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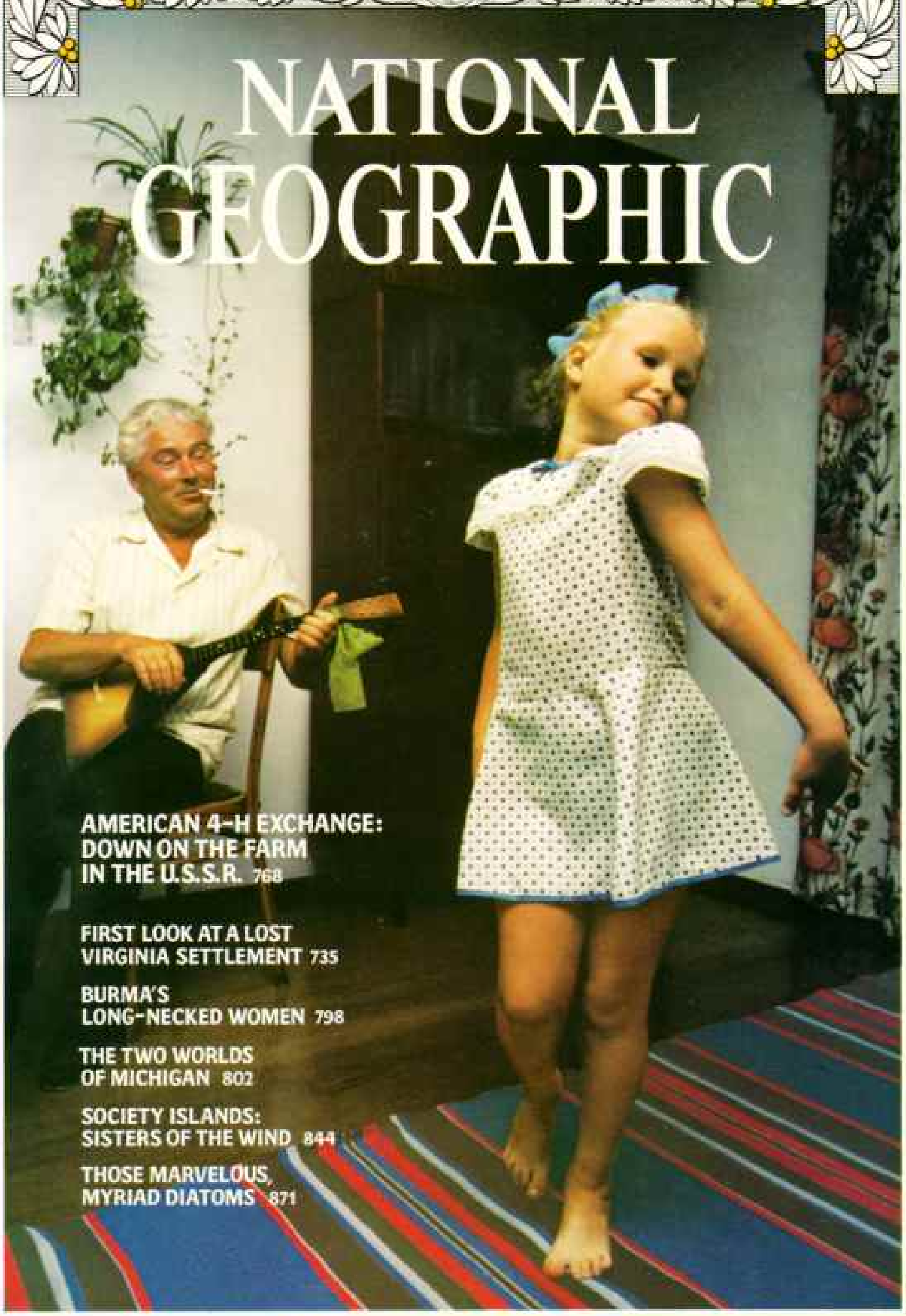

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY WASHINGTON, D.C.

WHAT MIGHT BE CALLED the raw materials of human life are the same the world over—love and hate, birth and death, individual identity and group belonging, work and reward, loss and luck. This shared commonality of human experience ties the human family together just as conflicting beliefs and political animosities drive its members apart.

As our readers know well, NATIONAL GEOGRAPHIC has long interpreted geography in terms of people who make and shape the landscape, and are made and shaped by it. The people who work with the land—the farmers and shepherds and ranchers of the world—have a great deal in common. Talk of crops and breeding strains, of wind and weather, of drought and bumper harvest, has a cogency regardless of the language in which it is conducted.

Such people-to-people conversations seem to go on far from the center stage of political drama, with its ideological drumbeats and blaring dissensions, and occasionally the GEOGRAPHIC has the opportunity to share in the experience.

It happened last summer, when a group of young 4-H delegates from the United States went to the Soviet Union to share experiences—farmer to farmer. The values in such an exchange seem fresh—a rare warmth and a bit of fun that so often fall victim to the kind of calculated, supervised schedule that thwarts and jades the journalist. The "more important" questions of our time lose some of their weight in the lilt of an accordion's tune and the simple dancing that accompanies a wedding.

How refreshing it is to contemplate the snows of winter, the rising of the sap in spring, the slow turning of the seasonal wheel, the rhythm that human beings have lived by under the succession of a thousand governments.

So, whatever the grand geopolitical context of the time, we are pleased to print this postcard from the country, with its age-old message that men can communicate as well as confront.

Gilbert M. Grosvenor

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 155, NO. 6

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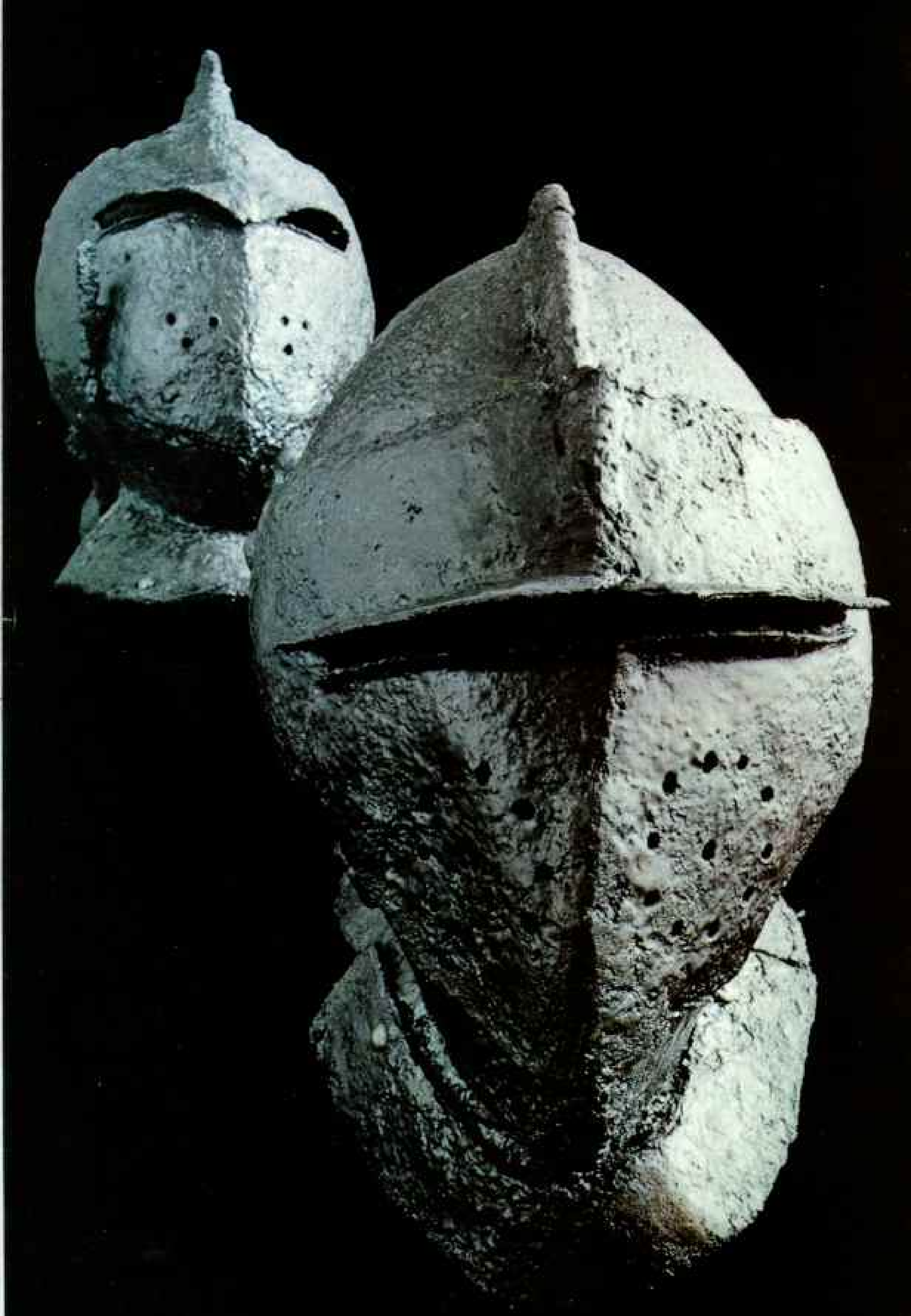
COVER: *A barefoot ballerina dances for her grandfather on a Soviet farm in the Ukraine. Photograph by James Tobin.*



At Wolstenholme Towne, archaeologists find fragments of 17th-century colonists' dreams, shattered by hardship and massacre

First Look at a Lost Virginia Settlement

By IVOR NOËL HUME
DIRECTOR, DEPARTMENT OF ARCHAEOLOGY, THE COLONIAL WILLIAMSBURG FOUNDATION
Photographs by IRA BLOCK
Paintings by RICHARD SCHLECHT

IN MID-APRIL 1623 the ship *Abigail* hoisted sail at Jamestown and slipped away down Virginia's James River, homeward bound for England. If Richard Frethorne paused from his labors to watch her go by, tears must quickly have clouded his vision. Frethorne was an emotional and unhappy man. "I thought no head had beene able to hold so much water as hath and doth dailie flow from mine eyes," he wrote. The life of a Virginia colonist was not for him.

Frethorne was one of hundreds of servants, many of them indentured, who arrived at the fledgling British colony in its early years. Driven by economic and family problems at home and buoyed by the prospect of a new life in the New World, they learned their first bitter lessons herded aboard ships like the *Abigail*, which had sailed from England in October 1622.

On March 22 of that year, Virginia Indians, led by warrior chief Opechancanough, had risen against the colonists, massacring them in their homes and in the fields. When news of the disaster reached England, the Virginia Company of London assembled relief supplies and shipped them out aboard the *Abigail*.

Along with quantities of old armor and weapons from the Tower of London to rearm the survivors, the ship carried about 150 new settlers and the provisions necessary to sustain them, including barrels of beer—beer which, according to one passenger "stunke so I could not

VITAL CLUES in a gripping detective story, the earliest dated piece of British-American pottery yet found (**above**) and two helmets, brilliantly restored (**left**), reopen a forgotten chapter in our colonial past.

endure the deck for it." Later, brewer Duppa, the London supplier of the beer, would be accused by the colony's treasurer of transmitting a "contagion" that spread from ship to shore and throughout the already ailing population.

Richard Frethorne, who had survived a voyage in which infection spread so fast that "after a while we saw little but throwing folkes ouer boord," found that he had been assigned to a plantation where only two houses and "a peece of a Church" had escaped the March massacre. Named Martin's Hundred after one of its London shareholders, the plantation stood beside the river about ten miles east of Jamestown, and at its founding in the spring of 1619 was home to more than two hundred settlers.

There were only about twenty left when Frethorne arrived in December 1622, and according to him, when the *Abigail*'s food reached them, they gorged themselves to a point where "itt killed them that were ould Virginians as fast, as the scurvie & bloody fluxe did kill us new Virginians."

Before long Frethorne was reduced to rags, not a shirt on his back. Even his cloak was stolen by one of his "owne fellowes" and traded for food. To his parents he wrote, "I neuer felt the want of father and mother till now, but now deare frends full well I knowe and rue it although it were too late before I knew it."

It was indeed too late. Before the year was out, Richard Frethorne was dead, victim of starvation or perhaps Mr. Duppa's beer. Frethorne had been sent to Virginia as a servant to William Harwood, "governor" of Martin's Hundred and leader of a group of settlers once considerably larger than the number who had landed at Jamestown in 1607, only 12 years earlier. *

Jamestown, however, survived, and Martin's Hundred did not. Harwood never joined Capt. John Smith or John Rolfe on the pages of Virginia history. Sir John Wolstenholme, a prominent Martin's Hundred shareholder who gave his name to the

*From documentary records historians know the general location of Jamestown's original fortified settlement, founded in 1607. Archaeologists believe that the site has been washed away by the James River.

"**We were totally unprepared** for what we found," recalls the author (**right,** at right). He had been directing the exploration of Carter's Grove, an 18th-century plantation near Williamsburg. Then came the surprise: thousands of artifacts from the previous century unearthed at three sites. His team found postholes marking the site of the earliest town plan in British America yet revealed by archaeology—Wolstenholme Towne, the seat of a settlement known as Martin's Hundred. Its first colonists, arriving aboard the *Gift of God*, docked at Jamestown in April 1619 and were ferried (**left**) to their new home, about ten miles down the James River.

DAVID L. ARNOLD, NATIONAL GEOGRAPHIC STAFF

settlement's central community, had to rely on desolate geographical features of Greenland and the Hudson Bay region to keep his name on the map. Even Martin's Hundred was destined for oblivion, its name first corrupted to Merchant's Hundred, and then succeeded by a much more enduring Virginia plantation name: Carter's Grove.

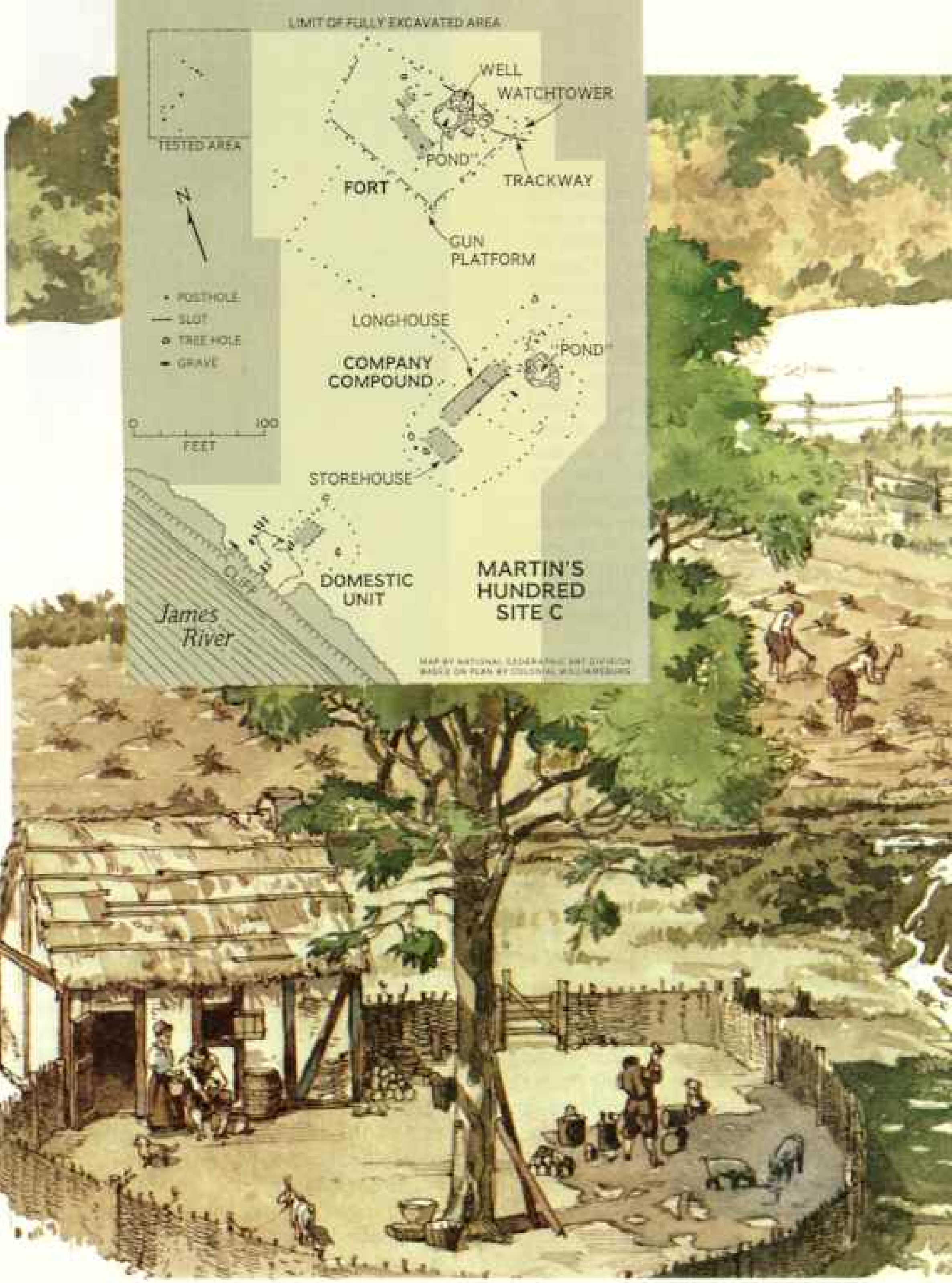
For close on 350 years the remains of Wolstenholme Towne would lie buried and forgotten—until archaeologists looking for something quite different came upon them. But even then, a few dirty marks in the soil and a handful of potsherds did not hint that we had stumbled upon one of the most dramatic incidents in American colonial history—or that there we would uncover postholes offering evidence of the earliest town plan yet excavated in British America, together with some truly astonishing artifacts.

So far it has taken us more than three years of painstaking digging (with the support of the National Geographic Society) to reconstruct what happened there and to put Martin's Hundred securely back on the map (pages 744-5).

IN 1969 the 18th-century Carter's Grove mansion and more than 500 surrounding acres were deeded to the Colonial Williamsburg Foundation to create an exhibit interpreting colonial plantation life. As Colonial Williamsburg's director of archaeology, I was given the task of organizing the 1970 exploration of those acres in search of buried clues to help re-create the mansion's 18th-century environment—and as survey archaeologist Dr. William M. Kelso often reminded me, 500 acres was a lot of territory. About half had been plowed for centuries; the rest was wooded gullies and marshland, and always had been.

Through the woods, Bill's survey team dug hundreds of test holes looking for even the smallest traces of past occupation: a nail, a scrap of brick, a potsherd—anything that would say "somebody did something here!"

The plowed fields posed another problem. There the land surface had been turned over time and time again, destroying the accumulated layers of soil and refuse that man leaves behind on his homesites, and that might otherwise provide *(Continued on page 747)*



They had come to stay, a company of men and women determined to hack Martin's Hundred out of the wilderness and make it a going concern. First order of business: Build a town. This is how it may have looked between 1619 and 1622.

Revealed when the archaeologists stripped away a layer of plowed earth, patterns of holes where fences and structures once stood diagram what almost certainly was part of long-forgotten Wolstenholme Towne (**inset**). Designated

Site C, the most extensive of the 17th-century sites excavated at Martin's Hundred, about four acres of the town have thus far been discovered, although the James River has probably eroded an equal area.

The settlement's leader may have lived in the fort, background, that served the community as a refuge from attack by Indians. Besides the colonists' crops of tobacco, used locally for barter, they raised food staples that included corn and livestock, such as the goats and hogs inside a wattle fence around the cottage at far left. In a company compound, above, a longhouse, at right, is adjoined by a byre or stable, flanked on the left by a storehouse.

The elements of the Martin's Hundred settlement that have been found thus far come tantalizingly close to a design that was employed during the same period by fellow English colonists—an ocean away in Ireland.

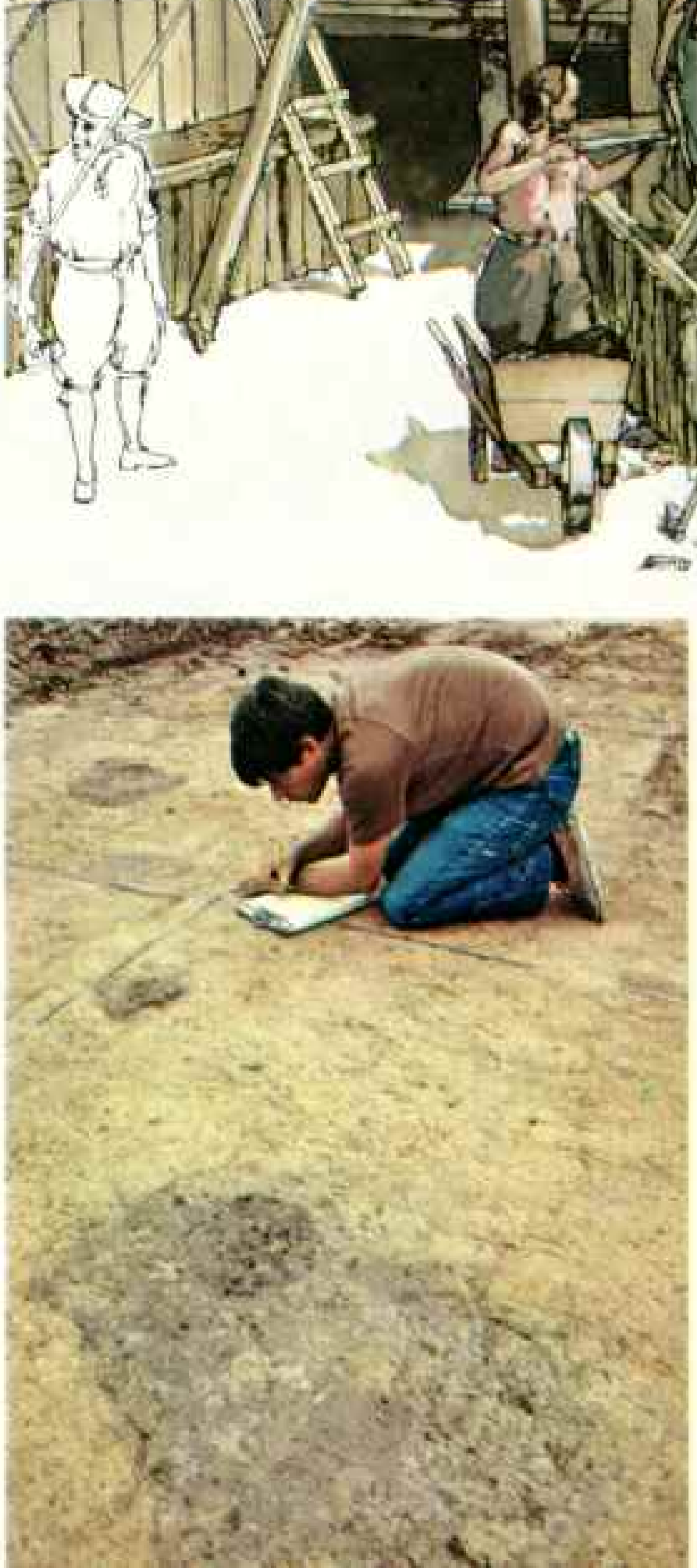
IVOR NOËL HUME

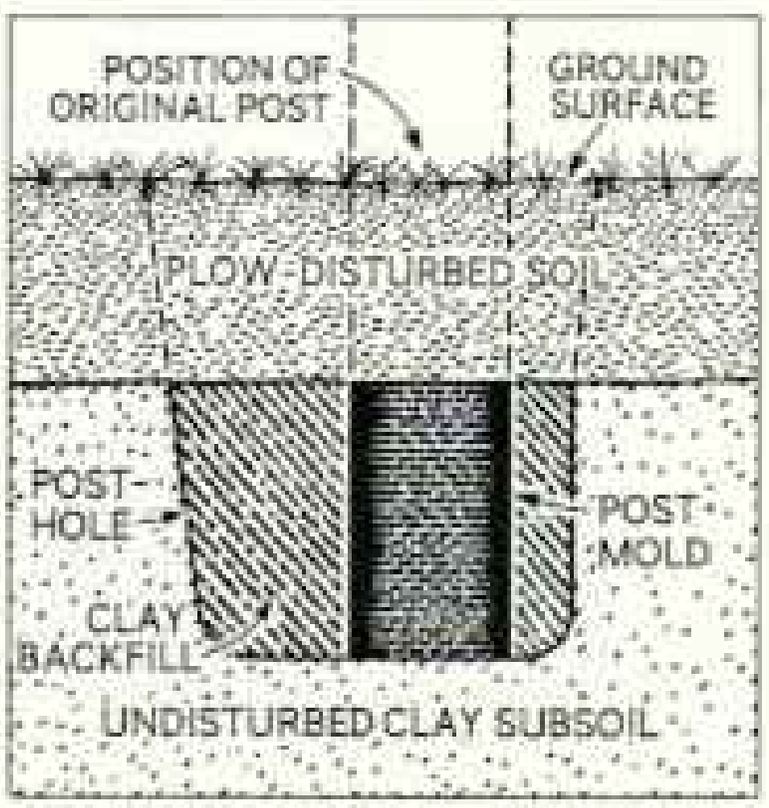
The earliest complete ground plan of a British colonial wooden fort yet unearthed is outlined by postholes and ground slots dug to seat timbers. But why were most posts nine feet apart? Archaeologists had long envisioned such forts with posts set side by side to repel arrows. Instead, the Colonial Williamsburg team deduced that a palisade fence with rails and planks connecting the posts—an irregular trapezoid enclosing about 10,000 square feet—had been Wolstenholme's refuge. In center foreground, four holes delineate a square watchtower. Within the fort, structures once existed, sketched by holes that yielded ashes—clues to a fiery disaster.

Remnants of a "Pallizado" Reveal the Settlement

SETTLER'S LOSS, archaeologist's gain: Found in one of the fort's ground slots, a tiny tinned copper coin known as a Harington farthing (**below**) was minted in England for only three months in 1613. Wolstenholme Towne's fort (**right**) was built six years later, probably in the manner of Jamestown's "Pallizado of Planckes and strong Posts. . . ." At center, colonists position a cannon to face the river, reflecting their fear of an invasion by the Spanish, a powerful threat from the south. At right, workers build a three-foot-high platform of earth and timber, designed to enable defenders to rest their muskets in notches between palisade planks, about 7½ feet tall.

The faint evidence left by these structures challenges archaeologists like William R. Henry, Jr. (**below right**), here plotting ash-filled postholes. Posts leave two marks (**bottom**). In the hole's outer perimeter, where earth was filled in around the post, the most recent artifact found gives a date after which the post was erected. In the small inner area, called the post mold, the most recent artifact found gives a date after which the post had rotted, burned, or was pulled out.



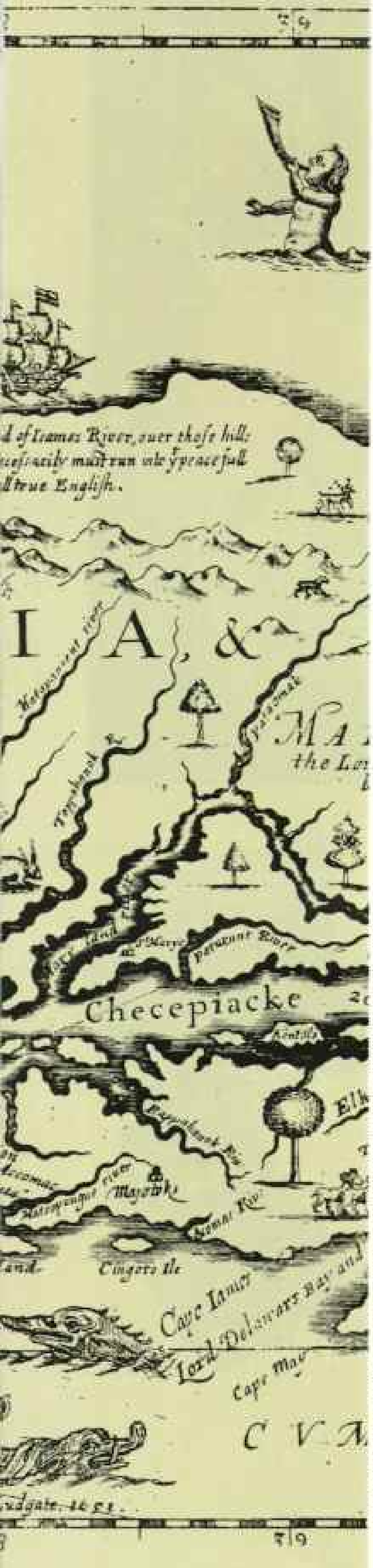


DIAMETER OF COIN 0.4 INCHES. DAVID BRILL (RIGHT)

The Sea of China and the Indies.

S.ir Francis Drake
was on this sea and landed
An.o 1577 in 37 deg. where hee tooke
Possession in the name of Q:
Eliza: Calling it new Albion.
Whose happy shoore, (in ten dayes march with 30 foote and 30 horsemen from
and through the rich adiacent Valleyes beautyfied with as prossitable rivers
Indian sea may be discovered. to the exceeding benefit of Great Brittain, and

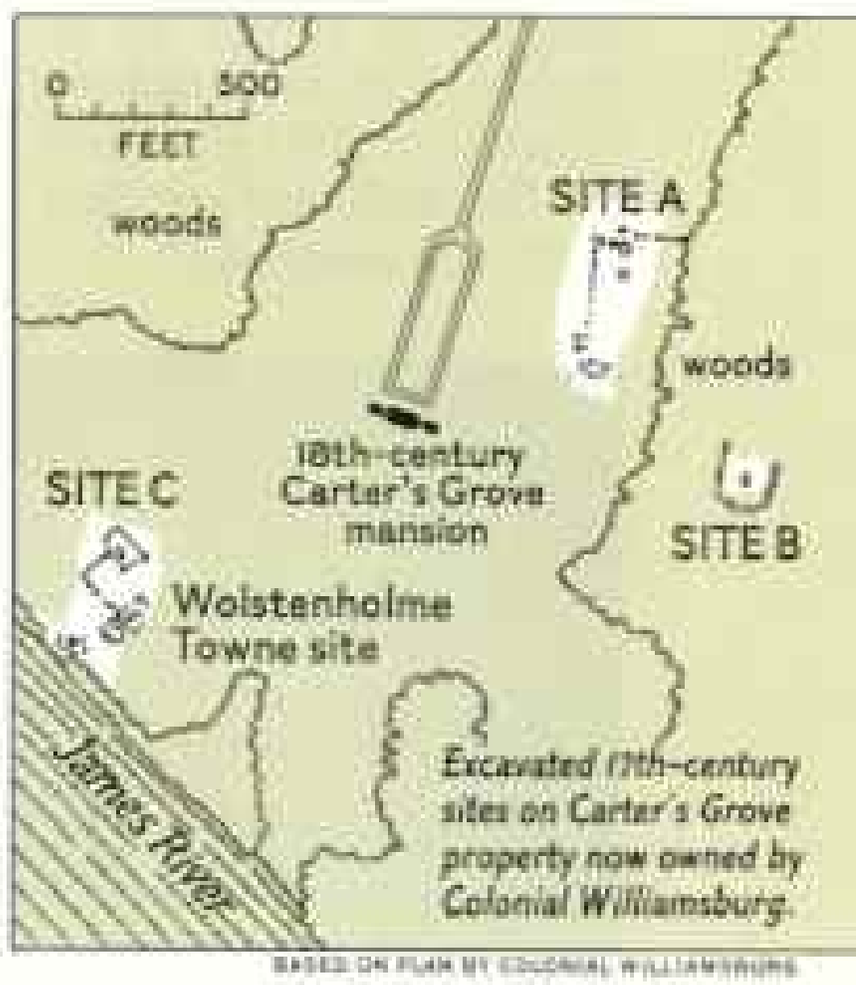
Ould
RAWL
IA
Carolana
VIRGINIA
Mangoacks C.
Manates C.
Meridies
Snakes
Sassafras tree
Chamahas River
Monsiack
Nansamond River
The Bay
Cape Henry
Cape Charles
Smiths I.
MARE
PACIFICUM
LAN
Ohio Goldsmith sculp
Domino Virginia Fautori Collegit. Are sold by I. Stephenson at ye Sunn be
Orientis



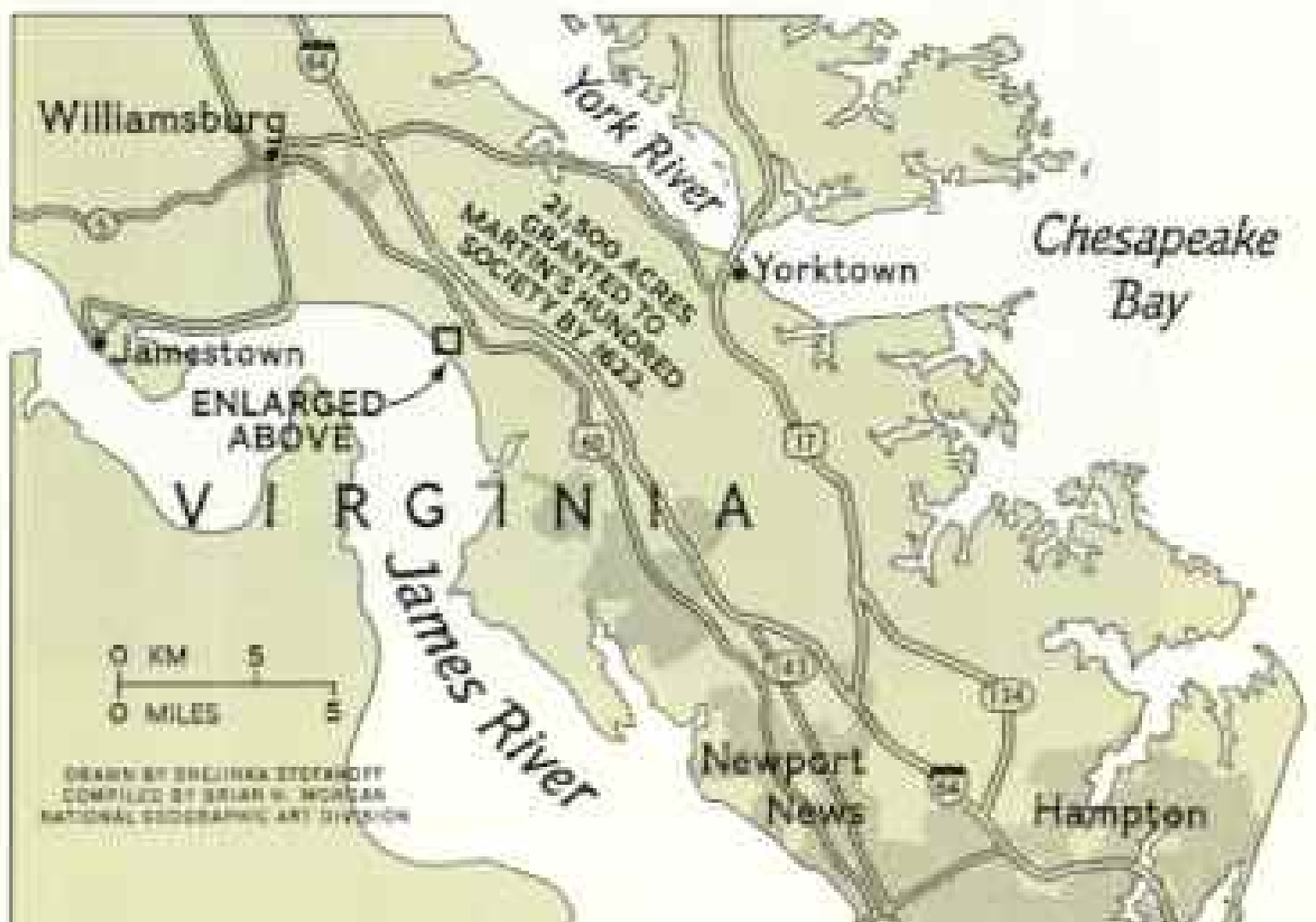
PATHWAY TO PROSPERITY, the earliest known map showing Martin's Hundred directed settlers up the James River to China. The 1651 map (with west at the top) led them to believe that just beyond Virginia's "Vallyes beautyfied" awaited the riches of the Orient, only "ten dayes march . . . from the head of Ieames [James] River." The colonists who had suffered in this alleged Virginia paradise did not know that the Orient was actually about 11,000 miles away, but they would have wondered why no copperheads, voracious insects, or hostile natives were depicted along with the birds and bunny rabbits.

