph Ramirez, a welding-shop foreman, lay beyond them, at the edge of town. Water lay wall to wall inside his one-floor bungalow.

"Each year we sink lower and the flooding gets worse," he said without rancor. "This time the kids couldn't get to school for two weeks. My wife says 'enough,' and I agree. We'll move."

Of nature's many rampages, flooding is the most destructive. In an average year floods kill a hundred Americans and destroy billions of dollars' worth of property.

Large rivers possess powers that almost defy comprehension; in 1927 the Ohio and lower Mississippi joined forces to inundate a region as large as Lake Superior and wreak a quarter of a billion dollars' damage.

But catastrophic floods also strike minor streams familiar only to those along their banks: Mississippi's Pearl River in 1979, 20,000 homes evacuated, half a billion dollars in damage; Big Thompson River, Colorado, at least 139 lives lost in 1976; Rapid Creek, South Dakota, a 1972 flash flood claimed 236 lives; Conemaugh River at Johnstown, Pennsylvania, 80 dead in 1977, 30 in 1936, more than two thousand in the grim disaster of 1889.

Since passage of the Flood Control Act in 1936, the federal government has spent some 13 billion dollars for control. These measures have prevented an estimated 40 billion dollars in property loss. Yet the damage figure continues to rise.

Part of the problem lies in the lure of floodplains. Farmers love their fertile lands; homeseekers and industries prize their level sites for building. When disaster drives off the occupants, many return as soon as the water subsides and rebuild.

What is the solution? Professor Gilbert F. White of the University of Colorado, whose career in floodplain management spans four decades, sees a welcome shift away from flood-control structures and toward political solutions: halting the reoccupation of flood areas, controlling land use to minimize

flood losses, providing warning systems. "It's not an engineering problem," he argues. "It's people."

Flood control was part of the stimulus in 1933 when Congress created the Tennessee Valley Authority. Its sweeping goals included navigation, hydroelectric power, encouragement to industry and agriculture, wildlife management—a massive uplifting of a region then much in need of a boost.

Today experts call TVA the world's most successful example of integrated regional water management. Attempts to duplicate it have been made at home and abroad, but never with complete success, usually because watersheds already were encumbered with conflicting commitments. In the U. S. only the Columbia River's development approaches TVA in scope.

When reservoirs blossomed on the Tennessee and Colorado Rivers, officials were surprised by their immense popularity for recreation. As more and more man-made lakes terraced our rivers, use by boaters and fishermen soared apace. Today the U. S. Army Corps of Engineers, the number one water development agency, is also one of the nation's leading recreation agencies.

As dam builders, Americans are a nation of beavers. Fifty-eight thousand dams capable of holding 16 million gallons or more span our streams. They range from high-rise Oroville Dam in California, towering 770 feet, to ramblers such as Utah's Watkins Dam, which stretches 14.5 miles.

How safe are these dams?

Breaks have been rare but some have been costly. A bursting dam at a coal-mine pond unleashed the Buffalo Creek flood that killed 125 West Virginians. Failure of the Teton Dam in Idaho claimed eleven lives; a Georgia collapse, 39.

Spurred by these disasters, and by inadequate laws for dam inspection, Congress has directed the Corps of Engineers to inspect dam safety, focusing first on those whose failure would cause greatest loss of life.

What does our water future hold? With constant supply and rising demand, something must give. Experts see some trends.

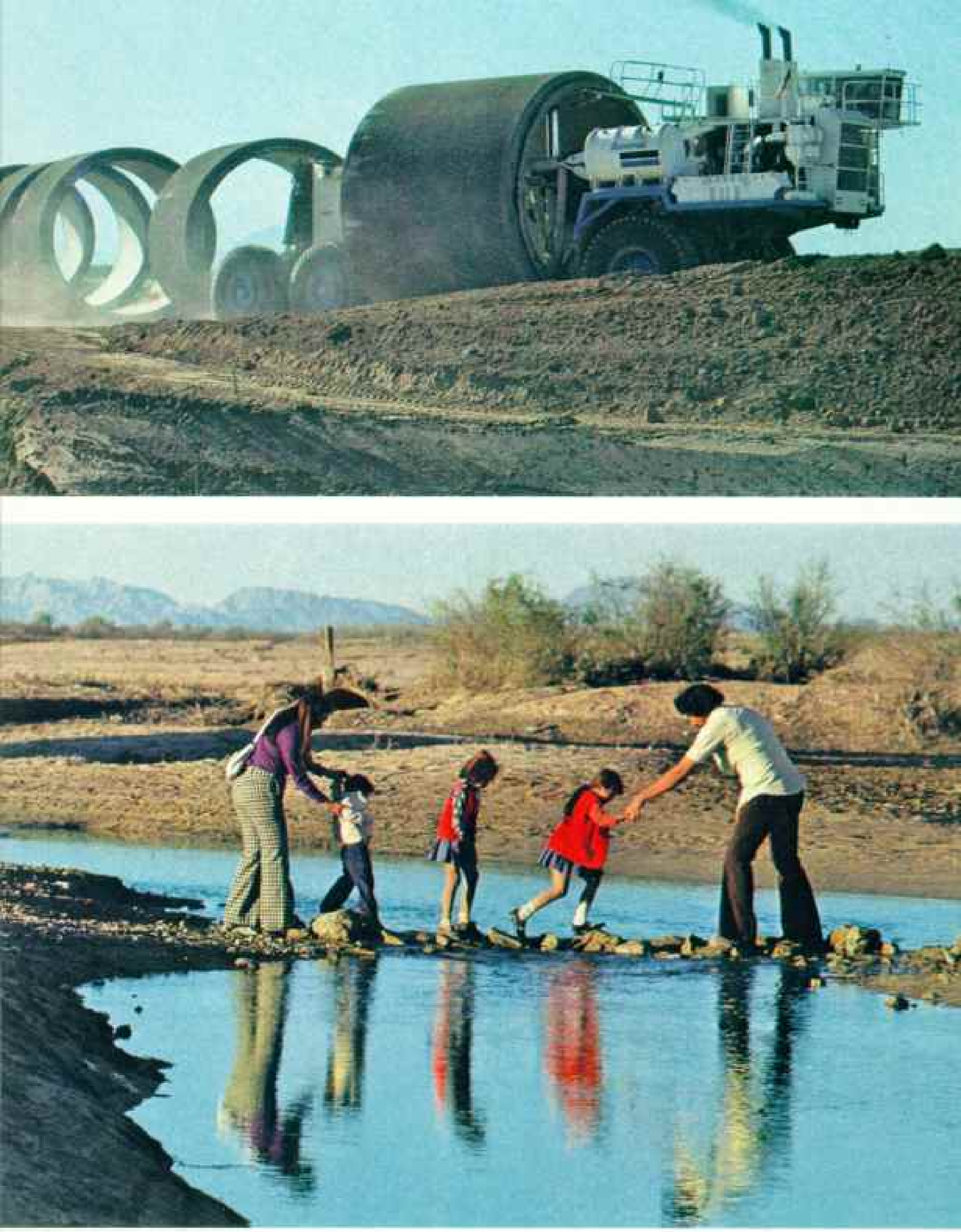
One is toward increasing competition for water, especially in the West. Often this will mean agriculture yielding to industry,

Less than a drop *in the nation's energy bucket, the thousand watts produced by Dan New's "hydromite"—a generator of his own design—is enough to light his cabin near Deming, Washington. Thousands of homes could use the device. A government study estimates that some 5,000 U. S. locations have the potential for much larger hydropower development.*

The Colorado River, used up before reaching the gulf

A river consumed, *the Colorado is reduced to a trickle* ***(above)*** *after its last commitment—a Mexican irrigation system—has been fulfilled. Even so,*

National Geographic, August 1980



construction continues on a 1.6-billion-dollar project that will divert 390 billion gallons to water-desperate central Arizona, where huge concrete pipe sections are readied for placement (**top**). *Though it carries only as much volume as the 306-mile Hudson River, the Colorado delivers water and life far afield of its 1,450-mile course through the arid West.*

which gets far greater value per gallon used.

Recently 375 irrigation farmers sold part of their rights to Utah's Sevier River water for a hefty 79 million dollars for use by a power plant.

As water grows more costly, recycling becomes more feasible. Setting the pace, Denver is building a plant that initially will recycle wastewater for irrigation, while engineers scrutinize it for eventual home use.

Conservation will loom ever larger.

In the West, where irrigated agriculture gulps nine gallons of every ten used, drip irrigation offers enormous economies. Many western homeowners shift from thirsty, eastern types of grass lawns to desert plantings of cactuses and indigenous flowers.

In the East, older cities such as New York and Boston strive to replace antiquated plumbing systems that lose as much as a third of their water to leaks.

Industry already is drastically cutting consumption. With tighter pollution controls, plants increasingly turn to recycling.

Reverence for water *is vividly seen in dry Arizona, where desert landscaping aids conservation near Tucson* ***(facing page)****. Upstate, a Navajo medicine man invokes water deities with a ceremonial sand painting* ***(below)****. A modern irrigation project has now begun to bring crops and jobs to his parched home—an answer to centuries of prayer.*

WHAT about cutbacks by individuals, meaning you and me? California's drought experience showed that we will conserve when our backs are to the wall. People in hard-hit Marin County slashed their use by 63 percent, Oakland area residents by a third. Both areas continue to draw less water than in predrought days.

For young people served by the East Bay Municipal Utility District, water awareness comes as easily as reading a comic book (page 169). Gallopin' gallons! The Water Bandit! He's opening faucets and making toilets leak and otherwise wasting water. Mild-mannered Marvin Priminsky spies him, ducks into a clothes dryer to change, and charges out in the flowing cape of—Captain Hydro! A mighty scuffle, and Captain Hydro vanquishes the water waster.

Leadership in the conservation movement comes from an innovative Maryland utility, the Washington Suburban Sanitary Commission. Faced with potential shortage during drought and a critical sewage disposal problem, the WSSC imposed water rates that reward reduced use, changed plumbing codes to reduce flush and shower flows for new houses, and distributed conservation aids to existing ones. Spurred by the WSSC program and California's drought experience, today hundreds of communities wage water-saving campaigns.

"More and more, we will face problems of water management," says Joseph Cragwall, former chief hydrologist for the U. S. Geological Survey. "Getting water from where it is to where it's needed, keeping it clean. I won't go so far as to say we'll need a national plumbing system, but we'll have to work together, because they're not making any more of it." □

Milwaukee: More

THERE WAS NO ROPE. He was just clinging with his fingertips and toes to the granite face of the Milwaukee Art Center, 20 feet in the air. I stared at him, wondering if he needed help.

"What are you doing?" I shouted.

"Practicing," he called down.

"Oh?"

As he spidered across the width of the wall, he introduced himself: a criminal lawyer named Bryan Borman. He said he found his job frustrating in this law-and-order city, where judges are apt to growl at bail. He rock-climbed to relax, often practicing on this wall. To make the exercise more difficult, he was now using only the smaller handholds. It was an hour before he touched the ground again, sweat streaming down his face.

In Milwaukee, I had concluded by now, not only does an hour's pay usually buy a good hour's work; Milwaukeeans tend to work hard even when they play. And if you're looking for other traits commonly found among the 613,000 inhabitants of Wisconsin's biggest city, throw in straight talking, God fearing, beer drinking, and about as honest as they come.

"Ever lived anyplace else?" I asked a Milwaukee cabdriver one day.

"Nope."

"Ever want to?"

"Nope."

"Why?"

"It's a clean city," he said. "Good place to raise a family. And, there is a lot more here than beer. . . ."

More here than beer?

Well, just at random, there is chocolate. Ambrosia Chocolate Company of Milwaukee is one of the largest wholesale chocolate makers in the country. Its machines ooze 2,760 perfect chocolate chips a second. Marquette University has a charming 15th-century Joan of Arc chapel—moved stone by stone from France. The Allen-Bradley Company, makers of electrical equipment,

Pitching the business *that makes Wisconsin famous, Becky Powell stars on Dairy Night at the Milwaukee Brewers' home park. Fans support their baseball team as they do their city—loudly and wholeheartedly.*

Than Been

By LOUISE LEVATHES
NATIONAL GEOGRAPHIC STAFF

Photographs by MICHAEL MAUNEY

Staunch pillar *of his party, Frank Zeidler (**above**) ended three terms as Milwaukee's last Socialist mayor in 1960. Dubbed "sewer Socialists" for emphasizing city services, Zeidler and his Socialist predecessors held the office 38 years, establishing traditions of balanced budgets and squeaky-clean honesty in government.*

*Conservatism sets the tone in the largely Polish south side, where first-generation American Casimir "Casey" Szymczak (**left**) cuts the lawn of his century-old house. "It's the children," he says of his neighborhood's ongoing ethnic character. "They come back."*

has a clock larger than London's Big Ben.

There are sports, from polo to Olympic-class sailing, and legendary sports fans. In 1953, the weekend after it was announced that the Boston Braves would be coming to Milwaukee, 10,000 people drifted into County Stadium—although no game was scheduled. As light rain fell, they stared at the deserted field. It was too wonderful to be true. No more guff from Chicago; Milwaukee had a major-league team of its own.

A love of the game, however, doesn't mean Milwaukee is Bushville for the arts. Its first musical society, the Beethoven Gesellschaft, dates back to 1843—three years before the city was incorporated. Today there is a handsome modern Performing Arts Center, a Milwaukee Symphony, and a growing ballet company. The Art Center, whose wall had attracted rock-climber Bryan Borman, houses an impressive collection of modern paintings and sculpture.

Milwaukee is also Liberace, who got his start in a piano bar as "Walter Busterkeys," and jazzman Woody Herman. Milwaukee was the home of Generals Billy Mitchell and Douglas MacArthur, and of Spencer Tracy, Carl Sandburg, and Edward Steichen.

It has also been a center for medical discoveries—multiple-vein bypass surgery for heart patients and a device called the "Milwaukee brace" for curvature of the spine. The city has, in the employee-owned Journal Company, a long and respected newspaper tradition. Milwaukee is both a city where Nazi-party candidate Arthur Jones received 4,790 votes in a 1976 mayoral primary, and where the late Israeli Prime Minister Golda Meir said her family, émigrés from Russia, first experienced freedom.

The heart of this city is an industrial valley—a tangle of railroads, shipping canals, grain elevators, foundries, tanneries, and junkyards. Often the smell of burning coal overpowers the bitter aroma of roasting hops in the downtown breweries. Indeed, although adult Milwaukeeans no doubt drink as much as or more beer per capita than do people in other large American cities, only one percent of the work force is involved in brewing. Milwaukee is among the world leaders in the manufacture of construction equipment, electrical controls, gasoline engines, and motorcycles.

Just 15 minutes from the stew of factories and smells, the city disappears into sleepy bedroom communities, charming county parks, sprawling dairy farms, and open country dotted with clear inland lakes.

The urban blight that devastated Detroit, New York, and other cities in the sixties dealt somewhat more kindly with Milwaukee. Still, the city suffered from a neglected downtown, an aging housing supply, and poor mass transit. There were Vietnam War protests, draft-card burnings, and civil rights marches. A bitter suit over school desegregation dragged on for 14 years. In the past decade the city's population has fallen 14.5 percent, with middle-class workers fleeing to the suburbs and the poor settling into run-down duplexes.

Yet in this familiar scenario, Milwaukeeans never doubted that the problems were solvable. Civic pride caps the beer city like a frothy head on a full stein.

"And the long cold winters?" I asked my cabdriver. "How do you make it through?"

"We drink a lot of brandy here," he said with all seriousness. "It's our antifreeze."

Good Samaritan Lends a Hand

One day I found myself lost on the south side of Milwaukee without my all-knowing cabdriver. While I studied a map, a young couple pulled up alongside my parked car.

"Are you all right?" said the man, leaning out of his car.

"Yes," I said. "I'm just trying to find South Shore Park."

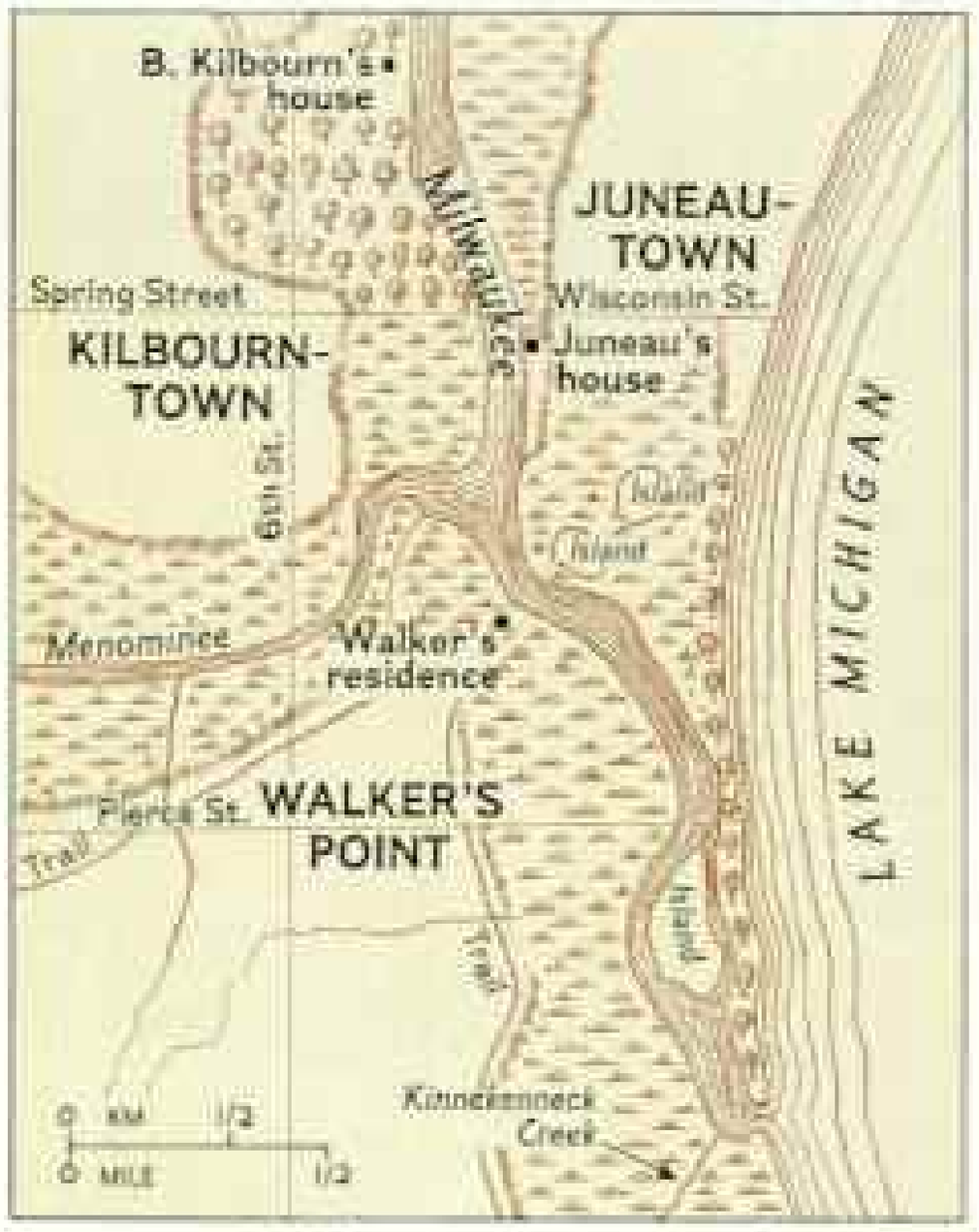
"Here, follow us." They took off through the narrow streets of Bay View, a neighborhood of neatly kept homes and family-run stores. I followed them, and, after a few turns, we were at the lakefront. Nothing in Milwaukee ever turns out to be very far away from anything else.

"Did you know that your left front wheel was loose?" said the man when we stopped. He pulled out a few tools and sat on the ground to fix it while his wife stood patiently nearby. Gradually I realized I had a complete stranger working on my car. Why was he doing this?

After a few minutes he stood up and said, "I'm sorry, I don't have the right tools. You'd better get this fixed right away. . . ." And they drove off.

Divided ethnically 1900

Three settlements in 1835



Milwaukee today

Bitter rivalries *separated the three settlements that first grew up where the Milwaukee River meets Lake Michigan. Yet with incorporation in 1846, they formed the nucleus of what is now the nation's 17th largest city. German, Irish, Polish, and Italian immigrants created distinct neighborhoods. More recently, black and Latino communities have arisen.*

Like a visitor *from another city, the First Wisconsin Center tower dominates the low downtown skyline. The city has steadily lost residents to suburbia in the past*

A hospitable city. A warm city. For some reason, Milwaukee has never lost its small-town civility. After spending some time there, I thought it might have something to do with the geography, the large ethnic population, and that magic golden brew for which the city is famous.

The land on which Milwaukee is built shaped the character of the city. Indians living beside the tamarack swampland in the 1600s called it Mahn-a-wau-kee Seepe, meaning "gathering place by the rivers." Indeed the city's rivers, the Milwaukee, the Menomonee, and the Kinnickinnic, naturally divided the area (map, preceding page). Three rival settlements sprang up there in the 1830s: Walker's Point, Juneautown, and Kilbourntown.

In 1845, the year before the city was incorporated, a bitter dispute over bridges arose. A cannon was loaded at the riverbank but was not fired. Byron Kilbourn, a surveyor

three decades, but the trend may slow with a recent infusion of cultural facilities, neighborhood-renovation drives, and large-scale commercial development.

and canal builder from Ohio, stubbornly laid out his streets so that they would not meet those of Juneautown, and the old bridges across the Milwaukee River stand at sharp angles to this day.

In succeeding decades, with the arrival of large numbers of European immigrants, the city divided along ethnic lines.

High ground near Juneautown, settled by New Englanders, became known as Yankee Hill. Most of the German immigrants, who began arriving about 1840, settled in Kilbourntown. The area was called Gartenstadt (Garden City) for its homes with fenced-in flowers and vegetables.

Although the Norwegians, Irish, and Serbs lived on the south side at one time or other, the Poles came and stayed. They built rows of modest wood-frame homes, known today as "Polish flats," as well as imposing, richly decorated churches such as St. Josaphat's Basilica and the gold-domed St.

Stanislaus. Most worked in the factories that sprang up along the Menomonee River.

I explored some of the older districts with H. Russell Zimmermann, a red-haired, ruddy-cheeked architectural historian.

"As far as I'm concerned, you can build a fence around this block and make it a shrine," he said enthusiastically. We were walking down East Michigan Street. On our left was the 1876 Mitchell Bank Building with its wonderful cast-metal griffins, lion-head keystones, and shameless, bare-breasted stone damsels. "It's one of the best examples of French Second Empire style in the country," said Zimmermann.

I had often walked past the old Northwestern Mutual Life Insurance Building at 611 North Broadway. "You've never been inside?" asked Zimmermann, shocked. I might as well never have tasted Heinemann's freshly grilled coffee cake, another sinful omission in this city.

Designed by the great Chicago architect S. S. Beman, 611 North Broadway is a jewel. Its skylighted, copper-plated iron staircase, marble-paneled walls, and colorful English tile floors are in mint condition.

Next we visited the magnificent turn-of-the-century homes in the Yankee Hill area. Like grand duchesses, Prospect Avenue's graceful Victorians sit contentedly on a summer evening catching cool breezes off the lake. Several of the mansions, such as the George P. Miller residence, were built by rich entrepreneurs as wedding gifts for their daughters.

Time seems to have stood still in this part of the city. At nearby Lake Park, planned by Frederick Law Olmsted, designer of New York's Central Park, the lawn-bowling club still dresses in its traditional whites for the Fourth of July matches.

Just Dining in the Rain

In the 1960s Milwaukee's downtown, like those in most large U. S. cities, was dying. Some signs of life have returned, particularly in the summer, when outdoor cafés sprout on the sidewalks, red antique wagons sell popcorn on street corners, and amateur music groups give spontaneous lunchtime concerts in building plazas.

I was sitting in a crowded outdoor café one chilly summer day when a brisk wind took off with my napkin and rain began to plop in my vegetable soup. I asked the waitress for the check—but no one else stirred.

You'll seldom hear Milwaukeeans complain about rain in the summer, and nothing short of a hurricane could make them stay inside. The reason: Milwaukee winters. Particularly the all-too-recent winter of 1978-79, when 80 inches of snow fell and the temperature didn't rise above freezing for

*"**Hizzoner**" for the past 20 years, Mayor Henry W. Maier (**above**) practices the fiscal conservatism that gave his city a triple-A credit rating. But he battles an outflow of industry to nearby communities, prompted in part by a high tax rate. Still, the civic fabric is strong; thousands jog for charity in "Al's Run" (**facing page**), a race inspired by Al McGuire, former Marquette University basketball coach.*

All-American bike *salutes Old Glory, the theme for children's events at parks within the city on last year's Fourth of July. The county's 14,475-acre park system offers swimming pools, golf courses, tennis courts, ski trails, and—along 11.4 lakefront miles—beaches and marinas.*

a record 52 days. An estimated 1,500 cars were abandoned in the streets.

From my vantage point at a breezy sidewalk café, morality appears to hang over downtown Milwaukee like clean smog. No one jaywalks. All the young men, it seems, get haircuts every week, own nothing but three-piece blue suits, and marry their high-school steadies. Milwaukeeans themselves joke about it. As one resident,

Richard Bernard, told me: "Here, a topless waitress is one without a babushka."

As I traveled about the city, it was clear that ethnic boundaries had begun to blur. German-Americans—200,000 or more—are no longer concentrated in old Kilbourntown. The East-West Freeway in the sixties helped break up the Third Ward's Italian community, now numbering about 44,500. And recently most of the estimated 30,000 Spanish-speaking residents have moved to the once heavily Polish south side.

One south-side priest commented, "My funerals are all Polish. My weddings and baptisms are all Latino."

The city is still full of wonderful German restaurants—Karl Ratzsch's, John Ernst Cafe, and Mader's—but it is difficult to find a Polish store, such as John Przybylski's on West Greenfield Avenue, which sells

Krakus hams, Polish mushrooms, and honey cakes called *katarzynki*.

"Milwaukee's foreign-language papers have largely disappeared," said Professor Alfred Sokolnicki, dean of speech at Marquette University, who is of Polish extraction. "Also Milwaukeeisms, such as 'I'm going down *by* Gimbel's,' which reflected the immigrants' struggle with English."

Upholding Traditional Mores

But you can still find old-country values. "My father always said to me, 'Go to church. Be honest. Work hard. Get married and raise a family,'" said Daniel Ligocki, a 55-year-old Allen-Bradley production worker of Polish descent.

With the additional income from a catering business run by his wife and mother, the Ligockis were able to move out of the south side recently into a handsome new four-bedroom house in suburban Greenfield.

The Ligockis invited me for dinner one evening. Sandra Gonsiorowski, the eldest of their six children, prepared a large pan of lasagna, the family's favorite meal, and Stephanie, 15, baked Chinese cookies for dessert. Around the dining-room table, the family talked of their cottage on Lake Auburn in central Wisconsin, of summers spent boating and fishing and winters sleigh riding, tobogganing, and baking Russian rye bread on cold nights. In the fall Danny and his sons go deer and duck hunting, and in the spring the family combs the woods around the lake for delicate morel mushrooms.

"I remember the day the topsoil for the lawn was just dumped in a big pile in front of the house," said Danny. "All the kids were there, my son-in-law, and my two grandchildren. It was a big job, spreading the soil all around the house. I don't know what I would have done without them. Afterward, I went out and bought pizza and beer for everyone. We had a good time. . . .

"Whatever I have today, it's because of my family."

"The immigrants were believers in law and order," said a political science professor at the University of Wisconsin-Milwaukee. "They were also very concerned about improving basic services, such as fire protection and garbage collection. Over the years the city responded to their concerns." Milwaukeeans now take it for granted that their streets and parks are clean, trash is promptly collected, and the crime rate low.

One immigrant group—and favorable

Toasting Milwaukee, *the nation's biggest beer producer, executives of brewery giants—from left, Pabst's chairman Frank DeGuire, Miller's president William Howell, and Daniel McKeithan, chairman of Schlitz—attend Summerfest, an annual brouhaha of international food, drink, and music.*

circumstances—led to the industry that made Milwaukee famous.

Breweries sprang up here in the 1840s and '50s because of the growing German community, and the cold winters of unlimited ice. Lager beer requires cool temperatures during fermentation.

Kegs of beer were hauled through Milwaukee's streets in wagons drawn by matched Belgians, their harnesses glinting with metal decorations. Saloons sold two beers for a nickel—with a free lunch of roast beef, baked ham, and sausage. Today Milwaukee's 1,595 taverns, almost one on every corner, function as neighborhood banks and community living rooms. They are an essential part of life here.

Many, like Big John's Tap on South 12th Street, are small, 12-stool bars. Big John's son, Bill Kwiatkowski, tends bar and cashes your paycheck if he knows you. On Tuesday night there is a running game of cribbage or sheepshead, and on Saturday nights John's brother, Tony, a retired postal worker, plays tunes like "Harbor Lights" and "Blueberry Hill" on the piano.

"When I was single, I came here almost every night to watch the ball games," said

John Gurda, a geographer and writer. "The night Sonja and I became engaged, we celebrated here, and when our son was born, one of the first people I called from the hospital was Bill."

The conviviality begins at the breweries. Milwaukee's beer barons were traditionally an outgoing, merry group, and so at least one of them seems today.

"Hi there. How'ya doing?" said August Pabst, vice president of quality assurance at Pabst and great-grandson of Capt. Frederick Pabst, who gave his name to the brew.

"Morning, Mr. Pabst," said two brewery workers as they passed him.

"Hi! And, how are *you?*" said Augie to a hostess in the brewery's hospitality tavern.

"Just fine. Fine, Mr. Pabst," she said.

When he was a young man, racing, not brewing, occupied Augie's mind. He won the U. S. Auto Club's road-racing title in 1959. On a bet, he once drove an expensive car into a swimming pool.

Now 46 and settled into his third marriage and his grandfather's imposing 35-room stone mansion in Oconomowoc, west of Milwaukee, Augie is spending more time at the office than at his garage with 15 vintage cars. Yet few industry observers believe that August Pabst, the Uihleins of Schlitz, or the Miller family will ever be at the helms of Milwaukee's great breweries again.

Pabst is the favorite beer in Milwaukee, and Pabst's cheerful brewmaster, Joseph Muehl, offered to show me why.

Muehl led me to one of the fermenting rooms—a cool, dark, damp cellar with long rows of large orange tanks filled with brewers' yeast and a barley malt mixture called wort. The yeast devours the sugars in the mixture, producing alcohol and happily transforming the wort into beer.

"This is the critical stage," said Muehl. "Here is where 80 to 90 percent of the beer's flavor characteristics are developed. We use a special strain of Carlsburg yeast, which gives our beer a slightly winy taste. We also let the yeast set its own pace. It can take anywhere from seven to ten days for the yeast to act on most of the sugars in the wort."

Technical advances can make equipment obsolete every 10 to 12 years. The brewmasters now take their cues from computers and marketing departments. In 1970 Philip Morris Inc. bought Miller Brewing, and other outside companies have eyed both Schlitz and Pabst.

Some Milwaukee businessmen have sold their firms and moved out of state because of high inheritance taxes. The standing boardroom joke is: "Wisconsin is a great place to live—but I wouldn't want to die there."

Rising water rates may soon be another problem. A federal court has ordered Milwaukee to install a new 1.6-billion-dollar

Opening up *careers in dental hygiene, the Milwaukee Area Technical College also offers more than 150 other programs, from child care to bricklaying to photography, for more than 68,000 full- or part-time students each year.*

sewer system to help clean up Lake Michigan. The cost must be borne by businesses as well as homeowners and may even threaten the city's envied triple-A bond rating.

Still, the small, proud, paternalistic company has not disappeared completely from Milwaukee. Frederick Usinger, grandson of the Frankfurt sausage maker, permits his 150 employees two sausage breaks a day, at 9:45 a.m. and noon, and they consume nearly six tons of free sausage a year.

My stomach was not quite awake one morning when the parade of sausages began in one of the four company dining rooms—a steaming hot bratwurst, knockwurst, Thueringer blood sausage, some mortadella with Sicilian pistachio nuts, headcheese (the frugal Germans throw in everything on the pig from the neck up), a yachtwurst with "just a touch of garlic," and a Hessische landleberwurst, a delicious liver pâté.

I noticed that Frederick Usinger had not taken the shape of a sausage after 45 years of these breakfasts.

"Ah, the secret is to eat sausage without bread," he said.

Singing Mayor in Tune With City

Sausages and beer are part of Milwaukee festivities, particularly on the Fourth of July, when families flock to the green county parks. There are softball games and high-school band concerts, and Mayor Henry W. Maier usually stops by to say a few reassuring words about the state of the city.

"Our city has a triple-A bond rating because of YOU, you the citizens, you have assumed responsibility for the city," he said. "Let's give you a hand. [He applauded.] I bet that's the first time you've had a hand?

"Will you sing 'God Bless America' with me? The country is not everything we want it to be, but it is better than most."

Slightly off key, the mayor sang "God Bless America," followed by a German folk song, "Du, Du Liegst Mir Im Herzen." Several couples began to dance on the edge of the crowd.

Henry Maier follows a tradition of singing mayors in the city. Milwaukeeans also esteem a politician like County Executive William O'Donnell, a former brewery worker, who walks to work and sometimes carries his lunch in a bag. Some say O'Donnell's style—deliberate, conservative, practical—is also Milwaukee's.

Once Milwaukeeans are sold on a politician, they keep electing him. A south-side congressman for more than 30 years, Clement Zablocki pushed hard for continued participation in the Vietnam War and later became chairman of the powerful House Foreign Affairs Committee. Representative Henry Reuss from the north side presides over the Banking, Finance, and Urban

"You don't get ulcers here," *says George Reedy, former press secretary to President Lyndon B. Johnson and now a professor of journalism at Marquette. "The weather's kind of fierce, but this is the warmest city in the United States."*

Affairs Committee of the House. Together with Senators Gaylord Nelson and William Proxmire, Reuss represents Wisconsin's more progressive Democratic tradition.

Milwaukee is one of the few cities in the country to have been governed by Socialist mayors. In the 1870s a branch of Karl Marx's International Workingmen's Association was founded here. The Socialists pressed for measures that hardly seem radical today, such as municipal ownership of utilities, an eight-hour workday, free medical and legal services to the needy, graduated taxation of individuals and corporations, and condemnation of slums.

I visited Frank Zeidler, Milwaukee's previous mayor and Socialist Party presidential candidate in 1976, at his modest Second Street duplex (page 183).

A serious, soft-spoken man who lives in baggy blue suits and picks up litter on the street when it catches his eye, Zeidler summed up the contributions of the Socialists: "We helped pass social security and workmen's compensation legislation. And we basically established Milwaukee's reputation for good municipal government."

Fearful that the police department would become a puppet of the mayor, Milwaukee began appointing police chiefs for life in 1885. The pendulum swung the other way; the incumbent chief, controversial and tough-minded Harold Breier, often ignores requests from the Fire and Police Commission. Not until 1971, in the wake of earlier civil-rights disturbances, was the city's first formal hearing held on a police-brutality charge. In 1978 Milwaukee's blacks took part in the fight to require reappointment every seven years for Breier's successors.

Business Community Leads the Way

The city has been traditionally tightfisted, even where its own redevelopment is concerned, and by 1948 the business community took matters into its own hands. About 150 business, labor, and professional leaders formed the Greater Milwaukee Committee, which spearheaded the building of an expressway network, sports arena, county stadium, zoo, war memorial, and performing arts center. Current projects, supported by the city and county, include the new Hyatt hotel, a downtown shopping mall, and a lakefront development plan.

"It is in our interest that the downtown doesn't turn into a slum," said I. A. Rader, chairman of Allen-Bradley, which invested $250,000 in the shopping mall.

The strong sense of civic responsibility even affects Milwaukee's small but vocal duck population. The businessmen apparently see no conflict of interest in enjoying duck hunting outside the city while making things more comfortable for waterfowl

Milwaukee's mettle *forged leaders in American heavy industry. Gears at the Bucyrus-Erie Company* ***(above)*** *will help move huge draglines. The personal touch persists at the factory of family-owned Usinger's Famous Sausage* ***(opposite)****, purveyor of 75 handmade varieties shipped to every state.*

*"**Suds City**" might be another name for the nation's beer capital. Original copper kettles at Pabst's brewhouse (**above**) produce Milwaukee's favorite brand.*

*Camaraderie flows with the drafts at ubiquitous neighborhood bars like Neal and Sharon Ward's Orchard Inn (**right**). Kids get soda pop and candy; whole families get the benefit of picnics, sports outings, and tournaments organized by the Wards. "They're wonderful to us," says one regular. "They make an atmosphere where everybody gets along."*

inside city limits. The late industrialist Herman W. Falk installed an air-bubbling system at his own expense to de-ice Juneau Park's duck pond so that the ducks could stay through Milwaukee's harsh winters.

While Milwaukee has all the charms of a small town—quiet neighborhoods, a strong sense of civic responsibility, a concern for strangers—it has some of the drawbacks as well. Insularity is one.

After living in the city for many weeks, I realized that there are still three Milwaukees. Now boundaries are social and economic. The east side of the city is the home of

professionals and academics from the nearby University of Wisconsin-Milwaukee; sections of the north and west have been left increasingly to the poor and to Milwaukee's estimated 140,000 blacks; and the south side is predominantly white working class. Such separation breeds fear.

During the long summer of 1967 Father James Groppi led marches for open housing into the south side. The white Catholic priest, with hundreds of blacks behind him, walked across the 16th Street Viaduct, dubbed the "longest bridge in the world" because it separated "Poland and Africa."

Milwaukee passed an open-housing law in 1968, after a stiff national law was signed. Twelve years later the city still has few truly integrated neighborhoods. The unemployment rate among blacks is one of the highest in the country, 17 percent overall and even higher for black youths. Although Milwaukee's school-desegregation suit was finally settled, there were disruptions at outlying city high schools last year. Black students, who were bused from the inner city, felt they were the ones bearing the burden of integration.

"There have been improvements for some

blacks," said Groppi, holding his baby daughter in his arms. In 1976 he married Peg Rozga, an English teacher. "But the potential is still there for Milwaukee to become another Detroit. . . ."

Groppi trailed off. Little Anna Georgina was restless. His words seemed to lack the fervor they once had. There was a softness in his eyes. Stripped of his parish, Groppi drives a bus while he considers a future in the Episcopal ministry. The inner city too is quieter now.

But not inactive. Building crews had been working in the Sherman Park area for months. Today the hammering and the clamoring came from Johnson and Rose Stroud's duplex house on North 26th Street, where I found Annette Evans plastering a bathroom ceiling.

"I'm not trying to compete with men," said the young woman, who hopes to become an apprentice in the painters' union. "I just like to make things pretty."

She was one of three would-be apprentices repairing the Strouds' house to bring it into compliance with the city's building

Sidewalks blossom *with vendors and open-air cafés when Milwaukee greets summer with a hug. Winters are long in the city by the lake—a price worth paying, most citizens agree, for the pleasure of living in their city.*

codes, as part of a Sherman Park Community Association project. The project seeks not only to introduce women and minorities to the building trades but also to save deteriorating houses that the city would eventually have to condemn and tear down.

Sherman Park put a new rain gutter on the Strouds' house and new flooring on the back porch. In three years the community group has repaired nearly 200 homes on the north side.

"People feel proud now. And this has made a big difference in our neighborhood," said Stroud, a retired factory worker.

Frustrated by lame redevelopment efforts, city neighborhoods, like big business, turned inward for help. Community groups, such as Sherman Park and the East Side Housing Action Coalition, and dozens of block clubs banded together ten years ago to raise funds and save their dying neighborhoods. Some say the inner city is lost. Others, like Mrs. Lula Chambers, community organizer, are more optimistic.

Three Generations of Pride and Promise

"Com'on into the kitchen, child, and have something to eat!"

Only a saint could have resisted the smell of Lula Chambers's fried chicken. Since I had been eating my way through this city anyway, why stop now?

"We eat good, and we don't owe nobody nothing," said Mrs. Chambers, who lives in a comfortable modern brick town house not far from the Strouds. She raised her seven children, mostly alone, working as a punch-press operator in a steel mill.

She handed me a full plate of chicken and fried green tomatoes, and I joined three of her daughters, Gershia, Tyler, and Bama, all in their 20s, at the kitchen table.

"One thing mother always said to us when we were young," said Bama. "'If you don't go to school, you're going to be at the end of the parade, sweeping the streets.'"

All of them went to college, and now hold good jobs and drive their own cars. Gershia, married to a health-department worker, has two children in private school.

"I think this is a good place to raise a family," said Gershia, whose 7-year-old daughter tugged at her arm for a piece of caramel apple. "I see Milwaukee improving for blacks, and I want my children to be a part of it. Here you go. . . ."

She handed her daughter a whole apple, dripping with hot caramel, and the little girl's eyes opened wide. □

Man's Eighty Centuries in Veracruz

By S. JEFFREY K. WILKERSON
ROBERT S. PEABODY FOUNDATION FOR ARCHAEOLOGY, ANDOVER, MASSACHUSETTS

Photographs by DAVID HISER
Paintings by RICHARD SCHLECHT

"WOULD YOU LET US HAVE some cigars to take hunting with us tonight?"

There was anxious urgency in the request. My Totonac assistants stood with me in the firelight of our night camp. Flames reflected on our faces and on the dense foliage of the rain-forest canopy.

Cigars? I had never seen my Indian helpers smoke them.

At our field camp in the state of Veracruz, in southeastern Mexico, I had been working up my notes on a 900-year-old Huastec temple we were excavating. Called back to what seemed purely mortal matters, I handed each man a cigar. They lighted up and vanished into the moonless forest. But the thought persisted—why cigars?

Later, as the hunters returned, one cried an alarm; not thirty feet from the campfire he had nearly stepped on a deadly fer-de-lance. I asked why they had wanted cigars for their foray in the forest. With a casual shrug, one said, "So the *duendes* of the night would not harm us."

The explanation stunned me. My Totonac co-worker had—unknowingly—referred to a mythological belief perhaps a thousand years older than the temple we were excavating.

In the ancient Maya Book of Counsel, the *Popol Vuh*, a collection of pre-Columbian beliefs and histories written down in early 16th-century Guatemala, two hero brothers descend into an underworld ruled by deities called Lords of the Night. As one of a series of supposedly impossible tasks, where failure meant death by sacrifice, the Hero

Following ancient lifeways, *Totonac Indians of Mexico's state of Veracruz plant a hillside in maize. Behind them rise the stately ruins of El Tajín, a metropolis built by Maya-related Huastec people. It flourished between A.D. 300 and 1100. A 15th-century Indian map of conquest* (**right**) *depicts part of the Gulf coast area, a region prized for its rich resources since pre-Columbian times.*

Twins had to keep cigars lighted through a night and return them intact next morning. Helpful fireflies, placed on the tips, tricked the malevolent lords, or duendes, into believing the cigars were burning continuously. Thus the two young Maya defeated the powerful deities.

Now, in July of 1974, my assistants were calling on the same protective powers that had been invoked hundreds, perhaps thousands, of years earlier. Their sudden encounter with the venomous snake, without being bitten, simply reinforced their belief that the cigars—once more—had proved their worth.

Customs Withstand Time's Passage

In Veracruz, during nearly two decades of research, I have come to realize the deep indebtedness of the present to the past. Even today, and usually unconsciously, the people of this richly favored state adhere to many customs and traditions that echo ancient ways. Their lives culminate an eighty-century continuum of human experience.

In our understanding of Mesoamerican civilizations, between the well-known cultures of the Maya and of highland Mexico, the Gulf coast of Veracruz had remained a gray area of scattered knowledge. A multidisciplinary scientific effort over the past 12 years has sought to fill in the gaps. We have traced the evolutionary chronology of Veracruz from an early hunting and gathering era through a remarkably artistic civilization known as El Tajín, and beyond that society's demise to Spanish conquest and the present-day synthesis of Indian and European cultures.

Blessed in the vitality and diversity of its peoples, Veracruz profits also from fertile soils, abundant rainfall, a 450-mile-long seacoast with harbors and excellent fishing, and—for a gilt edge on its certificate of assets—significant reserves of oil and natural gas. From the narrow coastal plain the land rises steeply through diverse ecological zones to glacier-capped Orizaba, at 18,700 feet the third highest mountain in North America, after Mount McKinley and Mount Logan. A few score miles separate tropical shores from the dry, high plateau of central Mexico west of the Sierra Madre Oriental.

Cortés gave the name La Villa Rica de la Vera Cruz (Rich Villa of the True Cross) to the town he founded during Easter week in 1519. From that first formal European settlement on the New World mainland, Cortés marched inland with his Spanish adventurers and Indian allies to conquer Aztec Mexico. Thus began the slow merging of Renaissance Europe and aboriginal America.

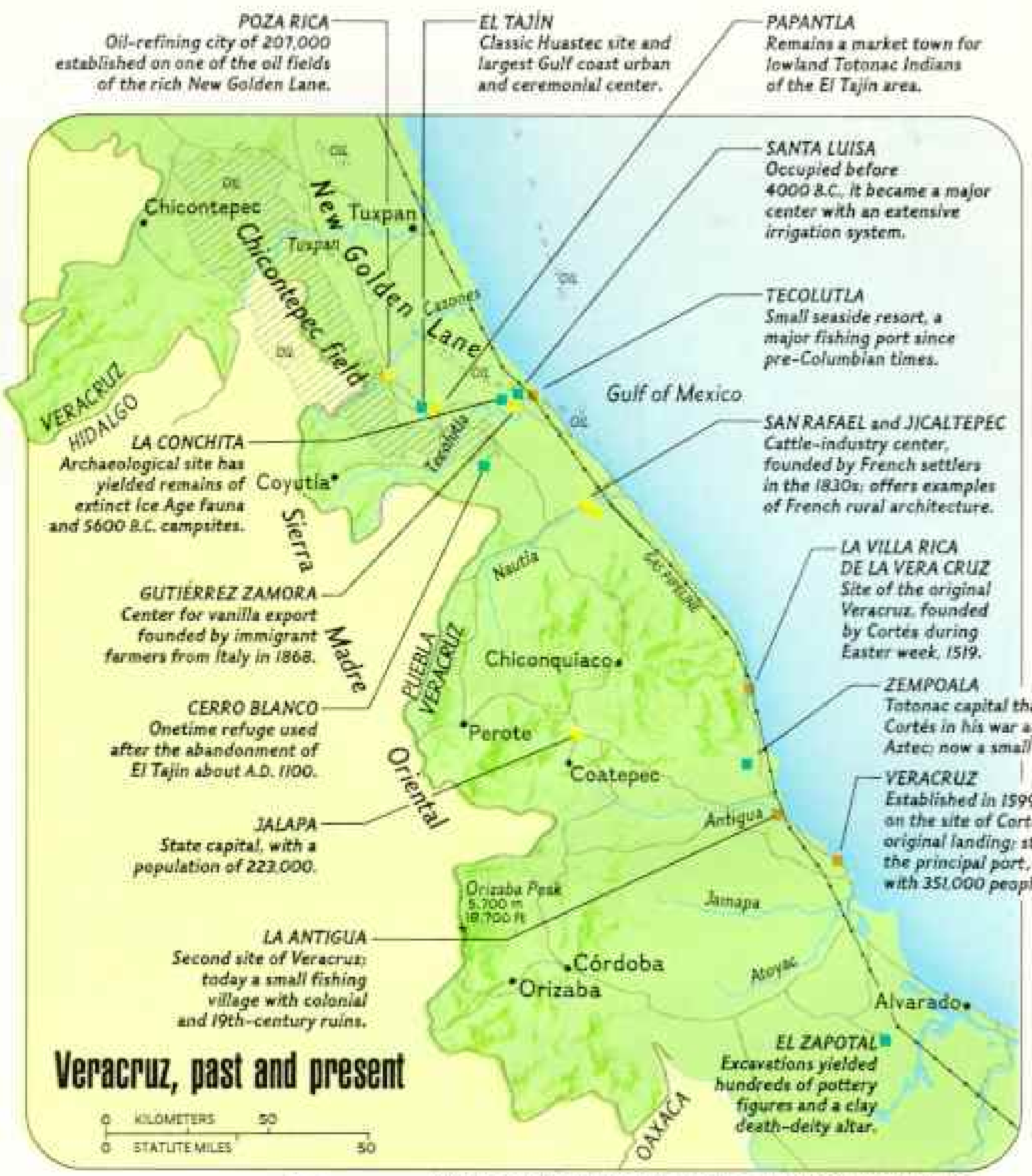
Veracruz—city and region—prospered. Commerce, ranching, fishing, and sugarcane production contributed first to the colonial and then to the Mexican economy.

The preeminent modern resources are, of course, oil and natural gas. In northern Veracruz alone, the Chicontepec area holds almost 15 percent of Mexico's estimated reserves. I remember, in the early sixties, driving from the state capital of Jalapa to the Totonac market town of Papantla. Riding the ferry across the Tecolutla River after dark, I stood transfixed at the rail. Upstream the sky, heavy with clouds, pulsated with color. It glowed red to pink, reflecting the burn-off of gas in oil fields known as the New Golden Lane. The scene was surrealistic—spellbinding.

We chugged past clusters of dugout canoes from which local fishermen cast their nets on the changing tide. In the channel, porpoises leaped as if in some aquatic celebration. Fragments of the popular folk music known as *los sones* wafted from the far shore. Harp and guitar in some small restaurant sent out these strains, which wove a graceful counterpoint to the visual drama of man's superscribed technology.

Riches not of the present but of the past first drew me to Veracruz. In 1963 I met Professor José García Payón of the National Institute of Anthropology and History in Mexico City. Professor Garciá Payón spent nearly four decades uncovering the great site of El Tajín, a city that flourished from approximately A.D. 300 to 1100. It remains today the architectural centerpiece of Veracruz's rediscovered antiquities.