The reality was that after the Virginia Company of London staked its fortune at Jamestown in 1607, most of its planters were lucky merely to survive, let alone show a profit. So in 1616, when dividends from the company's original "Incorporations" came due, all the enterprise had to offer was more land. That it did—to private adventurers and joint-stock companies such as the Martin's Hundred Society, named for shareholder Richard Martin. Another was Sir John Wolstenholme, for whom the society's town was named. Through investments by these and other like-minded entrepreneurs, a tide of settlements called "particular plantations" flowed up and down the James and peopled its banks.

Martin's Hundred—a "hundred" once meant a tract big enough to sustain a hundred families—was allotted at least 21,500 acres (**bottom**). The first settlement, with an initial population of about 200 people, was founded in 1619 on Site C (**right**). Later, several structures were built around a large house at nearby Site A, where residents discarded bits of bottles and pottery—datable trash indicating occupation between about 1625 and 1645. In the same period a house stood at Site B. Archaeological evidence has yet to be found pointing to occupation in Martin's Hundred beyond the 1650's.



BASED ON PLAN BY COLONIAL WILLIAMSBURG



MAP OF VIRGINIA DRAWN BY JOHN FARRER, 1651, WILLIAM L. CLEMENTS LIBRARY, UNIVERSITY OF MICHIGAN, ANN ARBOR

As the mystery unfolded, archaeological detectives trailed evidence of a man of means, perhaps William Harwood, "governor" of Martin's Hundred. A latecomer to the Virginia colony, he joined its governing council, which in 1621 forbade "any but ye Council & heads of hundreds to wear gold in their cloaths." Found on Site A, an inch-long scrap of woven gold called a point, similar to those shown on a garter in this 1621 painting of Sir Henry Paiton by Flemish artist Daniel Mytens (**right**), may once have adorned Harwood himself.

Likewise, a cast-iron fireback decorated with the royal arms of England bespeaks a wealthy owner. Discovered inside the fort, metal fragments (**below right**) comprise part of the motto of the Order of the Garter, HONI SOIT QUI MAL Y PENSE—"evil to him who evil thinks." Beneath the L on the upper piece, a unicorn's hoof proved to be in an identical position with another on a copy of an English fireback (**below**) dated 1621. Did Harwood live first in the fort and later in a house at Site A?

COURTESY SIR HEREWARD WAKE, BT (TOP RIGHT)

(Continued from page 737) archaeologists with the earth sequences that help them to figure out who did what—and when.

All we could hope to find amid the plow-churned acres of Carter's Grove would be those traces of human occupation that might lie deeper than the blade could reach: dark stains in the clay subsoil marking holes once dug to seat building foundations and fences, to sink wells, or to receive household garbage. Such marks would show up only after the nine inches or so of plow zone had been stripped away. But to do that over about 250 acres would have seriously damaged the farmland and cost a fortune. The only sane (but archaeologically frightening) course was to cut—and later refill—trenches across the fields with a mechanical grader, the slices ten feet apart and six wide, broad enough to expose any patterns in the subsoil.

The technique worked well enough, but we encountered a problem: Very few of the subsoil disturbances dated from the 18th century. Instead, scattered through the fields and woods all around the Carter's Grove mansion was evidence of European life there a hundred and more years earlier.

The court records of James City County had been taken to Richmond for safety during the Civil War, only to be burned in the fighting. Because they related to Jamestown and the settlements that grew up in its immediate vicinity, the loss of those records cost the nation one of its primary historical resources. Consequently we have few records to document the legacies and land transactions that converted the 17th century's Martin's Hundred into the 18th century's Carter's Grove or, indeed, to show that there was any connection between them.

For my part, although I had studied 17th-century artifacts for many years, I remembered so little of my early English history I had forgotten that a "hundred" was a term for a county subdivision usually defined as large enough to sustain a hundred households. To most of us it was simply a figure slightly more than 99. We had a lot to learn.

COLONIAL WILLIAMSBURG has long enjoyed a reputation as a pioneer and leader in the field of 18th-century architectural restoration, and in 1976 its instructions to me reflected those interests. A two-acre strip of flatland had been left untested in our 1970 survey, untested because we had backed off when we began to uncover graves—seven of them at first—all of unknown date. Now we needed to determine the age and extent of the cemetery so that Williamsburg architects could know whether they might legitimately use portions of the acreage for exhibits of 18th-century plantation life.

If success or failure is measured by how well we fulfill our employers' desires, we failed miserably. By any other standards our 1976 excavations succeeded beyond our most expansive hopes. The 23 graves we ultimately found belonged to a settlement—we called it Site A—dating from the second quarter of the 17th century. They flanked and straddled a fenced lane leading to the site of a major dwelling and at least seven other structures (pages 756-7).

Five of the graves lay in a straight line, suggesting that the bodies were all interred at the same time—perhaps victims of contagious disease. At once Richard Frethorne and the ill-fated voyage of the *Abigail* came to mind. But just as outbreaks of plague were common in England (41,313 died in the London contagion of 1625), so now-unidentifiable maladies carried off hundreds of Virginia colonists. According to a contemporary estimate, between 1619 and 1621 some 3,560 people were sent out from England to join the colonists. About 3,000 died within that three-year period. In short, taking one's chances as a "new Virginian" was a gamble that rarely paid off.

We had found some of the losers. Dr. J. Lawrence Angel, the Smithsonian Institution's curator of physical anthropology, examined the bones in the graves.

"The most startling thing about the skeletons is their youth," he told us. Of 15 graves grouped together, Larry estimated that not one was above the age of 32. Five children had died between the ages of 2 and 8, five women between 22 and 30, and five men between 23 and 32, all of them white.

Very little had gone right for the Virginia colony after its founding at Jamestown in 1607. Although a fragile détente had been reached with the Indians, inconsistent management and lazy labor, coupled with an alien climate and rampant disease, ensured

that when in 1616 it came time to declare the Virginia Company's dividends, the shareholders came away enriched only with more promises. It was then that the company began to offer land patents to individuals and other joint-stock companies willing to invest in America.

One of these was the Martin's Hundred Society, which, like London trade guilds planting settlements in Ireland's Ulster, undertook to build its own company community, to be called Wolstenholme Towne, and to send over enough people to work the land and return a profit.

They reached Virginia in April 1619 aboard the *Gift of God*, and in July the new plantation of Martin's Hundred sent two representatives ten miles upriver to Jamestown to the first legislative assembly to convene in British America. Not until April of the following year did the "governor" of Martin's Hundred, William Harwood, set sail from England. He was a newcomer of sufficient importance to be appointed to the colony's governing council, and he was still a member when in 1621 it passed a resolution to "Supress drunkenness gameing & excess in cloaths [and] not to permit any but ye Council & heads of hundreds to wear gold in their cloaths."

TOO MANY, the record of who should and should not wear gold in his clothes can be dismissed as historical trivia, but for us it had a special importance. In one of the Site A rubbish pits, supervising archaeologist Eric Klingelhofer found an inch-long scrap of woven gold, rolled and stiffened at one end. It was an ornament, probably from a man's garter, known in the 17th century as a point, a sartorial embellishment generally worn by men of importance (page 746). Perhaps we had found a trace of the clothing of William Harwood, council member and head of the hundred, the only man who, by that 1621 Virginia law, could wear gold in his clothes.

Unexciting in itself, but perhaps thunderous in its significance, was the discovery of a $3\frac{3}{4}$-inch cannonball: The 1625 census lists only one man in Martin's Hundred with a cannon—William Harwood.

Throughout the summer of 1976 the incoming artifacts from Site A continued to point to a household of substance, a place that had been home to at least 108 square glass bottles—an enormous number when one considers that no Virginia household inventory surviving from the first half of the 17th century lists more than five. There were double-handled earthenware flasks from Spain, marbleized slipware plates from Italy, stoneware bottles and jugs from the Rhineland, and tin-glazed ware from England and Holland.

One rare plate differed from any I had seen from Holland or England; its blue decoration looked more like designs on majolica attributed to Portugal. But then I remembered an identically decorated sherd I had picked up several years earlier on a mountain path on St. Eustatius, a West Indian island settled by the Dutch in the 1630's. I had little doubt, therefore, that the plate was Dutch and not Portuguese.

If the quality and variety of the domestic artifacts pointed to William Harwood (or to someone of his social and administrative stature), the largest artifact of all—the house—remained glumly unsupportive. It had left us no brick or stone foundations, no walled cellar, not even a brick chimney base—only a pattern of postholes to show that the building had measured 40 feet by 18 feet, and that in the course of its life a porch or narrow room had been added at one side.

Unexciting as they may appear, postholes can yield vital clues to the birth and death of an archaeological site (pages 741-3). Those faint stains in the clay subsoil at Martin's Hundred would ultimately tell us nine-tenths of the dramatic story that we eventually unraveled.

Similarly, the tedious task of numbering and crossmending often tiny fragments of pottery was contributing something more than patched-up pots: It was reestablishing associations in both space and time. A sherd unearthed from the fill of a cellar, for example, would be found in the laboratory to join sherds from the same vessel dug from a storage pit and a tree hole elsewhere on the site. Such painstaking linkage declared clearly to us that all three holes were being filled with trash at the same time, and that the cellar, by then, had already lost its house. This crossmending process lies at the heart of archaeological interpretation—which explains

why interpretive conclusions may not be reached until several years after the digging has ended.

ONE POTTERY VESSEL required no lengthy mending to tell its story. What it needed was the digging of an entirely new site.

"I think I've found a pottery nose cone!" exclaimed student excavator Richard M. Veditz. It looked more like a Turkish helmet to me—which was not too far off the mark. In the 17th century these conical vessels were often called helms. What Rick had found was an alembic, the top element from a three-part still (page 754).

Glazed on the inside and with a folded gallery around the interior rim leading to a tubular spout, the alembic captured the liquor or medicinal distillate as it cooled, turned liquid, and ran down the glazed wall out through the spout and into a waiting bottle. I knew of several fragmentary examples recovered from European sites, and I had seen them in Flemish and Dutch paintings, but none were as handsome as this. It was a superlative piece of potting, from its finger-decorated spout to its unique conical finial. The potter must have thought so too, for when he finished he dabbed a touch of glaze to the top as a crowning flourish.

As a relic of some master potter from the Low Countries, this discovery would have been cause enough for scholarly ecstasy, but I knew it to be something more. Made from the local Tidewater Virginia clay and found with waste from the kiln where it was baked, the alembic opened a new window on the genesis of American ceramic art. If only we could locate the kiln itself!

Before the 1976 season was over, we were to find more surprising evidence of the quality of early American potting. We learned that at least one potter made decorative ware, dishes embellished either with yellow-slip ornament or with similar designs incised into the clay in the technique called sgraffito. But we found no kiln, and there was nowhere left on this domestic site to look.

Believing that the kiln might be cut into the side of a hill, and knowing that another site of much the same period lay in shouting distance across a ravine to the southeast, we planned to move there in the spring of 1977.

Meanwhile, the crew would spend as much wintertime as weather would permit digging test holes through the woods in search of Wolstenholme Towne. We were now convinced that Site A could not be it. Our dating evidence indicated that the site had not been occupied before about 1625 and that life there continued to about 1645. We had found no signs of any major destruction by fire as we would expect of buildings attacked by Indians in 1622. The new site across the ravine seemed too small to seat a town, and, located above a shallow creek, it offered poor access to the James River.

Unlike Site A, this one (rather unimaginatively identified as Site B) had not been mutilated by plowing. Soil strata laid down in the 1630's had been disturbed only by roots and rodents. Once we moved the thin skin of dead leaves and recently formed humus, artifacts were everywhere. Alas, they belonged to a single, post-built house, and search as we did, there was no sign of a potter's kiln. Again, unlike Site A, this one yielded only a single rubbish pit, but it proved rich in content.

The pit's top layer contained two ax heads—one European, the other Indian—in association with pieces of armor, and at once we thought of the 1622 massacre. Could this be debris buried when the survivors came back to rebuild? Most of the artifacts were hard to date with sufficient accuracy: links from chain mail, an elbow section from a suit of armor, several pairs of scissors, a crystal bead, the lid and bottom of a small brass box, and fragments of local pottery, including pieces matching Site A slipware. On the other hand, finding most of a splendid German stoneware jug made between about 1610 and 1630 did nothing to weaken the possibility that the pit dated to the massacre period (page 751).

Archaeological directors are usually seen watching other people work, and that certainly is a necessary function of a supervisor. But for me, when it comes to the interpretation of critical details, there's no substitute for doing the work yourself. The Site B pit was just such a case, and together with crew foreman Nathaniel Smith, I stayed with it all the way. If we could be sure this was indeed a pit filled in 1622, it would be a Rosetta stone for the dating of colonial artifacts

in use in the first quarter of the 17th century.

Unhappily it was not. At the very bottom of the pit was another fragment of the local slipware—the date 1631 worked into its decoration (page 735). It gave us the earliest dated example of British-American pottery yet found, but it destroyed our massacre theory. The pit could not have been filled until at least nine years later.

Very few artifacts (other than coins) have dates actually marked on them, and the chance of finding a piece of dated pottery from the early 17th century was laughably small, yet many artifacts do offer clues to their place and dates of manufacture—if we are smart enough to recognize them. The little brass box found much higher in the pit's filling was to become a classic example. Stamped on the lid with its maker's mark in the shape of a hand, it reminded me of later Dutch and German tobacco boxes, but I had no proof, nor any clue to its date.

Six months later I learned that an identical box bearing the same marking had been recovered from the wreck of the *Batavia*, a Dutch merchant vessel lost off the Australian coast in 1629, a date extraordinarily close to that of our 1631 dish (page 753).

Failing to immediately date the brass box was not my only error at Site B. When planning the excavation, I had taken care to clear the site of poison ivy and underbrush that might hide venomous snakes, ticks, and hostile insects, but I had failed to consider the vicious deerflies that infest the Carter's Grove woods in summer. Attacking in late June, they made continued work on the site impossible.

The only recourse was to retreat to another of the sites found in our 1970 survey, one in open ground closer to the river. We designated it Site C. Thus luck and an army of deerflies led us to one of the most productive American archaeological discoveries of recent years.

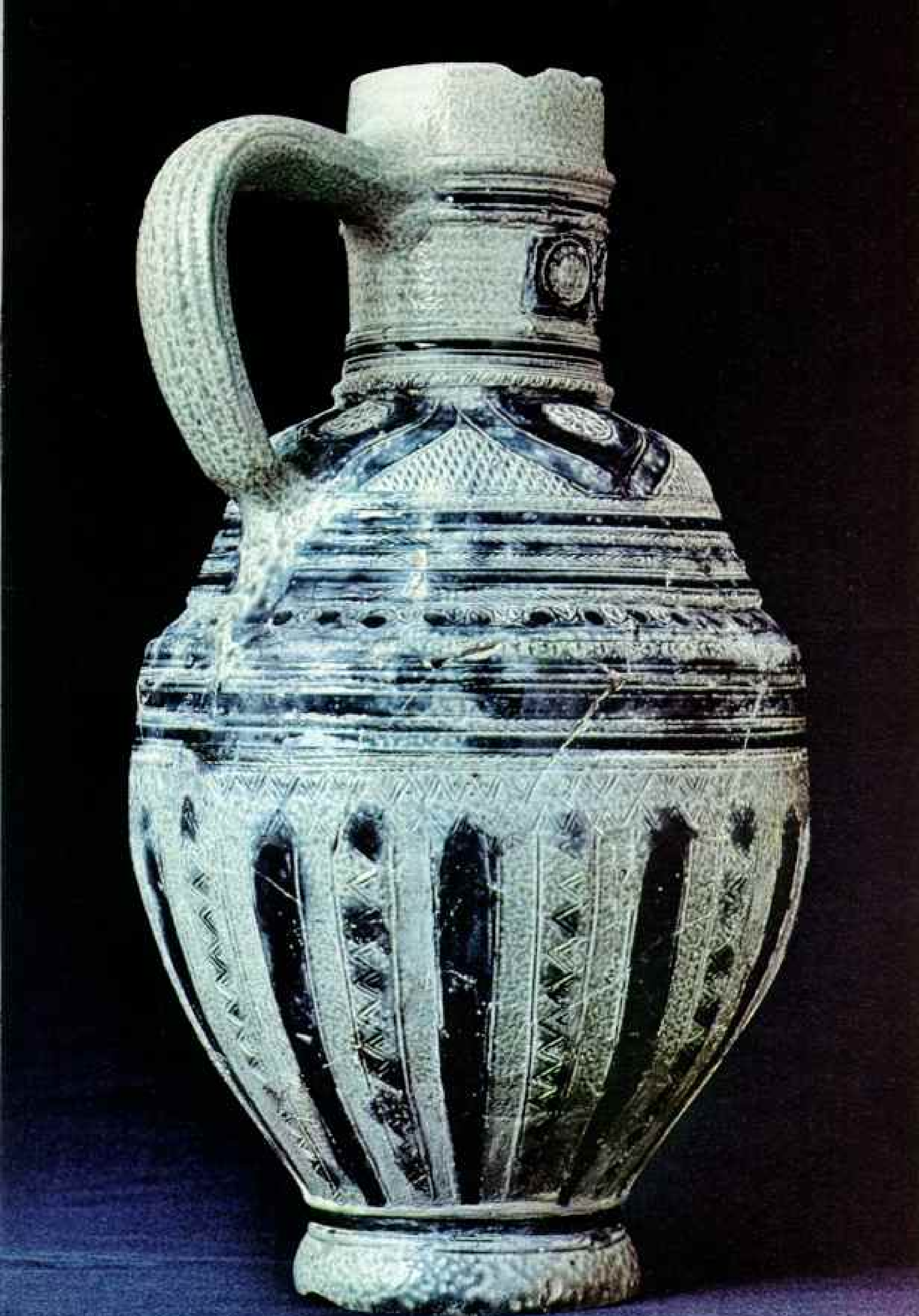
WITH the 1977 summer season half over when we began, I decided to limit our work to an area a hundred feet square where the 1970 testing had shown a large dirt-filled depression in the yellow-clay subsoil. Eric Klingelhofer found that feature again without any trouble, but he was disappointed to discover that about half of the hundred-foot area was totally barren; everything was crammed into one corner within two rows of large postholes set nine feet apart.

As each new hole was plotted, Eric and I became more puzzled. The lines of holes were coming together at a 72-degree angle.

"It looks for all the world like two sides of a triangular fort!" I don't remember which of us said it, but I do know that it was I who quickly rejected the fort theory. Forts, I insisted, had to have their posts set side by

Well-traveled artifact, this handsome German stoneware jug, probably made between 1610 and 1630 (**right**), was pieced together from Site B. Produced in the Rhineland, exported through the Netherlands to London, it crossed the Atlantic to add a graceful touch to a colonist's home at Martin's Hundred. A similar jug appears in "The Listening Housewife" (**left**), painted in 1656 by Dutch artist Nicolas Maes.

DETAIL REPRODUCED BY PERMISSION OF THE TRUSTEES OF THE WALLACE COLLECTION, LONDON



side, so close that an Indian couldn't zap an arrow between them. After all, that was the way the palisade has been built at reconstructed Jamestown, and that's the way they are in Western movies from *Fort Apache* to *Laramie!* But I was wrong—as Audrey, my research associate (who also happens to be my wife), gently pointed out.

Rereading William Strachey's 1625 account of the settlement at Jamestown, Audrey found that he had described the fort as being built "with a Pallizado of Planckes and strong Posts, foure foote deepe in the ground, of yong Oakes, Walnuts, &c." There, then, was our answer: a palisade built with widely spaced posts and with planks between (pages 741-2).

While we were still debating, Eric's team discovered four deeper holes that created a square box projecting eight feet beyond the junction of the two palisade walls. Strachey had a Jamestown explanation for this too. "At every Angle or corner," he said, "where the lines meete, a Bulwarke or Watchtower is raised."

Beside our watchtower, Eric pointed to an irregular soil stain extending both inside and outside the palisade. "There had to be a gate there," he said.

"But that would be hard to defend," I demurred. "Maybe the palisade was later used as a cattle compound, and an extra entrance was added at that time." But again Audrey pointed to the words of William Strachey. Beside each of the watchtowers, he had written, "there is a Gate likewise to goe forth," and at every gate a cannon.

By now we were sure we had stumbled into a palisaded fort. But who had built it, and when?

Surviving documents show that there were several forts or palisaded compounds defending the outlying plantations along the James. Virginia colony treasurer George Sandys was listed as having forts, two of them paled in, on each of his three properties. Every time the wording suggested he had both a dwelling and store buildings inside, indicating that the defenses were more than mere enclosures to retreat into in case of attack.

Although the 1977 excavations exposed only a corner of our fort, the number of postholes inside it hinted at considerable interior construction of one sort or another. The artifacts were more explicit. Fragments of glass bottles, cooking pots, and dishes left no doubt that someone once lived inside the compound—someone of sufficient importance to own a cast-iron fireback decorated with the royal arms of England. Proof came from fragments found at the edge of the large soil-filled depression.

In letters an inch high, the fragments read L:Y—enough for me to guess at the rest: [HONI:SOIT:QUI:MA]L:Y[:PENSE], the motto of the Order of the Garter—"evil to him who evil thinks." My hard-to-impress colleagues, sure that I was making too much from too little, were less vocal on the last day of the 1977 digging season, when another fragment turned up to add three more letters—[MA]L:Y:PEN[SE.] Later, a detail—the hoof of a unicorn—proved to be in identical position to one on another fireback in England, manufactured in 1621 (page 746).

Here was strong evidence that our fireback could date before the 1622 massacre. To ship such a heavy and elaborate household effect from England could only have been the action of someone with considerable money and foresight, someone who was coming to Martin's Hundred with a position to maintain—someone like the "governor," William Harwood.

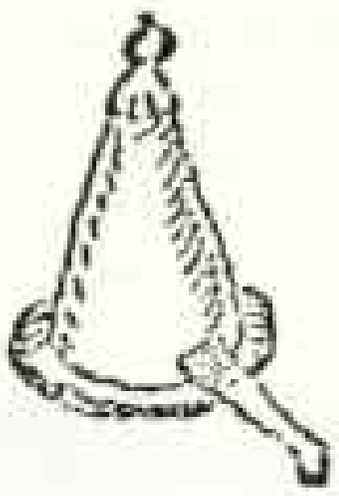
Was it possible, we asked ourselves, that Harwood had lived inside the fort before the massacre? That the interior of the fort had burned was revealed both by charcoal in many of the postholes and by ashes spreading into the large black patch that Bill Kelso had found in 1970. Scattered along the edge of the depression were burned brick fragments (plus the red baked-clay nest of a mud dauber) and many artifacts that should not have been thrown away, among them the firing mechanisms for five matchlock muskets. We know that in 1625 Harwood had 25 spare "matchcocks" in his arsenal.

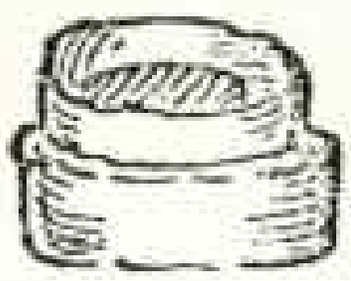
THE BIG BLACK DEPRESSION proved to be a silted saucerlike "pond" that fell away at one edge into a shallow well shaft. Filled with silted clay, the well contained an object that took our breath away. Lying on its side was what appeared to be a complete close helmet, the kind worn in Europe by officers and by

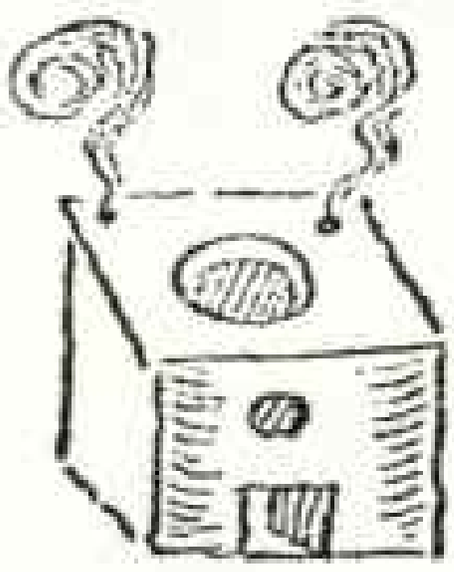
Survival tools. Bullets cast in single and multiple molds (**left**) were used to bring down game and answer arrows. Evidence of affluence amid the wilderness, a gilded brass spur (**below**) was discovered on a site occupied after about 1625.

TWICE ACTUAL SIZE

Quality shimmers in the haft of an English table knife (**above**) encrusted with silver in a floral pattern. A little brass box (**left**) bears a hand with a pointing finger. Such details might be ignored by the layman, but they ring bells in the minds of archaeologists. The hand is a maker's mark, and an identical box stamped with the same mark was recovered from the wreck of the *Batavia*, a Dutch merchant ship lost off Australia in 1629. The date helped another tiny piece of the Martin's Hundred puzzle fall into place.







Made in America: An outstanding piece of Virginia pottery called an alembic, the top element of a three-part still (**far left**), came almost intact from Site A. The firebox heated such ingredients as water, leaves, and flowers in the middle section. Steam condensed on the alembic's glazed interior and ran down a channel around the rim, which delivered the distillate —medicinal brews and liquor—to the spout. Pleased with his product, the potter crowned it with a dab of glaze.

A potter's rejects were discovered in a pit in the company compound. Research associate Audrey Noël Hume, the author's wife, pieces some together (**right**): a cream pan (foreground), bowls, jars, a colander, and small pots called pipkins. Made between 1619 and 1622, they represent the earliest known group of colonial Virginia pottery yet found.

cavalrymen in the 16th and early 17th centuries (page 758). To my knowledge no complete close helmet had ever been found on a North American site.

A telephone call to the late Harold L. Peterson, one of the country's leading armor specialists, confirmed my belief. Pete went further: If the helmet really was complete, he said, it would be the first discovered anywhere in the New World.

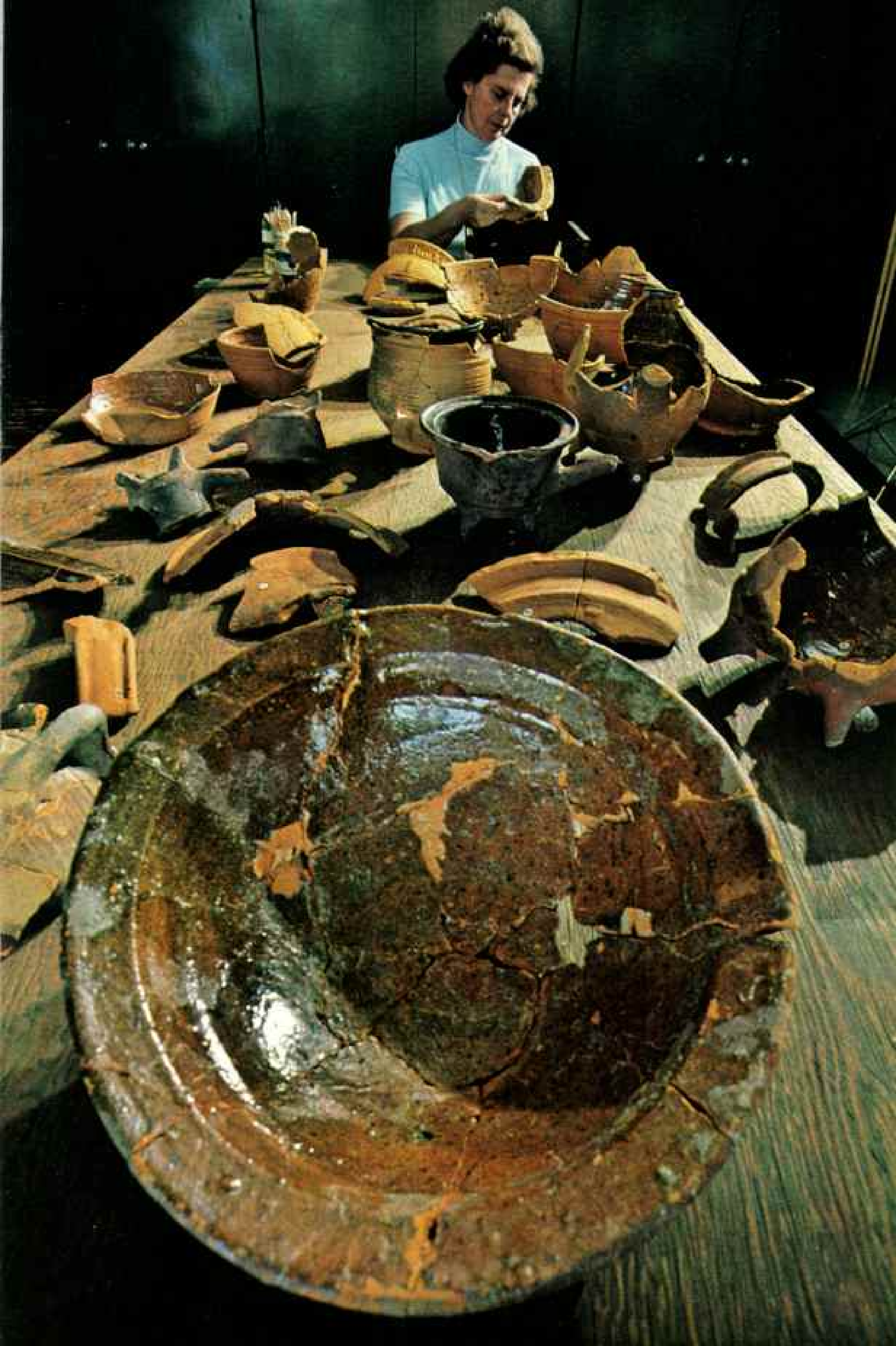
Details of the helmet's shape were obscured by rust-bonded clay. How much metal survived? I took a thin dissecting needle and gently prodded the rust. The point met little resistance. Then we tried a magnet. No pull at all. I had to tell a tensely waiting crew that although they had found an object unique in American archaeology, our chances of safely moving it were no better than one in twenty. On the other hand, if we could get it into the laboratory, I was confident that conservator Gary A. McQuillen's new metal-preservative techniques would give him a good chance of consolidating the rust and saving the helmet's shape.

Fearing that we were about to go down in the history of American archaeology as those idiots who failed to save the New World's first close helmet, we proceeded with snail-like caution.

We took more than two weeks to build protective walls around the helmet and to lift it and a massive block of the well's silt intact into the laboratory for careful excavation. The task was made more difficult by the presence of another piece of armor lying in the silt beside and beneath the helmet. It was an almost complete armor backplate. But thanks to Gary's skillful reinforcing, that, too, came out intact.

We knew that the 1625 census listed William Harwood as owning "Armours, 8," but it had never occurred to me that these would include helmets any more tightly closed than a burgonet (page 760). With its visor pulled down, our helmet restricted the wearer's vision to two narrow slots looking straight ahead. Its collar limited independent head movement, and with iron covering one's ears, the warning snap of a twig in the forest would have gone unheard.

Englishmen setting out with such armor, and whose combat experience had been limited to campaigns in Ireland or the Netherlands, can have had no concept of what war and weather would be like in Virginia.



IVOR NOËL HUME

Terrible trinity of disease, famine, and fighting once ruled the settlement. But sickness always threatened. Here at Site A, colonists bury a comrade (**above**). On and around a fenced lane lay 23 graves, the dead ranging from infants to an old man of about sixty. Some graves were dug in a row (**left**), probably at the same time, suggesting contagious disease had struck.

Nevertheless, conditions were better than in the early days, when hunger stalked the settlement. "I haue eaten more in [a] day at home then I haue allowed me here for a Weeke," lamented Richard Frethorne, a servant. Throughout Virginia the story was the same. Between 1619 and 1621 about 3,560 people left England to join the colony's settlers. Within those three years, seven out of ten perished.

Thus the Martin's Hundred helmet epitomized the European juggernaut approach to battle, and was to Indian warfare in the 1620's what tanks and helicopter gunships would be to modern guerrilla warfare in Southeast Asia. Although the helmet was the most evocative object we could ever hope to find on the site of a fort, I was sure it was an isolated anomaly, probably discarded for that reason. Wrong again!

Almost exactly a year later, in another silted "pond" not a hundred yards from the first, we were to find a second backplate—and another close helmet.

Not wanting to clear the remainder of the fort's interior before we had located the rest of its palisade lines, we began the 1978 season clearing inland toward the fort from the river. But as soon as we began, we ran into more postholes, holes so far from the fort that they could not be part of it.

They were, instead, the fence, or palisade, lines around an area comprising an apparent storehouse 15 feet by 25 feet and a longhouse, part dwelling and part byre or stable, 15 by 60 feet.

Beyond the longhouse was our second pond, a hole we think was originally dug by a potter to obtain clay, for into it he later threw his spoiled products. Ironically, he was not the man we had been seeking on Sites A and B; his potting shapes and techniques were different, though the range of his wares covered virtually every vessel that a colonist might need: bowls, dishes, mugs, cooking pots, bottles, water jars, colanders, and even perfuming pots to contain smoldering herbs to freshen the air of sickrooms (page 755).

The pond's contents were not limited to potter's waste, however; they included iron tools, a brass cooking pot, and five lead seals once used to identify bales of fabric from the city of Augsburg in Germany. By another extraordinary coincidence I had found an almost identical seal twenty years earlier on the foreshore of the River Thames at London. Eight are now recorded from sites in England and Europe, but the five from Martin's Hundred constitute the largest single group.

Then there were the military items: a sword pommel; part of a powder flask; a bandolier powder cap; two gun barrels (one inexplicably packed from breech to broken muzzle with small lead shot); iron plates from an armored vest called a brigandine; a throat-protecting gorget; plus, of course, another backplate and our second complete close helmet (pages 760-61). This domestic pond had yielded contents uncannily akin to those from the pond in the fort.

Like the fort buildings, those in what we now called the company compound had been destroyed by fire. We asked ourselves: Could both be the result of the massacre? If so, how were we to prove it?

Buildings with thatched or bark roofs were as likely to be set ablaze by an errant candle flame or a spitting log as by the torches of attacking Indians. On the other hand, houses were too far from the fort for sparks to be blown from one to the other. If Indians were responsible, we needed also to find the graves of some of the estimated 58 Martin's Hundred settlers who died at their hands. We had seen no graves in the excavated corner of the *(Continued on page 762)*

ABOVE, BELOW, AND BOTTOM RIGHT BY IVOR NOËL HUME

A Nervous First . . .