Beginning in 1939, Professor Garciá Payón peeled back the jungle from building after building of this most important ancient lowland metropolis north of the Maya region of southern Mexico. El Tajín and its distinctive culture formed a strategic bridge between the *(Continued on page 213)*



DRAWN BY JOHN WEBER, COMPILED BY ROSS M. EMERSON NATIONAL GEOGRAPHIC ART DIVISION

Pre-Columbian

Archaeological finds establish a human presence in the Veracruz area as early as 5600 B.C. Through time, Huastec, Olmec, and others lived on the coastal plain, a major thoroughfare for migration and trade. The Totonac were residents when the Spanish conquistadores arrived in 1519.

Colonial 1519-1821

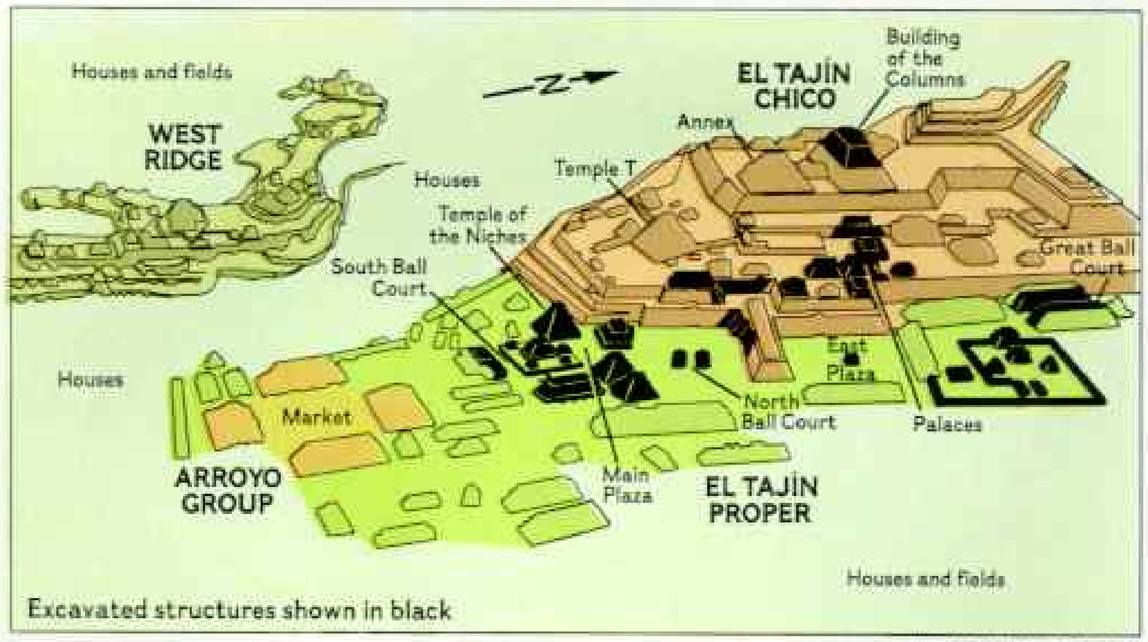
Rebellious Totonac aided Hernán Cortés on his whirlwind march of conquest of their Aztec overlords. Cortés founded the first Spanish town on the American mainland at La Villa Rica de la Vera Cruz. Twice it changed location, but Veracruz remained Mexico's principal eastern port.

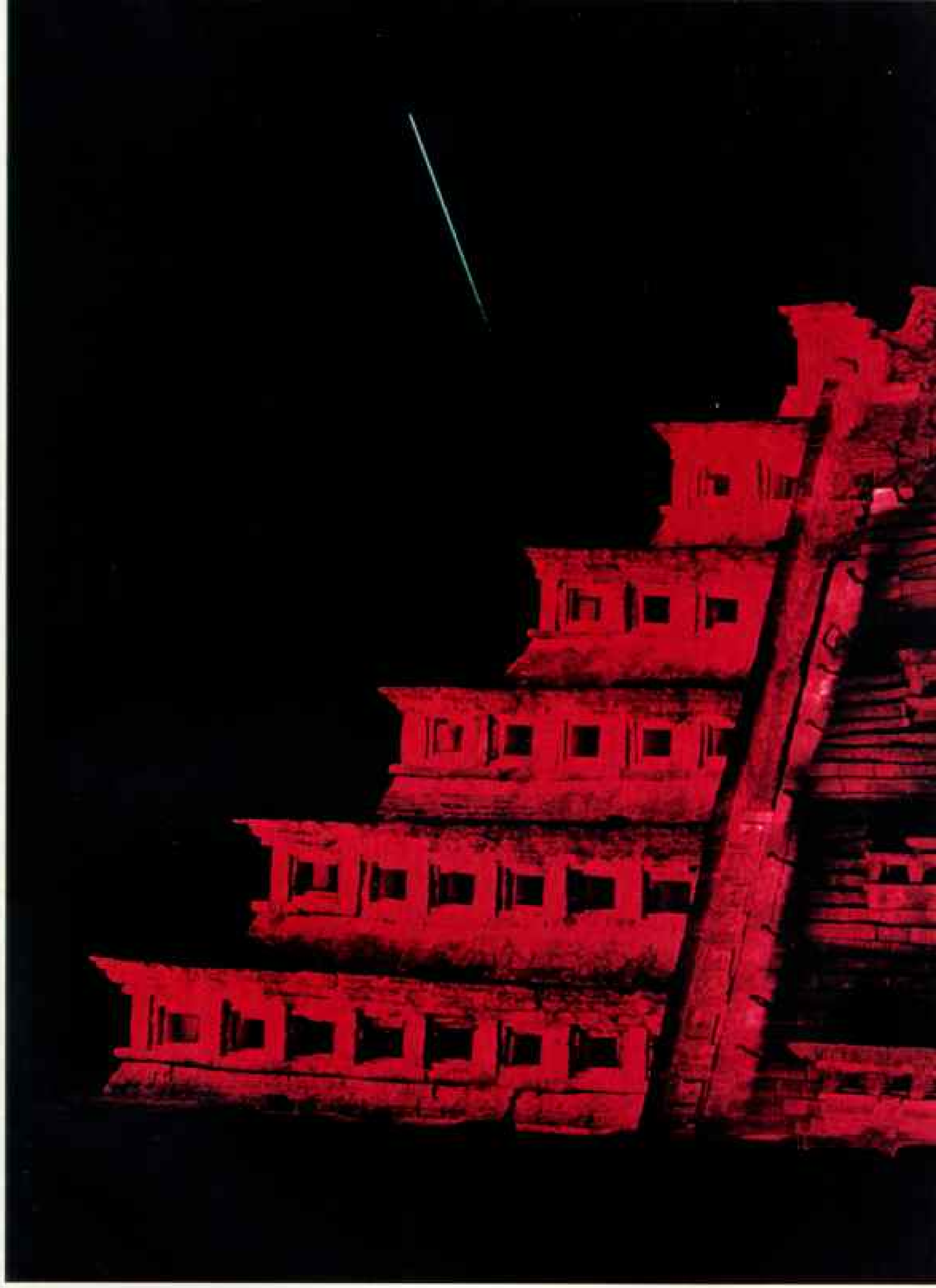
Modern 1821-1980

its native population virtually depleted by European-introduced diseases, Veracruz welcomed immigration by French and Italian farmers. The value of today's thriving agriculture is exceeded only by immense oil reserves, estimated at 10 billion barrels in the Chicontepec area alone.

Like birds in effortless flight, *four traditional Totonac voladores —fliers—descend in graceful spirals as they unwind ropes from a 100-foot pole at El Tajín. Their motion makes a wooden capstan slowly turn atop the pole, where an accompanist plays flute and drum.*

Pulsing with life, *El Tajín stands in splendor in a re-creation by artist Richard Schlecht* ***(foldout)****. Although only a tenth of the ruins have been excavated, enough is known of the 2,550-acre site to portray the teeming metropolis. People congregate in the Main Plaza* ***(diagram below)*** *at the foot of the Temple of the Niches, while others gather to watch ritual ball games in the South and North Ball Courts. Smoke from incense and burnt offerings rises from temple-pyramids within El Tajín, while on the outskirts fires clear land for the planting of maize. Awnings roof sellers' stalls in a bustling market that overflows from the plaza of the Arroyo Group. On the hill of Tajín Chico, the Building of the Columns dominates temples and palaces. Aristocrats' palaces also surmount the West Ridge, below which are scattered the thatch-roofed houses of common citizens.*





Ablaze in the tropic night, *El Tajín's Temple of the Niches gleams blood red —a color symbolizing life to its builders. Special lighting in this time exposure recaptures the building's original appearance. Traces of red, black, and blue*

paint, and even of exterior murals, remain on some of El Tajín's buildings. The tiered pyramid, with its 365 niches, epitomizes the Tajín style of architecture, one that makes use of light-shadow contrasts to create a powerful dramatic effect.

(Continued from page 204) civilizations of the Maya and of central Mexico.

In a cooperative effort with Professor Garciá Payón, who died in 1977, I undertook a long-term search for the cultural origins of El Tajín. As it turned out, the great metropolis itself yielded little of earlier, formative-period remains.

More than nine-tenths of the El Tajín structures, stretching over 2,550 acres, still have not been excavated. But finds beyond the periphery of the site now have taught us a great deal about the 6,000-year human history that produced this cultural apogee.

El Tajín lies 25 miles inland on a tributary of the Tecolutla River, which empties into the Gulf of Mexico through mangrove-tangled banks. I began my research by examining the Tecolutla Valley and adjoining areas. My base, nine miles up the Tecolutla, was the town of Gutiérrez Zamora, an enclave of Italian families whose 19th-century immigration to this land testifies to the ageless appeal of Veracruz.

Reconnoitering the alluvial terraces between El Tajín and the sea, I decided that I needed to excavate on a cattle ranch that was strewn with temple mounds and ancient living areas at a place called Santa Luisa. The rancher, however, politely but firmly denied us permission to dig.

Next day I had to cross a remote portion of the Santa Luisa Ranch to reach another possible site. Driving past a corral where cowboys were cutting out calves, I saw a zebu cow, infuriated at the separation from her calf, rip a heavy gate off its hinges. After running about fifty feet with the gate still on her horns, the cow stumbled and fell with her neck bent over her body. I ran to the scene as the cowboys rushed up. The foreman declared the animal's neck broken.

Raised on a horse farm and familiar with animals, I suspected the cow could be saved. The ranch hands were amused when I grabbed a machete and hammer and began hacking at the hard *zapote* wood of the gate. Just as I freed the horns, the rancher drove up. The animal jumped up and ambled off.

The foreman explained the disturbance and the owner remarked, somewhat testily, "That is one of my prize cows."

Later that day I enjoyed a splendid steak dinner at the ranch house. The following morning we began a test trench on the ranch. From it emerged the first major evidence of the long-sought cultural precursors of El Tajín.

Santa Luisa: Key to the Past

The Santa Luisa site, eventually found to extend over four square miles, took us back step by step to the very earliest confirmed human occupancy in Veracruz. The site was our key to reading the record of Mesoamerican history in these warm coastal lowlands of Mexico.

Our initial excavation yielded house remains and living debris from about 300 B.C. More trenches the following season produced abundant artifacts as unexpectedly old as 2900 B.C.

Beginning in 1973, with support from the National Geographic Society and with the permission of Mexico's National Institute of Anthropology and History, we broadened our search and methodology. Now our research format included engineering, oral history, ethnohistory, zoology, paleontology, sedimentology, and mineralogical and chemical geology. All this intensive work could not have succeeded, however, without the cooperation of the Institute of Anthropology of the University of Veracruz, and its director, Alfonso Medellín Zenil.

How far back from modern Veracruz could we trace human presence? Twenty feet down in a large trench at a nearby site called La Conchita, we uncovered skeletal fragments of extinct mammals: mastodon, glyptodont, giant ground sloth, and horse from the end of the Pleistocene epoch, some 12,000 to 14,000 years ago. Although at those levels we found no positive proof of human presence, three feet above we encountered fire pits and broken tools from

Courage and confidence *show on the faces of voladores resting before a performance at El Tajín. The hazardous aerial ballet, a ritual more than a thousand years old, calls for superb teamwork and timing, the product of constant practice. Voladores earn the respect of their peers, and occasional contributions.*

campsites used by early Indian hunters about 5600 B.C.

Plentiful natural resources kept drawing people to these coastal locations. At Santa Luisa, coming forward chronologically, we unearthed portions of a small village on an ancient island. Artifacts and radiocarbon dates showed us that the people lived there between 4100 and 2400 B.C. They were successful hunters and gatherers who used canoes and collected abundant fish, shellfish, and fruits in addition to hunting game. The find was critical, because it suggested that here in coastal Veracruz agriculture was not—as it usually is—essential to initiating the sedentary way of life, the first prerequisite for building a civilization.

Then, in what had been another island village, inhabited between 1700 and 1000 B.C., other significant artifacts were found. Here we found burnt-clay floors—made by baking packed clay with hot brush fires. Some dwellings had burials beneath the floors, deep hearths, and the Gulf coast's earliest ceramic vessels. We also encountered the oldest figurines—in jaguar and human forms—yet found in coastal Mexico.

The presence of ceramic grater bowls suggested a diet supplemented by growing and preparing plants such as chilies and tomatoes. Numerous obsidian chips excavated in house areas may have been used for preparing root crops such as manioc. The occurrence of grinding tools and the decrease in chips toward 1000 B.C. imply the cultivation of maize. Of immense importance in Mesoamerican civilization, the introduction of corn brought the lowlands into line with the long-established agricultural pattern of highland Mexico.

Hunting and gathering continued to be important though. In deep middens I found evidence that shellfish such as oysters and marsh clams were still consumed in large quantities. The shellfish population gradually declined from overharvesting and silt deposition in the estuaries. Studying the faunal remains, my colleague Elizabeth Wing showed that people also ate deer, monkey, catfish, and, for the first time, dog—later a Mesoamerican protein staple.

Toward a Time of Flowering

The pace of change, we found, quickened about 1150 B.C. At that time the dynamic and powerful Olmec people of southern Mexico spread their influence in the region. The Olmec may have been responsible for extending and emphasizing the intensive cultivation of corn in the lowlands.

Probably never present in great numbers, the Olmec nevertheless provided a dramatic stimulus. My research shows the emergence, following the brief Olmec impulse, of a strong regional culture, ethnically Huastec. Villages became towns, and population increase brought social complexity and commerce—the beginnings of a sophisticated civilization. In the first few centuries A.D., El Tajín emerged as a major administrative and religious complex. Its location in a sharp valley in the mountains between two major rivers allowed it to dominate nearby rich alluvial plains and to control trade. The stage was now set for the flowering of a culture.

Day after day I have walked among the massive mounds, vine-covered forests, farmers' fields, and Totonac house compounds that now cover the vast site of El Tajín. The sense of sacredness is pervasive in this ancient shrine, with its elaborate architecture and aura of splendor. One is led to

Luck of a fisherman *diving for octopus off Veracruz led to treasure from the Spanish conquest. Nine pounds of gold—including an armlet and a pendant and miniature shield decorated with tinklers (**right**)—were recovered from the Gulf of Mexico in 1976. The Spanish melted into ingots (**left**) much of the gold jewelry they looted; this one bears an assayer's symbol indicating a bit more than 20-karat purity.*

Workers lay bare *a 14,000-year-old past in a pit* (**below**) *that yielded bones of extinct Ice Age mammals at La Conchita. Earlier they had found the remains of fires used by hunters almost 8,000 years ago. A harpy eagle* (**above**) *with eyes of bone and obsidian accompanied a buried Huastec nobleman found at another dig nearby.*

S. JEFFREY K. WILKERSON (BELOW)

ponder the nature of the mighty rulers who held sway here by faith, hereditary right, and sheer force.

Weighing the archaeological and ethnohistorical evidence, I am convinced that El Tajín's people were of Huastec stock, cousins of the Maya. But today the ruined city is in possession of the Totonac, who consider it to have been built in the time of their "grandfathers," and still to be the abode of powerful, sacred forces. The Totonac work daily in the cornfields round about El Tajín, shun it at night—and help the archaeologist reconstruct the city's former grandeur.

Research suggests that El Tajín grew rapidly into an immense metropolitan center; its inhabitants counted in the thousands. During the 800 to 900 years that it flourished, its people erected hundreds of buildings of native sandstone—temples, two-storied palaces, numerous ball courts, huge retaining walls, defensive terraces, and countless houses (page 206-208).

El Tajín developed its own architectural style. Buildings were designed and aligned as individual units, sharply different from the rigid grid pattern of highland cities. The trademark of El Tajín's builders was flying cornices—triangular overhangs—and windowlike niches or recessed panels in vertical walls of the pyramidal structures. Buildings were painted—red, black, and blue—and some bore exterior murals. In use of poured concrete, says my engineer colleague David Hyman, El Tajín's builders excelled at techniques remarkably similar to today's.

The unique art style was intricate and ornate. Almost all sculpture served an architectural function. Artists were obsessed with filling panels and columns with detail as well as with narrative scenes. Major subjects were the deities of rain and wind who dwelt in an underworld and had to be propitiated. Reliefs document the belief that sacrificial death in the ball court, attended by the ritual use of the fermented drink pulque, afforded access to the gods.

In the heart of El Tajín rises the Temple of the Niches (pages 210-11), a shrine to the rain and wind deities, the focus of Tajín religion. The top of the temple originally displayed tablets framed by grotesque serpent-dragons. The tablets portrayed closely related gods (perhaps variations of the same

divinity), a cacao-cult ritual, a ball-court decapitation, and other events.

Buildings and artifacts at numerous sites show that El Tajín's power reached across a broad area of central Veracruz and into the neighboring highlands. Some large subordinate communities, like those at Santa Luisa, Santa Elena, and San Rafael, probably paid tribute in crops to the metropolis as well as traded with it.

Near Santa Luisa we unearthed large-scale irrigation works and hillside farming terraces, evidence of sophisticated engineering and intensive cultivation of such crops as corn, cotton, beans, and cacao. Through overflights and infrared photography I could pick out ancient irrigation ditches and canals. Skilled builders from A.D. 300 to 1000 diverted freshwater tributaries onto fertile terraces between tidal rivers and brackish estuaries. Projects of such scope bespeak the power of rulers at El Tajín, men who could command the resources of an entire region and control its large population.

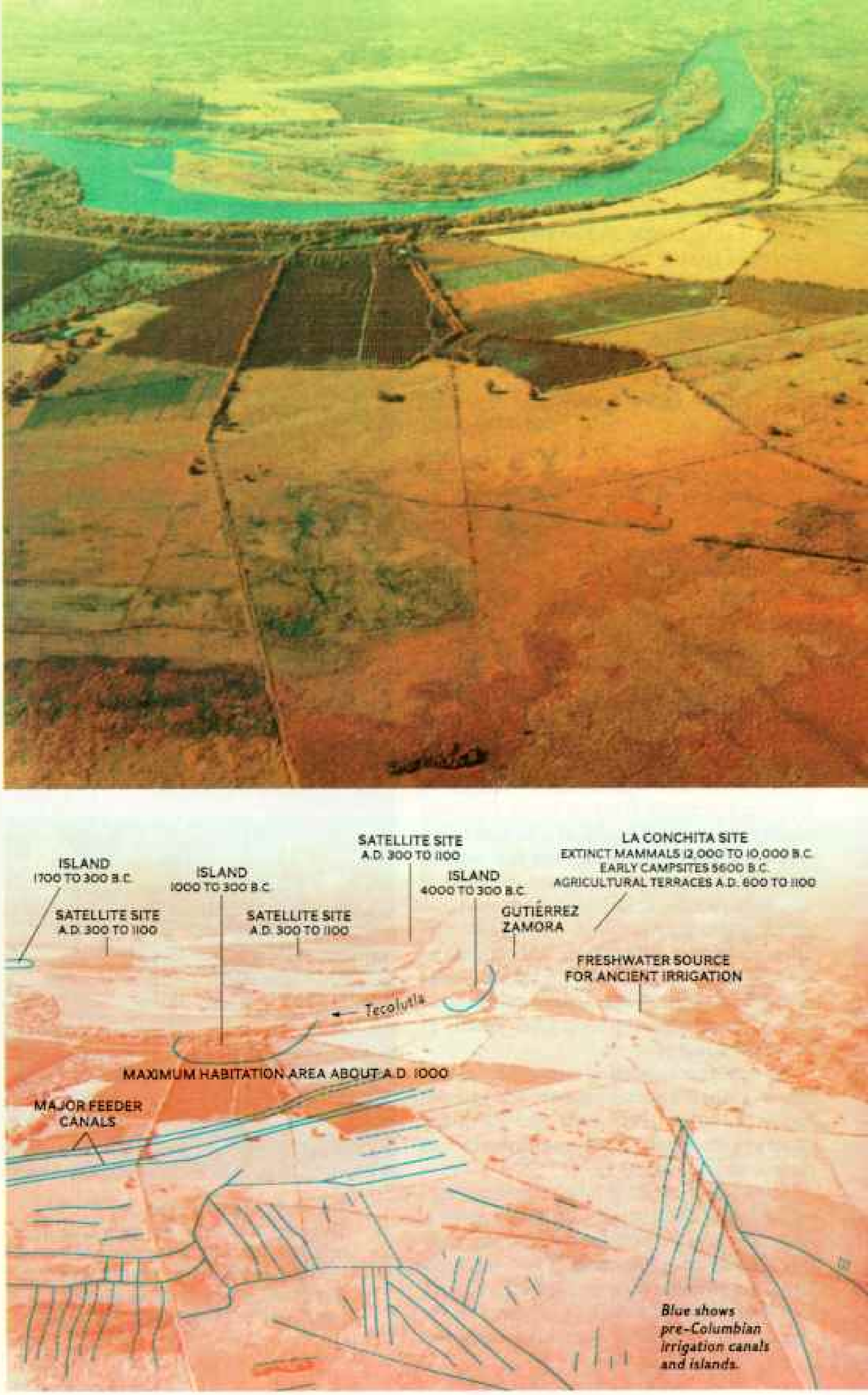
Evidence Points to Human Sacrifice

The cult objects and scenes of sacrifice depicted in the elaborate sculptures of El Tajín are sometimes verified at other sites. At Santa Luisa my Mexican colleague Ponciano Ortiz and I unearthed, beneath a thousand-year-old floor of burnt clay and plaster, an unusual burial of a human adult sprawled facedown, hands and feet askew. About the body had been strewn offerings of dog teeth, turtle-shell rattles, fragments of a grinding stone, a jade bead, and a pyrite earplug, all broken as if to release the spirits of the objects. The attitude of the skeleton suggested that the individual had been dropped into a prepared grave soon after death, or perhaps even alive.

Circumstances pointed to a sacrificial victim or, rather, an attendant for the journey to the hereafter. But where was the high-ranking person whose status and death had occasioned the sacrifice?

The answer was not long in coming. Below a cap of small stones we encountered a large inverted ceramic vessel directly over the head of an adult male. The dead man had been placed in a flexed, seated position, a jade bead in his mouth, a pendant on his chest, and red ocher sprinkled over the

Spanning 3,000 years, *clay figurines from Santa Luisa trace the evolution of a local style and a growing artistic and technical refinement. Shaped by hand until about A.D. 300, the heads were often made in molds thereafter.*


ISLAND
1700 TO 300 B.C.
SATELLITE SITE
A.D. 300 TO 1100
ISLAND
1000 TO 300 B.C.
SATELLITE SITE
A.D. 300 TO 1100
SATELLITE SITE
A.D. 300 TO 1100
ISLAND
4000 TO 300 B.C.
GUTIÉRREZ
ZAMORA
LA CONCHITA SITE
EXTINCT MAMMALS 12,000 TO 10,000 B.C.
EARLY CAMPSITES 5600 B.C.
AGRICULTURAL TERRACES A.D. 600 TO 1100
FRESHWATER SOURCE
FOR ANCIENT IRRIGATION
Tecolutla
MAXIMUM HABITATION AREA ABOUT A.D. 1000
MAJOR FEEDER
CANALS
Blue shows
pre-Columbian
irrigation canals
and islands.

B. JEFFREY R. WILKERSON

Ghosts of ancient waterways, *exposed by aerial infrared photography* ***(above)****, disclosed the secret of a long-ago people's agricultural success. Sensitive to radiation just below the visible portion of the spectrum, infrared film can detect invisible terrain features. Faint dark and light lines reveal to the skilled photo interpreter the location of old silted-over irrigation canals, later confirmed by on-the-ground surveys. The new information provided the basis for the diagram* ***(left)*** *of Santa Luisa on the Tecolutla River, 20 miles from El Tajín. The complex irrigation system enabled the people of Santa Luisa to produce an abundance of crops, such as maize, beans, squash, cotton, and cacao, sufficient not only to feed itself but also to export, probably as tribute, to its overlords at El Tajín.*

body. Probably originally wrapped in cotton fabric, the body had been placed upon a major ancient status symbol of Veracruz, an elaborately carved, U-shaped stone sculpture called a yoke. Here clearly was the type of personage, so often depicted at El Tajín, whose death and trip to the world beyond—an event of about A. D. 900 to 1000—required an attendant and the accoutrements of wealth.

Not all were buried lavishly in temples. At Santa Luisa we found children buried outside the walls of temple precincts. Frequently dogs were placed with them to guide them through the underworld labyrinth. Burials of women we almost always found beneath the clay floors of houses. Temples were reserved for the interment of men of high station.

Ball Game Ended With Death

El Tajín had at least ten ball courts, tangible remains of a very ancient Gulf coast ritual. We know that this most important religious ceremonial at El Tajín was played with a solid rubber ball, probably not more than six inches in diameter. The ball was volleyed from end to end of the court by use of hips and perhaps at times elbows, upper arms, or knees. At El Tajín the ritual was deadly serious, a player, perhaps preselected and often impersonating a god, being decapitated at the conclusion of the "game."

At El Tajín the wooden waist protectors and the stone copies of them, the yokes, were seen as symbols placing their wearers in the jaws of the earth monster at the entrance to the underworld. Not every male held the appropriate social status to play, and the outward symbols of the contest—all the paraphernalia of the ball game—became cult objects when carved in stone.

A pattern of beliefs related to drinking pulque, the fermented liquor from the maguey plant of the highlands, became central to the ball-court ceremony. The pulque-cult ritual came to supersede even the ball game itself. Propitiating the pulque god, participants quaffed the liquor to evoke visions of the afterlife and the underworld deities. One of the most splendid sequences of carvings, from the South Ball Court, depicts a sacrificed warrior, in death a semidivinity, asking the gods for pulque (page 223). The

setting is the Mountain of Foam, mythical source of pulque in the realm of the rain god.

In El Tajín's gallery of sculpture, of special concern to me have been the fragments of a set of carved columns showing the feats and activities of a great ruler called 13 Rabbit, who reigned probably in the tenth century A.D. Named in the ancient Mesoamerican fashion according to his day of birth in the 260-day Sacred Round calendar (composed of 20 rotating day names and 13 numerical prefixes), this man is recalled in elaborate scenes (right and below) showing conquest, ritual, myth reenactment, and sacrifice.

Thirteen Rabbit must have been one of the last major rulers of El Tajín. Shortly after erection of his narrative temple columns, much of the site was destroyed by invaders, among them perhaps the Totonac, and was then largely abandoned.

A City Returns to the Jungle

What became of the people of El Tajín? Seeking the answer, we found small fortified towns stretching southward, sometimes on mountaintops such as Cerro Blanco, the place where our workmen asked for cigars. These appear to be the fragmented remnants of Tajín civilization. Such sites, together with Huastec-language studies, suggest that the Tajín people migrated southward about A.D. 1000 to 1100 toward the Isthmus of Tehuantepec and the modern state of Chiapas.

El Tajín probably was never entirely vacated, but by the 15th century it seems to have become Mictlan, or "place of the dead," referred to in Indian documents. In the language of present-day Totonac, the name Tajín (or Taxim) means "lightning" or "place of the invisible beings."

Long before modern times rain forest overwhelmed temples, ball courts, and palaces. El Tajín slipped from the memory of all, save those few who lived and raised corn in small clearings and occasionally set flower and candle offerings among its ruins.

Time's toll notwithstanding, Veracruz today remains inseparable from its past. In October 1976 a Gulf coast fisherman, diving for octopus outside the port of Veracruz, noticed a flash of reflected light on the sea bottom. He retrieved a piece of yellow metal jewelry, then another, and another. Unbelieving, he took his prizes to a jeweler, who confirmed that they were gold and purchased them for melting down.

With permission of the authorities I was allowed to examine this historic trove, which was locked in a bank vault pending litigation between the state, the jeweler, and

***Stag head** identifies warrior 5 Deer, who helps hold a captive named 8 Rain.*

***Victorious** 13 Rabbit joins the procession with a defeated adversary.*

***Wearing** a fan-shaped headdress, 5 Deer appears again.*

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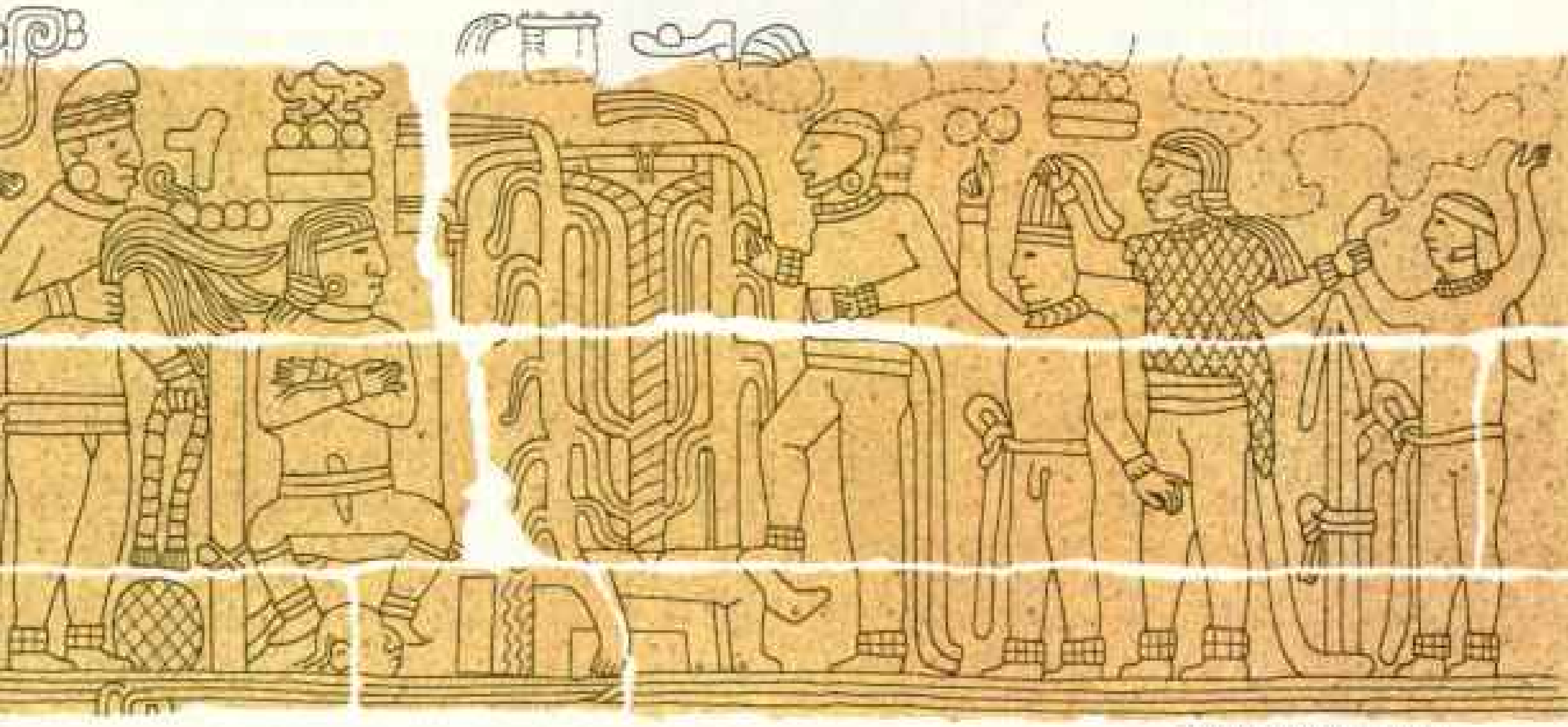
Tribute to 13 Rabbit

CARVED in timeless stone, exploits of a mighty lord adorn a building column at El Tajín. A rabbit surmounting two bars—each representing the number five—and three dots identify the man as 13 Rabbit, a name derived from his birth date in the Mesoamerican calendar. The scene appears unrolled below, with 13 Rabbit, one of El Tajín's last great rulers, flanked by a ritual parade of captors and captives who immortalize some ancient feat of arms. The vanquished appear naked, in humiliation. Blank spaces represent missing fragments of the column.



DRAWINGS BY RICHARD SCHLECHT

***Beside his** seated lord, 4 Ax holds a ritual sash above a cross-hatched game ball.*

***Decapitated** victim lies on a bench, his entrails strung upward on a frame.*

***Disdainful** victor, wearing a helmetlike hat, rests his foot on the slain victim.*

***Dressed** in a stylized jaguar skin, a warrior holds two prisoners.*

Preparing *for death, the richly garbed hero-victim receives a bundle of darts from a seated attendant.*

***Meditating** before the ordeal, he reclines while an eagle dances and musicians shake rattles and beat a drum.*

***Ball** set between them, protagonist, left, and priestly antagonist, who wields a stone knife, speak prior to the game.*

***At the moment** of sacrifice, the hero submits to ritual decapitation. A player-attendant holds his arms.*

Journey to the underworld

*RITES of sacrifice and renewal unfold under the influence of the Huastec god of pulque (**right**), a potent beverage made from the sap of the maguey, or century plant. Six scenes from the South Ball Court and one (third from right, **above**) from the Temple of the Niches at El Tajín serialize a heroic tale of human sacrifice, descent into the underworld, and the attainment of the gift of sacred pulque from the gods. The drawings above were abstracted from larger panels containing additional figures, including representations of death. The story combines two sets of rituals—the pulque cult imported from highland Mexico, where the maguey plant grows, and the ball-game ceremony so prevalent throughout Mesoamerica in pre-Columbian times. Ways of playing the ball game varied from place to place and from time to time. In one version, players, always members of the priestly or military elite, may have passed a rubber ball through a narrow stone hoop set in a ball-court wall. No such hoops have turned up in any of El Tajín's ten ball courts, and the author believes that events there had little to do with sport. Instead, they were religious ceremonies in which the "winner," chosen in advance, willingly submitted to ritual beheading after the "game." In death, this hero-victim entered the presence of the gods and from them obtained pulque for the people. The painting (**right**), based on the next-to-last panel, portrays the hero after death. Whole again, he carries a clay pot and beseeches the rain god for pulque. The god sits on a temple where a reclining deity called a Chacmool guards a vat of pulque, represented by wavelike lines. To the right of the rain god appears the wind god, seated in front of the Mountain of Foam, abloom with flowering maguey plants.*

Seven serpents *rise from the hero-victim's torso, representing his blood. The ball, now a skull, symbolizes death.*

With death *his passport to the underworld, the hero enters the presence of gods and requests a potful of sacred pulque.*

DRAWINGS BY RICHARD SCHLECHT

Giver of pulque, *the rain god performs ritual bloodletting. His essence becomes the drink, replenishing the vat.*

the fisherman. In the presence of a score of officials the box containing the treasure was opened, and wax and ink seals on the envelopes were broken.

Nine pounds of gold glowed in ornate bracelets covered with wind symbols, in effigies of turtles and of warriors in eagle headdresses, in a miniature pulque jar, serpent beads, and beaten gold disks from ear ornaments, in a miniature warrior shield embellished with teardrop tinklers (page 215), and in gleaming ingots and bars. Fifteenth- and sixteenth-century gold jewelry is very similar throughout central Mexico, but in the case of these objects, the motifs and place of recovery indicate that the objects were made here in the state of Veracruz.

Treasure Dates From Cortés's Time

I was truly awestruck, turning the warrior shield over in my hand. It bore the "crowned C" stamp, showing that it had formed part of the "royal fifth," the Spanish king's portion of the loot from Cortés's conquest. Two ingots also bore an assayer's "XX" mark (page 214). This surely was some of the earliest treasure from the conquest of Mexico, perhaps even obtained during early 1519 when Cortés arrived on the beach at Veracruz. Somehow these items had been lost overboard after the solemn process of inventorying the king's share.

As chief gateway to colonial Mexico, the city of Veracruz prospered. Two moves brought the port to its present location. Spain's maritime rivals viewed covetously the wealth of New Spain; England and France often stole whatever treasure they could by harassing Spanish ships and ports in the Gulf of Mexico and the Caribbean.

Piracy, particularly in the 16th century, often was disguised as commerce. The English merchant-freebooter John Hawkins came to Veracruz in 1568 in an attempt to "trade" slaves for coins at the point of his ships' cannon. But the Spanish counterattacked. Hawkins, his ships afire, lost his fleet and loot. Crowding some of the survivors on one small damaged vessel, he eventually made his way home to England. Imagine Hawkins's surprise to find that his kinsman, a novice master presumed lost, had beaten him home. That young captain, later known among the Spaniards as the

Goods ancient and modern *in a Totonac compound near Papantla (**facing page**) echo the contents of an Aztec tribute list from the same area (**below**). Jade beads, foreground, chili peppers, bowl at left rear, and blouselike huipils worn by the women turn up on the list—the beads in strings, the chilies bundled in matting, and the textiles bearing varied designs. The symbol for Papantla appears at the bottom of the list, third from left.*

Dragon, was Francis Drake. Elevated to the status of heroes at home, these freebooters aroused fear and hatred among the Spanish of the New World, who bore the brunt of piracy's increasing brutality.

Italians and French Add Flavor

Not all who came to Veracruz were pirates. Attracted by nature's abundance as well as by local policies encouraging immigration, settlers came from as far away as France and Italy. Population was sparse along portions of the coast after Indians suffered catastrophic loss from epidemics of smallpox and measles introduced from Europe. In fact, our excavations revealed large cemeteries from the time, and documentary evidence suggests that in some areas as much as 98 percent of the Indian population died or fled.

At Gutiérrez Zamora, founded in 1868 by Italian farmers, we were invited to a holiday repast and found a six-course feast of Italian dishes. At French-settled San Rafael and Jicaltepec, not only are the traditional cheeses and dishes encountered, but also tiled houses and barns in the 1830s style of northeastern France.

While sharing the national pride of all Mexicans, Veracruzanos display intense regional loyalty. It expresses itself in folk music, in dialect laden with double meaning—so perplexing to outsiders—and in cuisine derived from the produce of field and sea. The varied dishes hotly flavored with chilies are legend, and *huachinango a la veracruzana* (red snapper) is a gourmet delight.

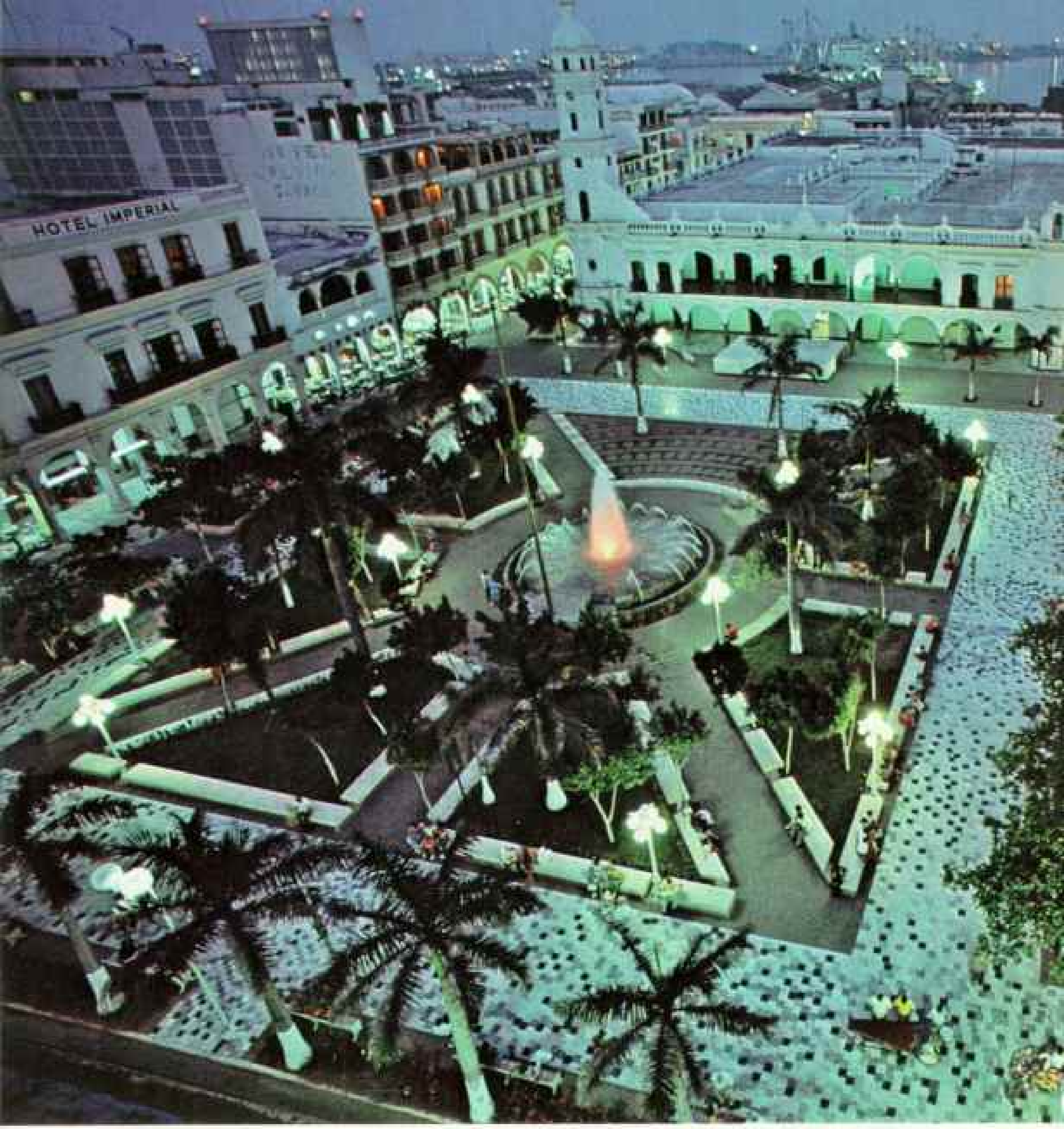
As in the times of El Tajín, agriculture in Veracruz is extensive and bountiful. The state supplies the rest of Mexico with tropical fruits, as well as corn, beans, chilies, bananas, coffee, vanilla, citrus, and beef.

The Maitret ranch in San Rafael typifies the burgeoning cattle business and produces many of Mexico's finest zebu cattle. I remember my surprise, upon being introduced to a huge 2,700-pound national-champion bull, to find that it was a timid animal that enjoyed being patted.

Today's industrial boom feeds on increasing production of oil and natural gas, a potential that has soared with the recent discovery of the immense Chicontepec reserves. A pipeline, longer than Alaska's, has

Urged by horsemen *and boat-riding cowboys, zebu cattle ford an estuary near San Rafael. The owner of the*

prizewinning herd, Clemente Maitret, is one of thousands of French-descended Veracruzanos. Many ranch houses of the region duplicate the architecture of France's rural northeast in the 1830s, when his ancestors migrated to Mexico.

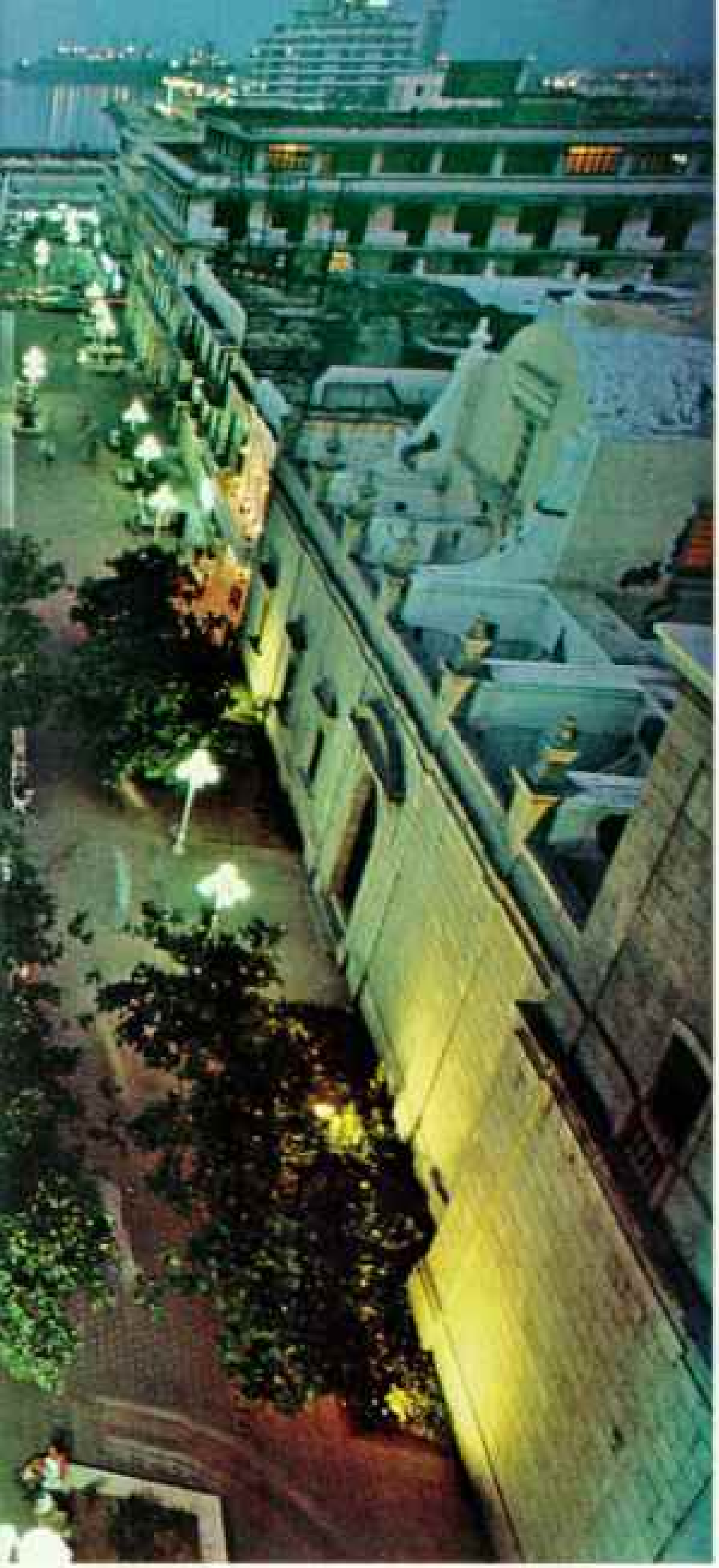


been laid the length of Veracruz from southern fields, eventually to transport natural gas to Mexican and U. S. customers.

This industrial growth and exploitation of natural resources has brought problems as well as benefits. Planners must cope with displacement, rapid changes in life-style, and pollution. In the summer of 1979 an offshore well, 200 miles southeast of the coast of Veracruz, began spewing tremendous quantities of oil into the Gulf of Mexico. Many beaches, lagoons, and fishing areas were fouled. The cleanup has been extensive, but such a catastrophe inflicts long-term ecological damage.

What of the contemporary Indians, the Huastec and Totonac descendants of the original inhabitants? Pre-Columbian tradition has most fully survived in the nearly inaccessible mountain areas.

Don Rafael Hernández Ochoa, Governor of Veracruz, shows deep concern for the welfare of the large Indian population. It was my privilege to accompany him on a



Alive with lights, *modern Veracruz—Mexico's busiest port—displays its colonial heart. Inland, in the market at Papantla, two generations of Totonac demonstrate the approaching demise of traditional Indian fashions.*

recent trip through the Sierra de Papantla.

Setting out from the state capital of Jalapa, we flew by helicopter to the market town of Coyutla "place of the coyotes." From there we struck out on horseback into the green mountains. White-clad Indians gathered in each village to welcome their guests, the first visit ever by a governor. We heard the people ask for better roads and schools, for potable water, a bandstand in the plaza, for electric power, even for a local airstrip.

People in many towns spoke only the Totonac dialect of the Sierra. Some towns were dwarfed by great baroque churches. We overtook a number of people plodding along under the weight of large back bundles slung from tumplines across their foreheads. There was little to identify the when of our journey; the reality was as much of the past as of the present.

In one village an elderly woman dressed in her finest embroidered blouse and shawl approached the governor. "Here, take," she

said in her memorized Spanish, and she decorously handed him a hundred-peso note. Initially perplexed, we soon realized this was a symbolic offering, not dissimilar to presenting the "keys to the city."

Later, reviewing the memoirs of Mexican Bishop Mota y Escobar, the only other post-conquest visitor of note, I read that he too was puzzled, upon stopping in the same village in 1610, to be presented with eight cotton blankets, then a valuable commodity used to pay taxes.

How astonishing to have witnessed the same ritual procedure, in the same town, 368 years later!

In some towns costumed groups performed ritual dances derived directly from pre-Columbian roots. Watching the stately movements and listening to the pre-Columbian drums and flutes, I was reminded of the problems confronting such traditionalists around El Tajín, even the renowned *voladores*, who unwind to ropes' ends from the tops of poles as high as a hundred feet (cover and page 209).

Trapped in the decline of ancient values, the Totonac suffer loss of their farmland under pressure from commercial cattle raising; they are bewildered by pollution and the breakdown of traditional authority. But here in the changeless mountains time-honored values still prevail and, as my friend and volador Don Pedro Pérez Bautista says with nostalgic reverence, "The flute calls."

The return by helicopter wrenched us from the past almost into the future. Hard to believe that we had crossed so many centuries in only three days! Looking ahead, the governor was optimistic, but realistic.

"The future for these Indian communities," he said after his firsthand survey of the area, "lies in long-range local and state planning for appropriate crops, for reforestation, and for organized regional projects to meet local needs."

For the Totonac and other Indians of Veracruz the future is, nevertheless, an uneasy path to modification of their historic ways and beliefs. Difficult as it was for me, after only a few days, to readjust to our present, how much harder will it be for many of the people I had met!