INCREDIBLE FIND issues a challenge: Save it. Virtually nothing but rust remains of the first complete close helmet found in the New World (**above**), so named because it entirely enclosed the head. In a process that took more than two weeks, a steel frame was built around the helmet and the clay in which it rested. After an armor backplate beneath it was gingerly removed, conservator Gary A. McQuillen applied a silicone molding compound to the helmet's surface—insurance in case it disintegrated—then added a layer of plaster (**right**). When the 200-pound load was winched up, the team held its breath. It worked.

. . . Becomes a Refined Art

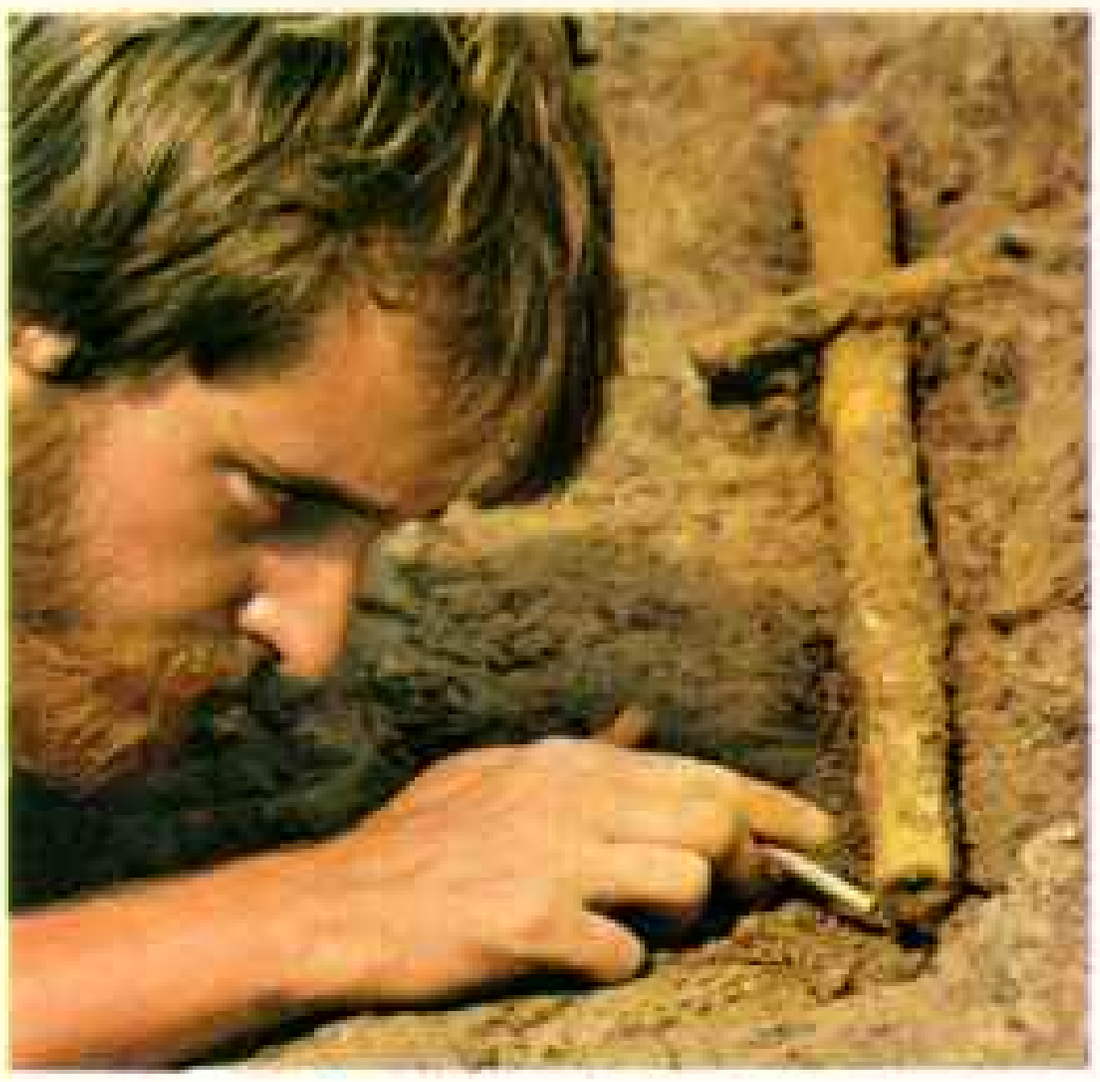
BY THE TIME a second close helmet was found, a hundred yards from the first, the archaeologists had developed a technique that safely unearthed it in six hours. Dispensing with the steel frame and

LEFT, ABOVE, AND BELOW BY DAVID BRILL

silicone mold, the author scraped away the earth down to the helmet's midpoint. Over the exposed side went strips of fiberglass screen softened with cellulose glue. When the glue dried, hardening the screen and bonding it to the rust, the helmet was covered with a blanket of wet paper and then by a protective plaster-of-paris casing. Finally, the buried half of the helmet was undercut, and the mushroomlike plaster mold was inverted, cushioned in an old tire, and borne to the laboratory (**upper right**).

In the lab, conservator McQuillen repeated the process on the untreated half. He then removed the dirt inside the helmet through its open collar and reinforced its interior with fiberglass screen and resin. Next he pried the plaster mold apart, took away the now dry paper, and dissolved the glue and screen on the top half with acetone to confront the original clay and rust. As with the first helmet, he used an airbrasive tool (**middle right**) to delicately pare the surface down to the firmest remaining corrosion, perhaps a millimeter thick. After the procedure was repeated on the other side, the helmet emerged, though part of it was crushed (**right**). He mended the damage and, as he had with the first helmet, applied a corrosion inhibitor mixed with lampblack (page 734).

For protection against the Indians, Virginia colonists were warned to carry arms and wear armor. The labeled pieces (**above**), or parts of them, were unearthed by the author and his team.



DAVID L. ARNOLD

IVOR NOËL HUME

Armor vs. Arrows in a Guerrilla War

FOR THE SALVAGES are so light and swift, though wee see them (being so loaded with armour) they haue much aduantage of vs. . . . Capt. John Smith thus recognized the same facts of life and death that surely dawned on the Martin's Hundred settlers who fought Indians. Properly equipped for European-style conflict, in Virginia they would have been encumbered by heavy armor and a close helmet, which hampered movement, restricted vision, and muffled warning sounds like the snap of a twig under a moccasin.

Dozens of armor fragments excavated from the settlement help re-create the battle dress of its defenders (**left**). Rectangular iron plates (**right**) that fitted together like fish scales were enclosed between two layers of fabric, forming a vest called a brigandine. Discovered beneath the first close helmet, a backplate (**middle right**), worn with a counterpart breastplate, was salvaged with its brass rivets and the ends of its leather straps. Iron links (**top right**) may have formed a shirt of mail.

Student excavator Jeffrey S. Parker uncovers a musket barrel (**above**) inexplicably packed with lead shot from breech to broken muzzle. The author's theory: Perhaps it stored the lead a potter used in making his glaze.

DAVID BRILL (TOP LEFT AND ABOVE)

(Continued from page 757) fort, but crew chief Nate Smith found one in the fenced yard behind the longhouse. It was located so close to an apparent doorway that people would have been forever stepping over it going in and out of the building. Thus, we deduced, the grave's occupant was buried after the house ceased to exist, perhaps interred close to where he fell defending the door while his colleagues fled to the safety of the fort. Imagination was running riot!

Taking more sober stock before we opened the grave, we reminded ourselves that a buried skeleton does not readily identify itself as a massacre victim. We needed evidence of hasty interment, perhaps some windblown ashes from the burned buildings on the grave floor under the body, and above all some evidence of what Agatha Christie fans know as "foul play."

All three were there.

The body had been dumped unceremoniously into the hole, its arms swinging loose and its left buttock jacked up against the wall of the grave. Underneath the body were scraps of charcoal blown or knocked into the open hole. But most revealing of all was the condition of the skull. Physical anthropologist Larry Angel tentatively attributed the cause of death to a frontal blow from a cutting tool like a cleaver, followed by blows to the side or back of the skull while the man lay on the ground.

The back of the head had been reduced to fragments the size of cornflakes and took weeks to piece together, but once it was done, everyone who saw the skull was struck by the strength of the man's features. About 5 feet 9 inches in height, taller than most of the skeletons we found, and with strong wrist development likened by Larry to that of a swordsman, our man has all the attributes of a soldier—perhaps the owner of the second close helmet.

Harwood survived the massacre, but his military lieutenant, Richard Kean, did not, and it is greatly tempting to believe that we have seen the face of the soldier responsible for the safety of the settlers and who gave his life in their defense (pages 766-7).

JUST AS SURVIVORS must have fled from houses outside the fort to the safety of its palisade, so we moved on from the company compound toward yet-to-be-found fort walls. They were there, but not quite where we had expected to find them.

The plan was not triangular, it was four-sided, trapezoidal, laid out by someone trained in the "why don't we stop about here" school of military engineering.

Entered through a small gate on the west side, and protected by inner parapets and a gun platform having a commanding view downriver, this fort must have been designed to defend as much against England's longtime Spanish enemy as against the savages. It almost certainly was the product of instructions given the first settlers when they left London in January 1619.

DAVID L. ARNOLD; DAVID BRILL (RIGHT)

Echoes of pleasure and pain: Virginia leaf, fruit of the colonists' labor, soothed a settler of the 1630's in an English clay pipe (**above**)—an important dating tool often made, exported, smoked, and discarded within a year or two. A delftware ointment jar (**right**) manufactured about 1610 may have held balm to salve cuts or burns.

ALTHOUGH THE DISCOVERY of the oldest complete palisaded fort plan unearthed to date in British America was cause for archaeological euphoria, we soon realized that neither it nor the helmets were the real prize.

Most significant of all was that slowly expanding pattern of postholes on our map. New lines of fences took shape; another house, another yard, then at the cliff edge a cluster of 14 graves, extending a line of colonial occupation all the way from the fort to the river. Here, simple but recognizable, was the record of the earliest town plan yet revealed by excavation on a colonial site in British America.

But the plan was by no means unique; on the contrary, it fitted a well-documented pattern of settlements in another English colony where fear of hostile natives made defense a key feature of the plan. In Ireland, plantation settlements in Ulster financed by London companies had three primary elements: a four-sided, fortified enclosure called a bawn, containing the home of the leader; outside it, a wide street, or green, flanked by two rows of tenants' and freeholders' houses; and an Anglican church to cater to the souls of both the settlers and the Irish.

We had our bawn and evidence of domestic life inside it, and we had one row of company houses. We had a cemetery but no church, though we know that the town had one, probably large enough to house 100 or more people, and substantial enough to leave a "peece" of it for Richard Frethorne to find still standing after the Indians had done their worst. Most of all we needed another row of houses flanking the fort to the north. Without them the parallel between the Wolstenholme Towne plan and contemporary drawings of Ulster settlements was incomplete and inconclusive.

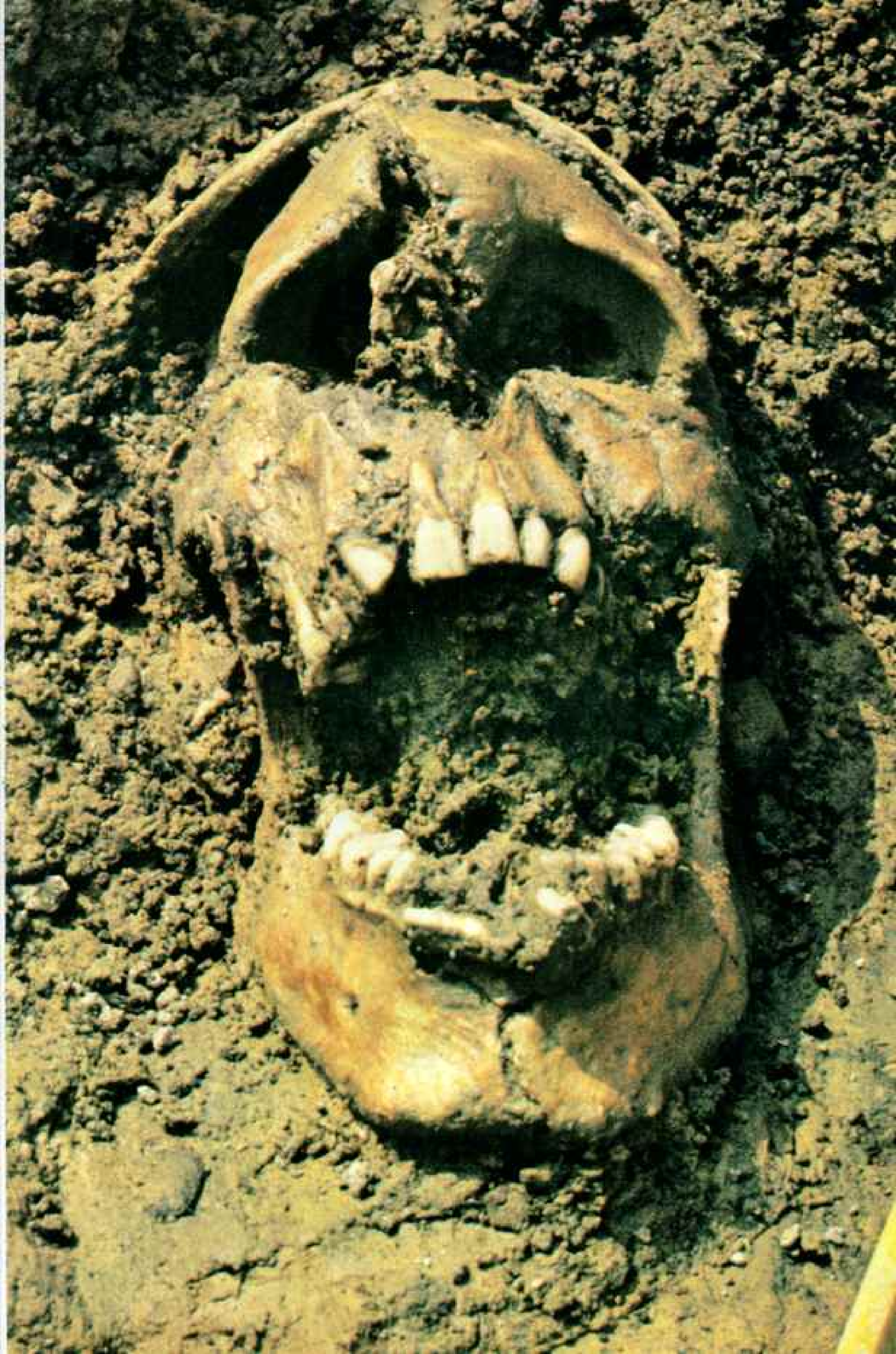
Taking a chance that the weather would hold through November, I asked Eric Klingelhofer to start stripping the plow zone beyond the fort in search of that second line of buildings. He began with widely spaced trenches to minimize the disturbance should the subsoil prove barren. But before we had cleared enough to lay out our grid, the weather turned bad. A week of rain transformed the trenches into canals.

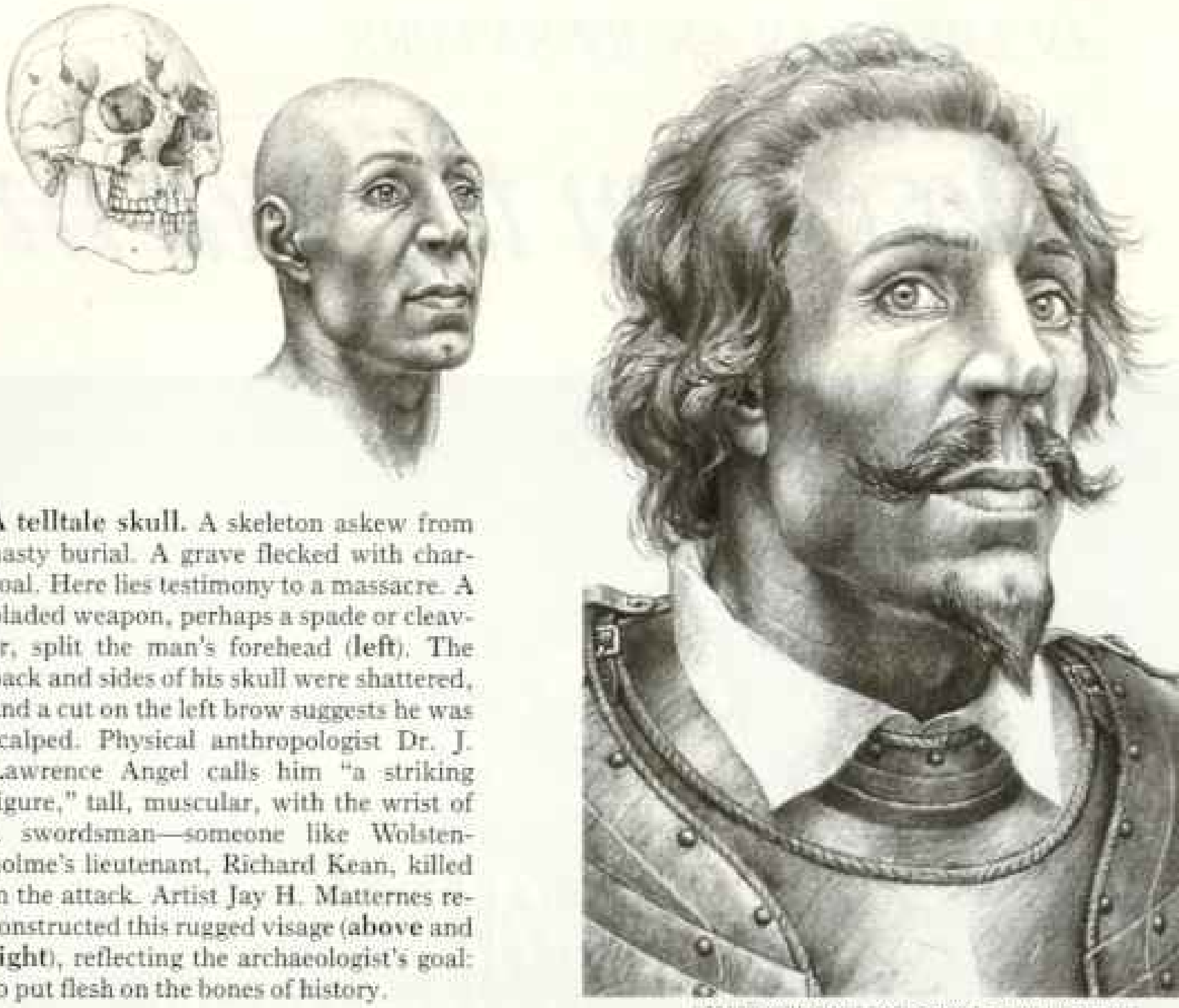
I knew we were beaten. By the time the ground dried enough to let us bring back the grader, nighttime frosts would be turning Wolstenholme Towne's fragile traces into featureless powder. The site would have to be backfilled to protect it until spring.

Had the trenching drawn a blank, disappointment would have been less acute. Instead, in the last hours before the rain began, the crew found a row of the site's largest postholes—the molds containing the now-familiar flecks of wood ash and burned clay. Running parallel to the other domestic units, the line lay 150 feet north of the fort gate, the same distance as those buildings were south of it. *(Continued on page 767)*

Beginning of the end of Martin's Hundred came on March 22, 1622. Recent relations with the Indians had been so cordial that, in settlements throughout Tidewater, "they came unarmed into our houses [**above**] . . . in some places, sate downe at Breakfast." Thus one colonist recounted the coordinated ruse. Suddenly the Indians seized the colonists' own tools and weapons (**right**) and "basely and barbarously murthered, not sparing . . . man, woman or childe." Jamestown, alerted by an Indian informant and thus on guard, foiled the attack. But elsewhere nearly 350 settlers died, about 58 at Martin's Hundred. There, archaeologists sought physical evidence to confirm documentation of the massacre.


REINHARD SCHLECHT





A telltale skull. A skeleton askew from hasty burial. A grave flecked with charcoal. Here lies testimony to a massacre. A bladed weapon, perhaps a spade or cleaver, split the man's forehead (**left**). The back and sides of his skull were shattered, and a cut on the left brow suggests he was scalped. Physical anthropologist Dr. J. Lawrence Angel calls him "a striking figure," tall, muscular, with the wrist of a swordsman—someone like Wolstenholme's lieutenant, Richard Kean, killed in the attack. Artist Jay H. Matternes reconstructed this rugged visage (**above** and **right**), reflecting the archaeologist's goal: to put flesh on the bones of history.

FOR NOEL HUME (FACING PAGE): DRAWINGS BY JAY H. MATTERNES

VISITORS TO THE SITE ask, "What makes all these holes in the ground so important? What makes the Wolstenholme Towne site unique?"

The questions are direct enough, but the answers are complex. Whenever we open a door into an unknown world, everything we see inside is important. Although traces of the 1622 massacre are intensely interesting and dramatic, and finding the colonists' arms and armor is exciting, what really matters is the new light shed on British life in America in the second decade of colonization.

History shows that in Ulster the Londoners built two fortified communities, Londonderry and Coleraine, but many more of the bawn-protected open villages. Historians have been aware of similarities between Jamestown and the fortified Irish townships, but now we know that the bawn village too had its Virginia parallel—at Wolstenholme. No town layout of so early a date has been excavated at Jamestown; thus Wolstenholme takes center stage as the oldest British domestic settlement plan unearthed in America.

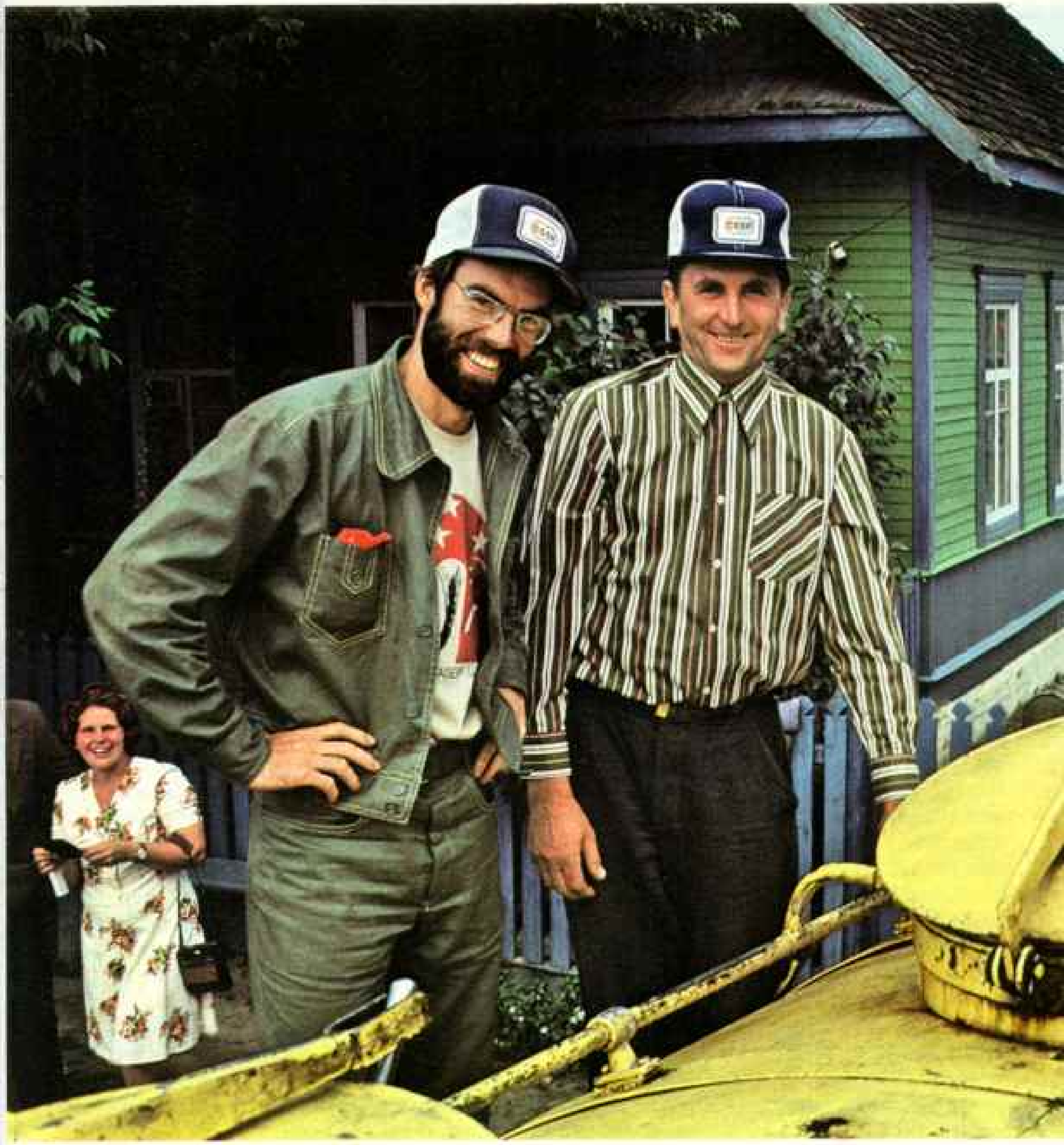
As fog settled over the site and the first thin films of ice stiffened the edges of puddles, Eric and his team of excavators dismantled their tents. Wolstenholme Towne would keep the last of its secrets through one more winter.

How early are the newly found holes? Why are they so large? Can they be a "peece" of the church? If so, why are the graves on the other side of the green? Do the holes really give us the second line of buildings we so badly need to complete the picture?

The questions were enough to keep us all in hot debate until Virginia's welcome springtime sun thawed this rich historic soil. More answers at Martin's Hundred now lie tantalizingly close at hand. □

AN AMERICAN 4-H ADVENTURE

Down on the Farm,



Soviet Style

By JOHN GARAVENTA
Photographs by
JAMES TOBIN and
CAROL SCHMIDT

JAMES TOBIN

THE WORDS to a favorite song rambled uncontrollably through my mind: "I'm your captain. I'm your captain." I, a Connecticut Yankee, fancied that like many New Englanders of the past I was piloting a ship. But this curious ship was no creaking whaler, it was a big Soviet SK4 grain combine, and I steered it over a billowing sea of wheat on the state farm of Urozhay, located in the Soviet Union's Crimean Peninsula, a part of the Ukraine.

Although I hummed the song, I knew in truth I was no captain but merely a deckhand taking a turn at the wheel while my Soviet instructor, Sergei, stood by. Occasionally he adjusted the combine head, keeping the huge machine on an even keel. We charted our route over a wheat field almost two miles long, parched from three rainless weeks in this spur of land that extends into the Black Sea. Instead of the smell of salt air, I breathed wave after wave of dust.

Yet we sailed under threatening skies. By early afternoon the rains finally came, obscuring the sea of wheat. Soon the combine sat motionless in a field too soggy to work. Some of the wheat already cut would be ruined by the moisture, but the farm manager expressed relief, hopeful that the change in weather might improve the harvest of the other crops. As for me, I felt tired

Person-to-person, farmers on opposite sides of the planet—and sometimes at opposite ends of the political spectrum—traded views last summer when a dozen young U. S. agriculturalists worked on Soviet farms under a National 4-H Council exchange program. Bearded Stephen Renquist of New York stands atop a milk truck with Ivan Skudny at his home on the Rassvet collective farm in Byelorussia.

WANDA ANDERSON (ABOVE); JAMES TOBIN

"**Ivan is better,**" a tractor driver proclaims in mock triumph as he bests Carol Schmidt, an agricultural-education student from North Dakota, in arm wrestling during a rest break at Rassvet, near Minsk. "Of course he was better at wrestling," says Carol, "but I'd like to take him on in cribbage."

For 12 weeks last summer Carol and her compatriots drove combines, milked cows, shoveled manure, attended an agricultural academy, and skirmished occasionally with bureaucrats.

David McAuley of North Carolina drinks from a water cart (**left**) during a break from picking apples at the Urozhay farm in the Crimea.

and satisfied, having completed another day on a farm in the U.S.S.R.

On such days in a Soviet wheat field I sometimes shook my head to be sure I was not dreaming, to remind myself that, with 11 other young agricultural specialists from the United States, I was spending the summer of 1978 in the Soviet Union. As part of a 4-H international exchange program we were learning about Soviet agriculture and rural life in a personal way afforded to few other Americans.

During our three-month stay we worked shoulder to shoulder with Soviet citizens on six farms in Byelorussia and in the Ukraine (map, following page), which contains one of the country's most fertile agricultural belts. Our duties ranged from cleaning out cattle stalls to piloting combines. On one farm we experienced the added intimacy of living for two weeks with families.

The experience was often not fun. We were exasperated many times by people's suspicion of us, and we were annoyed by their overbearing efforts to indoctrinate us to the Soviet way of thinking.

Yet we did gain a valuable firsthand look at rural Soviet society, studying in the process how the agricultural industry pursues its immense task of feeding more than 260 million people. Most satisfying of all, we were occasionally able to push away stereotypes and public masks—ours and theirs—and come into real contact with the friendliness and warmth of the Soviet people.

We Americans—nine men and three women—first met in Washington, D. C., where for three months we studied Russian language and culture.

Selected in national competition, we were all in our 20's, and we all either held a degree in some area of agriculture or were working toward one.

Our class was the third to participate in the United States-Soviet Union 4-H exchange program. Begun in 1976, the program was organized in this country by the National 4-H Council, which conducts similar programs with more than forty other nations. It was funded by International Harvester and the International Communication Agency. While we trained in Washington, a dozen agricultural students from the Soviet Union *(Continued on page 775)*

Passing in waves of barley, combines at the Rassvet farm contribute to the record Soviet grain harvest of 1978—235 million metric tons. The giant collective farm, Byelorussia's largest, sprawls over 9,000 hectares (22,000 acres). Byelorussia's climate reminded the 4-H'ers of the Dakotas; the Crimea suggested coastal California (**left**).

"Compared to our farms, they're really food factories," says one American. "The workers all specialize. They work regular hours, then go home."

By the dozens the group passed out American farm caps, worn here by a Soviet student (**right**) and a truck driver (**far right**), who lends unwitting support to a U. S. farmers' protest.

GARY SCHWARTZ (TOP AND ABOVE)

CAROL SCHMIDT

JAMES SCHESSER

Courting disaster? The Americans accepted a casual invitation for a basketball game at the Byelorussian Agricultural Academy in Gorki. They wondered when signs appeared advertising a contest between the academy and the "U.S.A." Then they discovered that their opponents were the academy's varsity team (**left**, red shirts). The 4-H'ers stand tall (**above**) after the inevitable defeat, softened by a consolation trophy.

At Saki a Soviet player and his friend sign a volleyball (**right**) for the Americans after an impromptu game.

CAROL SCHMIDT

JOHN GARAVENTA

were preparing in their country to spend the summer on farms in the United States.

By the time our crash course in Russian had ended, we were able to converse about basic agricultural matters and could stumble through a variety of domestic discussions. We were never more thankful for this training than when we met other Americans in the U.S.S.R. and noticed their helplessness in the simplest of situations.

My favorite example is of one tourist who wanted some bottles of cold wine. Ingeniously removing the label of the vintage he wanted, he demonstrated to the waiter that he wished to have five of this type put into the refrigerator. Thirty minutes later he was presented with five nicely chilled labels.

IT WAS EARLY JUNE when we arrived at the town of Gorki in the Republic of Byelorussia. We came as newly enrolled, short-term students at the Byelorussian Agricultural Academy, first opened in 1840 by Tsar Nicholas I. It is now one of the largest such schools in the Soviet Union with 10,000 full- and part-time students, some of them on foreign exchange programs.

As we passed through the town in a bus, Gary Schwartz of South Dakota observed that there were more tractors and horse-drawn wagons on the road than cars. The roads were built with utility, not comfort, in mind; they were quite bumpy. As in many rural towns in the United States, a number of buildings could have used a coat of paint.

The bus deposited our group at the foreign students' dormitory, a modern building that also housed a group from Africa. A young Nigerian walked up to me and shook my hand, saying, "Thanks a lot. Because of your arrival today, the hot water was turned on."

Indeed, we were shown the best face of the academy. Our living quarters were freshly painted, equipped with TV and refrigerator, and set up for sleeping two to a room. Soviet students lived three or four to each sparsely furnished room.

Though we felt we were continually under observation at the school, we at least enjoyed more freedom of movement than most other Americans in the Soviet Union.

We spent two two-week periods at the

"Now you must come for a little lunch."

A "little lunch" turns out to be a caviar and sausage feast (**left**) for James Schesser at the apartment (**right**) of a faculty member at the agricultural academy. Later she invited him to her private garden plot to pick strawberries—"some as big as eggs," he recalls.

The government allows citizens to grow their own crops on plots as large as half a hectare (1¼ acres). On the grounds of the academy, women hoe potatoes (**above**).

ALL BY JAMES TURNER

academy, attending formal lectures on the ways of Soviet agriculture and learning how to drive Soviet tractors. Our lessons centered around statistics. We often became disheartened by the constant, ponderous references to production and consumption figures, when we were much more interested in theory and methods.

Toward the end of June we finally moved from the classroom to the farm, all of us as eager as colts sprung from a corral. Our first stop was for three days of work at the Ulyanovsky swine complex, some 19 kilometers outside Minsk, the capital of Byelorussia. The Soviets like to trumpet the mechanization of their farms, and here we saw a good example of a modern layout.

The complex produces 40,000 hogs a year, all in climate-controlled barns, with one worker for every 1,500 animals. "The entire farm is mechanized," the farm director said proudly as we viewed the operations on closed-circuit television.

Every day a caravan of garbage trucks from Minsk brought forty tons of food scraps collected from schools, hotels, restaurants, and hospitals. The garbage was ground and cooked, supplements were added, and the liquid was pumped to the feeders pneumatically. The hogs seemed to enjoy the liquid feed, and we were told that it speeds their growth, though Americans would probably shudder at the fat content of these animals.

Stringent sanitation controls are needed with this mechanization and with such large numbers of animals. Whenever we entered or left the complex, we were required to take showers; hogs are susceptible to disease that can be brought in on clothes. After four showers a day I began to feel like a raisin.

From our first day on a Soviet farm we became aware of the major difference between a Soviet and a U. S. farmer. When I asked a worker in the garbage-processing plant at Ulyanovsky about the protein content of the feed, he answered, "I don't know. I am only a mechanic. You'll have to ask the feeding specialist."

An American farmer could give you a very good idea of the protein content. He is involved in the entire production cycle. A Soviet farm worker, on the other hand, sticks to one job, like an assembly-line worker. Farm directors say this is easier on the worker and more efficient.

The Soviet farmer also works a regular shift, like a factory employee. I remember the surprise on one Russian's face when James "Jamie" Schesser of Kansas said, "My dad will have us out working in the fields until we can't see our hands in front of our faces because it is so dark."

(The practice would be exhausting in this latitude during summer, because it stays

BOTH BY JAMES TUBIN

"Woman's work," chides a neighbor as Stephen Renquist washes his clothes (**facing page**) at Rassvet. Here the Americans lived with host families and insisted on doing their own laundry. Nina Skudnaya carries well water (**above**) for the wash—her house lacks indoor plumbing. When she decided that another 4-H'er had not scrubbed his clothes clean, Nina asked, "Didn't your mother teach you anything?"

light as late as 11 p.m., and the sun rises again at 3:30.)