For the state as a whole, however, the balance sheet holds many pluses. Rich in manpower and resources, Veracruz stands today at a historic juncture, facing new social and economic pressures. Tradition says it is likely to respond with the exuberance and vitality expressed in the dynamic verses of "La Bamba"—the contemporary folk anthem of Veracruz: *Up, up, for you I will be—Finish the Bamba . . . and begin a new song.* □

Living in two worlds, *a Totonac Indian tries to adhere to traditional values while he capitalizes on Mexico's petroleum-inspired economic boom. Marcelino Santés García sometimes works as a welder at an oil refinery in Poza Rica* ***(above)*** *but lives in a Totonac-style house near El Tajín with his large family and a flock of turkeys* ***(left)****—a symbol of wealth among rural Totonac. Santés removes a tray of wax-encrusted candleholders fashioned in animal shapes* ***(top)*** *while refurbishing the household altar, a fixture of Totonac homes.*

Bordeaux

FINE WINES AND FIERY GASCONS

By WILLIAM DAVENPORT
Photographs by ADAM WOOLFITT

WHAT IS THE GREATEST wine-growing region in the world? Why, of course, the Bordelais, that fertile tract of France that extends from the inland port of Bordeaux into the valleys of the Garonne and Dordogne. Or so the natives will tell you, confidently denigrating the claims of rival Burgundy and Champagne, as well as those of such outlandish places of vinous pride as Germany, Italy, and California.

Such self-satisfied panache is to be expected, for Bordeaux, once the capital of the ancient Roman province of Aquitania, was also a city of Gascons, whose descendants still display the swagger and aggressive vivacity of such heroes as Cyrano de Bergerac and d'Artagnan, captain of the King's Musketeers. The proud Gascon lives on in the Bordelais, "full of verve . . . a fierce individualist in perpetual rebellion against anybody who tries to bridle his independence," as Bordeaux writer Armand Got characterized him.

Ever since 1453, when Bordeaux and its Gascons were forcibly attached to France, the bridlers have been the central power in Paris. "Why should we pay taxes to that bunch of bureaucrats?" a Gascon farmer asked me. "I sell only for cash. That way the customer avoids the value-added tax, there's no record of the sale for the tax bandits, and everybody's happy."

"Except the government," I said.

"Not one sou to Caesar!" he riposted, practically quoting Cyrano de Bergerac, a Gascon to his soul. "We honestly appropriate it all!"

Such fire receives the approbation of every Gascon. Though Bordeaux's mayor was alleged, some years back, not to have paid enough federal income tax, his constituents reelected him with a thumping majority.

The Gascons traditionally have been hard to govern.

***Wines of grace** and good breeding flow from Bordeaux manors like Château Palmer (**facing page**), where Cabernet Sauvignon vines bear tenderly cared-for grapes (**above**). Ancestor vines found here by Romans in 56 B.C. began a trade that has lightened hearts and fattened Bordelais wallets for more than 2,000 years.*

In oar-ruffled stillness, the Dordogne lazes beneath Castle Beynac, a bone

of contention between English and French during the Hundred Years' War.

When this independent mountain tribe came across the Pyrenees into Aquitaine in the sixth century, they were already the "free fighters, free lovers, free spenders" immortalized in playwright Edmond Rostand's *Cyrano de Bergerac* centuries later. They fought everyone who came along—Saracens, Norsemen, Franks, finally succumbing to the French.

"But there are still a million Gascon-speaking people in the southwest," Professor Robert Escarpit of Bordeaux's University of Gascony told me, "an amazing fact considering that Gascony as a political entity disappeared from the map in the mid-11th century.

"Today we Gascons resist a lot of the grandiose economic planning that Paris seeks to impose on this region. We prefer business on the human scale. 'Small is beautiful.' We cling to individuality and an old Gascon tradition of human-size exploitation of the land."

I found much evidence of this as my wife, Roselle, and I drove south from Bordeaux through the vast maritime pine forest (largest in Europe) of Les Landes of Gascony and east through tiny Gascon villages cradled in the green hills of Armagnac.

"We have a private kingdom here," an independent Gascon duck farmer, Monsieur André Galey (right), told us in one of these timeless villages, Adoulins, as he showed us round his place. It was Sunday morning, and Roselle and I worried that we might be keeping him and his wife from Mass. Not a bit—for a good Gascon reason. "They don't use Gascon or Latin in Mass any more, so I'm glad to stay home and show you around." To emphasize his feelings, M. Galey made this pronouncement in the Gascon dialect of the old *langue d'oc* of southern France, which Roselle understands but I do not.

WE FOLLOWED the Galeys through their realm of 30 acres surrounding their half-timber farmhouse. "We cleared this land ourselves," M. Galey said, indicating the vegetable garden and fields of corn, oats, barley, and wheat. "We grow everything we need to feed our animals and ourselves. We could double production by hiring help, but that would mean paying 50 percent social security and an avalanche of paperwork for those parasites in Paris."

We passed a pond where we admired the geese, gray and white with orange bills, as stately in the jade green water as the honking patrolling ganders were clumsy on land.

"I take care of the geese," Mme Galey said proudly. "That has always been a woman's work in Gascony. My mother and grandmother raised geese; so do I. I have 15 reproducing geese, one gander for every three. A goose lays fifty eggs a year; we average about 750 goslings annually. I sell most of them when they're three months old for twenty francs [five dollars] apiece. I hate to part with my goslings at any price; they're so pretty, all green and downy, you just want to cuddle them."

On the day of our departure, M. Galey told me that his *henno* was *malauso* (sick). Thinking that *henno* must mean hen, I asked if she had stopped laying eggs. It was a terrible gaffe, for he was referring to his wife. Henno, Roselle said, is the Gascon

With much to gain, but more to lose, *a goose with a liver fated for foie gras is force-fed by André Galey near the old Gascon capital of Auch. Gascony, once a stronghold of unruly tribesmen in southwest France, lost its political autonomy in the 1050s, but endures in the independence of its farmers and the nose-proud flamboyance of playwright Edmond Rostand's hero, Cyrano de Bergerac* ***(left)****.*

APPELLATION Bordeaux

Atlantic Ocean

Gironde

Soulac

MÉDOC

Lesparre

CHÂTEAU CALON-SÉGUR

St.-Estèphe

CH. LAFITE-ROTHSCHILD

CH. MOUTON-ROTHSCHILD

Pauillac

CHÂTEAU LATOUR

St.-Julien

HAUT-MÉDOC

Listrac

Moulis

Castelnau

Margaux

CHÂTEAU PALMER

CHÂTEAU PRIEURÉ-LICHINE

St.-Médard

Garonne

Bordeaux

CHÂTEAU HAUT-BRION

Pessac

Gradignan

LIMITE DE L'APPELLATION BORDEAUX

CHÂTEAU DE LA BRÈDE

GRAVES

DEPARTMENT OF GIRONDE

NORTH

St.-Ciers

Le Blayais nuclear power plant

BLAYE

Blaye

CHÂTEAU MARGAUX

BOURG

Bourg

CÔTES CANON FRONSAC

CÔTES DE FRONSAC

POMEROL

LALANDE DE POMEROL

CHÂTEAU PETRUS

Fronsac

Vayres

Néac

CHÂTEAU CHEVAL BLANC

Libourne

St.-Émilion

CHÂTEAU ANGÉLUS

ST.-ÉMILION

GRAVES DE VAYRES

PREMIÈRES CÔTES DE BORDEAUX

Dordogne

CHÂTEAU DE MONTAIGNE

Isle

Ste.-Foy

ENTRE-DEUX-MERS

STE.-FOY-BORDEAUX

Cadillac

LOUPIAC

CÉRONS

Cérons

Loupiac

STE.-CROIX-DU-MONT

Barsac

BARSAC

CÔTES DE BORDEAUX-ST.-MACAIRE

Preignac

Ste.-Croix-du-Mont

CHÂTEAU D'YQUEM

Sauternes

Fargues

St.-Macaire

Langon

SAUTERNES

LIMITE DE L'APPELLATION BORDEAUX

0 KILOMETERS 10

0 STATUTE MILES 10

DRAWN BY JAMES A. MCFARLANE, JR
COMPILED BY DONALD A. CARROLL
NATIONAL GEOGRAPHIC STAFF

AREA ENLARGED

Crécy

Paris

FRANCE

Loire

Poitiers

Bergerac

Lascaux Caves

Bordeaux

Castle Beynac

Arcachon

Monpazier

DEPARTMENT OF GIRONDE

Villeréal

Auch

Adoulins

Biarritz

Font of fine wine, *the Bordeaux region, delineated by the limite de l'appellation, produces a harvest of some 800 million bottles a year. Areas such as Graves and Médoc represent an even more elite distinction; wines grown in a particular district. Greater Bordeaux, which today counts 600,000 people, was capital of Rome's province of Aquitania and flourished under the wine-doting Romans as it did centuries later under English kings.*

word for woman. From Latin *femina*, the French get *femme*, but the Gascons changed *f* to *h*, *m* to double *n*, and *a* to *o*. It's obvious they don't see eye to eye with the French!

EAST OF BORDEAUX, the fertile valleys of the Gironde, largest department in France, produce grain, cattle, vegetables, but above all, wine. The combination of all this with a protected access to the sea made Bordeaux the capital of Aquitania. This name, bestowed by the Romans on southwestern France, literally means "land of water." Today its 16,000 square miles (the size of Switzerland) stretch from Bordeaux to the misty green majesty of the Pyrenees and are drained by 1,400 miles of streams, including the Garonne and Dordogne, which join north of Bordeaux to form the Gironde.

Though geographically on the edge of Aquitaine, Bordeaux, with 600,000 inhabitants, remains its regional capital. Last summer there, I was invited to participate in the Aquitanian Regional Tourist Congress, a highlight of which was flying over the magnificent countryside in balloons named *Athos*, *Porthos*, *Aramis*, and *d'Artagnan*. As a member of the Regional Committee for Preservation of Historic Monuments, I joined my colleagues (after a huge lunch with Bordeaux wines) in a resounding vote that all historic monuments of Aquitaine still standing should be preserved.

Some of these monuments speak to us of the dawn of humanity: the amazing prehistoric cave paintings of animals in Lascaux, the Sistine Chapel of prehistory. Others make the Middle Ages seem still alive: especially the bastides, which come in both French and English versions.

Laid out in a grid pattern recalling Roman camps, these towns were built on the contested border of Aquitaine. Their arcaded streets, built around a central square and marketplace, still protect citizens from sun and rain. Many were created by the kings of France and England and endowed with privileges to induce popular loyalty to their respective claims to Aquitaine. The English derived their claim through Henry II, whose marriage to Eleanor of Aquitaine in 1152 made him Aquitaine's duke.

We strolled through Monpazier, an English bastide, built in 1285. In the marketplace a fishmonger sold us succulent oysters that he had picked up that morning from his oyster bed off the port of Arcachon (pages 254-5). Celebrated since the days of Ausonius, the fourth-century Latin poet, these *gravettes* cost about one-fifth of what they would in a Paris restaurant.

If there's an English bastide, a French one is sure to be nearby. We had tea a few miles to the southwest at Villeréal (Royal Town). It wasn't much different except for the rock concert, stereophonically amplified, projected from the market by a local youth group. "For the pleasure of the people," these disc jockeys told us, "we have turned this whole town into a discotheque." And so, at deafening heights, with Johnny Halliday we "Rock Around the Clock."

IN BERGERAC I was pleased to note that no one had tweaked or tampered with the nose of Cyrano (page 236). His statue reminded us of his biographer's lines. "For a great nose," wrote playwright Edmond Rostand, "indicates a great man—Genial, courteous, intellectual, virile, courageous."

In Auch, onetime capital of Gascony, Roselle exclaimed, "Look! There's d'Artagnan!" And there he stood, another of our childhood heroes, in burnished bronze: boots, cloak, plumed hat, rapier at the ready, most dashing of the Gascons. But I was even more interested in that living monument of Auch, the Hôtel de France, gastronomic mecca of Gascony.

There owner-chef André Daguin offered us a *pousse rapière* (rapier thrust), in honor of d'Artagnan. "Six parts sparkling wine, one part Armagnac," he explained. "God created all the ingredients. He wanted a Gascon cocktail to replace whiskey." The Armagnac, the idea of divine intervention in matters alcoholic, was making a rapier thrust to my head.

***Grapes sweet with sunlight** ride off to fermentation vats. Science and crossed fingers share in the dicey decision of when to harvest. A few days' delay risks rain or hail that can turn a potential quality wine into something less.*

M. Daguin explained that the bases of Gascon cookery are foie gras, geese, ducks, *confits* (preserved fowl), and Armagnac. "Parisian chefs long were ignorant of all the things we could do with these," he said. "Me, I cook for my own taste, to please my own palate, and," speaking like a true Gascon, he concluded, "if the clients don't like it, they can leave." No one did.

As a member of the monument preservation committee, I also inspected most of the relics of old Bordeaux and was delighted to find in the Museum of Aquitaine a Roman marble bas-relief depicting a Gallo-Roman cooper making a wine barrel.

By the Middle Ages, Bordeaux had become "the greatest wine-exporting region in the world" (historian Barbara Tuchman's phrase). Its surpassing treasure was a grape: the famous Biturica, named after the Celtic tribe, the Bituriges Vivisci, who welcomed the conquering Romans as protectors in 56 B.C. Today this variety is known as Cabernet Sauvignon (page 233). Nobody knows when it was first planted here, but by the fourth century A.D. the vines were doing so well in these sun-kissed, rain-graced valleys that the poet Ausonius began his rhapsodic hymn to the city, "Oh Bordeaux, my birthplace, renowned for your wines. . . ."

Doting on these wines, English kings gave Bordeaux special tax exemptions when they held the city as dukes of Aquitaine. In the

14th century they beat the daylights out of the French with the help of their Gascon allies, and for years exported an astounding 66 million liters of Bordeaux wines to their three and a half million subjects back home. They called the red Bordeaux claret, a name that endures, meaning "light in color." The Bordelais people, prospering on this commerce and the booty of daring Anglo-Gascon raids against the French, became addicted to their English rulers.

ROSELLE AND I became addicted to Bordeaux (I speak of the city) and were fascinated by its English flavor, its "*anglomanie profonde*" in the phrase of historian Pierre Guillaume: the tweedy clothes and lisle stockings at the racetrack, the "Oxbridge" accents of British-educated wine merchants, the prevalence of English names like Nathaniel, Archibald, even Ivanhoe. Most popular of all is Edouard, in honor of the 14th-century darling of the city, Edward of Woodstock, Prince of Wales, known in history as the Black Prince.

With his English archers and Gascon soldiers, Edward cut down the flower of French chivalry at Crécy and Poitiers and took King John II of France prisoner in 1356. The Bordelais hailed him as a hero. He was called the Black Prince, so far as we know, because his armor was black; he himself was blond.

"Isn't he a lovely man?" our expert on local history, Isabel Dussauge, said, as we admired his effigy in stained glass in Bordeaux's 11th-century church of Saint Seurin. She spoke of the Black Prince as though he were still alive.

"He was so handsome that ladies swooned at the sight of him," Isabel said. "He set up court here in Bordeaux in 1363, when Aquitaine became an autonomous principality. Those were the days! We all loved the English because they let us run our own affairs.

"We owed it all to Eleanor of Aquitaine—especially we women," Isabel said. "She was patroness of the troubadours. They exalted her and ladies in general in their lyrics. Women were put on pedestals. We never had it so good."

Beautiful, vivacious, intelligent, Eleanor was a great catch. Her dowry, the Duchy of Aquitaine, extended from the Loire to the Pyrenees. She bestowed it first on the future King Louis VII of France, whom she married in Bordeaux, but took it back after their divorce. The dashing duchess then married 19-year-old Henry Plantagenet, Duke of Normandy and Count of Anjou, who was 11 years her junior.

Two years later, in 1154, Henry became Henry II of England, and Eleanor was crowned queen in Westminster Abbey. She produced two future kings of England, Richard the Lion-Hearted and John Lackland, who signed the Magna Charta in 1215. The kings of England were thus at the same time the dukes of Aquitaine.

Dynastic fat was in the fire, and it burned for three centuries. In 1453, against the will of the people, the duchy was attached to France. The French king, Charles VII, fearing the English sympathies of the Bordelais, suppressed all their privileges and turned the cannon of Bordeaux toward the city instead of toward the sea. The Bordelais showed their disapproval by massacring the king's tax collectors.

"We have a long history of sedition and a strong taste for autonomy," Isabel told us.

"It probably goes all the way back to our Celtic ancestors: the Bituriges Vivisci, which may mean the 'Kings of the World,'" she said. "In any event, we still feel we should be monarchs of all we survey."

We got to know a number of today's "kings" quite well. They hold court in some 3,000 châteaus within easy driving distance of Bordeaux, purveyors of a luxury product that the world is eager to consume. But to the French, Bordeaux is more than a pleasant drink: It has therapeutic powers; it's a tonic to build up your health. Our own French doctor prescribes it for any stomach ailment, even ulcers, and the French Olympic Committee shipped Bordeaux to the Mexico City games for its athletes.

Daniel *(Continued on page 246)*

Rites of fall *unfold at the church of Saint-Émilion when the Jurade, the local wine officialdom, announces the harvest and inducts new members* ***(right)****.*

The sweetest of spoils, grapes covered by a mold known as noble rot ***(top right)*** *yield Château d'Yquem's golden Sauternes, "a blessing of God," says owner Comte Alexandre de Lur-Saluces. The grapes, selected and snipped one by one, raise a mist of spores when dumped in bins* ***(top left)****. Even divine blessings profit by human help. At Château Haut-Brion, wines made from experimental clones are tasted to pick rootstock for future vintages* ***(above)****.*

Carefully combed ranks of green gold *yield wine worth a billion dollars a year to the Bordeaux region. The essayist Michel de Montaigne, once mayor of Bordeaux, banked*

National Geographic, August 1980

on wine when seeking aid in Paris: "I have more faith in the eloquence of our wine than in that of my tongue to move the hearts of those gentlemen in the Louvre."

Vintners *extraordinaires*

Lawton, a distinguished wine broker who tastes some 500 different wines a year, eyed my gray beard and prescribed, "Drink a lot of Bordeaux. We call it the elixir of long life. My father died only last year after a lifetime of tasting. He was 97."

Two hundred and forty-seven thousand acres of the Bordelais are thus devoted to what all good Frenchmen conceive of as the cause of longevity, health, and the pursuit of happiness. The 1979 production of this panacea was 826 million bottles.

Bordeaux varies in quality—from ordinary table wine to such famous *premiers crus* (first-growth) wines as Château Lafite, Château Latour, Château Margaux, Château Mouton-Rothschild, and Château Haut-Brion. Four of them received this prime rating in a Paris exhibition back in 1855, and the rest of the 61 red wines selected, though all exceptional, were ranked as second, third, fourth, and fifth growths. This was a semantic disaster, implying they were not first-rate. Only Baron Philippe de Rothschild succeeded, after waging a twenty-year battle, in having this classification changed to promote his Château Mouton-Rothschild to premier cru (pages 250-51).

The antiquated classification is still in use. But in 1962 one of the latter-day Kings of the World created another list. He is Alexis Lichine (upper left), Russian by birth, American by citizenship, Gascon by temperament, owner of the Château Prieuré-Lichine in Margaux. Already distinguished as the author of the *New Encyclopedia of Wines & Spirits*, Lichine created and published his own classification of 190 Bordeaux red wines, as against a mere 61 in the 1855 classification.

In one brilliant stroke he eliminated the invidious numerical distinctions, and ranked the wines as Outstanding (including all the old premiers crus), Exceptional, Great, Superior, and Good. Who could complain when the least of the rankings was

***Owners** of fabled wine châteaus include former U. S. Secretary of the Treasury Douglas Dillon (**bottom left**) and his sister, of Château Haut-Brion. The neatly manicured estate produces some 150,000 bottles of wine a year. The wines of Château Lafite, now directed by Eric de Rothschild (**bottom right**), consoled Napoleon, who requested eight bottles for his exile on Elba. Owner of Château Prieuré-Lichine, author of three books, and wine's evangelist, Alexis Lichine (**far left**) unabashedly proclaims, "I converted America to wines!" As elegant as the wine bearing its name, Château Margaux belongs to Laura Mentzelopoulos (**left**) and her husband, André, who are restoring the mansion to its 19th-century splendor.*

The vineyards themselves know no hierarchy and recognize only the devotion of the vignerons who tend them. The family names of those who work the soil often remain the same for generations.

Good? Certainly not Lichine, who cheerfully classified his own wine, Château Prieuré-Lichine, as Great.

SOUTH OF THE CITY of Bordeaux, in the Sauternes district, Château d'Yquem produces the world's most outstanding sweet white wine. But the effort takes on the economic dimensions of Russian roulette. "Here it is the middle of November," said our host, Comte Alexandre de Lur-Saluces, scion of an ancient Gascon family. "The harvest is over everywhere else, the wine is in the barrels, and we're only half through.

"In this sunny and misty climate our grapes, Sauvignon and Semillon, mature individually. We have to pick them one by one by hand," Lur-Saluces said. "We're now in our third picking. Sometimes we have as many as ten or eleven. Very risky financially. In 1964 we had eleven pickings, nevertheless a total disaster, too much rain. We didn't have a drop of Yquem worthy of the name that year. So we didn't sell any. Our reputation is worth more than money."

The count explained about *pourriture noble*, noble rot, the basis of Yquem's fame (page 242). The sun and mist of the Sauternes area foster *Botrytis cinerea*, a beneficial mold that attacks the grapes until they shrivel like raisins and have the ideal 20 percent concentration of sugar—potential alcohol. That this produced a marvelous sweet wine was realized by one of Lur-Saluces's ancestors back in 1847.

The story goes that the ancestor, traveling in Russia, was late for the harvest, which, until that year, had produced a drier white wine, much appreciated by Thomas Jefferson back in 1787. Returning from Russia, the old count was dismayed to see his vines loaded with "rotten" grapes. He harvested anyway, and put the wine away for 12 years. In 1859 he opened a bottle for the Grand Duke Constantine of Russia. It was the superb sweet nectar we know as Château d'Yquem today, "a golden wine," as novelist François Mauriac said, "in which the sun of a far-off summer still burns." The grand duke was so entranced he offered 20,000 gold francs on the spot for four barrels.

"We've been getting enormous prices ever since," Lur-Saluces told us. "But not so enormous when you consider that one vine produces only one *glass* of Yquem per year."

Making an expensive wine is a matter of pride in the Bordelais, and one of the most expensive comes from Château Lafite, whose rare vines, flourishing in the gravelly soil of Pauillac, north of Bordeaux, produce an elegant red.

"We keep Lafite small on purpose," 39-year-old Eric de Rothschild, the director, told us (preceding page). "We produce only 300,000 bottles a year on about 220 acres. We could increase our profits by doubling the quantity, but then we could never restore our reputation."

In the red-damasked salon of the château, Eric showed us the mahogany desk with its stain of ink, allegedly spilled when Prince Otto von Bismarck pounded the desk with his fist. Germany's chancellor was filled with Prussian fury by one of Eric's ancestors. Baron Alphonse de Rothschild coolly agreed to pay the 1870 Franco-Prussian War reparations that Bismarck expected would ruin France. "Bismarck underestimated the power of Alphonse's bank," said Eric as he led us to the private family cellar, known as the *caveau* (page 250).

"There are some 8,000 bottles here," Eric told us, holding a lighted candle above a dusty bin marked 1797. "There are only seven bottles of this vintage left." Recalling that a single bottle of Château Lafite 1806 had recently fetched $28,000 at a Chicago auction, I did not ask for a sip.

"We opened a bottle of 1799 a while back," Eric said. "It was still alive. It had elegance and finesse. You could tell it was Lafite. We change the corks here every 25 to 30 years."

If the wines have turned, they sometimes wind up at wine auctions anyway. They aren't drinkable, but people like to have a few old bottles to display.

Estate manager Jean Crété told us that care, good soil, climate, and *cépage* (grape

variety) are the requirements of quality wine. "The older the vine, the better the wine. Our oldest vines are a hundred years of age; the average is 35. And nature blessed Lafite with the best soil in the Médoc."

The Médoc is a privileged peninsula apart, and its inhabitants, the Médocains, are even more independent than the Gascons. At Château Palmer (page 232), manager Claude Chardon said, "Our employees, like most Médocains, consider themselves artisans rather than laborers. They work in couples, man and wife, tending their sector of the vines from planting to harvest. They are *very* independent. They have complete liberty, can take a day off, four hours for lunch, all OK as long as their sector is cared for. Each person makes from $600 to $800 a month. The women—*fortes, braves, vaillantes*—often work better than the men."

I walked through the weedless rows of vines to talk to one of these valiant vineyard workers who was tying vines to wires with great dexterity. "I'm better than my husband at this," she said, "more nimble."

I asked her if there was a union of the vine cultivators.

"No! Unions are for the masses. We are individuals. Look at all this," she said, indicating the whole vineyard with a sweep of her hand. "We couldn't strike. It would ruin the product. Look at these tender young grapes. You have to baby them. A mother can't go on strike. Neither can we."

CROSSING THE GIRONDE, almost as wide and muddy as the Mississippi, by ferry, Roselle and I motored south to Château Pétrus. This small vineyard, with its heavy clay-and-gravel soil, produces the most expensive red wines in all Bordeaux. The 1975 vintage, which we tasted with director Christian Moueix, already retails at seventy dollars a bottle.

Reading the temperature of the soil under the hot southwestern sun, Christian regretted that the Institut National des Appellations d'Origine (National Institute of Names of Origin) does not permit any owner of an appellation vineyard to irrigate his vines, even during drought conditions.

Monsieur Pierre Perromat, president of the institute, later confirmed this restriction. "Artificial irrigation would tend to vitiate the power and finesse of the wine. Some say that we at the institute are rigid and inflexible. But the nation has delegated a sacred responsibility to us: to maintain the quality of all French wines. I am frankly elitist, and I am totally independent."

Something about this speech, that certain aggressive vivacity, made me wonder if Pierre was a Gascon.

"Gascon gasconissime!" he confirmed, "most Gascon of Gascons, purebred, 100 percent! My family have been wine growers here since the Middle Ages, at the Château de Fontgraves, 25 miles east of Bordeaux. It's a bastion of Gascony."

Another bastion stands thirty miles east of Bordeaux. Here lived another Gascon gasconissime, who was also France's greatest Renaissance writer. Roselle and I made a pilgrimage to the Château de Montaigne, where Michel de Montaigne was born in 1533. The castle still dominates the vineyards he cultivated on the right bank of the Dordogne, calling them "the chief good of the country."

"A marvelous synthesis of the Gascon spirit," in the phrase of Armand Got, Michel de Montaigne learned Latin and Gascon before French. He declared himself *"Gallus Vascus,"* a Gaul of Gascony.

Montaigne retired here at the age of 38, "tired of the slavery of the court," to cultivate his vines and his soul (although he subsequently served as mayor of Bordeaux and a Gentleman of the King's Bedchamber). We visited the self-sufficient tower where he escaped from his shrewish wife and wrote his famous *Essays*, filled with the spirit of humanism and Gascon independence: ". . . it would be better for us to have [no laws] at all, than to have them in so prodigious numbers as we have."

It was in this tower, its rafters incised with favorite quotations from Greek and Latin authors, that Montaigne wrote, "Plato


LAFITE
1799
LAFITE
1801
LAFITE
1809
LAFITE
1803

*"**Mouton must be first!**" asserted Baron Philippe de Rothschild (**above**). After a 20-year struggle he succeeded in having Château Mouton-Rothschild reclassified as a* premier cru. *In the private cellar of his cousins—who are also competitors—at Château Lafite-Rothschild, some 8,000 bottles slumber quietly under coverlets of dust (**left**). A 1799 vintage sampled recently was pronounced "elegant."*

says—' 'Tis to no purpose for a sober man to knock at the door of the Muses.' "

The dry white wine that opened the Muses' door is still made and sold here on the property. We bought six bottles of Château de Michel de Montaigne '78. I keep one in my library next to the *Essays*.

ON THE SAME SHELF I conserve a Château de La Brède, produced at a beautiful little moated castle just 12 miles south of Bordeaux. The château belonged to another great writer, Montesquieu, whose political philosophy was later adopted by the United States of America. He served Bordeaux as president of its parliament. He cultivated 76 acres of vines at La Brède and celebrated "the air, the grapes, the wines of the Garonne hillsides, the humor of the Gascons."

The Baron de La Brède et de Montesquieu was born in the château in 1689. Mentioning this date to a group of schoolchildren who were trailing after us, the guide pointed at me and said, "Imagine, even that monsieur was not living at the time!"

Nonetheless, I was thrilled to be in the castle where Montesquieu wrote his masterpiece, *The Spirit of Laws*, in 1748. In it he advocated the separation of executive, legislative, and judicial powers, the system of checks and balances that became the basis of the United States Constitution. Considered subversive in France, the book was a great success in London. Delighted, Montesquieu wrote to a friend that the popularity of his book, and the renown it brought him, was boosting the sale of his wines in England.

"But Bordeaux cannot live by wine alone," Mayor Jacques Chaban-Delmas told me in his office in the city's splendid 18th-century Hôtel de Ville. "The industrial revolution bypassed us, but now Bordeaux must marry the 20th century; industrialize or perish."

I was impressed with Bordeaux's recent industrialization: the aerospace and auto plants, and a port whose principal commerce is now in petroleum products.

Roselle and I *(Continued on page 258)*

A cook's tour of wine country, *like the day, begins with a crusty* baguette, *carried fragrant fresh from the bakery* ***(left)****. Pigeons sold in the local market* ***(right)*** *will reappear at table in tenderly roasted transfigurations. By the slab or sliver, cheese* ***(below)*** *ranges from ivory-hued Brie to piquant wedges of Roquefort to silken goat cheese. Garlic, braided and sold at the autumn fair in Saint-Estèphe* ***(below right)****, always stars in culinary productions.*

The French flair and love of the good life is tempered by an English flavor in Bordeaux. Mercantile shrewdness, Anglican surnames, and a predilection for tweedy looks among wine brokers reflect 300 years of English rule. Wine-trade ties were knotted after Eleanor of Aquitaine was divorced from her first husband, Louis VII of France, and landed the soon-to-become Henry II of England in 1152. France from the Loire to the Pyrenees was transplanted to the rule of the English, and an unquenchable thirst for claret, as the British call Bordeaux wine, developed.

Cloaked in morning-muted gray, *a fisherman prowls individually staked-out gravette beds in the Arcachon Basin, near silver beaches of this Atlantic coast*

National Geographic, August 1980

resort. These flat, round oysters—favored breakfast fare of the fourth-century Latin poet Ausonius—will be plucked from the bottom and served so fresh they flinch.

*The ever quickening step of the centuries echoes down arcades of Monpazier (**above**), a bastide, or 13th-century town, that helped protect Aquitaine's flank. The bell of the Great Cloch (**top left**) in Bordeaux tolled harvesttime until removed in 1548 by French King Henry II to punish*

a Bordelais tax revolt. He returned the bell eight years later. Spirelike cranes of the port (**facing page, top right**), mimic St. Michael's Tower beyond. Rain-slick pavement mirrors passersby in Mériadeck (**above**), a pet redevelopment project of Mayor Jacques Chaban-Delmas.

(Continued from page 251) stayed for a while in the Mériadeck quarter of Bordeaux, north of the city hall, the showplace of the mayor's "new program of humanized urbanism for our own time." One of its virtues is its invisibility from the old city; Chaban-Delmas was determined to avoid Paris's mistake of spoiling classic vistas with incongruous modern buildings.

It was a pleasure to walk along the

Fortress for tomorrow's energy, *a nuclear plant rises north of Bordeaux, part of France's drive for more nuclear power. It will provide electricity for a region surging into the industrial age, bulwarked by new auto, aerospace, and petroleum plants. But still there remains the time-honored and gentle harvest of the land.*

terraces and elevated pedestrian malls of Mériadeck without risking the mayhem of modern traffic below. On the pine-planted esplanade in front of the dazzling glass facade of the new Prefecture of the Gironde, we admired a vast reflecting pool. In spite of signs saying *Baignade Interdite* (No Bathing), the cool water proved too tempting to children in the summer heat. Ignoring the signs, they splashed happily about in the shallow water. In the ensuing municipal crisis provoked by this civil disobedience, Mayor Chaban-Delmas gave way.

"Take down the signs," he ordered, "and station a cop there so nobody drowns."

We were pleased to note that Chaban-Delmas's *urbanisme* really was *humanisé*, and that the old Gascon spirit of resisting authority is alive and well with the junior citizens of Bordeaux. □

"Kitty Hawk" Floats Across North America

By MAXIE and
KRISTIAN ANDERSON

ADRIFT in a tranquil sky, our helium balloon *Kitty Hawk* soars northeastward at 18,000 feet above Wyoming on the second morning of our transcontinental flight.

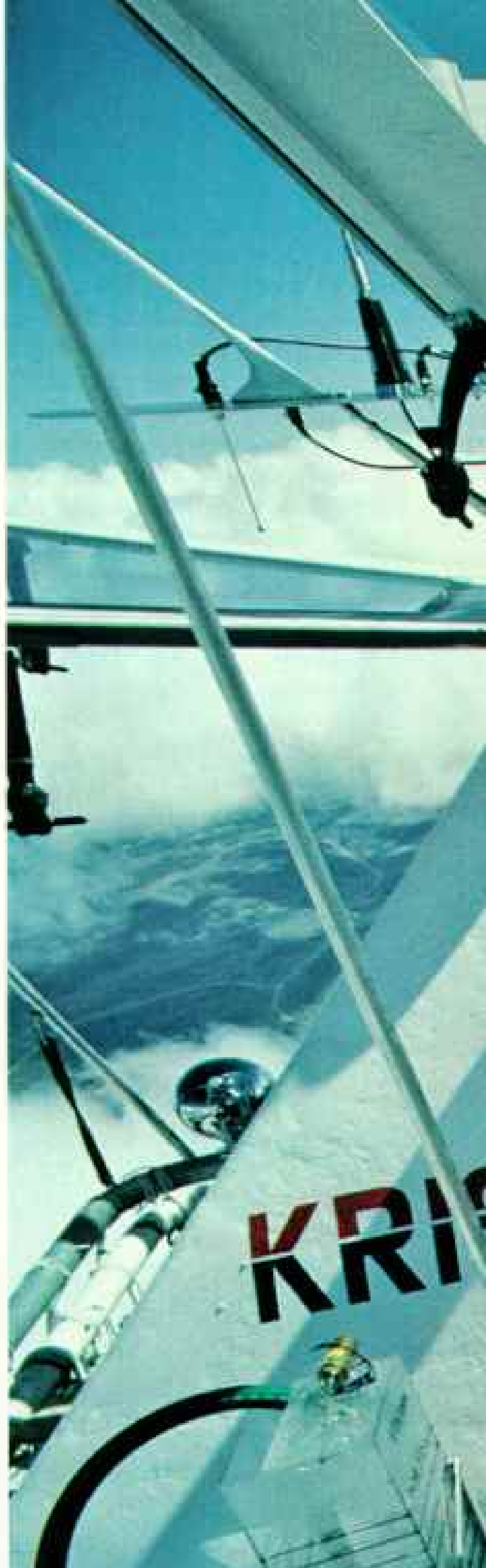
Despite the chill altitude and thin air—requiring oxygen masks—the temperature hovers at 45°F, allowing us to prop open the doors of our enclosed and heated gondola.

A father-and-son team with nine years' ballooning experience—mine including the first successful transatlantic flight*—we are backed by a dedicated crew whose names appear on both sides of the gondola.

As I photograph this scene with a camera attached to the boom in foreground, Kris stands secured by a safety belt atop one of our liquid ballast tanks bearing the name of our helium supplier. The graduated Plexiglas tank at left enables us to jettison liquid ballast in measured amounts.

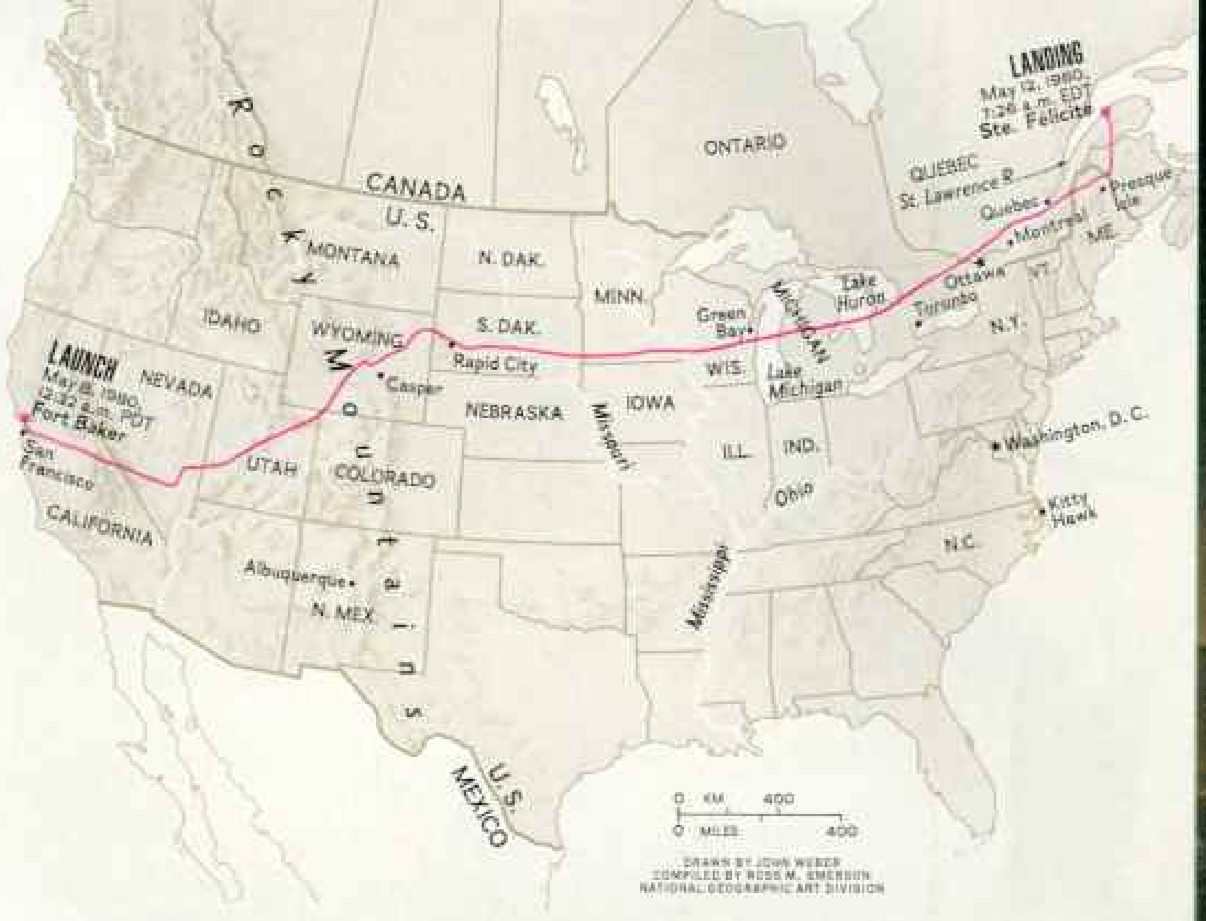
Such moments of peace are destined to end shortly: Within hours we will find ourselves encircled by violent thunderstorms that threaten to slam *Kitty Hawk* into the ground or loft us to our death at 50,000 feet. Fortunately the storms will subside, and *Kitty Hawk* will continue cross-country.

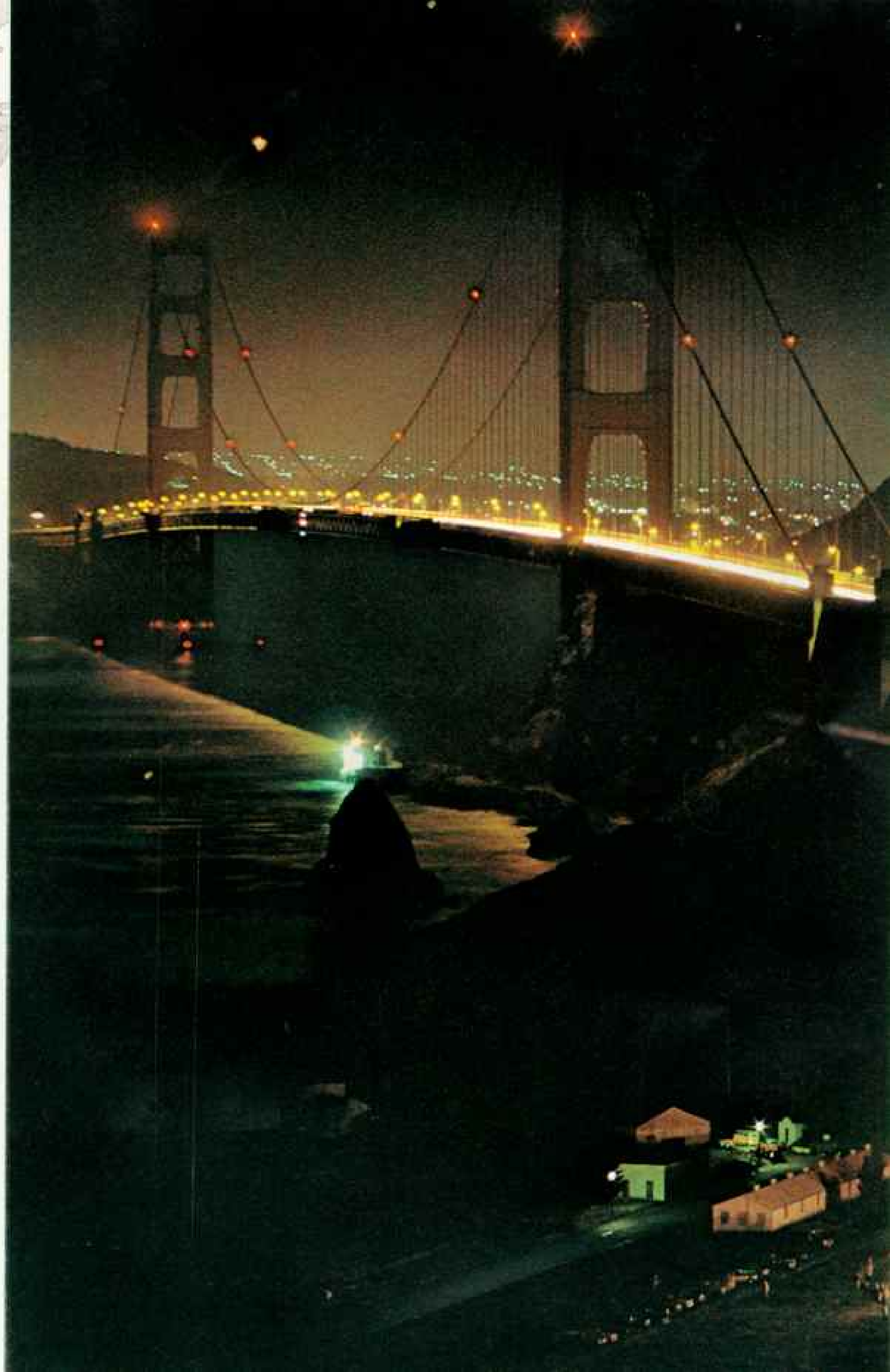
*See "*Double Eagle II* Has Landed!" by Ben L. Abruzzo with Maxie L. Anderson and Larry Newman, NATIONAL GEOGRAPHIC, December 1978.



Kitty Hawk

RICH SCHWOEBEL
SYD PARKS
DON IDA
DAVID SIPPLE
GEORGE FISCHB
RON WRIGHT
DICK KENT
TONY IBARRA





TRAJECTORY of triumph carries Kitty Hawk *3,400 miles in distance flown, from launch site at San Francisco Bay to Ste. Félicité on Canada's Gaspé Peninsula.*

Kitty Hawk's *historic flight, the first nonstop crossing of North America by balloon, covered a great-circle distance of 2,823 miles in 99 hours, 54 minutes. The National Aeronautic Association credits the Andersons with the first successful transcontinental flight, since they launched in view of the Pacific and sighted the Atlantic before touchdown.*

The Andersons chose to fly at extreme height, averaging 24,000 feet. Moving slowly northeastward during the first two days aloft, Kitty Hawk *picked up speed over South Dakota and reached a dizzying 85 miles an hour above Lake Michigan. Touchdown occurred a thousand miles north of the projected landing site: Kitty Hawk, North Carolina, where the Wright brothers first flew in 1903.*

*Tethered bubble of helium, a 200,000-cubic-foot polyethylene envelope (***following pages***) floats in the bright glare of floodlights high above the launchpad at Fort Baker, California, just north of the Golden Gate Bridge. One of the largest manned balloons ever built,* Kitty Hawk *weighed four and a half tons at lift-off, approximately half of it sand and liquid ballast. The latter consisted of 40 percent water and 60 percent antifreeze to combat sub-zero temperatures aloft.*

Here twin inflation tubes fill the balloon from either side. The tubes were then sealed and attached to the gondola to prevent loss of helium during the flight. An hour later, at 12:32 a.m. on May 8, 1980, Kitty Hawk *and its two-man crew rose smoothly into the California sky and caught the first winds sweeping eastward across the continent. Within hours the balloon was joined by an escort plane that accompanied it across the country, except for refueling stops.*

As a wind-powered machine, Kitty Hawk *enjoyed the right-of-way over all aircraft in its flight path, but the Andersons sighted half a dozen commercial jetliners that diverted from normal air lanes to catch a glimpse of* Kitty Hawk.

MICKEY PFLEGER

Life aboard the gondola

SURVIVAL ALOFT depended on teamwork and our ability to spot problems before they grew into disasters. We divided the nights into two four-hour watches and caught occasional catnaps throughout the day.

Despite closed doors and a propane heater, the gondola varied from daytime temperatures in the 70s to the minus 30s at night.

Precision work such as Kris's plotting on the flight chart (***above***) was hampered by the need for gloves, though he wore only the thinnest despite the cold. Our liquid ballast of antifreeze mixed with water worked to perfection. Even at the highest altitude it ran freely from the ballast tanks whenever we released it (***left***). Here the liquid flows past a wafer-like radar antenna and a bundle of chili peppers carried aboard *Kitty Hawk* in the Mexican tradition to ensure good luck.

Inflight fare proved tasty but monotonous. Friends in San Francisco had loaded us down with fried chicken and eight

KRISTIAN ANDERSON (OPPOSITE); MARIE ANDERSON

kinds of chocolate-chip cookies—a ready-to-eat menu that Kris occasionally varied with an omelet cooked over our small gasoline stove (***left***). We went on cold rations, however, when we discovered that our matches failed to light above 21,000 feet, rendering the stove useless.

My one encounter with canned ham nearly terminated the flight. The heavy food produced such indigestion and weakness that Kris considered landing in order to save my life. "I would have done it," he recalls, "but we were over Lake Michigan, we were traveling at 85 miles an hour, and it was the dead of night. I decided dad had a better chance staying aloft." Reached by radiotelephone in Albuquerque, a doctor friend prescribed 100 percent oxygen and a digestive aid and the crisis passed.

The cold was both a hindrance and an irritant. Our water bottles frequently froze over at the neck, requiring excavation (***above***). Even so, the water produced severe cramps if drunk quickly.

Snow-clad hurdle, the Sierra Nevada range slips beneath Kitty Hawk *as the balloon drifts eastward at 16,500 feet the first morning aloft. The flight profile* (**below**) *demonstrates a major difference between translucent polyethylene balloons such as* Kitty Hawk *and more conventional craft*

NATIONAL GEOGRAPHIC PHOTOGRAPHER SEAN CONLEY

made of fabric. The latter absorb heat from the sun during the day and release it at night. The result is a roller-coaster trajectory with daytime peaks and nighttime troughs. Absorbing far less heat, Kitty Hawk *remained more stable, varying in altitude less than a thousand feet between night and day.*

DRAWN BY JOHN WEBER, COMPILED BY ROSS M. EMERSON NATIONAL GEOGRAPHIC ART DIVISION

DEAN CONGER

JAMES A. SUGAR

JEAN-PIERRE LAFFONT, SYGMA (ABOVE AND FACING PAGE)

SUNBURST SMILE lights Kris's face (***facing page***) seconds after our victorious landing at Ste. Félicité, Quebec.

Thanks to a Canadian rescue helicopter, our initial touchdown in a tree (***above***) was succeeded by another one on the ground. The helicopter's rotors gently blew *Kitty Hawk* from its perch to safety.

To me, Kris stands as the unqualified hero of *Kitty Hawk's* continent-leaping flight. On May 8 I lifted off from San Francisco with a 23-year-old son and landed four and a half days later with a grown man.

At the moment of success, fatigue camouflages my delight, as reflected by before-and-after portraits (***left***). But I would not trade the flight for anything. □

The Wild World of Compost

By CECIL E. JOHNSON
PROFESSOR OF NATURAL HISTORY, RIVERSIDE CITY COLLEGE, CALIFORNIA

Photographs by
BIANCA LAVIES
NATIONAL GEOGRAPHIC PHOTOGRAPHER

IF YOU ARE NOT FAINT of heart, plunge your hand into a compost heap up to your elbow. Now you have touched an essential link in the cycle of life: a miniature universe inhabited by myriad creatures much, much smaller than lions or tigers or bears, though surely just as wild.

This is a dark, moist world, running smoothly, humming silently, well oiled by the machinery of time. Your hand will tell you that it also is a hot world.

Astronomical numbers of microbial short-order cooks, called aerobic (oxygen-consuming) bacteria, shoot the temperature up to 55°C (131°F) or higher during the first few days after organic wastes have been dumped into the compost bin.

They cook silently in the darkness, chemically breaking down soft, mushy, easily rotted wastes that are high in nutrients; these might include table scraps, coffee grounds, fireplace ashes, fallen leaves, and grass clippings.

Fungi can be seen with the naked eye seven to ten days after wastes have been placed in the bin. They draw their food from decaying material. Unable to tolerate the temperatures produced by the high-heat microorganisms deep within the pile, they live in an outer layer, in a zone two to five inches thick.