The principal difference, of course, is that in the U.S.S.R. the state, not the farmer, owns the land, and decisions are governed by the five-year plans handed down by the ministry of agriculture. This probably accounts for the Soviet farmer's seemingly indifferent attitude.

The Soviet Union presently operates 27,000 collective farms, averaging 6,500 hectares each (one hectare equals 2.47 acres), and some 20,000 state farms with a much larger mean size of 18,000 hectares. The only significant administrative difference is that on a state farm, the director is appointed by the government, while a collective's daily affairs are supervised by a manager selected by the farm's general population. On a state farm a worker is guaranteed a certain salary. On a collective the employee earns a share of the communal harvest, though in case of crop failures, a base wage will be given.

Motivation is a chronic problem; bonuses are awarded to encourage workers to exceed production quotas. Finding a buyer is no problem because the government purchases most of the national yield at preset prices.

The system seemed very strange to us, but Soviet planners say that given the huge scale of the agricultural effort and the country's socialist precepts, their way makes sense. Alex Booth of Georgia put it another way: "If you enjoy farming, but not the pressure of decisions and the caprice of the marketplace, come on over. You will not have to worry about paying off any farm loans in lean years. But do not expect any large profits in the good years either."

THE SIGHT of a Soviet farm does not bring to mind many of our usual pastoral images. Driving to our second stop—the Mir state farm outside the town of Baranovichi—our bus topped a hill, and down in a shallow valley we saw to our amazement a double line of 26 massive silos. The complex looked like a factory. Even more surprising was the cluster of modern apartment houses—slablike multistoried flats—where the farmers live.

Mir is a large farm by U. S. standards. The complex is situated on more than 4,000 hectares and is responsible for fattening 11,000 head of cattle. Jim Tobin thought the fields resembled those in his home state of Iowa. "With a little imagination," he said, "I could feel like I was working on my parents' farm—except for the storks. There were several dozen following the silage choppers around the fields." Jim inquired, and found another similarity: In the Soviet Union, too, he was assured, storks are responsible for delivering babies.

Proud of the complex, the farm director informed us that workers earn an average of 180 rubles a month, about $250. Although this seemed low to us, it is not hard to live on; a state-owned apartment rents for only seven rubles a month.

At Mir we cleaned manure from pens, loaded cattle onto trucks to be slaughtered, fed calves, and harvested hay.

The busiest spot appeared to be in the barn where Olya and Natasha, two of the hardest-working women I've ever met, were in charge of feeding the calves. In a gust of activity they dished out hay and powdered milk to the animals.

When the chores were done, we would show off our family pictures, and then questions and answers would fly. Al Atwood from Kansas could often be found in the barn teaching women how to make macrame plant hangers from hay-baling twine.

In another area Julie Cannell from Illinois paused to write down the recipe for Byelorussian rolls, with each worker adding special advice. The arrival of the farm director propelled everyone back to work, but as soon as he passed, the recipes reappeared. The women laughed at how Julie hurried to work at the sight of the boss.

The most significant incident during our visit to Mir was our own workers' strike. After a week of hard work at the complex, the day arrived when we could bring our cameras to the farm and shoot pictures. Or at least that's what we had been promised.

When we walked into the farm office that morning, all 12 of us wearing cameras, the receptionist insisted on taking our equipment. No negotiating could change her mind. Angry and perplexed, we recalled advice given us in Washington: Don't be rude or arrogant, but stand up for your convictions.

In this spirit, Gary Schwartz firmly

Cameras *nyet*—work *nyet*. Refused permission to take pictures at the Mir state farm near Baranovichi, the Americans refuse to work (**above**). The strike ended when one American spoke by phone to an agricultural official.

Before touring a dairy farm at Rassvet, 4-H'ers don plastic boots (**right**) as a sanitary precaution.

A Colorado potato beetle (**left**), potato enemy number one in the Soviet Union, perches on a leaf at Mir. "Our hosts were always joking that the U. S. gave them the beetle," says an American. "We told them Europe gave us their rat."

JAMES TOBIN

CAROL SCHMIDT (TOP AND ABOVE)

Free enterprise lives at the market in Gorki, where women bargain over the price of a pig (**below**). Farmers gather here to sell livestock and produce from their private plots. A smiling farmer and his wife leave the market for the ride home (**right**).

announced, "If we can't take cameras, we don't work." At that we all sat on the steps of the office and waited.

The assistant farm manager showed up only to reiterate the ban on cameras and to urge us back to work. Our refusal made him increasingly nervous and frustrated.

Finally Alex Booth asked to speak to the deputy minister of agriculture in Moscow. Handed the phone, he found himself talking instead to a local official in Minsk. Sensing that the Soviets feared that we would make propaganda of our photographs, Alex assured him we were only interested in the positive aspects of the farm.

"OK, you can take in six cameras," said the official. "All or nothing," replied Alex. Silence. "Very well, then," came the resigned answer.

The compromise allowed us only an hour to photograph all that the farm had to offer, but we felt victorious.

A month later on a farm near Vitebsk we were faced with a similar situation. Told our cameras would be unsanitary, we again voted to strike. Watching us vote, the director remarked kiddingly, "Oh, a democracy!" But our cameras were sterilized under ultraviolet light and returned in half an hour.

Our rides through the Russian countryside provided us with glimpses of agricultural practices centuries apart. Often we spotted rows of silos crowding the skyline and spacious fields crawling with tractors whose tires stood head-high. But in the same neighborhood we might also see a *babushka* —an old woman—herding cattle down a road with a stick, or a man operating a horse-drawn buck rake in a hayfield.

Most of the people we met shared their

BOTH BY CAROL SCHMIDT

government's passion for modernization. They were embarrassed when we noticed a horse and wagon on a dirt road (above). And they would beam with pride at an article of food or apparel that had been store-bought instead of homemade.

One vestige of the agricultural past—and of modern free enterprise—is the private plot. After finishing his normal day's labor, a farmer may develop as much as a half hectare (1¼ acres) on his own; he may keep whatever he grows or sell it at a farmers' market for private profit.

With this incentive, people tend to work harder on these plots than on communal property. Every inch of a private garden is cultivated. We found orchards and livestock pens, potato fields and strawberry patches, flower gardens and beehives. We even saw some healthy stands of marijuana. (Our guide, seeing our raised eyebrows, dismissed the plants as weeds, saying that fields of hemp once grew in the area.)

The yields from the private plots are spectacular. The plots account for only 3 percent of all land sown in the Soviet Union, yet they produce almost 30 percent of the food.

Some of the best garden produce is raised in the Ukraine, on the Crimean Peninsula where we worked for two weeks. If Byelorussia resembles Iowa, the Crimea looks like the coastal regions of California. Vineyards cover the hills, and a mixture of grainfields and apple and peach orchards spreads across the flatlands.

Known as black-earth country because of the rich soil, the Ukraine supplies a healthy proportion of Soviet fruits and winter wheat. We delighted in the region's warm weather and the easygoing temperament of

its people. Whenever we could steal time off from work in the orchards, we headed to the surf and sun of the Black Sea.

During our first week in the Crimea, we lodged in the city of Simferopol. Mornings would often find us waking at five and picking our way through the streets to the farmers' market. Before our eyes the city would awaken into a carnival of life as farmers arrived with their goods.

Everywhere vendors were calling to buyers to sample the strawberries, tomatoes, apples, and peaches, all grown on private plots. The more perishable the commodity, the higher the price. Raspberries were going for a dollar a pound, peaches fifty cents a pound, and potatoes only four cents a pound. The best of the produce would not look out of place in a supermarket in the United States.

Nearby, women sold bouquets of bright flowers that the Soviets enjoy so much. Here a man hawked baskets; there, others sold chickens and canaries.

During his wanderings in the market, Steve Renquist of New York located a board listing the price ceilings for each kind of fruit. He took out his camera. Immediately two women started rapping him about the head and shoulders with their umbrellas. "*Nelzya! Nelzya!*—Not allowed! Not allowed!"—they cried. Steve managed to shoot a few pictures, but he was convinced of the Soviet sensitivity to the camera lens.

Incidents in other markets were more pleasant and amusing. One woman offered Carol Schmidt of North Dakota a piece of food (left). She politely took a bite—and discovered the morsel to be fatback.

"Do you eat this at home?" inquired the Russian woman. "Why, no," replied Carol with some discomposure. "Why then, take it all," sweetly rejoined the woman. In such matters, we had been trained, diplomacy supersedes personal taste.

BOTH BY CAROL SCHMIDT

Strangers well met: At the market in Gorki a woman (**above**) offers fatback and bread, a favorite snack, to Carol Schmidt.

Modest pinups decorate the cab of Sasha (**facing page**), a Byelorussian combine driver at Rassvet. Racier pictures are seldom seen in Soviet publications.

WE LEFT the Ukraine in late July and headed back to Byelorussia and the collective farm of Rassvet, near Minsk. Here we would spend our longest stretch on a Soviet farm—two weeks—and for the first time we would be staying with local families.

Two by two we were dropped off at our new homes as the bus passed through Rassvet. Most of us found ourselves in front of one-family frame houses devoid of indoor plumbing, but equipped with telephone and television.

Wanda Anderson of Maine and I were deposited in front of a modern apartment complex. Walking past fragrant flower gardens, we came to a kitchen door where we met Nina Zelenkovets, whom we would come to know as Mom.

Nina was sturdy and had a ready smile. Although she had been cooking all day, her curly light hair was neatly styled and she was wearing a fresh dress. We exchanged greetings in Russian. Not until several days

CAROL SCHMIDT

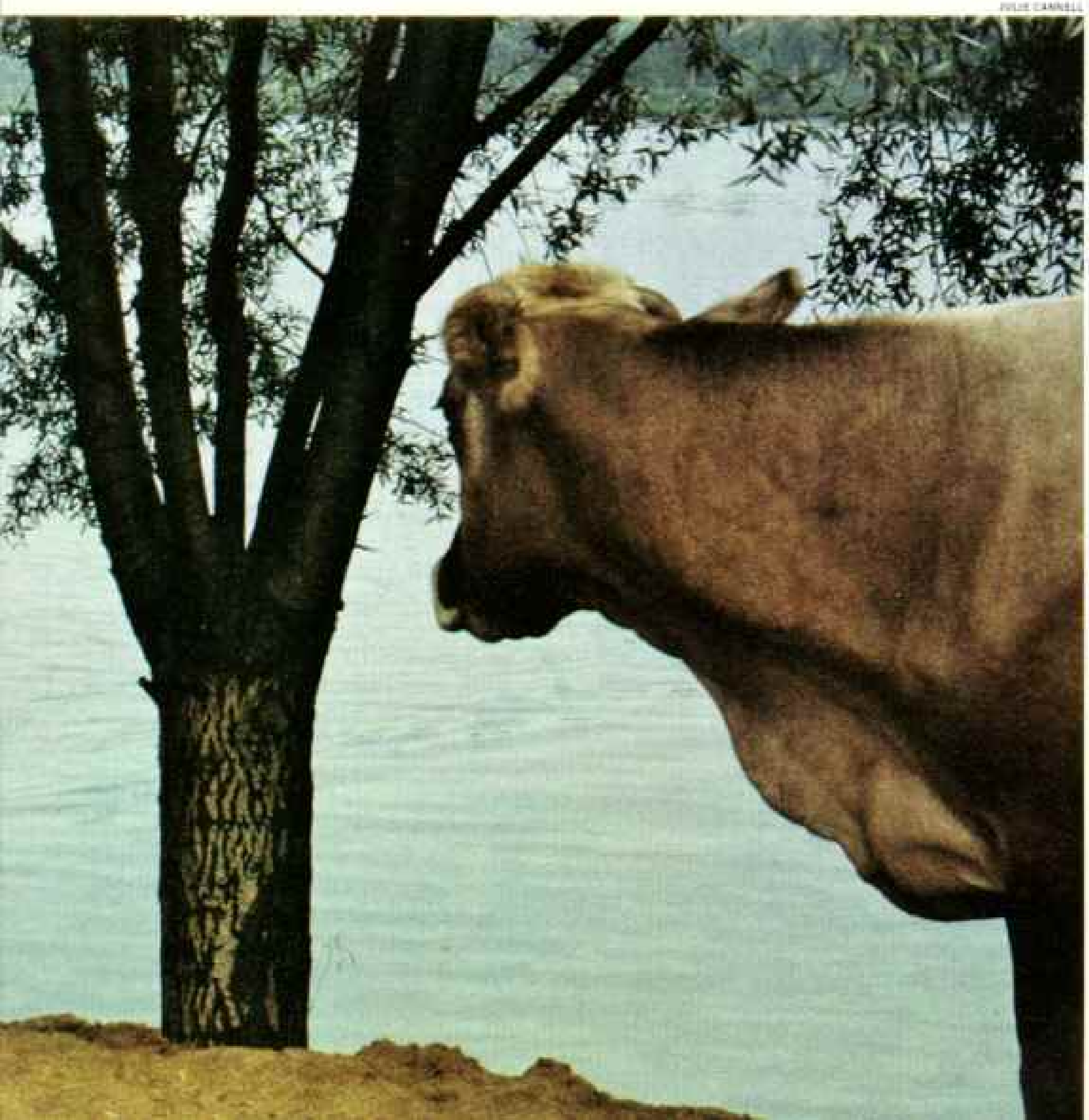
Growing up on the farm—

Chores for the children are uncommon on Soviet farms except at harvesttime. Then the older ones—like this teenager (**left**) picking apples at Urozhay on the Crimean Peninsula—pitch in to help. During summer vacation there's plenty of time for movies, riding bicycles, and rowing on a Rassvet irrigation pond (**below**). With bows in her hair and a bouquet in her hands, a young girl from Gorki is ready for a weekend picnic (**right**).

Children were eager to exchange *znachki*—souvenir badges—with the Americans. From Vitebsk to the Crimea hundreds of them now wear "Hogs are beautiful" buttons and miniature cloth ears of Iowa corn.

JAMES TOBIN

JULIE CAMPBELL



later did we learn that she taught English in the local high school.

As the evening passed, we met other members of the family: father Volodya, who managed the farm-machinery garage; daughter Tanya, a high-school student; and daughter Olya, 5 years old, who immediately displayed the family picture album. A son, Sasha, was attending school in Minsk.

Down the lane Jamie Schesser and Alex Booth were also being introduced to family life. Invited by their host to wash up, Jamie and Alex followed him out of the house, through the backyard, past the outhouse and hen coop, through the gate, and out to the village lake. Then no one moved. The host waited for the guests to go first; the guests waited to see what *he* would do.

Finally the host stripped to his shorts and jumped into the lake, soap in hand. Jamie and Alex looked at each other and followed him in, thus experiencing the first bath with their new father.

Just as in many parts of America, hospitality in the Soviet Union centers around the ritual of eating. Wanda and I sat down with the Zelenkovetses to an enormous meal of cheese, white and dark bread, potatoes, fish, meat cutlets, tomatoes, cucumbers, lettuce, salt pork, raw eggs, lemon drink, wine, and, of course, vodka. We talked about families and our farming backgrounds as much as our language ability would allow. After repeated toasts to friendship, I excused myself and, for the first time in months, went to sleep in a bedroom of my own.

"Ivan, Ivan." The once strange name for John woke me each day. After dressing in the green work uniform worn at Rassvet, I would come downstairs for breakfast.

The Russians have a saying that breakfast is for yourself, never to be missed; lunch is shared with friends and is not as large as breakfast; dinner, a very light meal, is reserved for enemies. After hearing this, I never knew where I stood with Nina, for she tried to stuff me at every meal.

For breakfast Wanda and I usually sat down to mashed potatoes, meat, noodles, fried eggs, and pancakes. "*Kushay*—Eat," Nina commanded, and we bent to our duty. We knew the other members of our group were receiving the same treatment, for when we met on the bus, most would be shaking their heads and holding their stomachs.

BOTH BY CAROL SCHMIDT

Wholesome as the land, Lyuba Korzun wears medals for excellence in milk production at Rassvet (**facing page**). With her daughter, Ada (**above**), she prepares dinner. "The meals were huge," says Carol Schmidt. Lyuba's unremitting admonition to her slim houseguest: "Eat. You will gain weight and be more attractive."

OUT IN THE FIELDS sooner or later the conversations would turn to politics. "Why do you want war?" some workers asked us, expressing worries about the neutron bomb, and the policies of China and the United States, and Soviet dissidents then on trial in Moscow.

"We don't want war any more than you do," we would reply earnestly. Hearing this, some asked us to report back to America that they didn't want to fight either.

I don't think any beliefs were changed by

these discussions, but at least Soviet and American came away with a more realistic understanding of each other's positions.

Only once were we openly harassed. That occurred at the Saki state farm in the Ukraine, when two Soviet officials accused Steve Renquist and Al Atwood of taking photographs of Soviet planes flying over the farm. Steve and Al vehemently denied the charges and were finally released from interrogation. It seemed that the Soviets wanted to instill a little fear into us.

Otherwise our actions and movements went unimpeded. Throughout our visit we agreed with what one farm director told us: "Agriculture is a most peaceful business. It is a business our countries should deal more in together, because when we are feeding our people, we can't be doing a greater service to mankind."

At Rassvet, the largest collective farm in Byelorussia, with 9,000 hectares, nine villages, and 1,370 employees, we enjoyed our most fruitful contacts with Soviet workers. Their eyes twinkled when we fumbled and fell through our Russian vocabulary, yet they seemed pleased that we kept trying.

We found men and women alike performing hard manual tasks. Their hands were callused and their handshakes sturdy, just like those of American farmers. Though almost always cautious at first meeting, they soon warmed to us. Workers showed patience at our lack of skill and knowledge whenever we were running an unfamiliar machine or mixing the wrong proportion of

JOHN GARVENTA

CAROL SCHMIDT (ABOVE AND FACING PAGE)

Jack-of-all-trades, Lyuba's husband, Kolya, gets a haircut from his son (**facing page**). Kolya uses a homemade saw to cut molding (**above**)—a typical decoration (**left**) on local farmhouses—for his self-built home. With pride he showed other handmade things—a linen tablecloth, rabbit-fur hats—as well as his own beehives. "Not from the government!" he proclaimed.

feed for dairy cattle. They beamed whenever we rolled up our sleeves and dived into tasks with enthusiasm.

We came to Rassvet during the harvest in a year when the U.S.S.R. produced a record amount of grain—235 million metric tons. One morning we were bused to the wheat fields where a fleet of 15 mammoth red combines stood in a row, ready to race down the fields to fulfill the drivers' quotas.

Red flags waved from some machines, signifying that their operators were ahead in the competition. The winner receives prizes, often cash. While we waited for the foreman's go-ahead shout, Jeff Layman of Ohio and Wanda Anderson joined a group of workers in a card game.

Suddenly the quiet splintered into noise and motion. All hands jumped aboard the combines and the race was on. Swath after swath, the wheat fell under the blades; row after row, it was swept up into the bellies of the machines. Only breakdowns—which were not uncommon—slowed the pace. By day's end the frenzy of harvest had exhausted everyone.

SEVERAL OF OUR GROUP had requested work in their special areas of interest. David McAuley of North Carolina longed for the sounds of a dairy parlor, so he was assigned to live with a dairy farmer. Rising at four in the morning, he operated milking machines that handled 16 cows every eight minutes, a fast pace for an American farmer.

Gary Schwartz also rose early to work in his area, artificial insemination. Each day the milkmaids watched for cows in heat so they could be separated for breeding. Gary

For cultivating the arts, each farm complex visited had a Palace of Culture. Not all were as imposing as this one at Rassvet (**below**), where workers dressed in their best, like first-nighters anywhere, converse before a concert. The building

and his supervisor, Nikolai, impregnated the cows with semen from a U. S. bull. Laughing, Nikolai bestowed a compliment: "Gary, you're doing an excellent job—the cow is smiling!"

On the day before our group left Rassvet, Nikolai approached Gary and said, "I wish you could stay here with me, but of course you can't. But you should feel good that, come spring, you will be the cause of many Soviet calves on this farm."

Such friendships catapulted our morale. We had made a breakthrough. Initially we had not been optimistic. An African student in Gorki had told us: "You don't realize how much these people fear and mistrust you. They want to coexist with you Americans, but not necessarily be your friends."

There was truth to the observation. But from our stay at Rassvet, we discovered that many common interests exist between Soviet and American people; with time, coexistence can ripen to friendship, just as planting gives way to harvest.

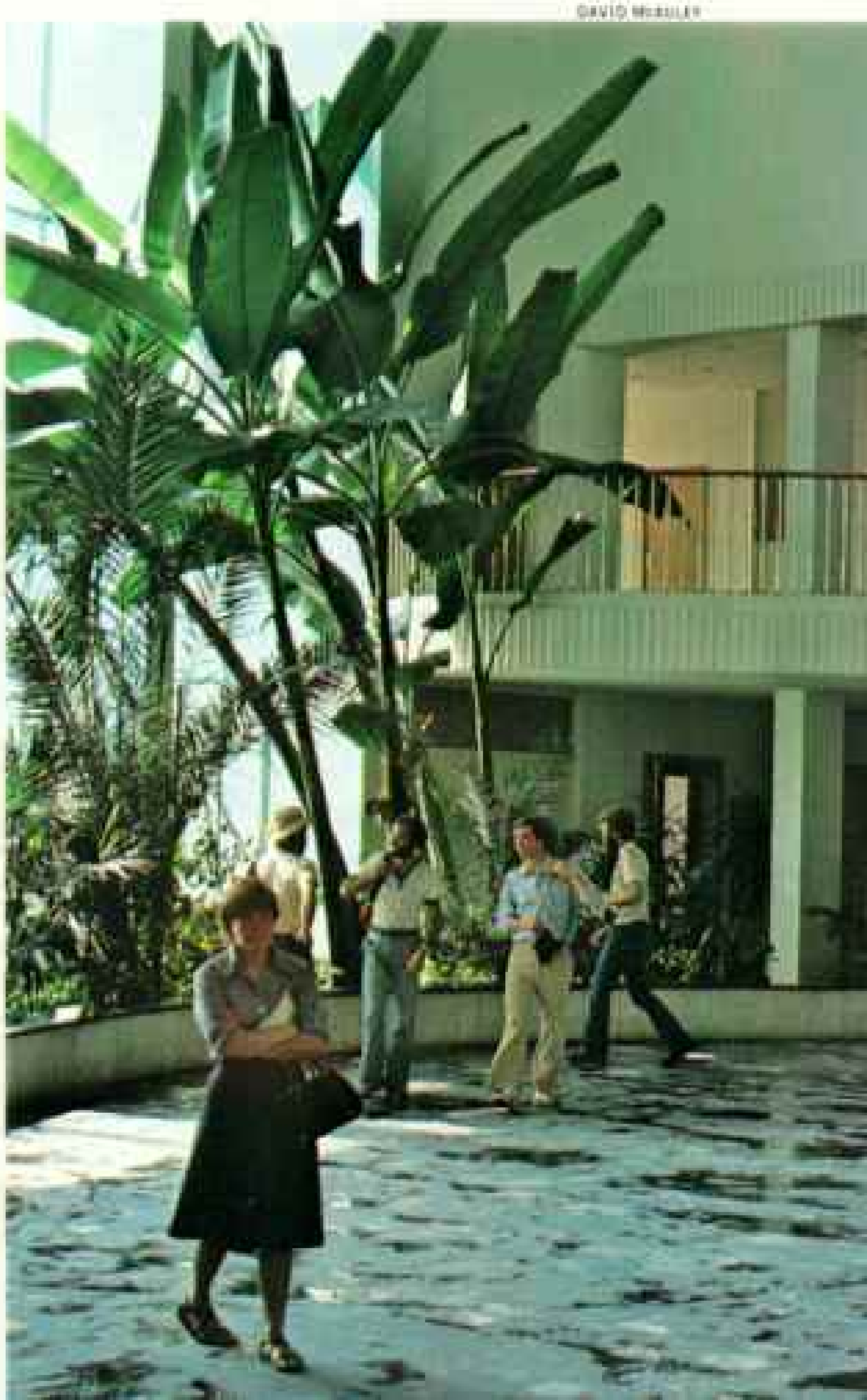
By six o'clock workers had left the fields and barns, and activities shifted to the home and village. We learned quickly that evenings here pass in much the same fashion as they do in an American farm town. After dinner Wanda and I looked at television, engaged in small talk with our host family, or retreated to our rooms to write letters and read. Occasionally Nina and Volodya would take us to a neighbor's house, where in typical Soviet fashion we would walk in the door unannounced and spend the evening visiting.

Other nights Tanya whisked us away to watch a Soviet movie that Wanda and I desperately tried to understand, or to attend a

also contains a restaurant, a museum, the managerial offices, and, in the lobby (right), towering banana trees, a rarity in the U.S.S.R. An agronomist remarked to an American that she had actually eaten one of the bananas.

JAMES TOBIN

DAVID McAULEY



The celebrating lasted three days

Conviviality reigns following a wedding at Rassvet. While dinner guests applaud, author John Garaventa congratulates the newlyweds (**left**) after presenting a NASA medallion commemorating Apollo-Soyuz, the American and Soviet craft that met in space in 1975, to the master of ceremonies.

"I thought the celebrating would end after a couple of hours," says photographer Tobin. "Instead it lasted for three days—with breaks for sleep and work."

After a brief civil ceremony the couple touch hands (**right**). The groom's parents toast them (**above**) and later exhibit gifts they received from their son and his wife (**middle right**). An overflow of dancers moves out of the house and into the street (**left**). "The parents were always bringing more sausage, more bread, more vodka," says Tobin. "It was like Christmas dinner, again and again and again."

ALL BY JAMES TOBIN

concert at the recently built Palace of Culture (pages 792-3). We also went to a local dance, where we witnessed teenagers waltzing to Western rock 'n' roll.

If I found free time before supper, I would go jogging, an activity largely unknown to Soviet farmers, who looked upon it with amusement or perplexity. As I trotted down country lanes and past log cabins, four or five children on bikes would tag along. *"Amerikanits?"* they asked, as if it were not obvious. *"Da, ya Amerikanits,"* I answered, and then came the barrage of questions about whether I had a dog, mother, father, sisters, brothers, wife, and so forth. A jog in the Soviet Union was never boring.

My exposure to Soviet social life would never be complete, friends told me, until I had attended a country wedding. Luckily one took place on one of our last weekends in the Soviet Union, a three-day marathon of celebration. The event began on a Saturday, when Valentin Skudny of Rassvet invited Jim Tobin and Steve Renquist to photograph the wedding of his son, Alexander (preceding pages).

At the Palace of Weddings the ceremony was performed quickly; they are scheduled every 10 to 15 minutes on the weekends. During the five-minute exchange of vows, Steve noticed that the parents had stayed home to prepare the reception meals. Farm director Vasily Starovoitov told us that the mother of the groom is allowed ten days leave from work, and the father seven, in order to prepare for the celebration. "After all," he explained, "a young man only marries once in his life."

Back to Rassvet came the entourage, horns blaring. On the street of the groom's house, a makeshift table held bread and salt, Russian symbols of good luck. At the bride's house, relatives bundled up her belongings in a sheet and carried them back to the procession. Thus was the bride, Maria, moved out of her home.

The groom's parents met the wedding party at the gate of their house, where the newlyweds each raised a glass of vodka, drank half, and flung the rest over the shoulder. Alexander then smashed his glass on the ground, and the reception festivities were ready to begin.

The party lasted long into the evening. Inside the house, guests ate and drank. Outside in the street they danced to the music of an accordion and tambourine.

The following day guests arrived at the house for another bout of feasting and jubilation. All during the meal well-wishers paraded gifts to the newlyweds. At our turn Wanda and I presented a medallion made from parts of the Apollo and Soyuz spacecraft, commemorating the first U.S.-U.S.S.R. international space mission.

The master of ceremonies read the Russian and English inscriptions. The entire gathering rose to applaud. I could only feel honored by the reaction to such a small expression of friendship.

On the third day of the wedding I woke with a throbbing head and queasy stomach, victim of numerous toasts to love, family, and fraternity. I vowed to rest, but in early evening Alexander appeared at my door to invite Wanda and me to yet another banquet. I accepted.

Nina, my host mother, looked at me as if she saw a lunatic: "Now, Ivan, don't make the same mistake twice."

As I walked to the party, neighbors who once watched me with question and suspicion came off their porches to shake my hand. I had been elevated to the status of *tovarich*—comrade. I recalled what a Soviet veteran of World War II had told our group in Gorki: "Two mountains will never meet, but people who live on those mountains can meet."

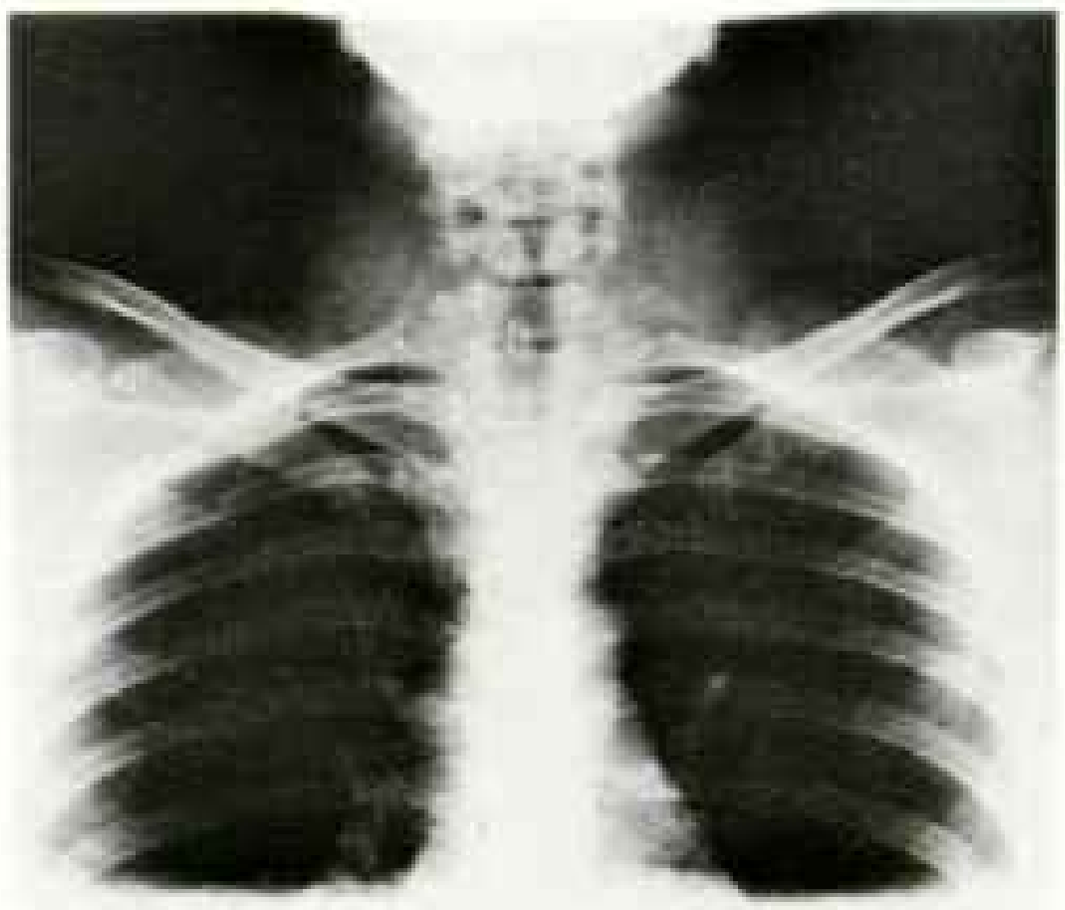
The wedding tables were again filled with food. Laughing, Valentin and his wife, Faina, offered me vodka to cure my ills.

Keeping my promise to Nina, I toasted them with lemonade. □

Friendliness, a slow-ripening fruit. Anna Feshuk and Carol Schmidt began the day picking cucumbers at the Saki state farm. Shy and nervous, Anna wondered aloud if "bad things" would be written about the farm. Cucumber for cucumber, Carol matched her work. Finally Anna produced a scarf and smock for Carol. With a hug she says, "Now you look like one of us." JAMES TOBIN

By JOHN M. KESHISHIAN, M.D.

Anatomy of a Burmese Beauty Secret



JORGEN BISCH (RIGHT)

A RELENTLESS EMBRACE of brass, the burden of beauty shouldered by a Padaung tribeswoman of Burma (**facing page**) armors the neck in a coil that weighs about 20 pounds, and measures a head-popping one foot high. The loops, draped with silver chains and coins and cushioned by a small pillow under the chin, signal elegance, wealth, and position.

But what is the anatomy beneath it all? Do the vertebrae stretch? Or do the ligaments binding them lengthen? Perhaps the disk spaces expand? An invitation to lecture at Burma's three medical schools enabled me to unravel the secret of the long-necked women.

At the Rangoon General Hospital I tracked down the X rays of a Padaung woman admitted for diagnostic tests. As fans swished lazily overhead, the films on view boxes illuminated the mystery. The neck hadn't been stretched at all. In effect, the chest had been pushed down. Each added loop increased pressure downward on the vertebral column. Something had to give—and did, as an X ray's ghostly shadow shows (**top**). The clavicles, or collarbones, as well as the ribs, had been gradually pushed down. The result of this displacement: a neck that just looks elongated. An X ray of a normal neck (**above**) shows the usual positioning of clavicles and ribs.

"THE LAND of the giraffe women," as Polish explorer Vitold de Golish called it, lies in eastern Burma (**left**) on a high plateau dimpled by terraced, paddy-filled valleys. Here live the Padaung, a tribe of about 7,000 members.

Legend claims that the brass rings protect the women from tiger bites, but actually the practice of wearing them helps maintain individual and tribal identity.

A brass rod a third of an inch in diameter is worked around a girl's neck at about 5 years of age by a village medicine man. After divination with chicken bones to determine

National Geographic, June 1979

BOTH BY BRUNO BARBEY, MAGNUM

the most auspicious date, several loops are twisted around her neck. Additional loops are added periodically.

Rings worn on arms and legs may weigh a woman down with an additional thirty pounds of brass. Since leg coils hamper walking, the women waddle. Constrained from drinking in the usual head-back position, a ring wearer leans forward to sip through a straw (**above** at left). And the voices of wearers, wrote British journalist J. G. Scott, sound "as if they were speaking up the shaft of a well."

After years of being straitjacketed in brass, the neck muscles atrophy. If the rings are cut off, a brace must support the neck until exercises rebuild the muscles.

In past times the punishment for adultery decreed removal of the coils. The head then flopped over, and suffocation could follow.

Two decades ago the encroachment of modern civilization prompted some women to remove their rings, though years of wearing them had left striations (**above right**). The custom, indelibly inscribed in Padaung culture, persists and, according to University of Illinois anthropologist F. K. Lehman, shows signs of a resurgence. □

THE TWO WORLDS

By NOEL GROVE

ON LABOR DAY in 1978, Margaret Comben walked backward across the Mackinac Bridge. The annual march over the five-mile structure, walked face forward by most of her 30,000 fellow hikers, is a popular event in Michigan. Perhaps unintentionally, it also has become a symbol of unity for this most peculiarly shaped state.

Before the bridge was completed in 1957, Michigan was cleanly split in two by the Straits of Mackinac, which connect two Great Lakes—Michigan and Huron. South of the narrow divider the mitten-shaped Lower Peninsula waves like a giant hand surrounded by water. The middle fingers point to the shapeless Upper Peninsula, geographically wedded to Wisconsin but part of Michigan since a 19th-century border dispute was settled (map, pages 804-805).