Actinomycetes are the last plants to appear on the compost scene. They are a form of bacteria different from the high-heat ones at the center. Like fungi, they cannot tolerate high temperatures except in spore form, and so dwell in a zone of medium warmth. The fungi and actinomycetes give the decaying material a gray cotton-candy or spiderweb appearance. Both are vital to the job of decomposition, since they chemically break down woody stems, bark, and even last week's newspapers with their current rash of national and international madness.

Nematodes are tiny, cylindrical, often transparent worms that take up considerable plots of real estate in the compost heap. A handful of decaying compost contains several million of these mostly microscopic tenants. A powerful magnifying glass will give you a glimpse of these animated bits of what look like fine human hair.

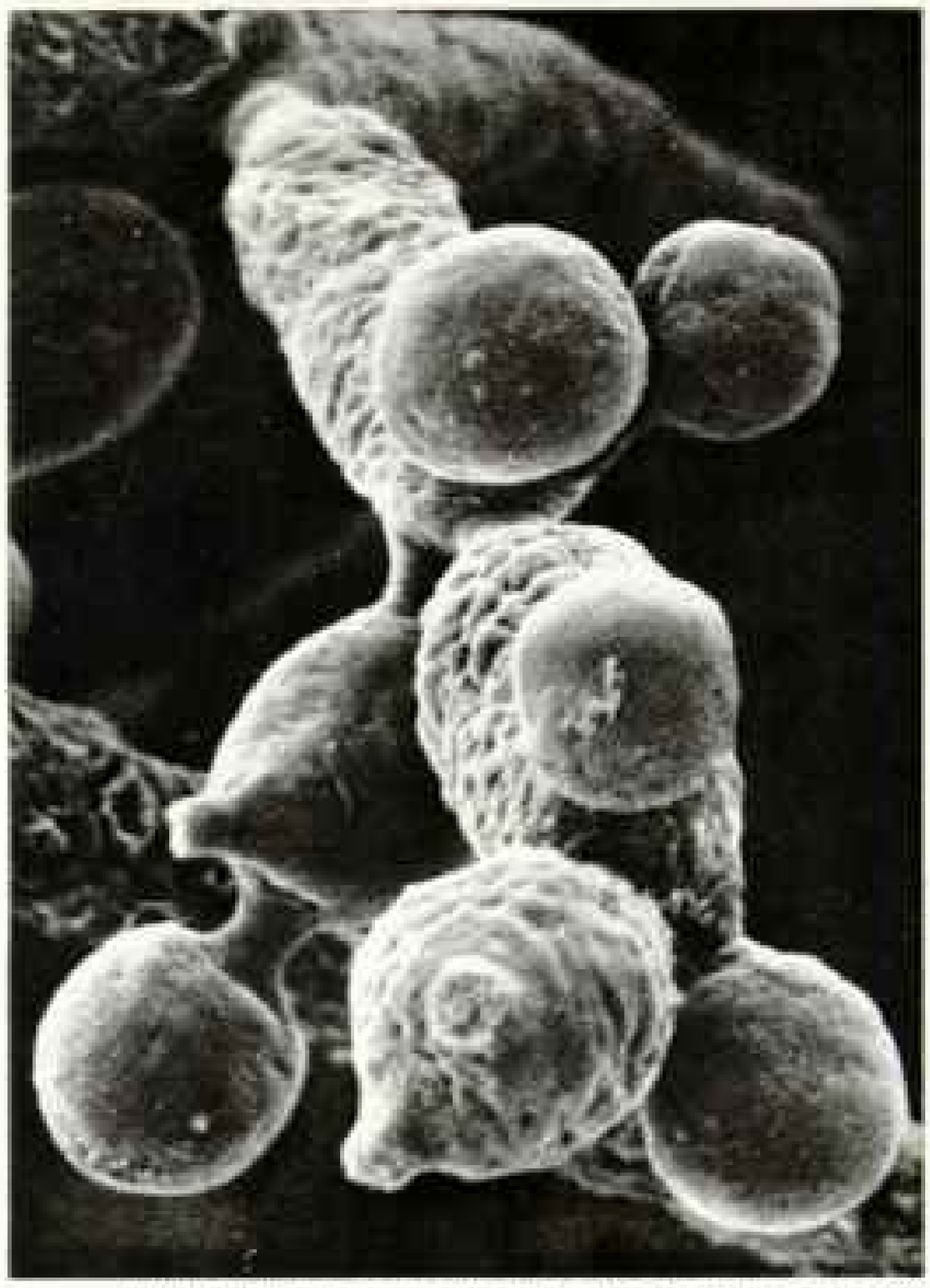
A nematode authority painstakingly counted approximately 90,000 in one rotting apple. Some species of nematodes in compost scavenge on decaying vegetation; however, some feed on bacteria, fungi, and other nematodes. A large number of terrestrial species spend the balance of their lives on the cells of plant roots, sucking out the juices. Root vegetables are especially vulnerable to nematode infestation.

One long-practiced way of making compost is to put organic waste into a pit and cover it with soil. Six months to a year later, it is dug up and spread over vegetable gardens and flower beds. This is a slow way to make compost, because of lack of oxygen. It is preferable. *(Continued on page 278)*

***Refuse is reborn** as gardener's treasure when the denizens of a backyard compost pile feed on kitchen scraps and plant clippings. Billions of microorganisms dine on the recycled feast, speeding the transformation of organic debris into compost, a valuable soil conditioner.*

To catch a resting millipede *on film proved no easy task—the shade-loving arthropod (**below**) quickly roused and fled from the photographer's light. A moist compost pile laden with decaying vegetation can support a large millipede population. In turn, their droppings contribute to the quality of the compost.*

Clusters of nonparasitic soil mite nymphs hitch rides on millipedes and other more mobile creatures passing their nests. A roving hister beetle toting adult soil mites ***(below)*** *soon collected a backload of pinpoint-size nymphs* ***(bottom)****. Some soil mites eat harmful fly larvae, unwelcome in a compost pile.*



DAVID SCHARF; FUNGUS, (ABOVE) 6,300X, AND BACTERIA (BELOW) 2,000X, PROVIDED BY BELTSVILLE AGRICULTURAL RESEARCH CENTER

The complex biochemistry of compost

Recipe *for compost begins with leaves, grass, weeds, organic garbage, or manure. Kept moist and aerated, the pile teems with bacteria, fungi, and actinomycetes, another microscopic plant group. These enzyme producers break down debris, freeing nutrients to feed compost dwellers and future plant life.*

Bacterial activity *heats the interior to 55°C (131°F) or higher, destroying pathogens and larvae of harmful insects. Species intolerant of heat work near the surface. Fungi and actinomycetes* (**above**) *attack tougher debris, enabling bacteria to decompose it quickly.*

PHOTOMICROGRAPH BY DAVID SCHARF

Nature's *second string of decomposers—insects, worms, and lower animals—eat decaying vegetation and microbes, and excrete organic compounds. Tunneling, they aerate the compost and increase the surface area where microbes can feed. At death, their bodies provide more food for the community.*

Final product: *compost, a light, dry matter like humus. The crumbly structure boosts the growing power of soil—air and water penetrate more easily, and water retention increases, limiting nutrient runoff and soil erosion. Compost can be produced in weeks or months, depending on the method.*

PAINTINGS BY WILLIAM H. BOND, NATIONAL GEOGRAPHIC ART DIVISION

HEAT *produced by the rapid biochemical breakdown of organic debris distinguishes controlled composting from gradual decomposition in the wild. Compost contains plant nutrients, but not enough to legally qualify as fertilizer.*

*Although microbes alone, such as this fungus (**above, far left**), may create compost, secondary decomposers enrich the product. Earthworms loosen debris, drop high-nutrient castings, and sometimes provide springboards for young springtails (**above left**). Ubiquitous decomposers, most springtails (**above**) catapult by releasing a springer tucked beneath the abdomen. Nematodes are the most numerous of the larger decomposers. One entangled in a fungus strand (**above right**) may die and become food for the fungus, as does a slice of bread (**right**).*

BOB BULLARD

I believe, to make compost bins six to eight feet across and no deeper than three to four feet. The wastes do not compact as easily, and such a bin exposes a large surface area to the outside world so that oxygen can reach the high-heat bacteria and other oxygen consumers. The heat is easily distributed, providing a warm home for large numbers of wiggly red worms and the somewhat more sedentary earthworms.

Worm inhabitants of compost and soil seem rather drab. But these silent subterranean contractors are the unsung heroes of the world beneath our feet. Constantly tunneling and feeding during the daylight hours, coming to the top during the night to mate, they help keep the soil and compost like a ventilated sponge. Their portholes on the surface enable water, nutrients, and oxygen to filter down. They relish the compost's pantry of goodies, such as dead plants and decaying insects, and pay for their meals by dropping tiny nuggets of fecal material, rich in nitrogen.

Invisible World Comes Alive

The high- and low-heat bacteria, fungi, actinomycetes, nematodes, and earthworms are certainly not the only principal actors on the compost stage. Hidden between decaying leaves and other decomposing organic wastes in the dark underworld of compost is a remarkable menagerie of jointlegged beasties.

Spying on these minute creatures is easily done. Grab a handful of decomposing damp leaves from your compost bin. Inhale its good tidings and place the material on a saucer. Focus light on it with a flashlight. With the other hand, Sherlock Holmes the

stuff with a magnifying glass. Carefully turn over the fragile decaying leaves with a hairpin, all the while looking for any evidence of movement.

There are a number of mini-superstars in this largely invisible ecosystem, but the pinpoint-size pseudoscorpions and springtails surely capture the spotlight, Because of their tiny size, these beautiful creatures are almost never seen, except by scientists specializing in joint-legged animals, or arthropods. They have a worldwide distribution, and about 5,000 species of the two animals have been described.

When you first spot a pseudoscorpion under your magnifying glass, you will swear that you have run head-on into a southwestern desert scorpion. Closer observation will reveal that it lacks the upright tail with a stinger on the end. On sensing an invader,

Laying groundwork *for an assignment to record life in a compost community, photographer Bianca Lavies prepared compost bins at her Annapolis, Maryland, home and waited for the cast to appear (**far left**).*

*Her bountiful garden was a side benefit. Beans and tomatoes planted around the outside of the bins threw their roots underneath the composting debris, drawing direct nourishment (**left center**). Ten-foot-high tomato vines yielded fruit three times the size of tomatoes planted away from the bins (**above left**). Composting can continue during cold weather, though at a greatly reduced rate (**above**).*

the pseudoscorpion throws up its claws in what may be a challenge display.

Pseudoscorpions are predators moving silently through the dark rain forest of damp decaying leaves, seizing victims with their viselike front claws, then injecting poison from glands located at the tips of the claws. Their prey includes minute nematode worms, mites, and larvae. After mating, they produce from two to thirty young, depending on the species. Maturity is reached within a year, and the life span is often more than twice that.

Kenneth A. Christiansen, professor of entomology at Grinnell College and an authority on springtails, has estimated as many as 100 million per square meter of Iowa farm soil. Another scientist, Howard Ensign Evans, professor of entomology at Colorado State University and former curator of the Museum of Comparative Zoology at Harvard University, has said: "It seems to me

perfectly safe to say that springtails are by far the most abundant six-legged animals on the land masses of the earth, and the most abundant of all animals on land having any legs at all, with the probable exception of the mites. He who would prove me wrong had better start counting!"

Turn over a partially decomposed leaf, and the springtails—the jumping jacks of compost—will perform. They run in, around, and over soil particles and decaying

Fastidious preening *cleans fungi and bacteria from sow bugs perched on a mass of slug eggs* ***(left)****. The shell of a dead millipede, hollowed by nematodes in two days, dwarfs an exploring springtail* ***(below)****. A pill bug, slower relative of the sow bug, speeds travel for a snail* ***(bottom)****. "The snail acted as if it were catching a bus," the photographer said. "It would get on and off where it wanted to."*

materials. To go over, they spring upward like gymnasts on a trampoline. They have a small springlike structure under the belly that catapults them into the air when the spring catch is triggered.

Some springtails gobble up those ever present nematode worms; others with less selective palates feast on fungi, the droppings of other arthropods, fallen leaves, and leftover salads. They are meticulous little creatures and can be observed cleaning themselves after feeding, somewhat like a housefly after it has dragged its legs through a gravy bowl or a field mouse combing its whiskers.

In some species the male has been observed caressing the female at mating time in an apparent loving fashion. As courtship progresses, they touch antennae, and the male chases the female in a playful manner. Eventually he moves around the female, pouring out droplets of semen. It is likely that her genitalia will come into contact with the semen, and little springtails will be forthcoming in short order. The affectionate displays exhibited by lower animals are

"***Behold this compost!*** *behold it well. . .! It grows such sweet things out of such corruptions. . . ." The earthly alchemy that enchanted American poet Walt Whitman can conjure the unexpected in your own backyard.*

sometimes said to be the result of instinct. But isn't it possible that lower animals like the springtails leap skyward and make love because it's fun and it feels good?

Small in Size, Mitey in Number

Mites scavenge around in compost, feeding on leaves, rotten wood, and yesterday's flowers. Some of them, however, are meat-eaters and feed on nematode worms, eggs, larval stages of insects, and other mites. Thirty thousand species of mites have been classified, but mite specialists reckon these represent possibly only a tenth of the total number. Compost mites are smaller than a grain of sand and globular in shape, with bristling hairs on their backs. They look like blobs of red-orange Jell-O, with four legs on each side.

Like gray galleons, sow bugs move slowly through the compost, grazing on decaying material. These crustaceans may also be found around water faucets and practically any pile of rocks or wood where moisture accumulates; their delicate gill-like breathing organs must be kept moist. Some members

Heat generated by composting usually kills seeds carried into the pile. But on the cool perimeter of a friend's compost bin, the photographer observed a sprouting cantaloupe seed ***(far left)****. A fruit fly, omnipresent occupant of compost piles, rests on a maturing shoot* ***(center)****. The ripening fruit* ***(above)*** *soon graced the breakfast table. This is the essence of compost, thought the photographer: "New life from old."*

Slow but efficient worker *in the compost factory, a slug produces a gut enzyme that breaks down tough cellulose. Recycling is the name of the game in the teeming world of the compost pile.*

of this group roll up in a tight ball for protective purposes.

Another common compost animal is the earwig. Sometimes as long as an inch, earwigs can easily be seen with the naked eye. They are nocturnal, passing the daylight hours in the damp darkness of compost humus. At night they move about quickly and feed on a variety of things. Some species are predators; others feed chiefly on decayed vegetation; still others feed on both. After eggs hatch, the female earwig watches over her young for as long as four weeks. The hatchlings use their mother as chicks do a brooding hen, scampering beneath her body at the slightest sign of danger.

Earwigs have jawlike pincers, called cerci, on the tail end. In the female they are straight, stout, and lie close to one another. In the male they are slender, curved, and have a more pincerlike appearance. If you pick up an earwig to distinguish the sex, don't grab the cerci; they can inflict a painful, but not really harmful, pinch. The earwigs derived their name from an old wives' tale that these insects crawl into and live in people's ears. It is a story not based on fact.

Compost centipedes are small but powerful predators, which move mostly in the top few inches of the heap. Their formidable claws possess poison glands that paralyze their upcoming meal, which may be small red worms, insect larvae, newly hatched earthworms, or joint-legged animals. Centipedes are divided into many segments with one pair of legs on each segment. Like all animal compost dwellers, centipedes add nitrogenous wastes and ultimately their own recycled selves to the heap.

Watching a millipede crawl slowly, softly over decaying humus is like watching a symphony in movement. Children marvel that this thousand-legged worm can coordinate so many legs without getting them all tangled up. Of course, millipedes do not have a thousand legs, nor are they worms. Careful observation reveals that each body block, or segment, has two pairs of legs, in contrast with the one pair per body block in centipedes. Though they have more legs than centipedes, they move much more slowly, feeding mainly on decaying plant tissues.

Sometimes newly hatched larvae cause a slight rustling near the top of the compost pile or a wiggly red worm becomes too venturesome. Perched statuelike on a telephone wire is a very alert robin—a part of the larger scheme of things. Spotting the slight movement below, it swoops down to snap up its afternoon meal.

In the dark, field mice scamper onto the compost heap to feast on last night's table scraps. A great horned owl, perched like a Christmas tree ornament on the spire of a nearby cedar, cocks its head. With hardly a feather ruffling, it glides downward and grabs one furry feeder, carrying it off into the night.

Like the tides, compost organisms rise and fall, but each contributes a bit of chemical change. The teeming microcosm of the compost heap recycles with no thought of conservation, involved, as it were, with what makes the universe tick. □

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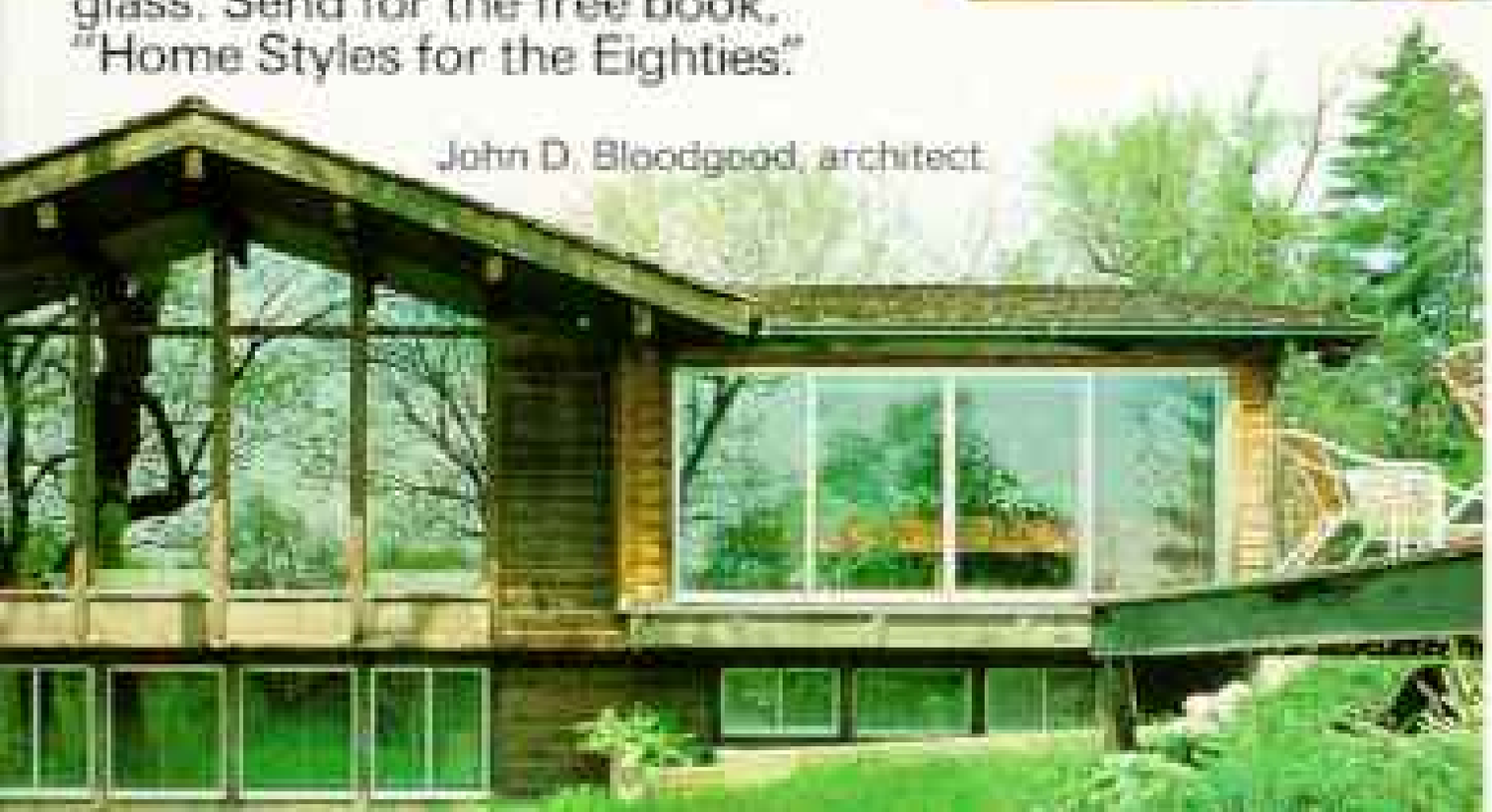

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DISSE BRIMBERG (ABOVE); ROBERT M. LIGHTFOOT III

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The post office chosen for a first day of issue usually bears particular significance to the subject commemorated. For example, a first day cover of the 1977 Charles Lindbergh Transatlantic Flight stamp bears the "First Day of Issue" postmark of Roosevelt Field Station, N.Y., the site of Lindbergh's take-off on his historic flight.

The nation's leading artists and designers are called upon to portray the subjects chosen. Such commissions naturally are highly prized, and bring forth the best efforts of the distinguished artists selected.

Membership in the Postal Commemorative Society makes it possible to easily collect First Day Covers as they are issued. The Society will guarantee that you receive a personally addressed First Day Cover for each new U.S. commemorative stamp issue. All details of arranging for your First Day Covers to be sent to you will be handled by the Society.

Commemorative stamps are issued by the United States at the average rate of about one every three weeks. You will receive a beautiful First Day Cover for every United States commemorative stamp issue during the term of your membership at a total cost of just $1.95 each.

As a member, you will also receive the Society's exclusive display page for each new issue. Each beautiful, specially designed page is die-cut to hold the First Day Cover, and contains a full description of all important historical information about the subject of the commemorative issue. These pages are available only to Society members.

At the surprisingly low cost of $1.95 per issue, you will be building a truly worthwhile First Day Cover collection to be enjoyed now and preserved for future generations of your family. Shouldn't you really give it a try?

Becoming a member now brings you an important collector's bonus at no additional cost. The Postal Commemorative Society makes available to each new member a handsome collector's album with the member's name hand-embossed on the cover. This album, especially designed to hold the Society's display pages, makes it possible for members to keep each new First Day Cover in perfect condition. It is yours free, if you join now!

MEMBERSHIP APPLICATION

815

Postal Commemorative Society
47 Richards Ave., Norwalk, Conn. 06857

NO PAYMENT REQUIRED. SIMPLY MAIL THIS MEMBERSHIP APPLICATION

Please enter a membership and address First Day Covers as indicated below. Send me a U.S. First Day Cover and display page for each new U.S. commemorative stamp issue (normally 15 to 20 per year) at a total cost of just $1.95 per issue. Bill me $15.60* to cover the total cost of my first eight issues.

As a new member, I will also receive a personalized collector's album at no additional charge. I may cancel my membership at any time upon 30 days' notice.

Mr., Mrs., Miss _____

Address _____

City _____ State _____ Zip _____

Personalize my album as follows: _____
(Print name to be shown on album)

☐ The above membership is a gift membership — please bill me. (Indicate your name and address on a separate sheet of paper and provide information on any additional gift memberships you wish to give.)

☐ As a convenience, I prefer to pay $15.60* now for each membership. (Simply mail the completed application with check payable to P.C.S. to the address above.)

*Conn. residents pay $16.77 for each membership to include sales tax.

A delightful new limited edition

The Magic Moments of Childhood

12 fine porcelain collector plates featuring colorful paintings
by the renowned children's artist Elizabeth Moyes

Catching a Butterfly

Plate shown smaller than approximate 8½" diameter.

Reservation Deadline: September 30, 1980

Childhood is the happiest time of life—filled with magic moments of fantasy and make-believe, wonder and discovery, tenderness and love. These golden moments stay with us the rest of our lives, mirrored in the smiling faces and beaming eyes of the children we love.

Now, to recapture and rekindle those moments again, the Danbury Mint is proud to announce a new limited edition of collector plates that portray the magic and wonder of childhood as never before—*The Magic Moments of Childhood Plates.*

Exquisite Colorful Paintings.

Rare indeed is the gifted artist able to portray the emotions as well as the experiences of childhood. Such a talent is Elizabeth Moyes, a renowned children's artist of unusual sensitivity and extraordinary gifts. With the award of our commission, she has created a new series of colorful paintings of great sensitivity and beauty, evoking the innocence, enchantment and joy of childhood. Her works of art were painted exclusively for this collection and will never appear anywhere else.

Convenient Acquisition at a Guaranteed Price.

To reserve your collection, simply complete the attached reservation application. You need send no money now. Your twelve plates will be issued to you at the convenient rate of one every two months. You will be billed for each of your plates at two-month intervals and the original issue price is guaranteed for each plate throughout the entire collection.

Satisfaction Guaranteed.

Each plate will be thoroughly inspected by the Danbury Mint prior to shipment. However, if you should receive any plate you are not completely satisfied with, you may return it for replacement or refund. And you may discontinue your subscription at any time.

Please Act Promptly.

Remember, your reservation for this offering must be postmarked no later than September 30, 1980, in order to be guaranteed acceptance. To avoid disappointment, reserve your collection today!

The Beauty of Fine Porcelain.

The Magic Moments of Childhood Plates will be crafted of fine Bavarian porcelain, treasured the world over for its translucence, whiteness, and strength. The tradition of Bavarian porcelain is one of the oldest in Europe, going back over two and one half centuries. The creation of a collection of such quality would be impossible without the specialized knowledge and time-honored craftsmanship that only a few master porcelain makers possess.

Hand-Decorated with 22kt Gold.