In pre-bridge days auto ferries chugged between the two landmasses, and backed-up cars waited for hours. "The longest line that I remember stretched 23 miles on the south side," said Ben Wiggins, former personnel officer with the ferry system.

The two Michigans developed separately, the Upper Peninsula (U.P.) surging ahead while its minerals and timber were booming, then falling behind as the south began to industrialize. Then came the bridge, and crossing time changed from hours to minutes and brought a flood of vehicles, some two and a half million in 1978. Cultural and economic differences remain (you can still hear talk of U.P. secession into a 51st state called Superior). But bridge enthusiasts like to say that the long engagement between the two Michigans became a marriage when they were joined with a band of concrete and steel.

Once a year it becomes a ribbon of humanity. Light laughter and the shuffle of thousands of shoes rode the cool lake air the day I joined the foot pilgrimage over a structure built for the hum of automobile tires. Less than halfway across I met Margaret Comben, who had chosen to walk backward across one of the longest suspension bridges in the world. On an artificial leg.

"A what?" I exclaimed.

"An artificial leg," she repeated cheerfully, and still walking, she pulled up her trouser to prove the presence of a birth defect.

"But . . . but why are you walking backward?" I stammered, astounded at her grit.

"Because I've already done it forward three times," she said, laughing.

WHEN YOU CONSIDER the history of this state, it appears that Michigan, like Margaret, has occasionally backed into the future, and into success. The westward surge pushed right past the two peninsulas that seemed more a part of Canada than the United States. "Ohio became a state in 1803, and the movement into Michigan hadn't even started by then," I was told by Robert Warner, director of the Bentley Historical Library at the University of Michigan.

Missouri, Illinois, Arkansas, and Louisiana, all farther west, became states before Michigan backed into the Union in 1837. Long before that, Jean Nicolet paddled through the Straits of Mackinac with barely a sideways glance. The 17th-century French explorer had his eye on bigger game. Surely on the far shore of this great body of water lay the Orient, with its wealth of spices and silk. When his birchbark canoes reached a western beach of Lake Michigan, the confident Nicolet donned a mandarin's robe and stepped ashore. He was met by red men, not yellow, in what is now Wisconsin.

Later, when the U. S. Congress decided

OF MICHIGAN

Photographs by JAMES L. AMOS BOTH NATIONAL GEOGRAPHIC STAFF

to award free land to veterans of the War of 1812, the unsettled Michigan Territory was considered for the gift. The report of Edward Tiffin, Surveyor General of the United States, indicated that the area was swampy, dotted with lakes, and had poor sandy soil, "not worth the cost of surveying." Congress gave the veterans land in Illinois and Missouri instead. Poor Michigan. There was a time when you couldn't give it away.

That was before the state's copper rush in the 1840's brought a flood of European immigrants to the Upper Peninsula to mine copper so pure that it merely had to be hammered into shape. Before the great pine forests in both peninsulas were leveled "to build the Midwest," as one Michigan native put it. Before the locks at Sault Ste. Marie became the watery gateway for iron ore from Michigan and Minnesota to the steel mills of the East. Before Detroit became "Motown"—short for Motortown—and built the automobiles that changed a nation.

As for that early surveyor general's report, Michigan farmers have proven it a bum rap. The state ranks 17th in total acreage of principal crops grown in the nation, despite being more than half covered by forests. Michigan State University in East Lansing was the nation's original land-grant institution, and the school remains a leader in agricultural research. I perused a list of research projects under way, a farmer's catalog of dreams: vegetables that kill weeds, bugs that eat crop-damaging bugs, the use of satellites in mosquito control.

Indians, the first inhabitants, coined Mich-i-gan—"big water"—and feasted on sturgeon weighing as much as 300 pounds that once swam in the Great Lakes. Water accounts for many names in the state. If Michigan's rivers flowed in one continuous line, the stream would course 36,000 miles. Separate lakes number about 11,000. Four of the five Great Lakes lap at Michigan's two large peninsulas and several islands. Its total shoreline would stretch more than 3,000 miles, twice the distance from Maine to the tip of Florida. Peering ahead to the riches of China, explorer Jean Nicolet had sailed past a land of future superlatives.

I WAS GUILTY of a similar negligence, as, belatedly, I set foot for the first time on the nation's seventh most populous state. In weeks of wandering that touched on all four seasons, I explored the two worlds of Michigan, urban and rural. Perhaps more than any other state, it combines the tedium of assembly-line labor with the pleasures of the great outdoors.

"If I were to compare Michigan with any other state, it would have to be California," said a native Michigander. "In both, people live for their cars and their weekends."

"When I was a kid, we never vacationed outside the state," I was told by Eleanor Josaitis of Detroit. "We had everything here—camping, fishing, skiing on snow or water. You could go to the locks at Sault Ste. Marie and watch ocean freighters, or go to the Sleeping Bear Dunes on Leelanau Peninsula and feel a sense of desert. The only thing we lack is big mountains." (The Porcupine Mountains near the west end of the U. P. are all less than 2,000 feet high.)

Michigan terrain doesn't hold the grandeur of the Rockies. Its cities lack the flash and dash of a Las Vegas or New York. Michigan scenery never startles, but it rarely disappoints. In the gently rolling palm and flat green thumb of the mitten, the farms are well manicured, the wooden barns either brightly painted or aged slate gray or chocolate. The north is hillier and occasionally rugged, according to the whims of the

glaciers that periodically crept south over the land. Colorful hamlets, dignified by watery vistas, dot the long coast. Their names are unfamiliar to most Americans—Leland, Tawas City, Whitefish Point, and Charlevoix, "the beautiful." On a Lake Michigan shore one evening I looked over a quiet harbor lined with nodding sailboats in a town whose name I had never before heard. A teenager strolled by wearing a T-shirted message that aptly demonstrated the charm of Michigan's unheralded pleasures: "Where the hell is Saugatuck?"

THE GIANT automobile industry of Michigan's best known city serves as an economic bellwether for the nation. Satellite plants making piston rings, steering gears, and wheel bearings help swell the populations and payrolls of Detroit's neighbors—Flint, Saginaw, Ypsilanti, Lansing, Kalamazoo. Others in that blue-collar south have their own industrial identities—Battle Creek, the Cereal City, and the furniture town of Grand Rapids.

Yet this state on wheels has an entire community where horses clip-clop through the streets and cars are banned. At Mackinac Island in Lake Huron, I stepped off the ferry and into the past. A two-horse hackney delivered me to the Grand Hotel, and later I hired a horse and buggy for a leisurely tour of the island, returning in time to dress for dinner and enjoy chamber music in the lobby.

Although 22 states are larger, few are more sprawled. When I stood in Copper Harbor at the northern tip of the U.P., I was as far from Detroit as Detroit was from my home near Washington, D. C. And there was more of Michigan to the north of me.

With my 16-year-old daughter, Lisa, I boarded a 50-passenger launch for a four-hour voyage to Isle Royale. In the wolf's head shape of Lake Superior, the long (45 miles) and slender (nine miles at its widest point) island forms a near-perfect eye. That eye also serves as the near-perfect window for scientists to study the relationship between wolves and moose.*

Through forests quiet as a bobcat's footfall, Lisa and I *(Continued on page 816)*

*Biologist L. David Mech of the U. S. Fish and Wildlife Service and a world authority on wolves reported his studies in the October 1977 GEOGRAPHIC.

MICHIGAN

SPRAWLING ARM of the Midwest, Michigan stretches across two peninsulas and touches four of the five Great Lakes. A motorist following the most direct route from Temperance near the Ohio border to Ontonagon at the west end of the Upper Peninsula would drive 600 miles. The Wolverine State developed late as western expansion flowed beneath it into Illinois and Missouri. Backwater Michigan eventually flexed its economic muscles in mining, timbering, farming, and the industrial giant, automaking.

Glaciers honed the state's irregular profile, blanketing what is now Lake Superior and the Upper Peninsula, gouging Lakes Michigan and Huron, pushing into Saginaw Bay to shape the Lower Peninsula into a mitten. Eighty-eight percent of the population lives in its industrialized palm, 8 percent in the wooded fingers and green thumb, and only 4 percent in the Upper Peninsula. Nearly all make use of forests and freshwater resources in a state that thrives on outdoor recreation.

AREA: 58,216 square miles. **POPULATION:** 9,200,000. **ECONOMY:** Manufacturing—automobiles, machinery, metal products, processed food, chemicals; tourism; agriculture; mining. **MAJOR CITIES:** Detroit (pop. 1,270,000); Grand Rapids (pop. 185,000); Lansing (pop. 126,000), capital.

Commodity names locate Michigan's major production centers

DRAWN BY JOHN C. WEBER
COMPILED BY HAROLD A. HARRON
NATIONAL GEOGRAPHIC ART DIVISION

KILOMETERS 50
STATUTE MILES 50

ONTARIO
MICHIGAN
CANADA
UNITED STATES
Lake Superior
Lake Michigan
Lake Huron
Lake Erie
Lake St. Clair
WISCONSIN
ILLINOIS
INDIANA
OHIO
MICHIGAN
FERRY
Copper Harbor
Eagle Harbor
Keweenaw Peninsula
Skanee
Mount Curwood
604 m
1,980 ft
Marquette
PICTURED ROCKS NATIONAL LAKESHORE
Whitefish Point
Two Hearted River
SOO LOCKS
St. Marys River
Sault Ste. Marie
IRON
LUMBER
Seney
Germfask
SWAMP
LIMESTONE
DOLOMITE
Escanaba
Iron Mountain
FISHING
Beaver Island
Straits of Mackinac
Mackinac Island
MACKINAC BRIDGE
Cheboygan
ALOHA STATE PARK
Petoskey
Charlevoix
CEMENT
LIMESTONE
Grand Traverse Bay
Manitou Islands
Leland
Walloon Lake
OIL
Alpena
Menominee
Green Bay
SLEEPING BEAR DUNES NATIONAL LAKESHORE
Traverse City
FRUIT
NATURAL GAS
HARTWICK PINES STATE PARK
Harrisville
Grayling
Au Sable
Frankfort
Kewaunee
Tawas City
Manistee
SALT
Cadillac
Manitowoc
Ludington
Muskegon
Saginaw Bay
BEEF
Bad Axe
DAIRY
Big Rapids
Mount Pleasant
CHEMICALS
Midland
Bay City
GRAIN
Saginaw
Alma
Frankenmuth
VEGETABLES
Grand Haven
Grand Rapids
FURNITURE
AUTOMOBILES
Flint
Owosso
Port Huron
TULIPS
Holland
Saugatuck
POULTRY
Lansing
East Lansing
Durand
Pontiac
Warren
Hamtramtk
Livonia
Detroit
Windsor
Dearborn
Wyandotte
Kalamazoo
Battle Creek
PAPER
CEREALS
Ann Arbor
Ypsilanti
Jackson
Benton Harbor
St. Joseph
Portage
Detroit River
Monroe
Adrian
Temperance
Toledo
Milwaukee
Chicago
Gary
South Bend
Niles

LOWER
PENINSULA

Hardworking playground

AN UNCOMMON BLEND of indoor and outdoor life daubs a patina of well-being over Michigan's Lower Peninsula. "It's a rich state, because of the industrial activity," says a Michigan legislator. "The standard of living is high and recreation is a major business."

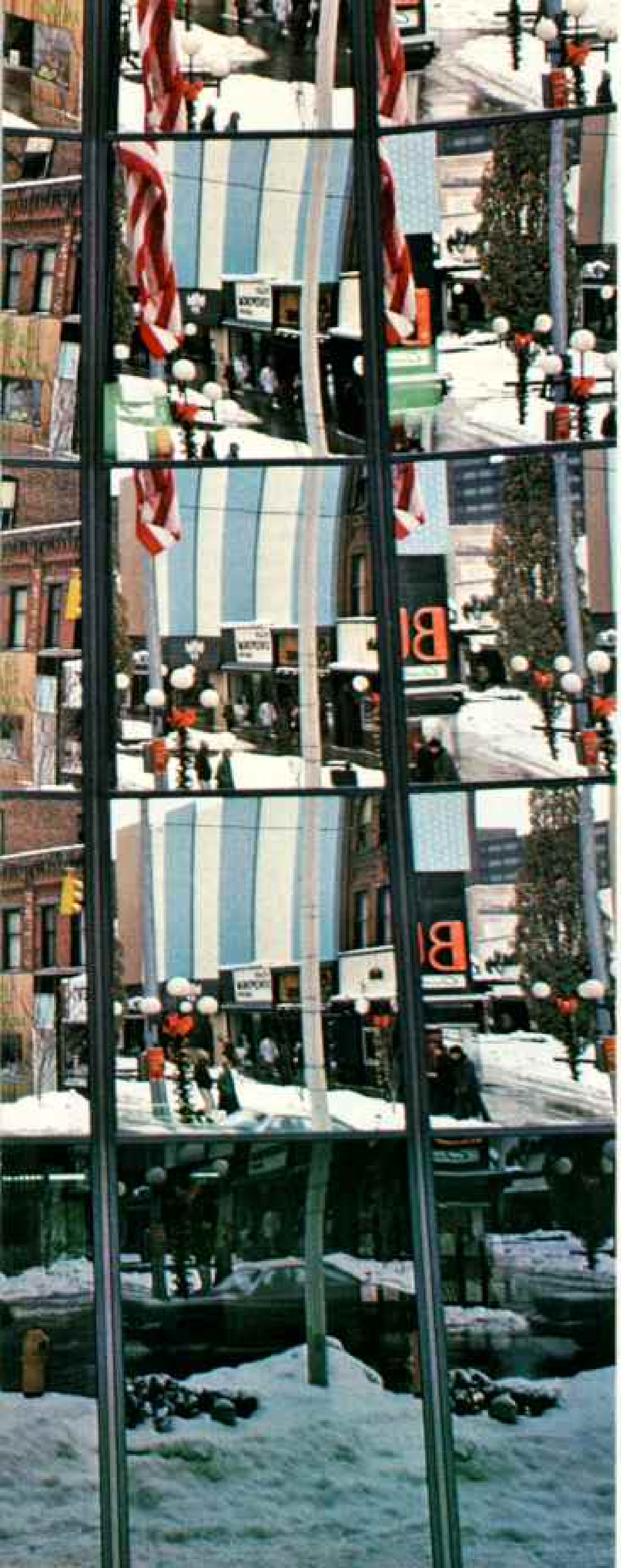
On weekends, comes the great exodus. Workers exchange blue and white collars for sportswear, and travel the excellent highways to abundant streams and rivers, ponds and lakes.

Inside in the outside, two students at Interlochen's National Music Camp near Traverse City test acoustics in a plastic bubble. Some 1,500 highly qualified young artists from nearly every state and many foreign countries keep the hills around the camp alive with music for eight weeks each summer.

SUBURBIA TRANSPLANTED, *tents and campers jam a campground at Aloha State Park near Cheboygan, where a youth tosses snacks to attentive gulls and ducks. Residents often contest for space with outsiders in the 80 state parks; Michigan ranks sixth nationally in tourism.*

"**There is no better land** than is to be found in Michigan," wrote a pioneer woman in 1831 to relatives in Connecticut. Today, corn, beans, and wheat are grown on farms like this one (**right**) in the mitten's green thumb. Michigan ranks 19th among states in the value of its farm products.

Chemical contamination threw a shadow over Michigan in 1973 when polybrominated biphenyls (PBB's) were mixed accidentally with cattle feed. Farmers reported emaciation and abnormal hoof growth among cows exposed to the chemical (**above**); its effects on people are yet unknown.



Urban kaleidoscope reflects from a bank building in Kalamazoo, one of the first American cities to close streets for a pedestrian shopping mall. Satellite automobile plants and support businesses help keep many Michigan cities vital. Others prosper with industries such as furniture, chemicals, pharmaceuticals, and breakfast cereals. Giants of processed food like Kellogg, Post, and Ralston Purina have earned Battle Creek the nickname Cereal City. At the Kellogg plant (**above**), which daily packages breakfast servings for more than ten million people, executives meet each week to sample their products.

Quiet crossroads marks the change of transportation in Michigan. Once 42 passenger trains a day rumbled past the station at Durand. Now there is only one, to Chicago, though freight trains maintain an active schedule. The nation's first mile of concrete highway was laid in Detroit in 1909, paving the way for the decline of passenger rail service.

Witness to change, Madelaine "Sunny" Hemingway Miller (**below**) spent childhood summers at a family cottage called Windemere on Walloon Lake. There a portrait of the Clarence Hemingway family behind her includes her brother, novelist Ernest Hemingway, as a boy at far right. His Nick Adams stories of trout fishing still speak to those who love the solitude of the north woods.

Heavyweight fishing prize is now the Chinook salmon, transplanted along with smaller coho to the Great Lakes to control an infestation of alewives. A happy fisherman hefts a Chinook caught in Lake Michigan (**left**) near Ludington. The state record is 46 pounds.


FFF

(Continued from page 804) walked 12 miles to a campground called Daisy Farm, an improbable name on an island that is 95 percent wilderness park. We saw no wolves, for people-shy *Canis lupus* retreats to remote corners of the island in warm weather and is glimpsed by fewer than a dozen backpackers a year.

"There are six to eight hundred moose on the island and about forty wolves," said Joe Scheidler, who has monitored wolf kills for three summers. "They tend to keep each other in dynamic balance. In a hard winter the moose weaken, there are lots of kills, and the wolves increase. When food is plentiful, the moose are strong and can defend themselves, and some wolves starve."

Isle Royale provides a catalog of wildlife for the casual observer as well. Lisa conducted a census of our sightings: two cow moose and three calves (one cow had twins), three red foxes, two frogs, a red newt, a garter snake, at least a dozen small red squirrels, countless birds, and 16 trailside toads. Almost giddy from the profusion of life and color around her, she chirped one day, "Red, white, and blue flowers. Very patriotic forest!"

Perhaps rightly so, for the inclusion of this far-north island within U. S. boundaries seems a masterpiece of negotiation. Later, in Ann Arbor, map curator Douglas Marshall got out a brittle map for me at the University of Michigan's Clements Library.

"When a French mapmaker named Bellin drew Lake Superior in 1744, he threw in some extra islands and named them after the man he worked for to curry favor," Doug said. "Tradition has it that Benjamin Franklin found out that all but Isle Royale were fabricated. So at the Treaty of Paris at the conclusion of the Revolutionary War, Franklin 'graciously' conceded all of the fictitious islands lying northeast of Isle Royale to the British."

A BIGGER BONUS came to Michigan through another mapping error. When the correct latitude was drawn, Michigan's southern boundary extended five to eight miles into Ohio and swallowed Toledo. Both states claimed the "Toledo Strip" in 1835, and their militias teetered on the brink of war. Congress gave the strip to Ohio and granted Michigan the Upper Peninsula in compensation.

The trade-off angered many in Michigan, although the state gained some 14,000 square miles. The U. P. had been called "the sterile region on the shores of Lake Superior, destined . . . to remain forever a wilderness." But like Alaska, it proved a bargain.

Michigan's U. P. mines—some of them a mile deep—led the nation in copper production until Montana became first in 1887. Labor and supply costs have closed all but one of the Michigan mines, although less than 10 percent of the copper—the world's purest type—has been extracted. "When the price of copper exceeds the cost of removing it, the mines will reopen," explained J. W. Robb, mining engineer and lecturer at the Michigan Technical University at Houghton. "That could be 25 years from now."

Iron mining in Michigan started later and survived because of improved technology. Instead of smelting raw ore with its costly impurities, producers now crush the ore, separate the iron magnetically, and roll it into pellets. Michigan shipped more than 550 million dollars' worth to steel mills in the Great Lakes area in 1978, making it second in production only to Minnesota.

Most of the iron from both states passes through one of the world's busiest waterways, located nearly 2,000 miles from the nearest ocean. Where Lake Superior joins Lake Huron, the water level drops 21 feet in less than a mile, down a channel the French voyageurs called Les Sault de Ste. Marie—the Rapids of St. Mary.

"The first copper and ore mined in the Upper Peninsula came down Lake Superior in hogsheads, which were portaged around the rapids," I was told by Eugene "Shine" Sundstrom, a marine-affairs reporter who has covered the locks at Sault Ste. Marie for nearly half a century. "Now four ships 700 feet long and 75 feet wide can pass through the locks at once. They carry mostly iron and wheat. During World War II the Sault was known as the 'jugular vein of America'; there were 20,000 troops stationed here to protect it."

A growing nation's hunger for lumber shaved hundreds of millions of towering white pines from all Michigan north of Saginaw, midway up the mitten. "Those trees

were so tall that when you walked in them at midafternoon, you walked in the dark," said one former logger, wearing a patch over the eye lost in a lumbering accident. Over coffee and Scandinavian pastries in the little community of Skanee, he reminisced about the days of the timber boom.

"It was best to cut the trees in fall or winter. Then you could skid logs on ice roads to rivers or to railroad tracks," he said.

"It was sad to see the big trees go as we cut them, but they were like the buffalo—we didn't think they would ever end."

They ended. Incredibly, those tall, straight white pines that covered most of the state were reduced to a few small groves. One, north of Grayling, in the middle of the mitten, was preserved by Karen Hartwick in memory of her husband.

I visited the Hartwick pines at the time when they would have been cut in lumbering days—in midwinter. In a snowy silence interrupted only by the swish of my cross-country skis, I glided to the foot of a giant called the Monarch, one of the oldest and largest of the remaining white pines. A sapling when Joliet and Marquette traversed the Great Lakes in the 1670's, it now stretches 155 feet high and nearly four feet across. Felled, it would produce enough lumber for a five-room house.

The distant tops of these survivors nearly disappeared in an unseasonable fog, and at their bases swirled pure white snowdrifts graceful as the contours of heaven. I left the pines with a confusion of realism and romance: Of course it was necessary for a developing nation to build its houses. But was it necessary to tear down its cathedrals?

COPPER, IRON, TIMBER—what might be Michigan's next great resource boom? "Water," was the quick reply of Len Barnes, editor of *Motor News*, published by the Michigan chapter of the American Automobile Association. "As far as I know, we have more fresh water available than anyplace in the world, and that's a commodity getting a lot of attention these days. In Michigan you are hardly ever more than twenty miles from a stream or lake. You can swim in them, fish in them, ski on them, boat on them."

Recreation is a 7.5-billion-dollar industry in Michigan, which ranks sixth among the states in tourism. Twice in a four-month period I could not get a room in any of the 15 hotels in Grayling. The town of 2,000 lacks the tourist-tailored look of an Aspen or Lake Tahoe, but it stands in Michigan's most voluptuous, reforested hills and is cut through by a diamond-clear river, the Au Sable. "Sorry, sir, the whole town is full of cross-country skiers and snowmobilers," said a young desk clerk on my midwinter visit. In Michigan you plan ahead for an outdoor trip, no matter what the season.

The uncrowded U.P., emerald in summer and a rainbow of fall color, suffers economically when winter winds sweep off Lake Superior. By December 11 in 1978 Houghton had a hundred inches of snow, compared with 18 at Lansing. The chill keeps many people away. The population of the Upper Peninsula, which is the size of Massachusetts, Delaware, Rhode Island, and Connecticut combined, stands at only 330,000.

Agronomist Rich Leep thinks the land north of the straits is a sleeping giant. "There's a lot of good farmland just standing idle," he told me at the State Cooperative Extension Office in Marquette, the U.P.'s largest city, with a population of 20,000. "The potential for raising seed potatoes is great; fungi and aphids don't give us much trouble. Dairying is a strong industry, and beef production is good. But the growing season is short, and you have to be able to cope with long winters."

"If it weren't for the U.P. winters, I would probably have never written a book," said John Voelker, a former state supreme court justice whose best-selling *Anatomy of a Murder* was set in the Upper Peninsula (page 839). "In the summertime," he added, "I fish." I became his admirer in both arts.

Fishing to Voelker—who writes under the name Robert Traver—and to many aficionados in Michigan, means one thing: outwitting the wily brook trout with an artificial fly. We drove in John's jeep to his fishing camp by a quiet beaver pond in the U.P., stopping often for a harvest of sugarplums. "In berry season . . . mmm . . . I sort of . . . ummm . . . gnaw my way to camp," he said, scooping in sugarplums with both hands like a white-maned bear. Later there would be blackberries and blueberries.

At camp he gave me a tiny hand-tied fly, no bigger than a kitchen match head. I was to flick this weightless nit to the middle of the pond, fool a trout into thinking it was a water-hatched insect, and then bring the angry, leaping fish to shore on a gossamer thread thin as spider's silk. Although my creel was empty at the end of the day, I vowed to continue the sport. "You are a ruined man," said the author of *Trout Madness*, with wicked glee.

COMMERCIAL FISHING in Michigan was a ruined industry in the late 1950's, partly because of an invasion of bloodsucking sea lampreys through the St. Lawrence Seaway, and because of excessive harvests. A specialized poison has now controlled the lamprey larvae, allowing the whitefish and lake trout to stage a comeback.

Coho and Chinook salmon, introduced in 1966 and 1967, now control alewives, members of the herring family, that also invaded through the seaway. And sport fishermen couldn't be happier. At Harrisville in October I watched as an underwater monster doubled a heavy rod before snapping the line. "Coho," said the angler as he reached for his tackle box, and I quietly returned my light gear to the trunk of my car.

"We want to improve commercial fishing," said specialist Ned Fogle of the Fisheries Division at the capital city, Lansing. "But at this point sport fishing comes first. We're trying to bring fishing to the people by targeting urban areas, stocking golf-course water hazards, and instructing youngsters in the sport. We've built fishing piers in Detroit. . . ."

Fishing in Detroit? In that crime-ridden, riot-torn pool of industrial pollution that one hears about? To this first-time visitor, Detroit was full of surprises. Walleye and muskellunge have testified to the cleanup of waters by moving back into the Detroit River. Gourmet James Beard has ranked the city third in the country for dining out, mostly because of its ethnic variety. Festivals featuring some 20 different groups drew four million people in 1978.

The city has 2,000 night spots, and more amateur theater groups than any U. S. city except New York. A disc cut in 1978 by the Detroit Symphony outsold all other records in the city during the Christmas season.

"Detroit," summed up an ardent but realistic native, "is where you come for the best and the worst times."

The worst of times are little more than a decade distant. Rioting in 1967 killed 43 people, injured hundreds, and left 5,000 homeless. Property damage totaled 250 million dollars. They were called race riots, although there were white looters as well as black. I heard many explanations for the outbreak, but value one highly because it came from widely divergent sources—a white former mayor and a black looter.

"Before it happened, we were considered a model city in community relations," said the former chief executive, Jerry Cavanagh, now in private law practice. "But black expectations for economic gain rose so quickly that they exceeded the reality of being met. When setbacks occurred, frustration set in. Of some 4,000 arrested during the riots, most were gainfully employed, which shows they had something, but expected more."

One of the formerly frustrated is now manager of a Detroit warehouse. "A lot of us were just waiting for some chance to 'get over,' which in those days meant getting ahead," he told me, ebony brow crinkling around a razor scar above his left eye. "How were we supposed to do it? Get a college diploma and then a job as a big executive?

"I hit pawnshops and got TV's, clothes, and stereos. I served 15 months in Jackson [Michigan State Prison] and made my turnaround. Now I think blacks know that if you really apply yourself you can get ahead, but it seemed futile then."

Shock waves from the riots drove out not only residents, but industries and retail stores as well. "The city was losing its tax base, and without tax income you can't support good schools and services," said Jim Gallagher, who works for an architectural firm. "Detroit was in a downward spiral."

THE CITY NEEDED a renaissance to lift it from the dark ages, and that's what it got. A 350-million-dollar complex of offices, shops, restaurants, and—at 73 stories—one of the tallest hotels in the world arose on 33 acres of riverfront. The Renaissance Center alone increased the

tax assessment from two million dollars to 50 million, and exuded a confidence that boosted other downtown construction.

The man generally credited with the success of the project was Henry Ford II, whose grandfather's automobile production turned Detroit into Motown before most carmaking moved to the outskirts.

"Two men—one black and one white—came to me in the late sixties and asked if the automobile industry could help the city," Ford told me on the east lawn of the complex now known as RenCen. "Fifty-one companies put up money to build it. We never expected the Renaissance Center to be the answer to all Detroit's problems, but I did think it could get things moving again."

RenCen has its detractors, who say the 350 million dollars could have been better spent on schools and services. "I asked my eighth-grade class to write a theme entitled 'Why I Think Detroit Is a Great City,' and they burst out laughing," I was told by Father Larry Ventline, parish priest and schoolteacher in a largely Polish neighborhood. "Their fathers say the city spends too much money on the downtown, and their mothers say there is too much crime."

Both statements may be true. But judged by its core, Detroit is on the upswing. Washington Boulevard in the heart of downtown is undergoing a four-million-dollar restoration into a pedestrian mall, with trolley cars and police in Keystone Kop uniforms. Spurred to compete with the 1,400-room hotel in RenCen, other hotels have undergone refurbishment. A trickle of residents is moving back into the city, and Mayor Coleman Young hopes to increase the flow. To get Detroit on the move, the black former union activist now works with a coalition of the very auto industrialists he once bedeviled.

"We are planning 5,000 new housing units downtown within the next year and a half," Mayor Young told me at ground breaking for two future RenCen office towers. "Real-estate sales are up, and values are increasing. I think all these signs add up to a turnaround for Detroit."

His constituents seem to agree. A recent survey conducted by an urban coalition showed 71 percent of Detroit-area residents are now optimistic about the city, compared to less than half two years earlier. In the decade following the riots, more than a quarter of a million residents expressed their opinion with fleets of moving vans.

AND WHAT do outsiders think of the city now? In 1978 Detroit's convention business hit a peak of 501,746 visitors, who spent 90.8 million dollars, an increase of one third over 1977. A major reason is safety. Detroit crime dropped more than 30 percent in the last two years, compared with 4 percent nationally.

"We set up in hot spots for a couple of weeks, using a radio-equipped van as headquarters," explained Sgt. Harrison Tolliver as we drove one evening through an East Side neighborhood. I mentioned surprise that almost half the squad at muster had been women, and many of the men were of average size, or less. "We emphasize brains, not brawn, these days," he answered. "Man, I grew up in this neighborhood, and the police would knock your head off if you looked at them wrong. We'd rather officers talk someone out of trouble than scuffle with them."

I watched talk versus tussle when I joined rookies Terry Baskin and David Witherspoon on a walking beat in the early evening. They halloed to porch sitters, joked with youngsters, and gently lifted the driver's license from a sullen traffic violator in the midst of a gathering crowd. Later in a squad car I joined a rookie teamed with a three-year veteran who assailed him with almost nonstop training advice: "Mosey, mosey . . . you'll never see trouble if you cruise too fast! Check for keys in the ignition when you stop a car; it may be stolen or wired. Use your searchlight to check stores for broken windows. You got to *work* to catch a felon."

Around midnight the radio crackled that a neighbor had seen a jimmied rear door on a house two blocks from us. "Let's go! They may still be there!" urged the veteran, and we sped to the address. They entered quietly, guns drawn, one yanking doors open while the other stood ready. The house was ransacked, but empty. "Maybe next time," said the older officer.

I commented later to Sergeant Tolliver about the veteran's professional intensity that I had witnessed. "Officer Deborah Robinson is *(Continued on page 834)*

DETROIT

Outgrows its past

SEEDS OF OPTIMISM sprouted a downtown face-lifting for Detroit, a city nearly given up for dead a decade ago. Destructive riots in 1967 speeded the flight of the middle class from the city. Crime filled the gap and accelerated the migration of businesses and residents. Demolition of abandoned buildings left whole blocks of Detroit empty.

Catalyst for change has been the glass-towered Renaissance Center along the Detroit River, a complex of offices, shops, and a 740-foot-tall hotel.

This tangible act of faith encouraged millions of dollars in other construction, including a downtown shopping mall and a riverside sports arena seating 20,000. Expanded hotel facilities and a dramatic drop in crime have brought a flood of conventioneers. The city that outsiders once avoided will host the Republican National Convention in 1980.


NEIGHBORHOOD
WATCH
CRIME REPORTING AND
OPERATION IDENTIFICATION
IN USE BY THIS BLOCK GROUP.
DETROIT POLICE DEPARTMENT

Digging in, neighborhood groups have organized to fight crime and decay in Detroit. Two thousand of the city's 13,000 blocks now cooperate in vigilance against burglaries through the Neighborhood Watch program. Coached by police, citizens learn how to safeguard their homes and to recognize and report potential crimes. In one target area, losses from break-ins dropped nearly 50 percent, compared with 11 percent citywide.

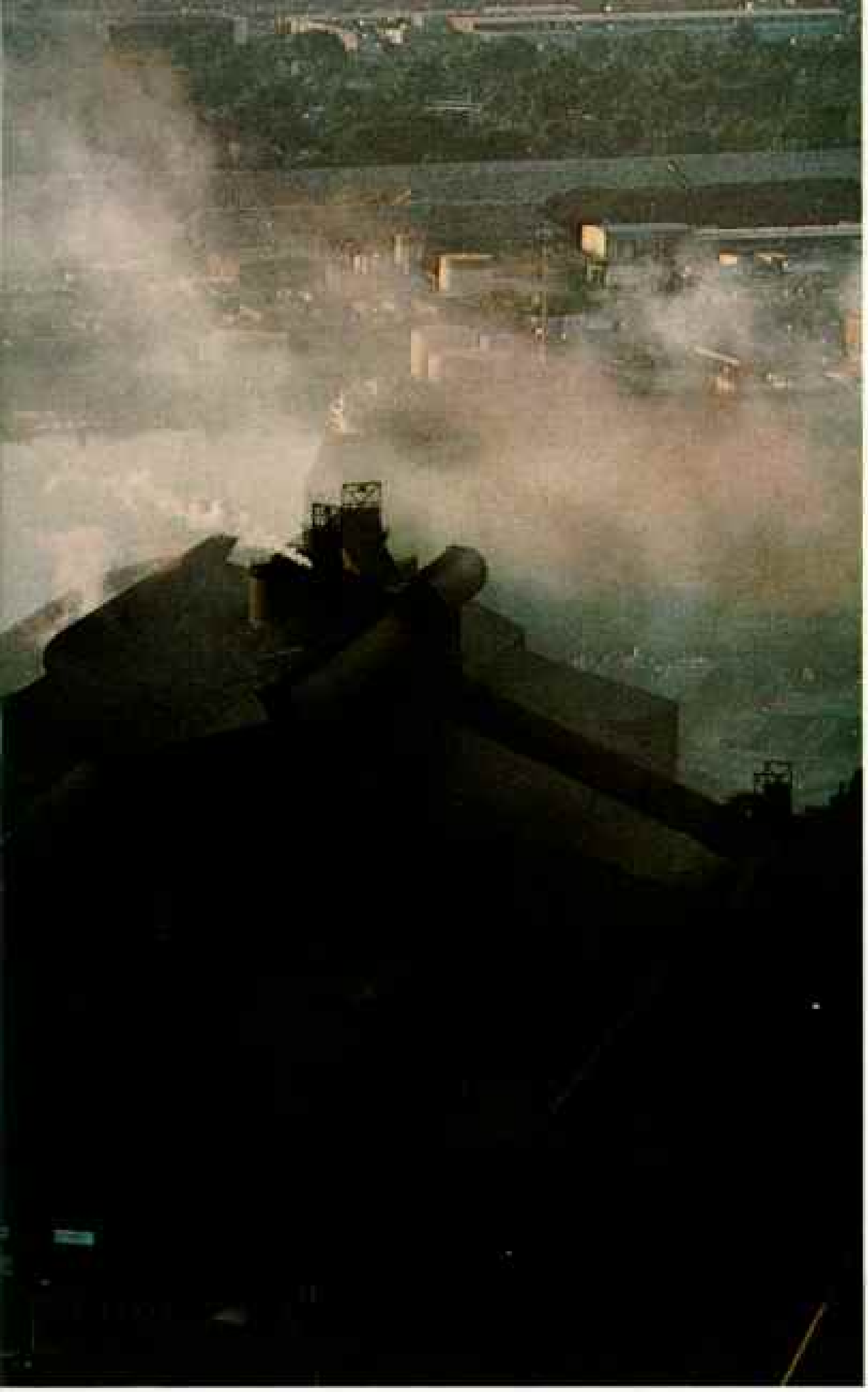
To combat urban mess, platoons of young people have been recruited to paint murals over wall graffiti, pick up trash, and clean gutters (**right**). Despite their efforts, much work remains: Eight blocks from where the 1967 riots began, a rusting car hulk stands at streetside (**below**), and vacant lots mark a once active neighborhood.

More critical are the vacant lives of Detroit's disadvantaged. A Michigan economist has estimated that half the young black men growing up in Detroit will have had no job experience by the time they reach the age of 25.

The front lines of Detroit's struggle for self-respect include allies that might have been unlikely a decade ago. A former union leader, Mayor Coleman Young now works with coalitions of industrialists for city progress. At a ceremony announcing plans for two new towers of the Renaissance Center, he shakes hands (**above**) with David Rockefeller, a director of Rockefeller Center, Inc., which will develop the addition in a joint venture with the Ford Motor Company. At right is Henry Ford II, who solicited initial funding for RenCen.

The Reverend Charleszetta Waddles (**far right**) founded the Perpetual Mission that provides social aid for the needy. Her kitchens each month offer 7,500 wholesome meals free or at low cost.

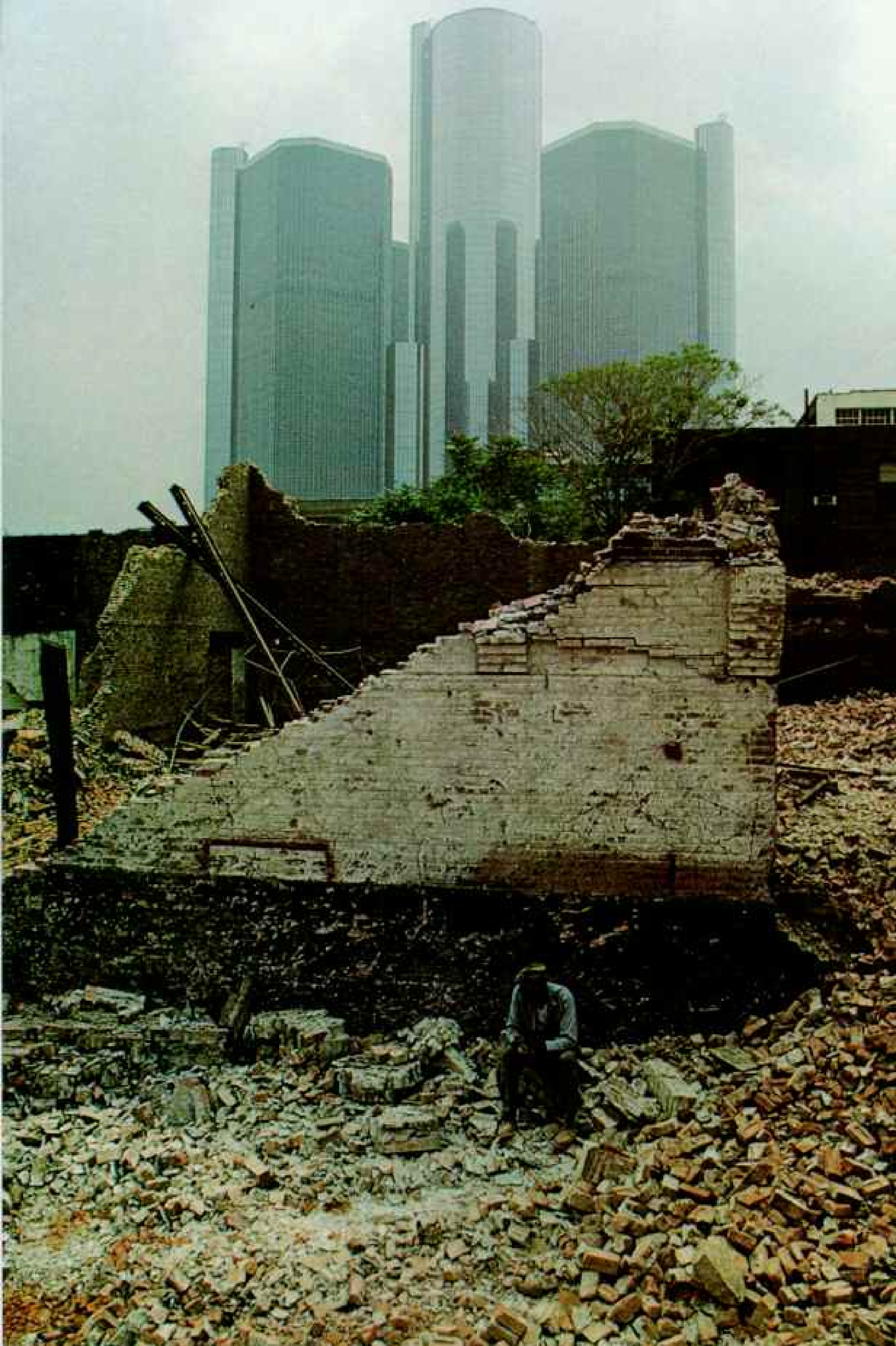
The new face of Detroit law enforcement includes police officer Beverly Harris (**right**), one of 669 women in the 5,601-member police department.



The acrid smell of industry drifts across a manufacturing complex that includes Ford's River Rouge plant (**left,** foreground), Michigan's most complete auto-making facility. Cars begin here as iron ore, which is converted into steel, then rolled into sheets and molded into auto components for assembly. The giant complex uses as much electricity in one day as 240,000 households.

About a quarter of the nation's cars and trucks are assembled in Greater Detroit, but the industry employs only 12 percent of the labor force. At the Lynch Road plant of Chrysler Corporation, largest employer within city limits, programmed robots weld metal panels to form car bodies (**lower left**). A chassis in search of a body rolls off a Cadillac assembly line (**lower right**); it will be sold to another company for completion as a hearse or an ambulance.

Spiritual beacon, a Roman Catholic church rises above a sea of look-alike houses in Hamtramck (**following pages**), an autonomous city whose residents, primarily of Polish descent, are completely surrounded by Detroit. Weekend ethnic festivals at the riverfront plaza run all summer long and feature some 20 groups.



CLARK MISHLER (LEFT)

"**It shall arise again from the ashes.**" Towers of the Renaissance Center near a demolition site give new meaning to Detroit's motto, conceived after the first settlement burned down in 1805. Age and abandonment have led to the destruction of many buildings over the past decade. City within a city, RenCen includes 16 restaurants and space for 100 shops and 10,000 office workers. In the 1,400-room hotel (**above**), an eight-story atrium features cocktail pods, shrubbery, and a half-acre lagoon.

Grooving on the upbeat, patrons jive at Ethel's Cocktail Lounge, popular Detroit night spot in a downbeat commercial and residential district (**right**). A blues solo by guitarist Albert King draws applause from the audience and a smile from the musician (**above**). Lively tempos made Detroit a rhythm capital in the early sixties when the Motown sound became a byword for ghetto-inspired pop music.

Marching to a newsbeat, Emmy award-winning newscaster Doris Biscoe (**below**) conducts an interview for a television news show.

(Continued from page 819) top-notch," he said. "She's very aggressive."

GREATER DETROIT swelled during and after World War II, when the end of sharecropping in the South coincided with war production in Detroit plants. "When we were kids in Alabama, we thought Michigan was paved with gold," said Gary Owen. "When I got off the bus at Ypsilanti in 1963, I had a duffel bag and ten cents for a phone call. I got a job as a laborer building an automobile plant and later went to college. The upward mobility is much easier here."

He did not have to explain what that meant. Sixteen years later Representative Owen was speaking to me across his desk at the House of Representatives in Lansing, where he is associate speaker pro tem. The speaker of the house grew up in Missouri. The associate speaker is from Georgia.

Robots have taken over for a few workers at a Chrysler assembly plant I visited on Lynch Road—one of the few auto plants still in Detroit proper. I watched them crane and poke their turkeylike heads into the corners of automobile bodies and belch sparks in a spot-weld (page 826). "They work 16 hours a day, don't take coffee breaks, and don't strike," said my guide, Dennis Conlin.

Farther down the line a computer led an inspector through the final checkout on an automobile. "Start engine," the display board flashed. Then: "Rev to 2,500 rpms."

"It takes the guesswork out of final approval of a vehicle," said Steve Summers, who supervised the operation.

Analyzers, both human and electronic, can also cut down on carelessness and sabotage born of assembly-line boredom—the "blue-collar blues." "There's a big effort these days to create a feeling of teamwork," said a Chrysler spokesman. I saw several workers wearing buttons that proclaimed "Our Car Team."

"A job is whatever you make of it," said Vince Welch, who checks the auto air-conditioning units at the Pontiac assembly plant in the suburb of that name. With Vince I got into car after car as they rolled slowly by his station. "There's some variety," he said, running yet another system through its hot and cold paces. "Sometimes there's something wrong that has to be fixed."

An auto worker for 15 years, 38-year-old Vince rises before 5 a.m. to punch in at the plant at six. He's off at 2:30 p.m., "early enough to play golf or spend time with the kids." He makes $17,000 to $22,000 a year—"depending on overtime"—and owns a three-bedroom home. On holidays he fishes in summer and hunts deer with bow and arrow in winter. "A good life," he admits, a sentiment echoed around the state.

ONE HUNDRED FIFTY MILES west of Detroit lies Grand Rapids, a monument to comfortable middle-class living. Several years ago Alexander Calder was commissioned to render a sculpture that now sits in soaring, modern splendor before the city-county offices. But the art that summed up the city for me was conceived by a 5-year-old named Cheryl in a citywide contest and reproduced on a downtown building. One side of the six-story structure is painted into a green, paisley face with window-size eyes, a two-story nose, and a smile a quarter of a block long.

Nationally the city's smiling values were advertised by the 38th President of the United States. I missed by a few hours Gerald R. Ford's visit home to dedicate a highway named after him, but his host, businessman Peter Secchia, had plenty to say about Grand Rapids.

"I came here from New Jersey, and my friends there told me, 'You're moving to the boondocks,'" said the restaurateur. "But it's great! We've got opera, good symphony, wonderful parks, safe streets. The county government runs in the black, the police are respected. You go to a restaurant and see youngsters holding hands with their parents. Why? It's the Dutch influence, partly, with their emphasis on family unity."

Grand Rapids, Kalamazoo, and a town called Holland are the three points of Michigan's Dutch Triangle. The first wave of immigrants came at mid-19th century to escape poverty as well as state interference in the Reformed Church of the Netherlands. Unemployment and overcrowding brought a second major wave after World War II.

On the shores of Lake Michigan they recreated the old country. At the wooden-shoe factory in Holland I purchased a pair of

klompen and had them whittled into a perfect fit by 80-year-old Fred Oldemulders, who learned shoemaking from his father near the German border. In a 36-acre downtown park a windmill transplanted from the Netherlands turns its 12-story-high blades to grind flour. During Holland's annual Tulip Festival the municipality of some 50,000 increases more than tenfold.

In Michigan one never has to wait long for a celebration. I arrived in Traverse City in time for the Cherry Festival and found myself in a no-hands pie-eating contest. Lining up next to a contestant who outweighed me by a hundred pounds, I plunged beard, nose, and eyebrows into syrupy cherries grown on the slopes above Grand Traverse Bay. A slip of a girl named Nancy Schneider beat us both, then admitted she had fasted for two days. I would have asked for her disqualification but feared a rematch.

The Traverse City area produces 40 percent of the nation's tart cherries, and a quarter of its sweets. "The coolness of the bay delays blossoms until the danger of frost is past," explained Nick Kroupa when I visited his orchard. He was driving a $28,000 hydraulic shaker that grasped a tree with rubber-lined steel arms. The tree shuddered, and cherries rained onto a tarpaulin. "When we're going good, we can shake a tree every fifty seconds," he said.

People pose a larger threat to the cherry harvest than frost; homes are rapidly displacing farmland. "The area is glutted with doctors, dentists, teachers—professionals who come looking for the good life," said leatherworker Larry Doe, himself an immigrant from southern Michigan.

WILL AND JILL Case-Daniels are not farmers in the commercial sense, but they live off the land on four acres on Grand Traverse Bay, in what they call "enforced simplicity." They built their house, expanding on a chicken coop. Will makes jewelry, Jill keeps goats, and together they garden. "We don't fool ourselves. We're not farmers," said Will.

"We just like to produce our own food, know where it's coming from, and what went into it," added Jill.

Food fanatics? Not in Michigan. In 1973 the state experienced what may have been the nation's most intense case of chemical contamination. Ingredients for a toxic fire retardant that included polybrominated biphenyls (PBB's) were mixed by mistake into farm livestock feed. Milk, meat, butter, eggs, and cheese containing the substance entered the human food chain before the contamination was discovered.

New York City researcher Dr. Irving J. Selikoff reported late in 1978 that of 938 Michigan farm residents tested, 899 showed traces of the chemical in their bodies. An estimated eight million of the state's 9.2 million residents may be similarly contaminated. "We don't know what the long-term effect is on people," Dr. Selikoff told me, "but the fact that it stays and builds up in fat tissues adds to the seriousness."

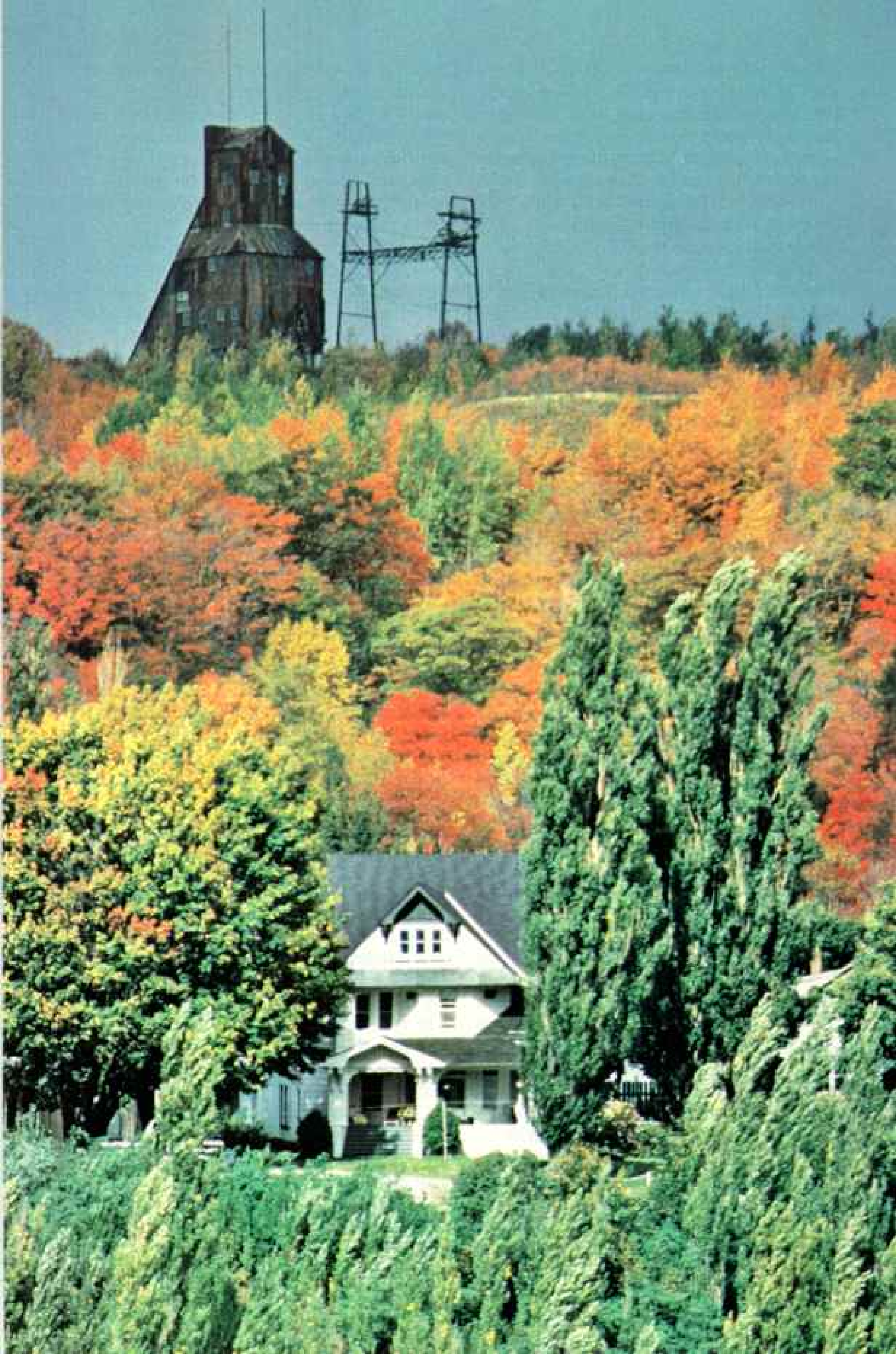
"About half our calves were stillborn after the cows had ingested the feed," said Frederic "Rick" Halbert, a young dairy farmer north of Battle Creek who uncovered the source of the contamination. "Many of the cows collapsed from giving birth."

Thousands of Michigan cattle have been destroyed and buried in huge pits in an attempt to remove the chemical from the food chain. At the Halbert family's 2,400-acre farm, the nightmare goes on. "We have eliminated contaminated cows from our herd, but the chemical, passed on through manure, is still here," said Rick, a modern farmer with a degree in chemical engineering. "A rabbit trapped on our property and tested in 1976 contained more than the allowable PBB's. Traces have been found in the dust in our furnace filters."

Disposal of PBB-contaminated cattle in Michigan cost more than a million dollars in 1978 alone, but a state court has found that low-level contamination poses no hazard. Other battles, against other chemicals, are also being fought. The fishing license I bought came with an advisory explaining that fish caught in certain Michigan lakes and streams may contain another toxic chemical, polychlorinated biphenyls (PCB's). Unlike the direct contamination of the cattle through their feed, PCB's invade the environment from a wide variety of industrial sources.

"I don't think we're any more polluted than the rest of the country," I was told by Howard

(Continued on page 843)



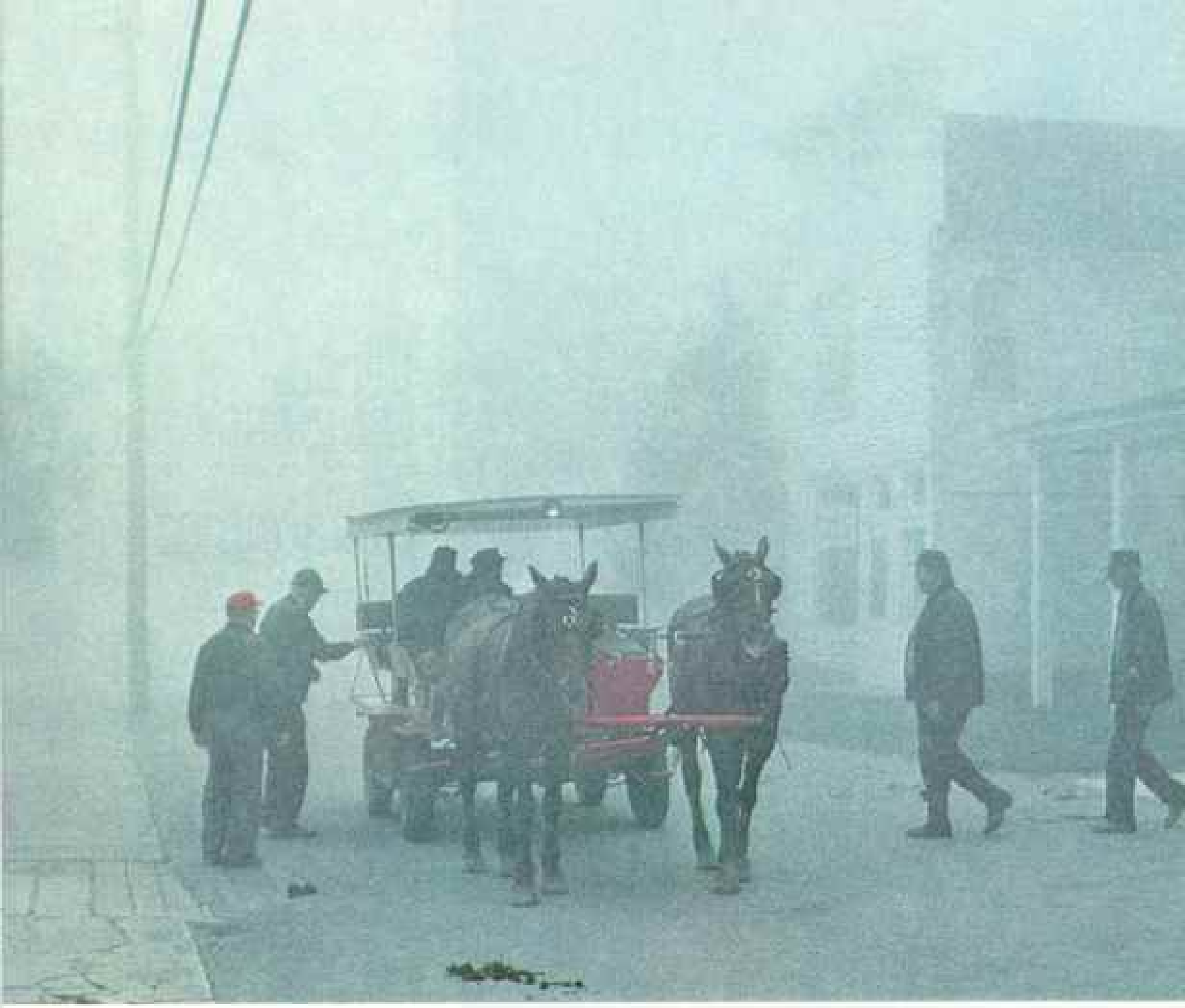
UPPER PENINSULA

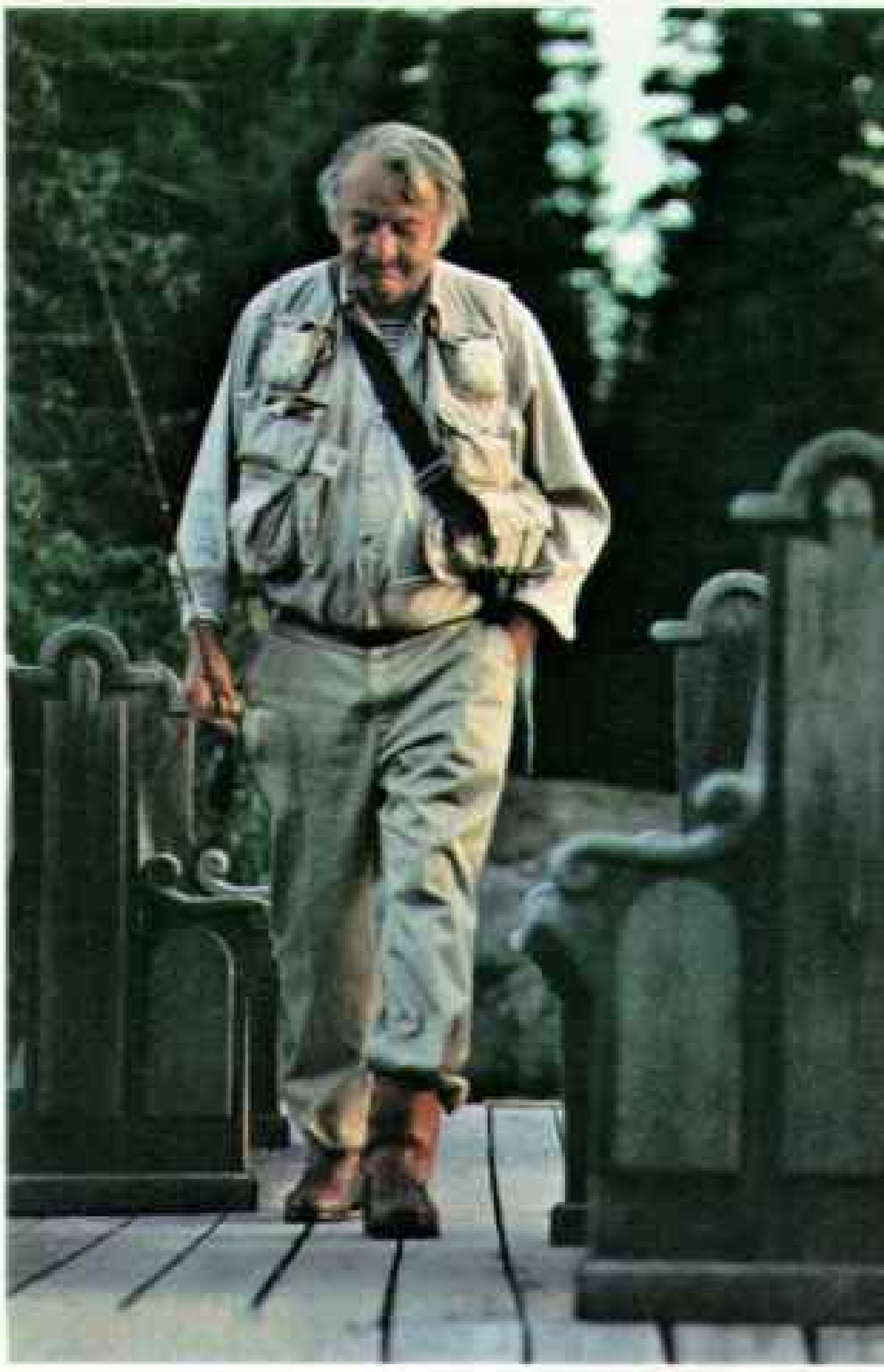
Seasons of boom and bust

FLAME-COLORED hardwoods and the shaft house of an idle copper mine tell a tale of Michigan's Upper Peninsula: Once booming with minerals and pine timber, the economically depressed area now subsists mostly on visitors who come to admire its natural beauty.

Immigrants from depressed areas of northern Europe swelled the population in the mid-19th century when the purest type of copper in the world was being taken from shafts that finally reached a mile deep. The Quincy mine shown here produced for some 90 years before high production costs and slumping copper prices closed it.

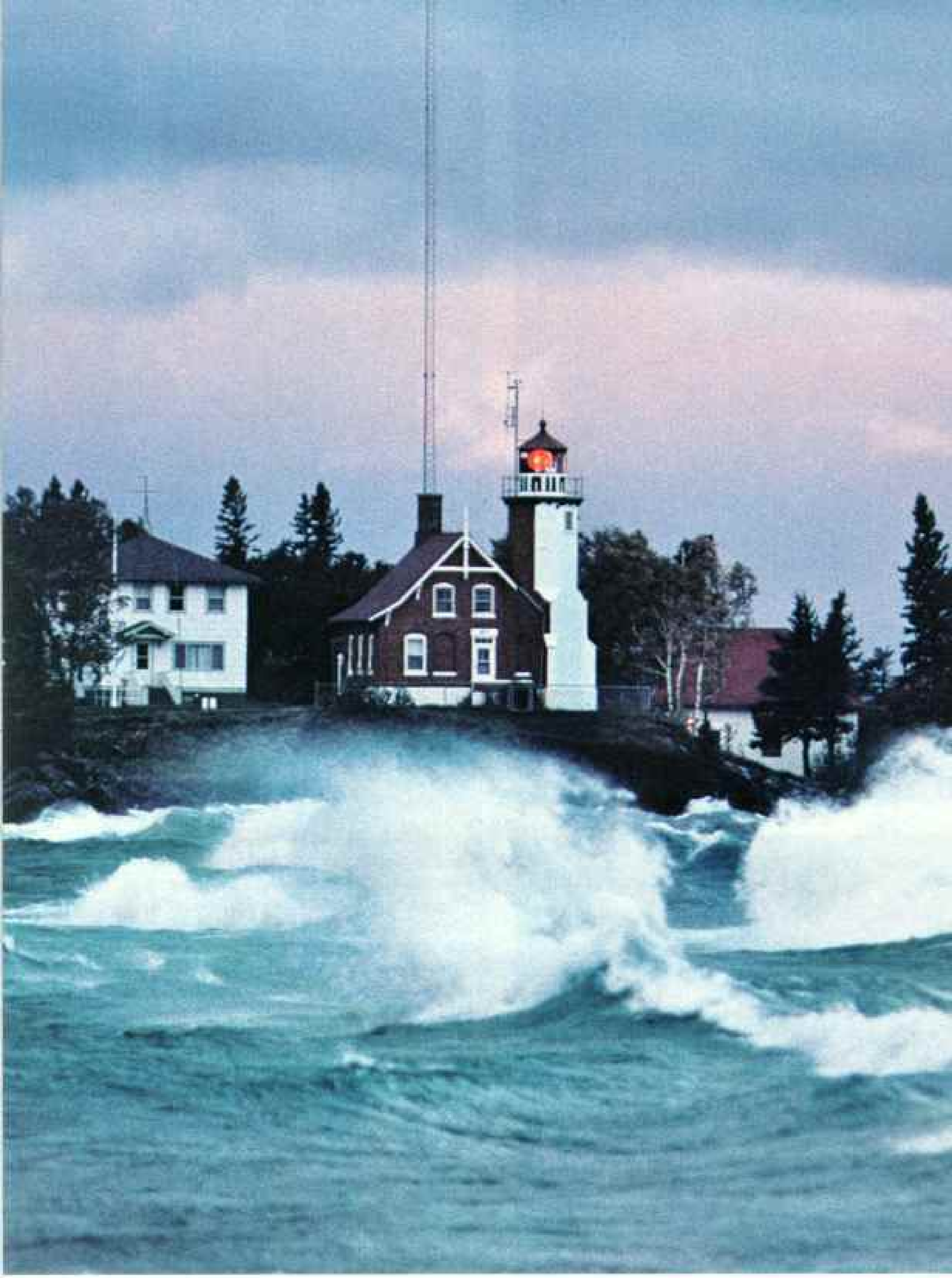
The copper miners are all but gone, and their descendants scattered. What remain are superb fishing and hunting and a countryside regrown with forest and returned to silence.





"**The unwanted ugly duckling** had turned into a fabulous golden-haired princess," John Voelker wrote of the Upper Peninsula in his best-selling *Anatomy of a Murder*. The author (**above**), who publishes under the name of Robert Traver, returns to his camp near Marquette after a day of trout fishing. Early Michiganders scorned the inclusion of the U.P., believing it worthless. Timber, tourism, and minerals proved them wrong. Long a source of wealth, iron mining (**left**) still prospers with improved technology.

Like figures in an archaic dream, carriage drivers and stablemen file from their rooming house for a horse-powered commute on Mackinac Island (**upper left**), where cars are banned. "Visitors come to savor life as it was when the century was young," says W. Stewart Woodfill, owner of the famous Grand Hotel and a leading preservationist of the island's ambience.



A Superior storm on the world's largest freshwater lake batters the shoreline at Eagle Harbor on the Keweenaw Peninsula. Screaming gales with sea-size waves

have taken their toll of ships and lives in Lake Superior. A November storm in 1975 sent the 729-foot ore boat *Edmund Fitzgerald* and 29 crewmen to the bottom.

Tuneful old warriors of the nation's only remaining World War I drum and bugle corps practice regularly at Sault Ste. Marie, site of the locks between Lakes Superior and Huron. The former doughboys, all in their 80's, traveled to France in 1978 to play in the 60th anniversary ceremonies for Armistice Day. Similar endurance has led their state through hard times to economic vitality.

(Continued from page 835) Tanner, head of Michigan's Department of Natural Resources. "We've just been more open than most in talking about it. We take pride in the cleanup of our streams, and I believe we've spent as much or more than other states on environmental action."

AND WELL THEY MIGHT, for the pleasures of the outdoors fit closely with a way of life long enjoyed in Michigan, especially by urban dwellers. Novelist Ernest Hemingway, son of a Chicago-area doctor, spent his boyhood summers near Petoskey, and his short stories about a young outdoorsman named Nick Adams were largely autobiographical.

The writer's sister, Madelaine "Sunny" Hemingway Miller, still spends her summers at Windemere, the family cottage on Walloon Lake (page 814).

"Ernie loved this country," she said as we sat at lakeside, looking past a water-skier to forested hills on the opposite shore. "He loved the adventure, the freedom, the expanse. It wasn't all fun—we heated lake water for washing clothes and had to clean the fish we caught. But it was different from our life back in Oak Park, and we couldn't wait to get up here."

Wounded in body and spirit in Italy during World War I, Hemingway took a solo fishing trip in the Upper Peninsula in 1920. It resulted in one of America's most famous fishing stories, *Big Two-Hearted River*. A Two Hearted River flows in the U.P., but descriptions in the story suggest that Nick Adams was probably young Hemingway seeking peace on a waterway called the Fox.

Curious about a river that may have salved a young man's soul, I rented a canoe from outfitters Tom and Carma Gronback at Germfask and was trucked fifty miles upstream from their dock for a solo fishing trip of my own. I pushed off and soon became acquainted with a friendly, personable little river whose banks were close and whose current, though swift, had no white water. For hours I drifted, tying up briefly at times to cast for brook trout, with familiar results.

With mental apologies to my fly-fishing mentor, John Voelker, I finally impaled a squirming worm on a hook and let it drift into a deep pool below me. A brookie snapped the line tight and offered a spunky, headshaking struggle before being lifted into the canoe. I stared in wonder for long seconds at the brilliant colors of the trout, the jewel that sealed my growing love affair with the Fox.

But like many a lover, the Fox can break a heart as well as fill it. Eager to add to my catch, I grew careless—and paid dearly. Tied to a snag at mid-river I half-rose to reach for my bait, and the craft rocked hard to starboard. As I overcompensated, it rocked sharply back and, feeling utterly ridiculous, I flipped backward and very alone into the chill autumn waters and swift current of the Fox.

After several quick strokes toward shore, I felt my shoes touch bottom. Working my way along the bank to the snag, I retrieved the water-filled canoe and pulled it ashore.

I HAD NOT CREATED a Nick Adams idyll, but then neither had Hemingway. Wilderness is not automatically idyllic; the challenge of dealing with it calms the mind. Hemingway wrote of a young man who sought to blot out the shock of war in a single-minded confrontation with the outdoors. Today's Michigan urbanites head for their wilderness to seek solace from the confusions of a fast-paced world. The same therapy, for the ordeals of war and peace.

Dried and chastened, I continued my journey down the Fox, circumventing trees that had fallen across it, learning to read its eddies and ripples, treating it with respect. I camped that night on a small peninsula where the stream doubled back within yards of itself. A young maple in flaming color leaned far out from the bank, doomed to be undercut and toppled in spring. I cooked and ate my single trout.

I paddled next day in intermittent rain, and quit fishing after seeing plentiful worms in the roiling water around me. I donned a poncho, settled into a rhythm of paddling, and listened to droplets dimple the river.