Each flawlessly crafted plate in the collection will be a stunning work of art, reproducing the colorful Elizabeth Moyes painting in precise and faithful detail. And each plate will be hand-decorated with a border of precious 22kt gold. As a collection, they will bring you and your family joy and delight for generations to come.

Strictly Limited Edition.

The Magic Moments of Childhood Plates will be issued in a strictly limited edition available exclusively from the Danbury Mint. No plates will be sold separately and none will be made available in stores. The attached reservation application is guaranteed acceptance only if postmarked on or before September 30, 1980. The size of the U.S. edition will be forever limited to the exact number of subscriptions reserved by this final deadline.

RESERVATION APPLICATION 8-21

The Magic Moments of Childhood Plates

The Danbury Mint
47 Richards Avenue
Norwalk, Conn. 06856

Guaranteed acceptance only if postmarked by September 30, 1980

Please accept my reservation application to *The Magic Moments of Childhood Plates* collection. I understand this is a collection of 12 fine Bavarian porcelain plates featuring colorful paintings by Elizabeth Moyes. The collection will be issued at the rate of one plate every two months at a cost of $31.50 per plate (plus $1.50 for postage and handling).

I understand I need send no money now. I will pay for each plate as billed at two-month intervals. I may discontinue my subscription at any time, and any plate I am not completely satisfied with may be returned for replacement or refund.

Name _____

Address _____

City, State _____ Zip _____

Signature _____

☐ Check here if you want each plate charged, as it is shipped, to your:
☐ Master Charge ☐ VISA

Credit Card No. _____ Expiration Date _____

SUPER AVILYN:

The future of videotape is suddenly very clear.

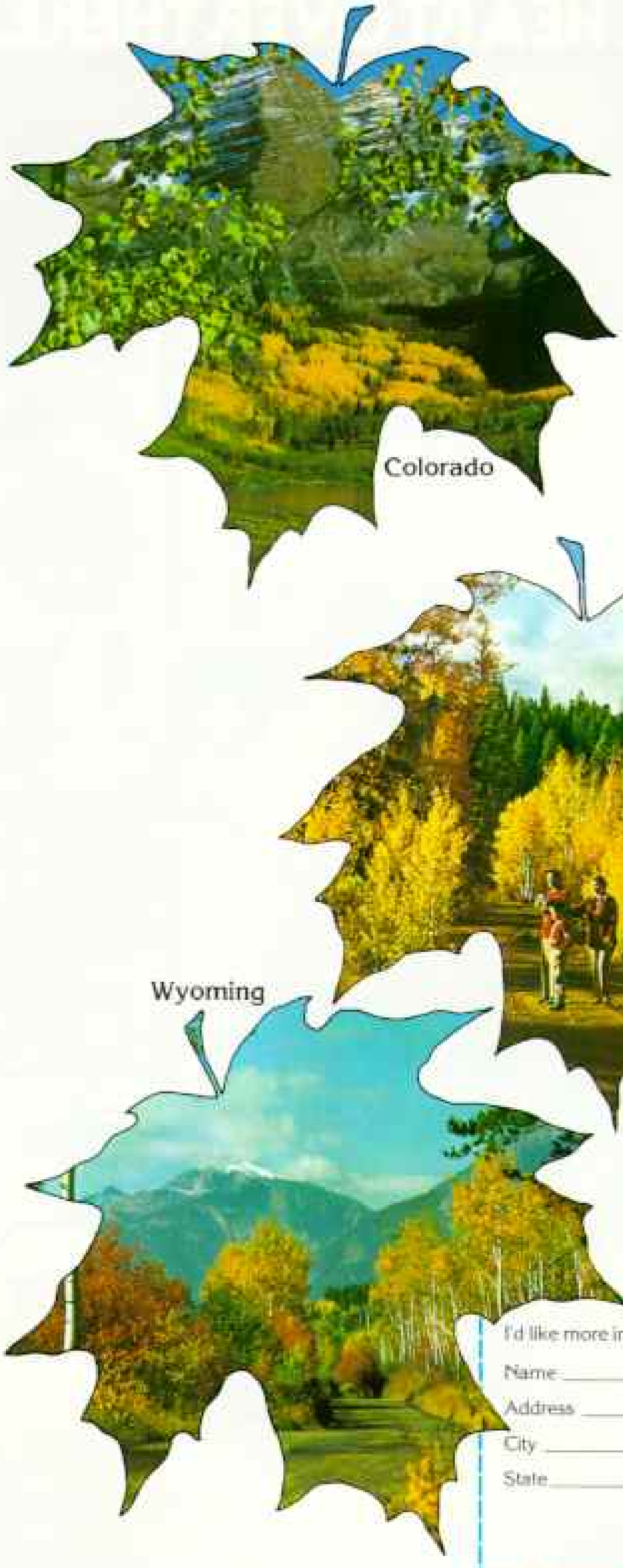
Super Avilyn is the TDK videotape that produces great pictures at two, four and six hours. But a good picture isn't everything. Inside your videodeck there's a harsh reality. Video heads spin at 1800 rpm. At that speed, poor quality tape sheds oxide particles, which can damage your deck. During six hours, when tape moves only .43 inches per second, problems get magnified.

Super Avilyn helped make six-hour videodecks possible. Its high density particles effortlessly deliver superb crispness and brightness. Colors stay separate. Pictures are rock steady and clear through hundreds of hours of play.

Now that you know the inside story, don't judge a videotape only by its picture. Judge it by its future.

TDK.

The Vision of the Future



Get More Autumn Per Gallon

Autumn is a special time here. Colors flood the landscape. Things have quieted down after the summer pace. Here, in America's high country, we're crowded with everything — but people.

Come, let us pamper you in our clean, fresh air that's morning-crisp and evening-invigorating.

Choose a high-mountain resort. A cosmopolitan city. Or a leisurely, worry-free drive through our majestic lands of contrast.

We're three great states with the uncommon in common. There's no better time to see us than now. In Autumn.

I'd like more information about the Rocky Mountain West in Autumn.

Name _____

Address _____

City _____

State _____ Zip _____

Send to Rocky Mountain West
4382 Grape Street, Dept. B
Denver, Colorado 80216

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WHEN YOU WET YOUR WHISTLE...

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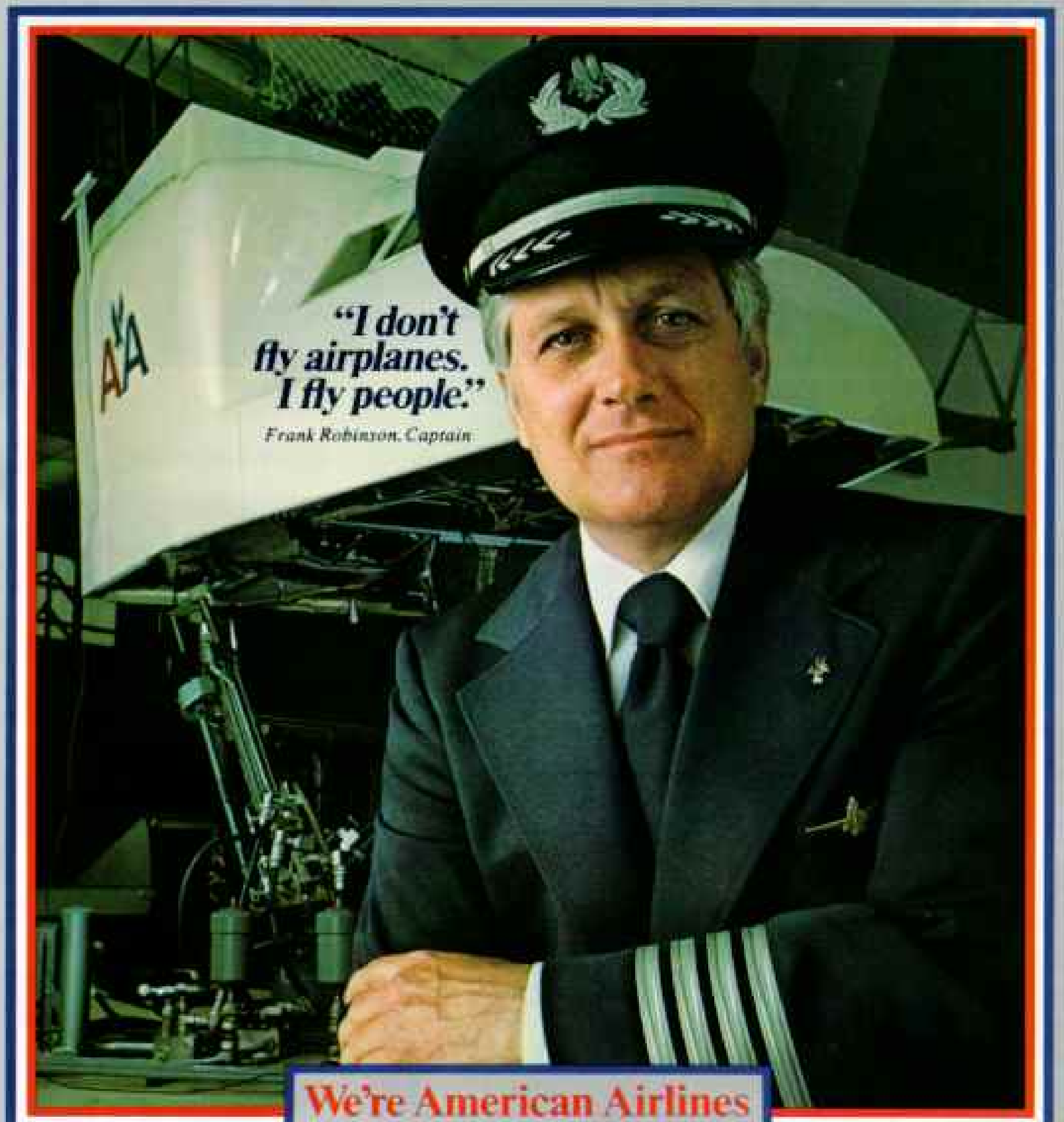
Something on the rocks?
Enjoy it with Smokehouse® almonds.
Champagne? Serve Blue Diamond®
blanched salted almonds. Sherry?
It's a natural with our whole natural nuts.
Whatever your beverage, it goes better
with one of our seven snack flavors.

The Almond People®
California Almond Growers Exchange
P.O. Box 1768, Sacramento, CA 95808



We're American Airlines
Doing what we do best

Frank Robinson learned to fly twice. For America, in F-100 fighters and SAC B-52's all over the world. And for American, in 727's, at Fort Worth, Texas.

There, at American's Flight Academy, many of his hours in the air were spent on the ground—in one of our multi-million-dollar flight simulators. These marvelous machines realistically simulate all aspects of flight, and enable us to conduct emergency training that's too hazardous to do in airplanes and too important to do without.

In the airline business, safety comes first. So we've trained all our pilots this way—and pilots from 44 other airlines in 21 different countries as well.

We're proud of our Flight Academy. But we're even prouder of our pilots.

It takes the best people to make the best airline. Captain Frank Robinson is one of them, and we wanted you to meet him.

THE WORLD WILDLIFE FUND

Animals of the World Stamp Collection

European Bison

WORLD WILDLIFE FUND INTERNATIONAL - ANIMALS OF THE WORLD STAMP COLLECTION

A comprehensive collection of the most significant and beautiful wildlife stamps from all seven continents of the world . . . Europe . . . Africa . . . Asia . . . North and South America . . . Australia . . . Antarctica.

Includes important new postal issues—and hard to obtain out-of-issue stamps.

Each stamp in perfect mint condition, protectively mounted, and issued together with a new and original work by a leading wildlife artist.

A limited edition.
Advance deadline for Charter Subscriptions: August 31, 1980.

Official. Unusual. Beautiful and definitive. Imagine owning a stamp collection with all these qualities and *more*. A collection that actually brings together *the most fascinating stamps in all the world*—on the one subject that interests stamp collectors most: nature's animal kingdom.

Here is a stamp collection that *reaches across time*, to include both new issues *and* postal issues that haven't been available for years. With each stamp a superb *mint quality* specimen. Preserved in perfect condition.

In addition, every stamp in this collection is accompanied by a *striking work of art* in full color. A richly detailed work that complements the stamp. Created *especially* for this series by one of the world's foremost wildlife artists.

To own a collection that combines *all* these advantages is to possess a philatelic delight. One you can enjoy with your family now . . . display with pride . . . and pass along in later years to children and grandchildren.

Now, this remarkable collection can be yours. It is World Wildlife Fund's official *Animals of the World Stamp Collection*. The guaranteed Charter Subscription price is only $2.75 for each issue. And by becoming a Charter Subscriber, you'll have the exclusive privilege of building this collection *right from the very first issue*.

A collection assembled by experts

Headquartered in Switzerland, World Wildlife Fund is dedicated to preserving endangered wildlife and wilderness areas throughout the world. And to create this collection, it has combined its own expertise with the world-wide resources of The Franklin Philatelic Society—appointed as WWF's philatelic agents. Through concerted endeavor, they have assembled the most significant and desirable animal stamps from every inhabited corner of the earth. *No continent has been excluded.*

Equally impressive is the *timespan* of this collection. Some of these stamps will be brand new. Others will be *out-of-issue* . . . no longer possible to obtain from the postal authorities and therefore especially sought-after. Still others will be *special foreign commemoratives*, difficult for even the most experienced collectors to obtain, because they are issued in comparatively small numbers, for brief periods of time.

But each and every stamp—regardless of age or place of issue—will be in flawless condition. Unused and uncanceled; in the desirable "mint" state preferred by serious philatelists. Each will be a *perfect mint specimen* of one of the most outstanding animal stamps ever issued.

Just $2.75 per issue brings you a wealth of benefits

Each Charter Subscriber will receive:

- Perfect mint quality specimens of the world's finest wildlife stamps. Each *sealed in its own transparent "pocket,"* so that both sides of the stamp are untouched—and protected from dust and moisture.
- A newly commissioned work of art to complement each stamp. Not an "illustration," but a *captivating work in its own right*—created on special commission by an internationally known wildlife artist.
- A special *newsletter*, published quarterly, exclusively for subscribers. Feature stories will focus on relevant aspects of stamp collecting, natural history—and on the artists who contributed to this collection.
- An official certificate, signed by the Director General of World Wildlife Fund, attesting to the authenticity of the stamps and the *limited edition* status of the collection.
- A handsome, hardbound *collector's album*. Designed to store and protect each new issue—while displaying the collection in all its rich variety.

Charter Subscribers protected from inflation

As a Charter Subscriber, you will have the pleasure of watching your collection grow *systematically*. For the collection will be sent to you at the rate of three issues per month, and you will be billed on the same convenient basis.

You will also possess a *guarantee against today's persistent inflation*. Throughout the three-year period of your subscription, the low Charter price of just $2.75 per issue will never rise—regardless of any upward pressures in cost.

And you will be among the few with the opportunity to possess the complete collection—including all the coveted first issues. For the total edition of these first issues will be *permanently limited* to the exact number of registered Charter Subscribers, plus a small quantity for WWF's archives and official use. No "extras" will be available for those who may enroll later. Furthermore, if the amount of important new stamp issues merits extension of this collection in the future, you will have the option—but not the obligation—to renew for those issues.

This important World Wildlife Fund collection will be available *only* by subscription. And *The Franklin Philatelic Society*—international stamp division of The Franklin Mint—has been appointed to aid in the task of assembling, creating and distributing the collection. Their experienced staff will ensure that your subscription is serviced to your complete satisfaction.

The Charter Subscription rolls for the World Wildlife Fund *Animals of the World Stamp Collection* will close *forever* at the end of 1980. This is an advance announcement—and the advance application below is valid only until August 31. To subscribe, simply mail your application directly to The Franklin Philatelic Society, Franklin Center, Pennsylvania 19091, no later than the advance subscription deadline of August 31, 1980.

INTERNATIONALLY RENOWNED ARTISTS

Among those artists who will create important new works for this collection are:

PETER BARRETT—One of Great Britain's most eminent nature artists. Works displayed in the Royal Academy and widely known through publication in numerous books and periodicals.

MARIANNE GOLTE-BECHTLE—Award-winning German artist, exhibited internationally.

NINON PHILLIPS—President of The Society of Wildlife Artists of Australasia.

CHARLES RIPPER—Outstanding American artist. Works featured on covers of 79 magazines, commissioned by the Carnegie Museum and National Audubon Society.

ADVANCE CHARTER SUBSCRIPTION APPLICATION

THE WORLD WILDLIFE FUND

Animals of the World Stamp Collection

Valid only if postmarked by August 31, 1980.
Limit: One subscription per applicant.

World Wildlife Fund
c/o The Franklin Philatelic Society
Franklin Center, Pennsylvania 19091

Please enroll me as a Charter Subscriber to the *Animals of the World Stamp Collection*. I understand that I will receive three official issues per month for 36 months, beginning in October 1980. The issue price of $2.75* per issue ($8.25* plus $.75 shipping and handling for each shipment of three) will be guaranteed to me throughout the entire three-year period. I also retain the right to cancel my subscription upon 30 days' written notice.

I need send no money now. I will be billed in advance of each shipment. *Plus my state sales tax

Signature _____
ALL APPLICATIONS ARE SUBJECT TO ACCEPTANCE

Mr.
Mrs.
Ms. _____
PLEASE PRINT CLEARLY

Address _____

City _____

State, Zip _____

Canadian residents will be billed $9.75 plus $1.50 shipping and handling for each monthly shipment of three issues.

Stamps shown actual size. In compliance with government regulations, these illustrations have been overprinted here to prevent counterfeiting. Subscribers to the collection will receive unmarked stamps in mint condition. Issues shown are typical of those to be included in the collection but are for the purposes of illustration only.

Each subscriber will receive a deluxe hardbound album, especially designed to protect and display the collection.

All you need to get $75,000 travel accident insurance automatically.

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.

For sheer number of dazzling beaches, no vacation spot on earth can rival The Bahamas. Our 700 islands offer more than 600 miles of pure white pleasure.

Choose a quiet hideaway island surrounded by clear, turquoise water. Or a luxury resort where the person next to you is within shouting distance, but a friendly waiter just a whisper away.

Relax all day, and at night, catch the excitement of our discos, casinos, clubs and goombay music.

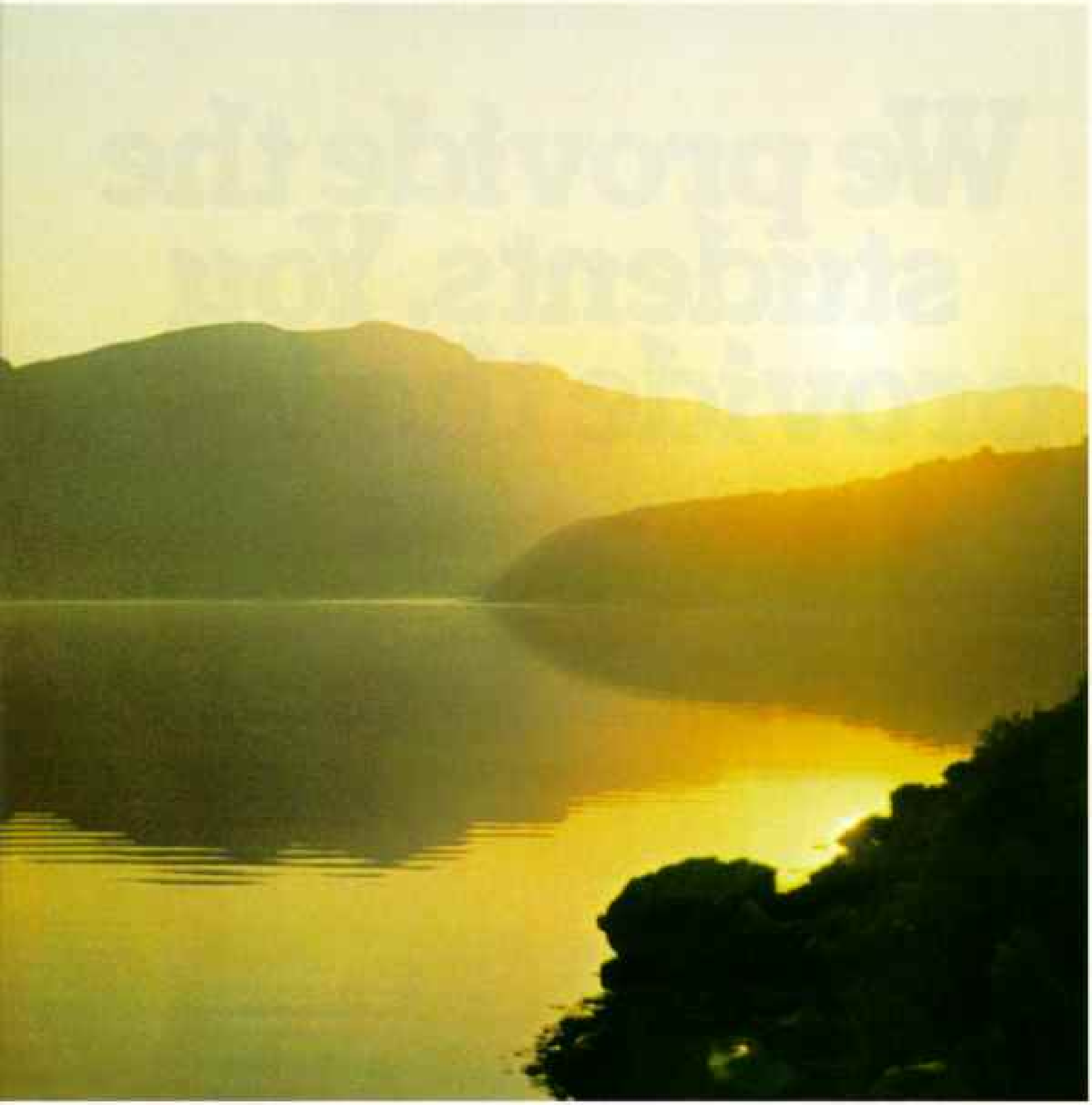
See your Travel Agent. Or call toll free, 800-327-0787. In Florida, 800-432-5594. In Dade County 443-3821.

The Bahamas has more beautiful beaches than the entire Mediterranean.

It's Better In The Bahamas

It's a perfect night for sparkin' on the front swing.
For love that's still young.
Still full of Snap! Crackle! Pop!®

It's gonna be a great day.™ Kellogg's®



Real quality has a way of creating its own image.

Images can be fleeting. A shadow. A rippling picture in a pond. Or they can be as lasting as a lifetime. A lifetime of hard work.

As a maker of home appliances, Whirlpool Corporation believes that a lasting quality image is simply the reflection of the people who build and stand behind the product. Special people. Motivated by pride of concept. Of craftsmanship. Of their ability to make things that last.

This is why we take pride in stocking parts for as many years as we do. Why we maintain a toll-free Cool-Line® service number* you can call 24 hours a day. And why we have a nationwide organization of authorized Tech-Care® service companies that are as close to you as your phone book.

You see, at Whirlpool we believe every appliance we build should create its own image of quality. And do it for one person — you.

It's our way of saying this is more than just an appliance. This is our way of life.

Whirlpool
Home Appliances

*800-253-1301. In Alaska and Hawaii 800-253-1121. In Michigan 800-632-2243.

We provide the students. You provide the love.

Families all over America are taking foreign high school students into their home through a program called AFS.

The student attends high school in the local community for a year and learns about the American way of life, about our cultures and traditions.

The family learns about the student and the student's country.

It's a sharing and loving relationship. And it's fun.

And all you have to do is write us. Or call toll free.

It's a big world and there's much to learn from its youth.

AFS International/Intercultural Programs, 313 E. 43rd Street, N.Y., N.Y. 10017. Or call toll free (800) 327-2777. In Florida (800) 432-2766.

AFS International Exchanges for high school students.

We provide the students. You provide the love.

Join 270,000 members who treasure this monumental new book.

". . . a masterpiece." "Words cannot describe it." "You outdid yourself on this one. 'Ancient Egypt' is far superior to any books I have seen on the subject." "One could be virtually transported through those magnificent photographs."

These are just a few of the words of praise that have poured in to the Society since the publication of **Ancient Egypt.** To examine a copy, simply clip and mail the coupon.

Giant sized at 10¾" by 14".
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306 full-color illustrations.
Written by outstanding scholars.
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NAME _____ (please print)

ADDRESS _____

CITY, STATE, ZIP _____ 2809

What to do if your body's in Peking but your heart's in Poughkeepsie.

It's business as usual. You're in a strange hotel. In a strange country. Meetings all day long and client dinners at night. All you can think of is home.

Well, Sony understands. So we've made a multi-band radio that'll bring you the familiar sounds of home. Like a Dodger doubleheader. And the stock prices from New York. It'll even pick up world news from the BBC.

The Sony ICF-7600 comes with 5 shortwave bands. Plus AM and FM, of course. And it even comes with a map so you can check the best shortwave reception times for cities around the world.

It's really compact. About as big as a paperback. But it's very sensitive. The 3" speaker gives you full rich sound. There's AFC for drift-free reception, a 3-way power supply, and an FM/SW telescopic antenna. And it has the built-in reliability you expect from a Sony.

So next time you're in a foreign country, just reach into your suitcase and go home for the evening.

SONY
THE ONE AND ONLY

One size fits all.

Our Pride. Your Joy.