Around noon on the third day the Gronbacks' golden retriever woof-woofed a greeting. I paddled hard on the left, watched the bow come around, and rode the canoe onto a low spot at the bank, weary but refreshed by the Michigan north woods. □

TAHITI AND BEYOND

The Society Islands,

By PRIIT J. VESILIND Photographs by

THERE ARE ALSO MEN in Tahiti. It comes almost as a surprise, so persuasive is the myth, packaged and sold in the warm flicker of a hundred travelogues. Always the promise of trade winds sweet with hibiscus, the musk of succulent fruit, undulating palms, and women—endowed to the last with indolent grace, smooth brown skin, and laughing eyes.

They are all there. But there is more. And there is less. In the Society Islands, myth and reality often share the same bed.

The mystique began when English Capt. James Wallis, the first European to visit the islands, anchored off Tahiti in 1767. Wallis found his frigate surrounded by hundreds of canoes filled with strong, laughing men and tantalizing young *vahine* who performed, as a ship's officer penned in his journal, "a great many droll wanton tricks."

Rhythms of the sea provide a playground off Tahiti, principal island of the French-administered Society archipelago in the South Pacific. In a time of economic and political

Sisters of the Wind

GEORGE F. MOBLEY BOTH NATIONAL GEOGRAPHIC STAFF

A sometimes grand, sometimes sordid parade of whalers, artists, and tattooed adventurers followed Wallis. Each had his own tale on a single theme—a lush, innocent paradise where the equality of man was innate, and passion unfettered by guilt.

I came to Tahiti, as most men do, a victim of this most forceful propaganda. But no wanton vahine awaited at the international airport. And on the highway to the capital city, Papeete, motorcycles, pickup trucks, and Peugeots jostled one another for the right to speed.

The paradise of travel posters has not changed so much as fragmented. Said a musician at the Hotel Royal Tahitien, "Now you must see the other islands to see Tahiti."

Tahiti and her sisters, mere specks of volcanic rock and coral scattered in the constant wind of the South Pacific, lie 700

flux the sea remains a cherished constant for the islanders and their traditional Polynesian way of life. And its untapped resources provide hope for a more independent future. 845

kilometers (430 miles) north of the Tropic of Capricorn and halfway between Australia and California (map, pages 850-51).

They were settled before the ninth century by seafaring Polynesians, who developed a complex social and political structure mired in fratricidal warfare as ruthless and bitter as any in Europe.*

Nine of the 14 Society Islands huddle to the lee of the trade winds; the others lie roughly windward. English explorer James Cook named the leeward islands the Societies because "they lay contiguous to one a nother," and the windwards were later included under the same rather prosaic label.

Together the Societies span 800 kilometers, one of five archipelagoes annexed by France in 1847. Along with the Marquesas, the Tuamotus, the Gambiers, and the Australs, they comprise a French overseas territory known today as French Polynesia. The principal island is Tahiti, the name often informally extended to the entire territory.

FRANCE, it is said, exports ideas but not people or enterprise. In Polynesia she administered with benign neglect for more than a century, an era of amiable but seedy insouciance and isolation—a time whose passing is still mourned by many romantics.

But it ended in the early 1960's with two jarring events. The first was a motion picture—MGM's 1962 remake of the 1935 classic *Mutiny on the Bounty*, from the book by Charles Nordhoff and James Norman Hall. Filmed in Tahiti, the 18-million-dollar project showered the islands with jobs and money and quickened the Tahitians' own awareness and pride in their history.

Actor Marlon Brando's portrayal of mutineer Fletcher Christian led to his long romance with Polynesia. In 1966 he purchased his own atoll, a necklace of coral islands called Tetiaroa, 50 kilometers north of Tahiti. Here Brando has built a small hotel, nurtures a variety of conservation projects, and has found peace from celebrity.

On the heels of the film came the bomb. Between 1962 and 1966, more than 15,000 French soldiers, technicians, and bureaucrats of the Centre d'Expérimentations du Pacifique (CEP) arrived in Tahiti to test nuclear weapons on Mururua atoll, 1,300 kilometers to the southeast. The agency, headquartered in Papeete, spurred the enlargement of the airport at Faaa and opened the way for the jumbo jets of mass tourism.

If the movie perpetuated the Tahitian myth, the CEP brought home the reality of colonialism and of power politics.

"And it was a great cultural shock," remembers Hans Carlson, director of industrial development for French Polynesia. "The new bureaucrats held to themselves and had their own social groups. Local people who had been happy with their lives, proud of their position, were suddenly made to feel inferior. The newcomers brought a huge amount of money . . . but they also brought materialism and unhappiness."

Wage-earning jobs quickly turned self-sufficient fishermen and farmers into proletarians as the CEP scraped the islands for able bodies. The agency now employs 10 percent of French Polynesia's labor force.

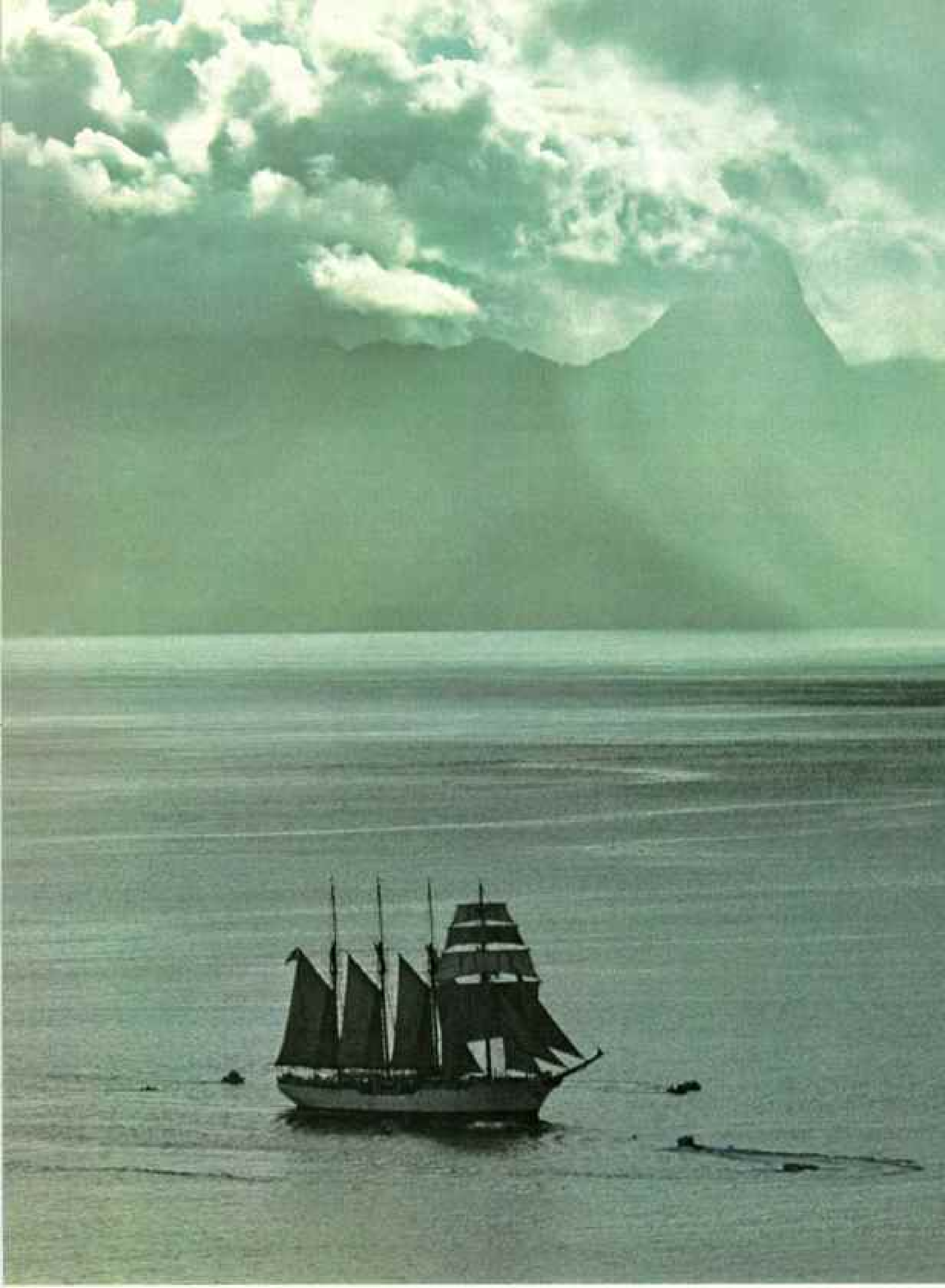
"I went to Huahine in 1963," said an American businessman who lives in Tahiti, "and in one village not a man was in sight—they were all on Mururua working for CEP. And when they got a taste for money, they didn't want to go back to Huahine."

They went instead to the urban complex around Papeete, home to nearly half of French Polynesia's 140,000 people. Often they crowded into shantytowns on the outskirts. Gangs of jobless youths appeared—anti-French, anti-European, anti-anything. Small but radical independence movements exploited the frustration, spawning unaccustomed violence.

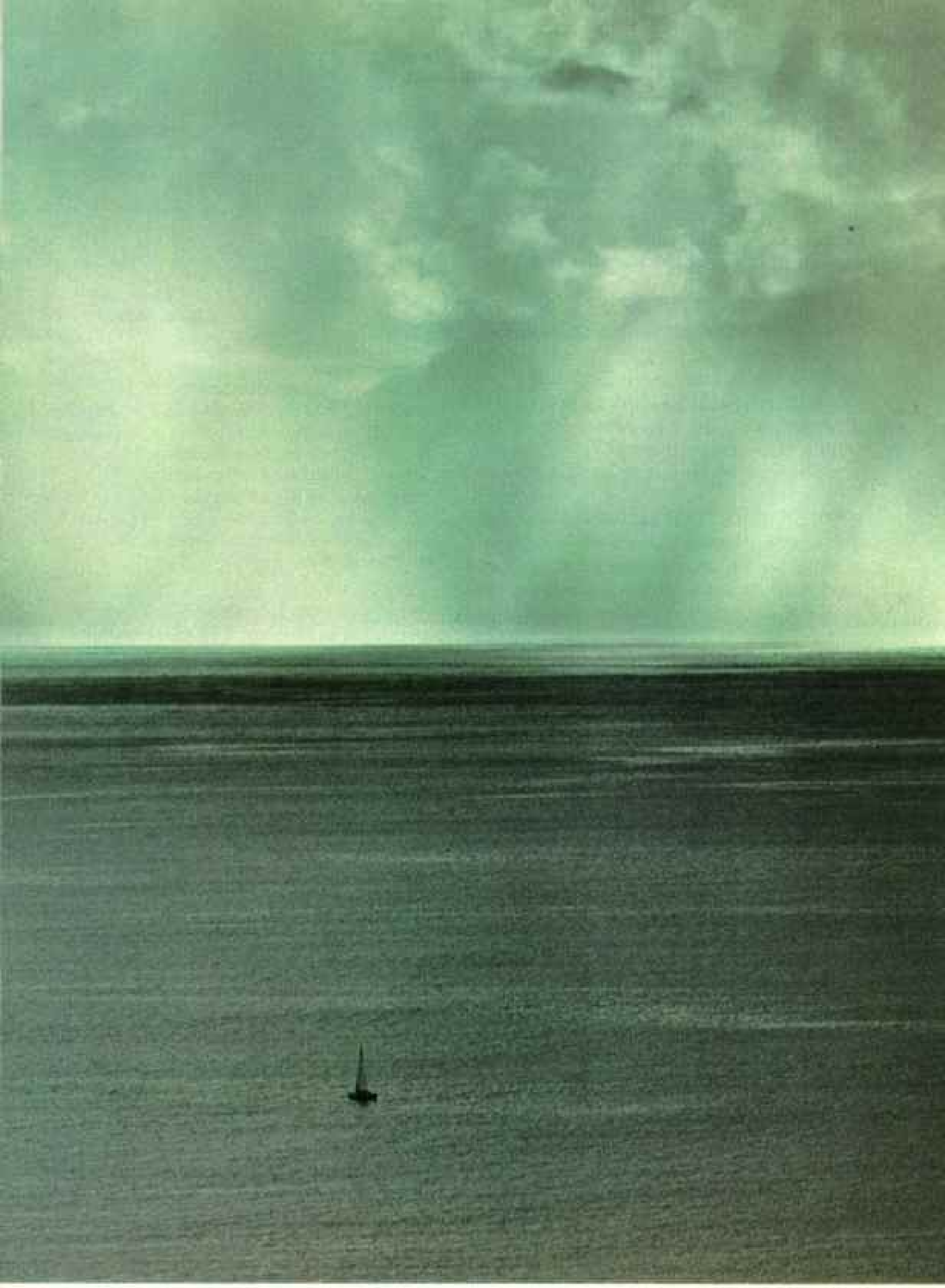
To compound the problem, better health care and a high birthrate are creating a

*An overall look at the Pacific Islands, including a double-sided supplement map, was included in the December 1974 GEOGRAPHIC.

Showers seldom dampen the endless summer of childhood in the islands, where the struggles of life seem secondary to the pleasures of living. Children, loved by all, are left virtually free to explore and grow, and, in a community where all men are brothers, they are unhesitatingly given for adoption to neighbors or friends who want them.



Squalls veil Moorea island as the Chilean training ship Esmeralda *leaves Tahiti.*



The islands' grandeur astonished sea-weary Europeans, who first saw them in 1767.

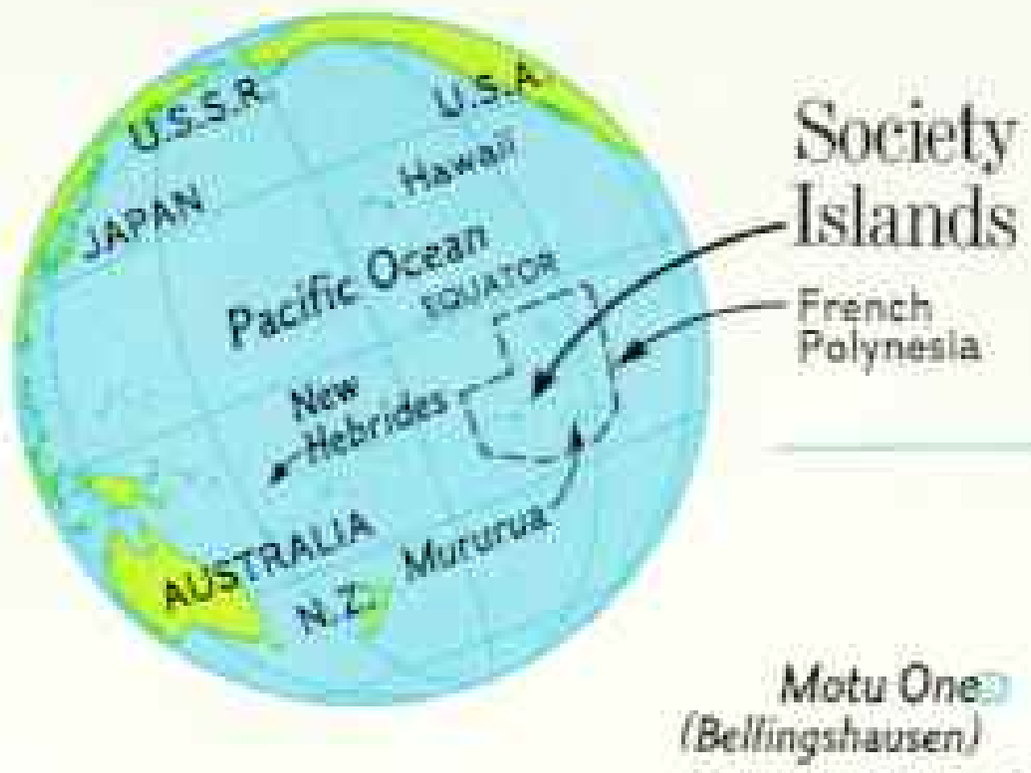
nation of the young. By 1980, 60 percent of French Polynesia will be under 16.

Local and international protests drove the nuclear testing underground in 1975, and today the bitterness toward France seems tempered with resignation. Demonstrations against the bomb continue, but many Polynesians face the dilemma of how to criticize an unsavory benefactor—one who has brought an elevated standard of living that they have learned to accept and enjoy.

For most, life in the islands is good. Wages are adequate. There is no income tax. The sea and the land still provide.

So what, islanders say, if the economy is artificially propped up by French money? So what if things cost too much?

"*'Aita e pe'ape'a*—It's no big thing."



Nearly lost in the vast Pacific, eastern Polynesia sought British protection, but was annexed by France in 1847. Internal self-rule came in 1977, but continued French nuclear testing and erosion of island culture concern leaders like Henri Hiro (**below right**), campaigning on Raiatea for deputy to the Territorial Assembly, the islands' governing body.

EVEN THE PROBLEMS that weigh on the expanding city seem to vaporize in the humid warmth of a January daybreak. At the market, under the green shag-rug mountains that press Papeete to its harbor, women wrapped in cotton pareus and crowned with plumeria chatter among the bonitos and papayas in the melodic language that few Europeans master (pages 852-3). Bargaining is *tapu;* prices are fixed.

In a small Chinese café I breakfast on a steaming bowl of fresh island coffee and *firi-firi*, a kind of doughnut.

In the harbor, across the tree-lined Boulevard Pomare, outrigger canoes slide past freighters filled with flour and Datsuns, and a polynational fleet of transpacific yachts rub gunwales at the quay.

The once seamy copra port has cleaned up its waterfront. A modern shopping center called Vaima breathlessly hawks the chic of Paris and Honolulu. The strip that harbored the infamous barnacle of a dive called Quinn's has been sanitized with four-story blocks of concrete. And tourists pick and gawk at souvenir stands.

Despite the jetport, tourism has not yet eroded the fundamental dignity of Tahitian life. Tipping is vigorously discouraged. There is no servility, no hucksterism. Fewer than 100,000 visitors passed through French Polynesia in 1978—seven times the trickle of 1963, but less than a weekend's gate at California's Disneyland.

Still, many suffer in the emotional limbo between cultures. I sat one night at a hotel bar with Parea Moeino, a 35-year-old Polynesian who captains a charter fishing boat.

"You're looking at half a Tahitian," he told me. "I'm like a *popa'ā* [European]. I drink whiskey, I eat cheese. You know, my son is 10 years old. He won't be a Tahitian at all. He'll be a . . . a Frenchman.

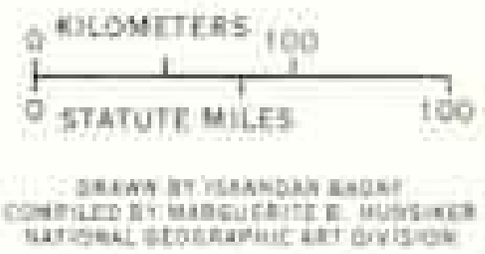
"But what can we do? We can't go back now. It's too late, the Tahitians are lost."

Few Tahitian political leaders share such pessimism. After decades of smoldering pressure for autonomy from France, a new constitution passed in 1977 gives locally elected officials control over internal affairs. The Paris-appointed high commissioner who had governed French Polynesia is the nonvoting president of a seven-member council of government.

For a nation with few natural resources, the most immediate concern of the new government is the economy. Until 1963 products such as copra and phosphate made the islands largely self-sufficient. But the price of copra fell and the phosphate ran out. The movie and the CEP brought a boom, but the new money and demand for foreign products created a dangerous imbalance between imports and exports by a ratio of 95 to 5. Suppose France decides to pull out?

"There is no reason for the French to

Society Islands



DRAWN BY ISKANDAR BADAT
COMPILED BY MARGUERITE B. HUNSAKER
NATIONAL GEOGRAPHIC ART DIVISION

leave," says Francis Sanford, Tahitian vice-president of the government council. "Where else can they make the tests? But we need to teach our youngsters that they can't all be *fonctionnaires;* we need more farmers, many more fishermen, and people to *raise* fish. The most important thing here for the next five years will be the production of protein through agriculture and aquaculture. The reality of Tahiti is the soil and the sea.

"And I think the French love Polynesia," he adds with a shrug. "It becomes for them a . . . sentimental question."

An artist in Papeete had described that relationship as one of a man to an old mistress: "The passions have cooled, but she's too dear to abandon now."

I SPENT several months looking for the object of that affection, starting counterclockwise around the 150-kilometer road that teeters along the shoreline of Tahiti, an island dominated by dizzying mountains, savage ravines, and legendary waterfalls.

Nearly the entire population clings to this quasi-paved highway, which seems constantly overrun by a noisy mélange of children, dogs, and chickens. But a few individualists still farm in the steamy interior valleys where taro and wild coffee tail off

A cultural stew simmers in Papeete, the capital and commercial center of French Polynesia (**right**), where buses called *les trucks* thread the central market between taro and papaya stalls and Chinese stores. A beautiful blend of nationalities shines in a young woman of Bora Bora (**above**).

into a crevice of rushing water, and where fence posts sprout leaves and blossom.

Near Papara I spied a figure silhouetted against the sky, a man in baggy trousers trudging up an improbably steep hillside planted with rows of crops.

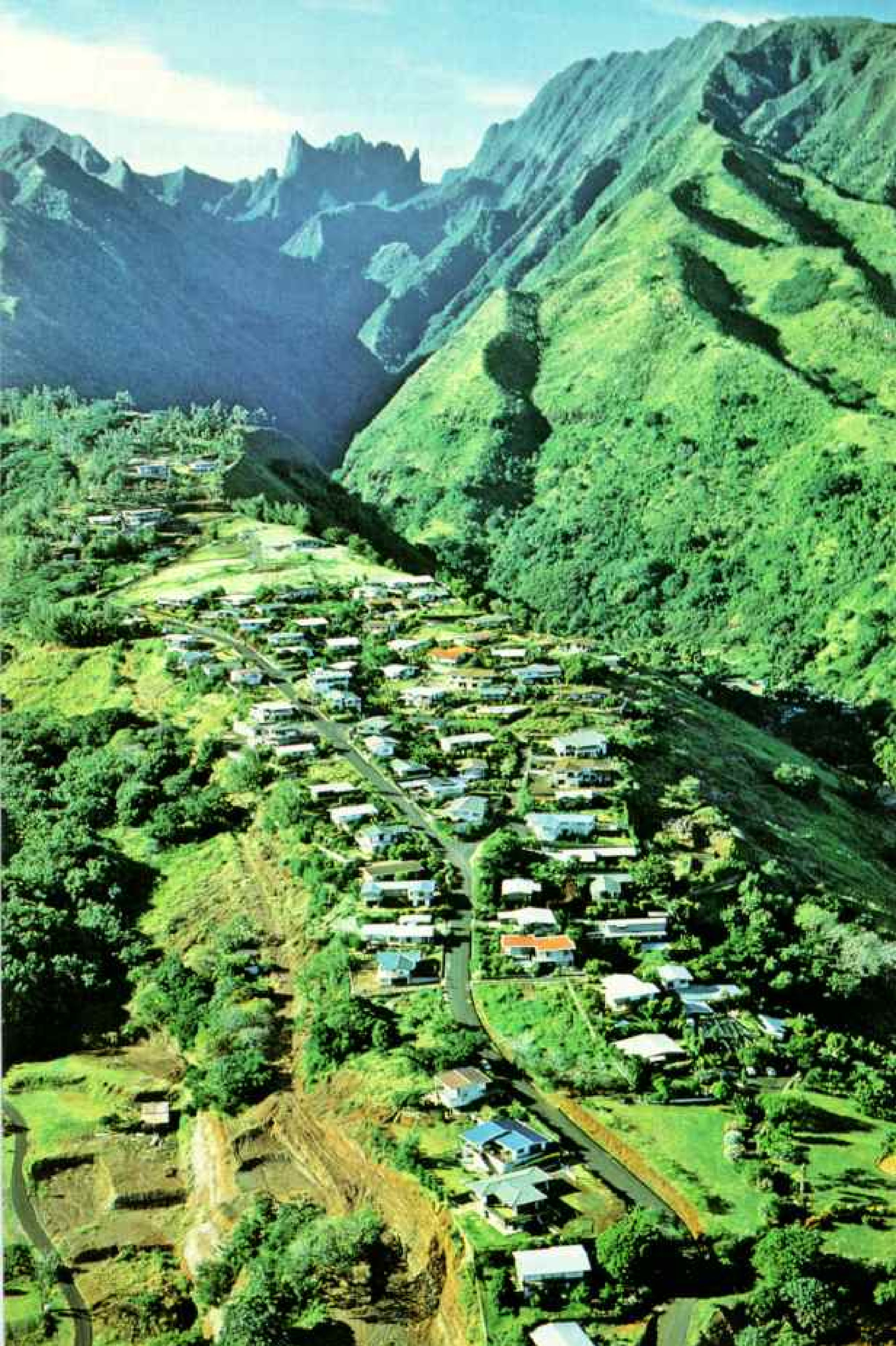
"*Tinitō*—Chinese," I later learned from Henri Carsalade, then chief of agriculture in French Polynesia. "When they came to Tahiti, they had no land, so they used the mountains to grow vegetables."

More than a thousand coolies from the Hakka-speaking region of China were imported to labor on a Tahitian cotton plantation established during the U. S. Civil War, when cotton from the South was unavailable. When the enterprise faded, about a hundred Chinese stayed on—the nucleus of what has grown into a powerful society of merchants and middlemen that makes up 10 percent of French Polynesia's population.

Even in the small villages, when a Tahitian mother sends her child to the store for bread, she is apt to say, "Run to the Tinitō."

One afternoon I rode with Jean-Louis Reboul, French Polynesia's director of agricultural research, up a corrugated jeep trail above the village of Mataiea, where French artist Paul Gauguin had lived.

Auguste Wong, working 14 hours a day,



had carved a masterwork of his own here—in vegetables. We talked of fertilizers and the peanut farm of Jimmy Carter, and I asked why he, who had once been a hotel accountant, had been attracted by farming.

"To tell you the truth," Wong said, "I'm in it for the money."

The government, hoping to encourage lagging production, sets the market price of all vegetables at the price of those that are imported. Local farmers, working with little overhead, are amply rewarded.

In Tahiti you cannot freeze and you cannot starve. "The problem is overeating," said agriculture chief Carsalade. "Obesity rather than hunger."

Lush vegetation covers much of the island, and although agricultural acreage is scarce and the soil is tired, the sun and rain create a virtual hothouse for growth.

Why then is 65 percent of the islands' food imported? Even the copra-oil factory in Papeete, French Polynesia's only real industry, was forced to bring 720 tons of copra from the New Hebrides in 1978.

"There are few real farmers here," says the frustrated Reboul, "only gardeners and businessmen. And sociologists keep reinforcing the notion that work is unnecessary. There have been many glib talkers here, and people will believe anything. 'Don't worry,' they say. 'The future is in the ocean. We are rich—we have plenty of ocean.' Maybe . . . but we can't wait for this future. It's a dream. The reality is that now we must make the copra!"

Past Papeari the road leads through a narrow isthmus to embrace Taiarapu Peninsula, the island's smaller lobe. On the southern coast, fishing nets hang from ironwood trees, silhouettes for a dozen postcards.

In the village of Vairao, a flying-fish fisherman named Joseph Teikivaeho invited me to dine with him and his family.

Upward mobility, boosted by French money, brings well-to-do bureaucrats and Chinese businessmen to suburban developments in the mountains behind Papeete (**left**). The urban area swells with 60,000 people, many of them Polynesians lured from the outer islands by the promise of wages and Western luxuries. French champagne, a symbol of the new affluence, helps enliven a birthday party on Moorea (**above**).

A summer smile softens a French foreign legionnaire (**above**) at Papeete's Bastille Day parade. Tahitians wrap a July-long revelry of Polynesian sport, music, and dance (**below**) around the French holiday.

Straining joyously against the water, teams of double-hulled pirogues vie in

Papeete harbor during the July competition. Teams practice year round for the events and for a chance to represent Tahiti in the annual October races in Molokai, Hawaii.

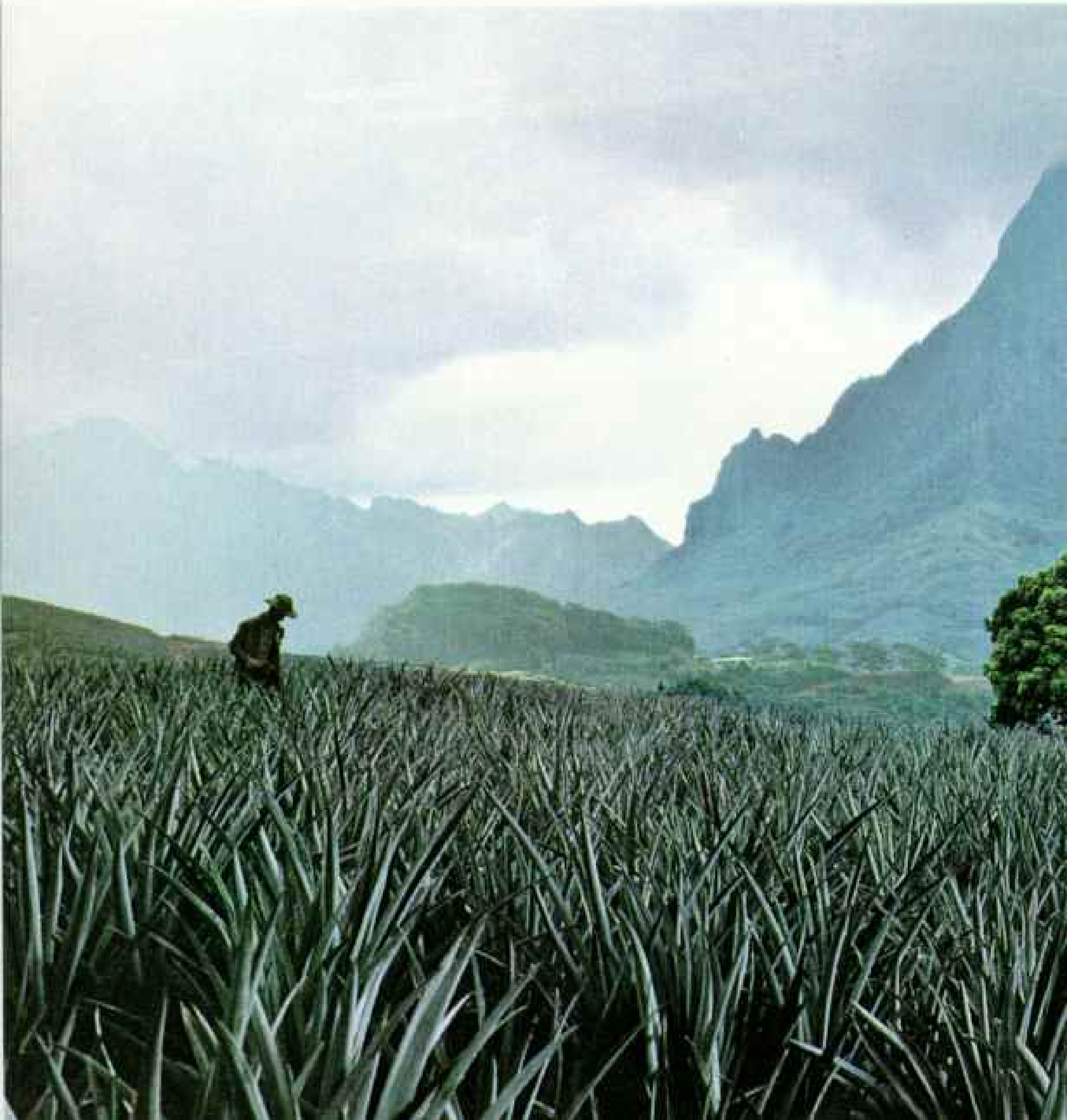
A soccer game from France fluttered incongruously from the television as I removed my shoes to enter the Teikivachos' bungalow. Dinner was *poisson cru* (raw fish marinated in lime juice), New Zealand corn beef, baked breadfruit, and bananas, all lumped into a bowl of salted coconut milk and eaten with the fingers.

After dark we went fishing in Joseph's 50-horsepower launch. He stood in a cockpit in front, one hand on the controls, the other wielding a small net on a long bamboo pole. On his head he wore a helmet fitted with a searchlight, powered by a generator.

Joseph scanned the lagoon with his beam as we skimmed over the water, waiting for a flying fish to break the surface.

Now! A silver streak fluttered and Joseph wheeled his boat for the high-speed chase, scooping with uncanny accuracy into the foaming water, then dumping a frenzy of flapping, two-foot wingspans and nocturnal fish eyes into my lap.

Suddenly the generator coughed and quit, snuffing out the beam. Joseph cut the engine, and we were alone with the dark and the gentle swell of the lagoon. He muttered an oath; he had left his flashlight behind.



The fish sighed in the hold, their gills heaving quietly now. And then this Polynesian, whose ancestors navigated the open oceans by the stars and the feel of the waves on their hands, fixed the cursed generator anyway, holding up each part to the moon as if it were an offering.

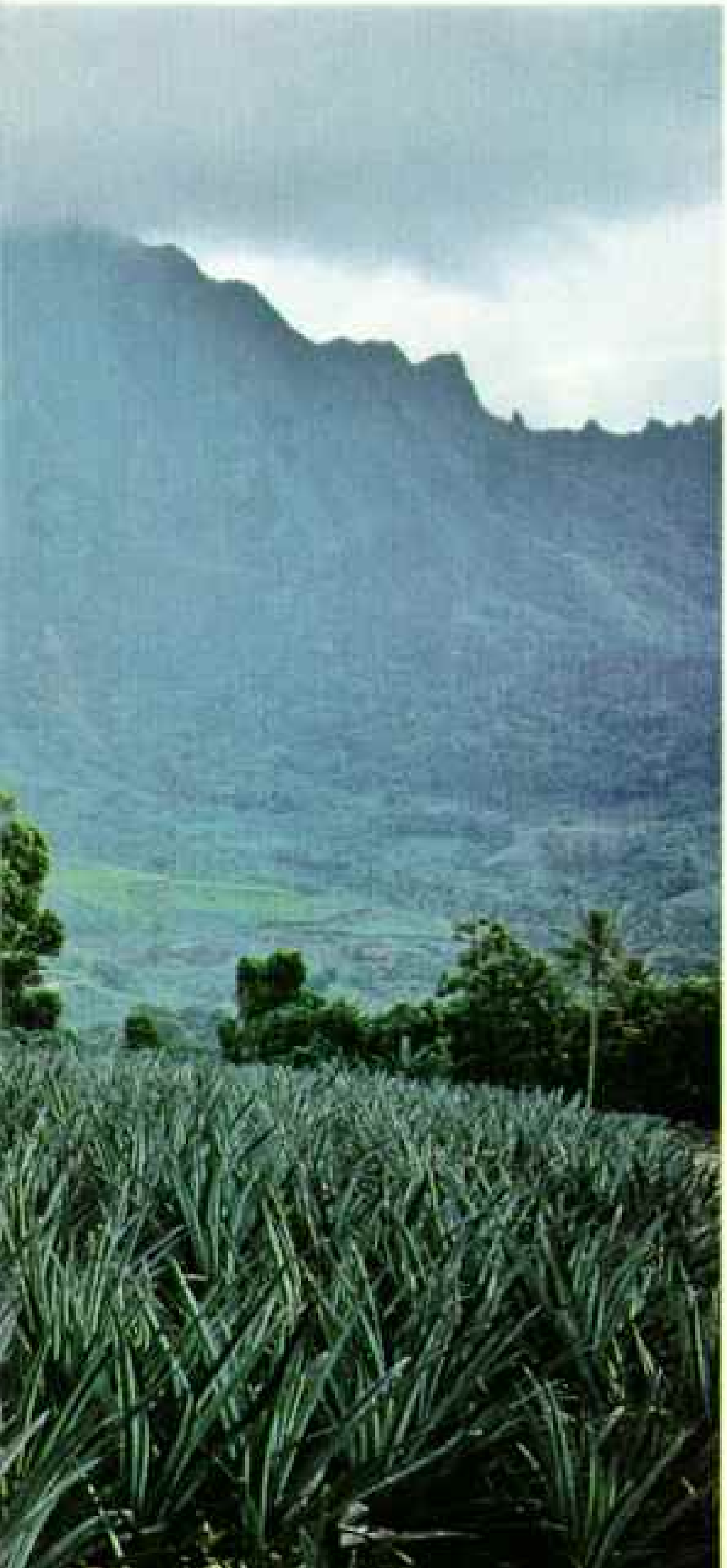
IN THE MORNING, as Joseph slept, his wife drove the catch—500 or so flying fish—to the market, five on a stick.

Bonito, mahimahi, white tuna, yellowfin, redeye, and spear-caught parrot fish and surgeonfish from the reef—nearly all are sold only for local consumption.

"We have problems," says Yves Brosse, assistant director of the Bureau of Fisheries. "The water here is not very rich."

Yet many island leaders are placing the future of Tahiti squarely on the ocean. In February 1978 the government expanded the maritime zone from 12 to 200 nautical miles around French Polynesia, adding more than four million square miles that can only be fished by official permission.

At the Polynesian branch of CNEXO, the Centre National pour l'Exploitation des Océans, in Vairao, they are experimenting



The earth is willing in Moorea's fecund Opunohu Valley, where Ismaël Durietz (**left**) grows pineapples with his wife (**above**). But agricultural progress is slow, for few are inspired to farm in a land where fruit may literally hit you on the head.

"The most beautiful island in the world," James Michener wrote of Bora

with baitfishing for tuna, with tropical aquaculture for shrimp, and with ocean mining of metallic nodules.

From Vairao the road burrows under the weight of mango and breadfruit trees, past the village of Teahupoo, and then . . . only the *fenua 'aihere*, the brushland, and the monumental Te Pari cliffs, with their ravines strung in plumes of falling water.

I drove back toward Papeete in the darkness, the rectangles of shadeless windows and doorways slipping by like a filmstrip. In each, a vignette: a family at supper by a kerosene lamp; a woman, haloed in the blue glow of television, nursing her baby; a man with a shiny oval face leaning back in his chair and laughing at an unknown joke.

TO MARK Bastille Day 1978, the newspapers reported, the biggest nuclear test to date was held on Mururua. The CEP "would neither confirm nor deny."

Bora, home to more than 5,000 U. S. servicemen during World War II.

There was a parade with marching soldiers, and bemedaled veterans leaning on canes on the reviewing stand, but the storming of the Bastille, far away, long ago, seemed incidental to the Fête du 14 Juillet, the carousel of sport, song, and dance that mesmerizes the islands for most of July.

Other islands celebrate, but Papeete swells with visiting dance troupes, spear throwers, and uncles and aunts. Pirogues and outrigger sailboats vie in the harbor (pages 856-7). Burly men yoked with 110 pounds of bananas and breadfruit race through the city streets.

In the evenings the harbor sparkles with the lights of carnival. Aromatic pork and mutton hiss over charcoal grills; Chinese pitchmen sell chances on the spin of a roulette wheel. In quayside clubs, bold-faced island girls the color of café au lait toss their waist-long hair to the hip-swiveling *tāmūrē*, trailing scents of soap and flowers.

ACROSS THE SEA OF MOONS, 25 kilometers from Papeete, the mountains of Moorea lounge like slumbering dragons. It is said that an agile race of dwarfs—the lizard men—once lived among these gargoyled ridges and crags, and periodically descended to carry off wives and other useful objects.

A tingle of magic things persists on Moorea. I spent one morning deep in a steamy forest of *māpē*, Tahitian chestnuts, in the valley called Opunohu. Here amid the shadows of the māpē's twisted roots lie the remains of eighty stone *marae*, centuries-old shrines where Tahitians once prayed to their ancestors. And here the aura of an unknown presence is almost palpable.

So when Medford Kellum, who owned Opunohu Valley for forty years, told me his story, I was a believer.

I sat with him and his wife, Gladys, one evening at their home on fjordlike Opunohu Bay, where the air was warm and soft with the scent of plumeria. Mr. Kellum had made a crown of flowers for his wife that morning, as he has done every day for fifty years.

"When we first came here from Honolulu in 1925," he told me, "I found a marae in the valley with a stone tiki still on it. I didn't know if I could bring it home, so I left it there and marked my path with blazes on trees.

"The chief down at the village said, 'Kellum, you are a good man. You wouldn't mistreat it. Take it home.' So I took a gunnysack and went back to the forest where I had been two days before. But the blaze marks were gone. Not a single one left."

Mr. Kellum came across the tiki often in later years, he said, "But I never moved it."

Shadows and sunlight flickered over the cratered road that winds 60 kilometers around Moorea. My guide, Isabel d'Etigny, and I bounced along in a rented jeep, past sheet-iron-roofed "vanilla houses," built for prominent families in the 1930's and 1940's, when the vanilla bean was an economic mainstay of the island.

Seven major hotels dominate the economy today and make Moorea an obligatory stop for tourists from Tahiti. Still, the island of 6,000 remains faithfully Polynesian, uncluttered and provincial, with little of Papeete's French dressing.

We stopped for lunch at Chez Michou, where diners were shirtless and geckos skittered on the walls. We asked for sea urchins. "It is Sunday," came the reply with a smile. "Today the sea urchins are making love."

Three of the Society Islands' most successful hotels are run by a trio of Americans —Jay Carlisle, Hugh Kelley, and Muk McCallum—"The Bali Hai Boys."

I found McCallum barefoot, in a filthy pair of shorts, digging a drainage ditch high up in a pastoral valley. This is the Bali Hai's 410-acre farm, source of the Moorea hotel's fresh produce, field laboratory for experimental crops, and supplier of a surprising 65 percent of the Society Islands' eggs.

"To get really good workers is hard," he said. "How excited can they get about working for me? Who needs Muk? They can go out there and get a big string of fish."

It is hard to miss this constant clash of values—the achievement-oriented popa'ā against the relaxed, indifferent Polynesian. Vice-president Sanford had warned me about this characteristic of his people.

"Their philosophy is simple," he said. "Yesterday was yesterday, today is really today, tomorrow is another day."

Life is to be enjoyed. Reasonable enough. *Fiu* is a common ailment. When a worker becomes fiu, tired or bored, he simply leaves, seldom stopping to explain why or even to collect the last paycheck.

One concept that changed with the coming of the Europeans was communal ownership. No one really stole; he just borrowed from the common stock. Thus no man was forced to compromise his pride by accepting charity.

Medford Kellum tells of a young man who left Moorea to fight in North Africa during World War II. When he returned, his family and friends gathered around to ask what wonders had impressed him most. Was it all the cities? The strange lands? The killing?

"He said, 'Do you know what I saw?' "

"We said, 'No, Temui, what was it?' "

" 'I saw a man put out his hand and ask for money.' "

HUAHINE, 135 kilometers northwest of Moorea in the Leeward group, remains the most tranquil and unpretentious of the major Society Islands. Life in Fare, the principal village, still revolves

around the Wednesday-morning arrival of the copra boat, a freighter that docks under the stately *'autera'a* trees of the quay. Off come bicycles, T-shirts, families flushed with city shopping, a soldier on furlough.

On the grounds of Huahine's Hotel Bali Hai, the most important archaeological dig in the Societies has yielded a treasure of preserved wooden items—the support posts of a storehouse, war clubs, and a canoe paddle—from the ninth century. The excavation, funded in part by the National Geographic Society and directed by Dr. Yosihiko H. Sinoto of the Bernice P. Bishop Museum in Honolulu, provides new clues to the incomplete chronology of Polynesian migrations.

The soul of early Polynesia abides on Raiatea, second largest of the Society chain, 40 kilometers west of Huahine. Raiatea was the center of religion and the seat of a dynasty that ruled the western islands for centuries. Today its capital, Uturoa, is the seat of government for the Leeward Islands, and the only other urban municipality, besides Papeete, in the Societies.

Near the slash of Uturoa's airport runway is the red-roofed village of Apooiti, home of Polynesia's only remaining fire walkers. I watched them one night as they stepped barefoot, stoically, in grave procession through a 25-foot-long pit of rocks heated for eight hours with burning wood.

This ancient ritual was almost forgotten, but was revived by the Bali Hai trio, who convinced elders at the village that fire-walking displays would help bring tourists and their money to the island.

On the east coast lies Opoa, the most sacred site on this most sacred island. Here, at Taputapuatea marae, the nation's elite

"My life is poisoned!" laments Raymond L'Eglise, the 72-year-old "nature man" of Tautira. "There are 250 chemicals in our food—authorized by the social communists!" For 27 years the retired French mariner has lived in isolation on the rugged east coast of Tahiti, perhaps the last of the European ascetics who came here to practice Rousseau's philosophy of the "noble savage." "I've traveled from Paris to Ceylon," says L'Eglise, "but all places are the same. The problem is the pride of man."

invested their rulers and offered human sacrifices to the fierce god Oro.

"Do people still use the marae?" I asked a villager. "The *tahu'a*—the priests," he replied carefully. "Sometimes they go at night, but nobody sees them."

The tahu'a of Tiva, a village on the island of Tahaa, is a kindly man with a broad face, no teeth, and a loving grandson who clings shyly to his pant legs. I had come to Tahaa, the splendid green cone linked to Raiatea by a common lagoon, to get cured.

"Yes, yes," agreed the tahu'a as I described my symptoms. "It is a pain that progresses like the waves of the sea, which grow stronger and then diminish. It is the illness called *'ō*."

Dr. Yen Howan, a physician in Papeete, had told me, "Tahu'a in the past could make tikis walk. Now, no more *mana*—no more power. And trust in bad folk medicine causes the death of several babies each year—too much of a medicine or a poison."

The tahu'a regards an illness as either natural or supernatural. In some cases the patient must be tied down to prevent his escape, then the phantom is purged.

"But phantoms do not approach popa'ā," the tahu'a of Tiva assured me. "The spirits are afraid. White people can sleep among the dead and nothing happens. I saw this on television. For Tahitians this is impossible, for the phantoms would follow them."

"What is the most serious illness you can treat?" I asked.

The tahu'a cradled his grandson's head in his big, rough hands. "Cancer," he said.

"You come back tomorrow. I will go into the mountains to gather fresh herbs."

Next morning I received a quart bottle containing the cure for 'ō: a thick mixture of *moa hau'a 'ino* and *pape ha'ari*, substances for which my translator could find no translation. It was the color of spinach and just sweet enough to be nauseating.

"Drink it all before eight o'clock tonight," admonished the tahu'a, "or the herbs will lose their power."

Again and again that miserable evening I drank of the concoction, and at five minutes to eight I breathed deeply and forced down the final swig. But it never cured the illness called 'ō—my heartburn.

BORA BORA, 20 kilometers west of Tahaa, looms from the sea like a cathedral, its triumvirate of brooding peaks sweeping down to a confection of white beaches and a lagoon whose colors shimmer from midnight blue to lemonade.

More than 5,000 U. S. troops were stationed on this tiny island during World War II, at a rearguard naval base and airstrip. Green money, Hershey bars, and Lucky Strikes controlled the economy for four years. Copra and vanilla were abandoned.

Bora Bora reverted to its old ways when the Americans left in 1946, but the afterglow of this golden age survives.

"What we have is a type of cargo cult," French teacher François Tiger had told me in Papeete. "Like a religion. The people had electricity all around the island—for free. That was thirty years ago, but the wires and poles are still there. When the Americans come back, they'll plug them in. If you ask about it, they say, 'No, we are not that childish.' But deep inside they believe it."

In 1977 Italian film mogul Dino de Laurentiis invaded the island with 300 hand-waving moviemakers who monopolized the labor, resources, and water supply. More than 200 Tahitians were hired. Faced with limited room in the island's hotels, de Laurentiis grandly erected one of his own.

The film? *Hurricane*, by *Mutiny on the Bounty* authors Nordhoff and Hall.

As happened to Tahiti 18 years ago, Bora Bora is reeling toward a loss of innocence, a time of fundamental—perhaps terminal—change. New jobs have reversed emigration to Papeete; the island's population has almost doubled since 1961. Money once again lures fishermen from their age-old tasks.

And now a complex of condominium homes has taken root on the north shore.

The world turns slowly for this island madonna, sitting in her doorway on Maupiti. The tiny, peaceful island has no tourist hotels, and its mayor, Yee On Tarano, likes it that way. "I go to the city and see the freaks," he told the author. "But I love my island. I can't stay in Papeete for more than a week. I go crazy."

Says its developer, American Robert Fraser: "The future of these islands is in their proximity to the United States. There's a travel boom in the South Pacific that's just beginning, and it's going to go all the way from Pitcairn to Papua."

"Before, people worked together," a schoolteacher in the hamlet of Faanui said darkly. "Now it's every man for himself. Everybody wants to get *more*."

I watched a day of filming on the former soccer field, sacrificed for a facsimile of Pago Pago, Samoa, circa 1920. The set depicted the inside of a church, where 120 townspeople huddled to pray for deliverance from the hurricane. Gusts from huge wind machines (engines from World War II fighter planes) howled through the cracks of the church. Fire hoses simulated stinging rain.

All afternoon extras and stars slogged about in ten-inch-deep water. Later into the evening, Dino decided to record the villagers singing a *hīmene*, a missionary hymn set in Tahitian harmonies.

"Quiet on the set!" demanded assistant director Pepe Lopez. "Quiet!" He waved his arms at the extras. "OK—hīmene!"

The film rolled, and these Polynesian villagers, selected simply for their appearance, suddenly began to sing. No tuning notes, no director, no rehearsal, but the balance of sweetness and harmonic power gripped the film set so that no one moved. And in the eyes of an Italian technician I saw tears.

When the hymn ended, the entire film crew stood and applauded. And the villagers, understanding the nature of spiritual things, applauded them back, warmly.

Content with simpler things, young Tahitians ignore the TV sets and tape recorder that add prestige to a bamboo *fare* in Mataiea (**above left**). Thirteen people —two families—share the home. The head of one household is a mechanic for the French nuclear-testing agency; the other is a spear fisherman. But with only one station, why two TV's? "One is mine," explains the mechanic with a deep sense of propriety, "and the other is his."

On isolated Maupiti (**above**) a man prepares copra—dried coconut meat—a traditional source of income for islanders. Few Tahitians bother to do the work today. Says Papeete's copra-oil plant director Julien Siu, "They sell the coconuts to tourists for water and throw the meat away. More money."

FIFTY KILOMETERS west of Bora Bora lies Maupiti; beyond that, only crumbs of the Society archipelago—Maupihaa, Manuae, Motu One.

Maupiti is a rock inhabited by 700 people, and ringed by a reef with only one pass, a channel so dangerous that the freighter *Manuia* has wrecked twice in its violent currents, once with the loss of 15 lives.

For many years this island was left to the white seabirds that constantly circle its central massif, but an airstrip was opened in 1975. Still, few tourists have come to Maupiti. There are no hotels, no running water, nothing to buy. It takes only three hours to walk around the island, and people still wave and call *"Ia ora na*—Health to you!"

I remember simple pleasures from Maupiti: washing with buckets of rainwater in

the backyard of our guesthouse; a steaming platter of *varo*, or mantis prawn, the size of small lobsters; sitting in darkness by the wharf as neighborhood kids played guitars and sang; the intensity of burning stars.

But electricity came last summer, and with it a portent of plumbing and refrigeration, not to mention bright lights.

Even so, the town council met last spring and voted down a proposal to build a tourist hotel on Maupiti. The young mayor, Yee On Tarano, told why. "I just got back from Bora Bora," he said. "If we welcome a hotel here, it's the end of everything. Maybe the clever European who still wants to see the roots of Polynesia will come to Maupiti. The hotel will not appear as long as I live."

The last of the Tahitians, I thought, digging the trenches.

But I remembered what Francis Sanford had told me back in Papeete. He had pointed to a large map of the Pacific on his wall.

"New Zealand, Hawaii, Tahiti"—he said. "They were discovered at approximately the same time. You had the English in New Zealand, the Americans in Hawaii, and the French here.

"We are, of course, way behind the others

"I came to find purity," says the young Frenchman who lives with his wife

economically. Look at Hawaii. Whoo! Last year almost four million tourists. Big skyscrapers, all full of pigeons.

But who are happier? That's the big question in life. We have the land. We have the language. We have the Polynesian people."

AT THE MAUPITI AIRPORT, a hut of thatch squatting beside a stretch of crushed coral, a Twin Otter waited to take us back to Papeete.

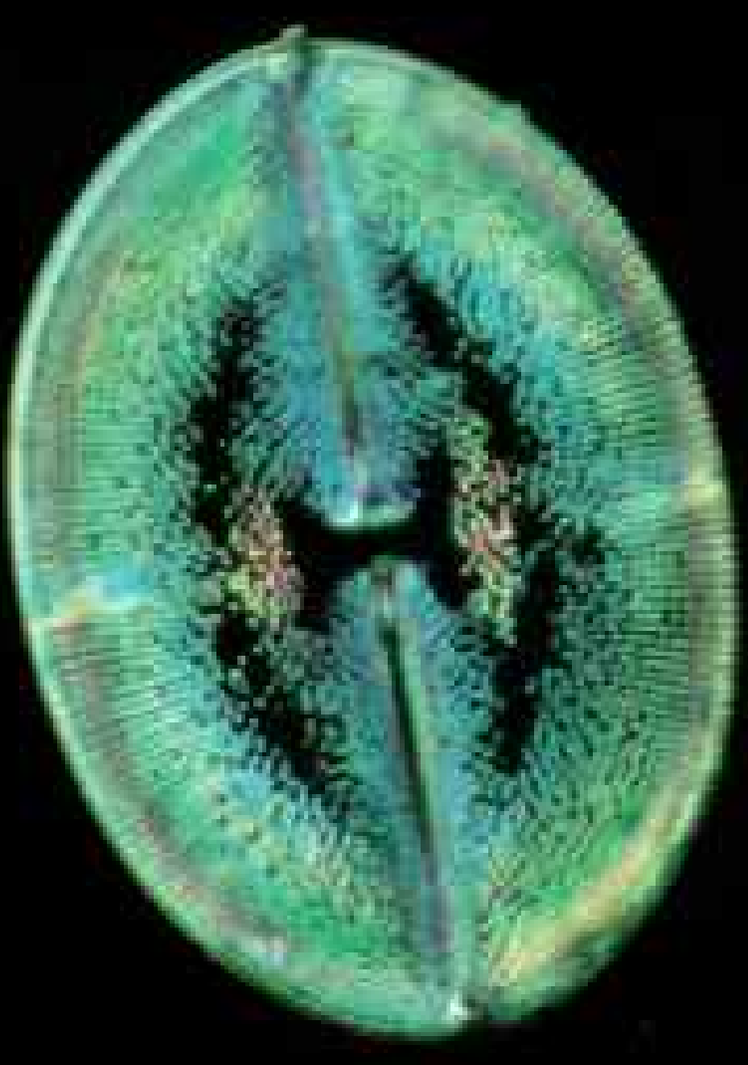
A heavyset Tahitian woman, perhaps 60, sat down beside me. On her head was a hat of pandanus, decorated with a band of *tiare tahiti*, a fragrant island gardenia. She wore a watch that didn't work, but, as she explained, she likes the way it looks. And when she smiled, gold teeth flashed.

She was barefoot, her toes splayed. As she propped her feet up in front of her, sand scattered on the Dacron of the airliner's seat.

It was her first flight, she confessed nervously, her first trip to Papeete. And when the engine coughed to life and the props kicked up coral dust from the runway, she suddenly gripped my hand in hers. And that is how we sat, suspended in space and time as the islands slipped beneath us. □

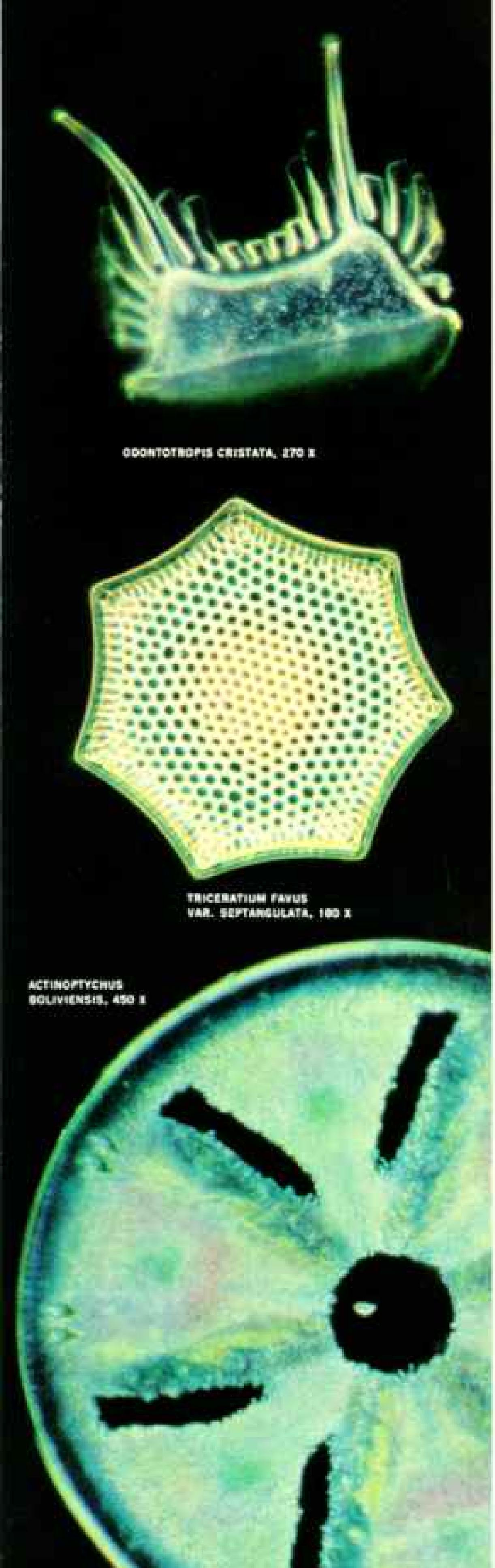
on this tiny island off Maupiti. Others have only dreamed of paradise.

ARACHNOIDISCUS INDICUS,
MAGNIFIED 810 TIMES



NAVICULA PRAETEXTA, 330 X

TRICERATIUM MORLANDII, 360 X



Those Marvelous, Myriad Diatoms

ARTICLE AND PHOTOGRAPHS BY
RICHARD B. HOOVER

SUCH PERFECT ARCHITECTS, these diatoms. They spin themselves intricate houses of opal in the sea. Glittering pinwheels, spirals, stars, and chandeliers! More than twenty-five thousand species of diatoms, and no shell the same. Each a living jewel. My microscope becomes a kaleidoscope.

Diatoms are so exquisite it is hard to believe they are also enormously important. They are, one could argue, the most vital plants on earth. They bob, drift, and sometimes glide through most of the waters of the world in incredible numbers. Just one liter of seawater may contain as many as ten million of these one-celled specks of algae—the primary foodstuff of the sea.

Even land-dwelling creatures, including man, are in their debt, for diatoms that teem in the upper few meters of the oceans

They come from inner space and are essential to life on this planet. Single-celled algae, diatoms by the trillions produce oxygen by photosynthesis, support the oceanic food chain, and help mankind do a host of industrial chores.

produce, through photosynthesis, much of the oxygen we breathe.

By profession I explore the universe as an X-ray astronomer. About a decade ago I discovered a collection of these brilliant little plants my bride-to-be had inherited from her great-grandfather, an early diatomist named Cornelius Onderdonk. Now my off-hours belong to diatoms. They enchant and intrigue me. I have photographed thousands of them, and I travel the world to collect new specimens.

These golden-brown algae thrive wherever there is light, water, carbon dioxide, and the necessary nutrients. I find them in cold Rocky Mountain streams, in thermal springs in Arkansas, in polluted pools and roadside ditches. Marine species often form a brown coating on Arctic ice floes.

Not all diatoms are aquatic. Under moist conditions, some live in topsoil, or attached to moss, tree trunks, or even brick walls. Diatoms can endure lengthy droughts. Recently, while studying the famous Van Heurck diatom collection in Antwerp, Belgium, I added water to diatoms that had been dried on paper in 1834. I was astounded when they began to swim—revived after nearly 150 years of slumber.

Diatoms vary widely in size, but the very largest measure only a millimeter across. To the naked eye, their appearance is usually unimpressive. In the Australian desert I once spotted a brownish layer of diatoms floating in a salty pool.

"Are you sure they're diatoms and not just something left behind by a passing emu?" chuckled my naturalist friend John Ison. I scooped up a sample, and later at John's bungalow my microscope convinced him. Hundreds of graceful S-shaped *Pleurosigma* glided past slender rods of *Synedra*.

Diatoms are the most abundant kind of phytoplankton, and colder oceans support the greatest numbers. Some dwell near the seabed, and will even burrow into the mud. Most float near the surface, however, to absorb sunlight.

One Species Has Built-in Tidal Clock

Photographing diatoms, I soon learned to distinguish two basic forms. One group is often called the Centrales. They have markings—rows of pores or spines—that radiate with perfect symmetry. Most Centrales are oceangoing and are commonly wheel-shaped. They are typically bobbers, drifting near the surface, basking in sunlight and letting nutrients come to them.

Then there are the Pennales. These tend

Diatom graveyard gives man agents that filter, polish, insulate—and even help save his life by supplying the reflective sparkle in roadway-lane striping. They do all this through trillions of their lifeless shells, called diatomaceous earth. Kelly Phelps holds 25 pounds mined at Lompoc, California.

CHARLES O'REAR

to be elongated, their markings in bilateral rows. Most live in freshwater streams, swamps, or ditches, or on the bottoms of shallow regions of oceans and estuaries.

Many Pennales can move about by themselves. On tidal sand flats of Cape Cod, a species called *Hantzschia virgata* demonstrates their locomotion elegantly. When the tide is in, the *Hantzschia* lie buried in the sand. Marine biologist John Palmer has found that just after the tide goes out the diatoms glide to the surface for a sunbath, turning the sand flats a golden brown.

Remarkably, the *Hantzschia* know precisely when to burrow back into the sand. They retreat moments before the return of the tide, which could wash them out to sea. Even after weeks in a laboratory, under constant light, they continue to dig in and out of the sand with such accurate timing that Dr. Palmer can use them as tide tables.

Still, to me the diatoms' most impressive skills are as shell builders. They are alchemists, changing dissolved silicon into a silica almost identical to the gemstone opal.

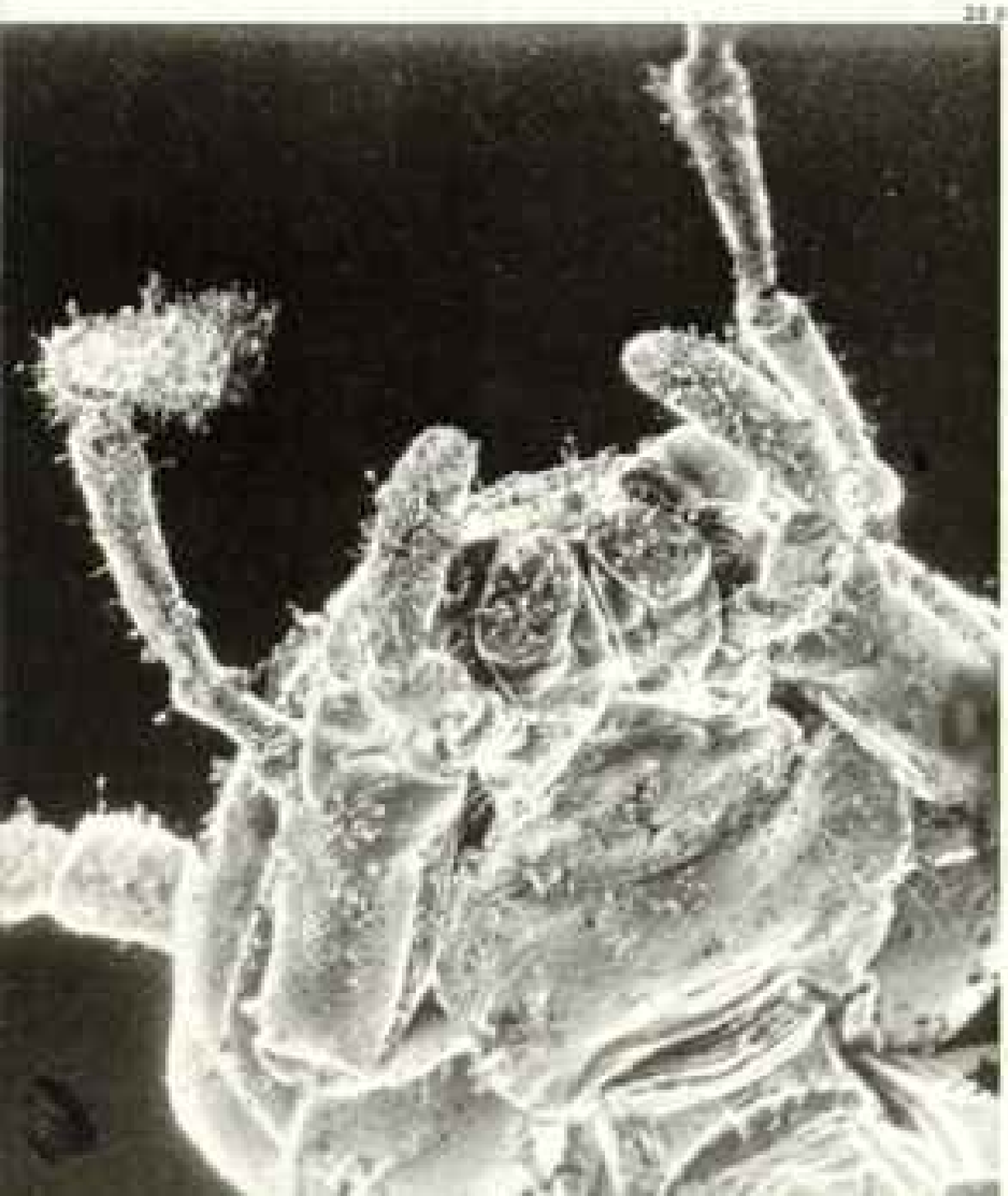
The glassy shells are of incredibly varied and beautiful architecture; some are riddled with pores, which both lighten the structure and permit the intake of nutrients and the exchange of gases. In their teeming trillions, diatoms produce oxygen far in excess of their own needs, making an enormous contribution to our atmosphere.

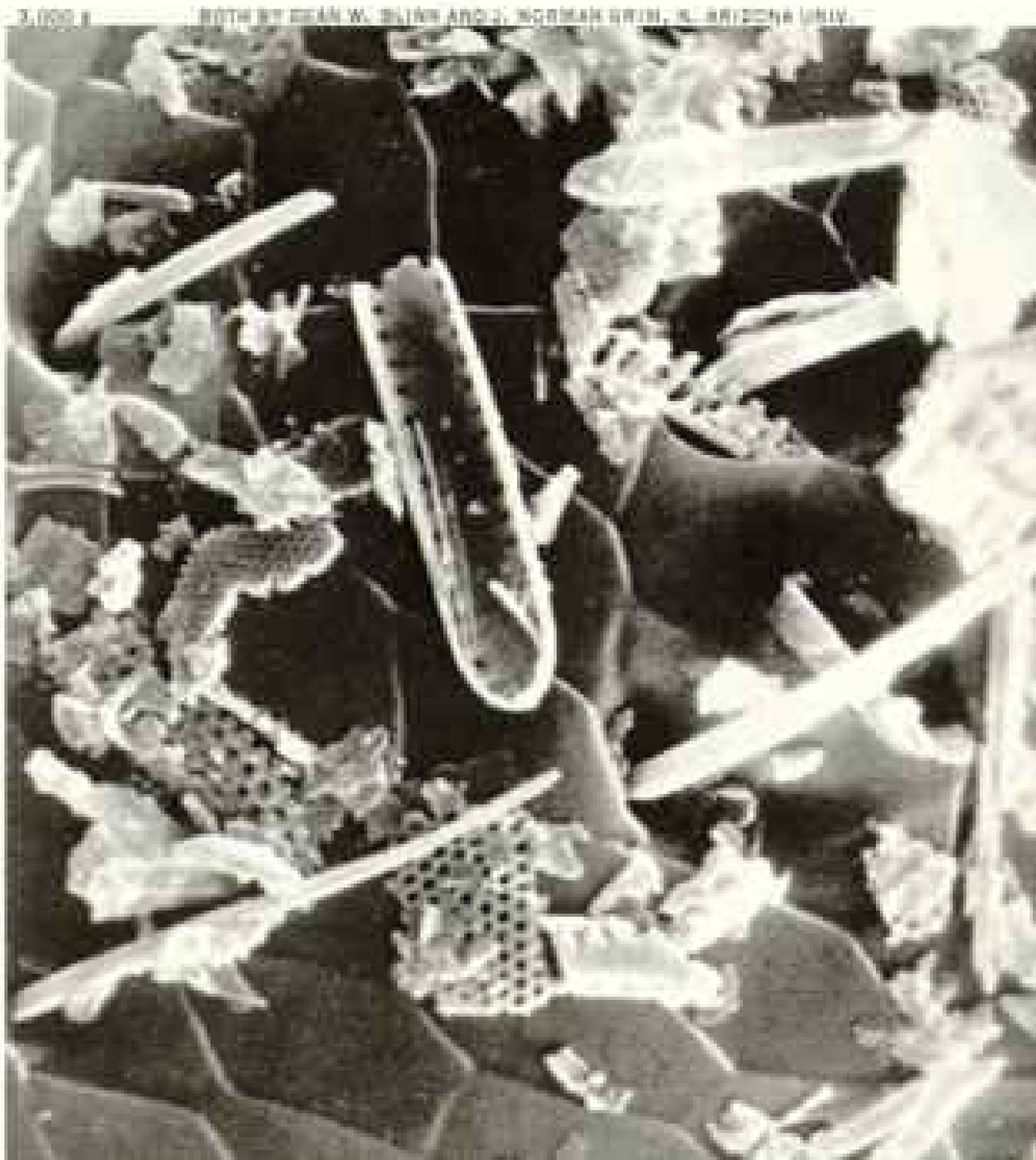
They also play a vital role in the food chain. There is probably more available organic matter—in other words, food—contained in the world's diatoms than any other living thing. Sometimes called the grasses of the sea, they are the main fodder for the little vegetarian animals, such as copepods and shrimplike krill, that make up the zooplankton community. These are typically consumed by small fish such as herring, which in turn become food for larger species.

It requires several hundred billion diatoms to feed a humpback whale for just a few hours. Marine biologist N. J. Berrill estimates that it takes half a ton of diatoms to make a pound of seal. A pound of killer whale, a predator of seals, would require five tons of diatoms.

Even the diatoms' own food is of great importance to mankind. The food reserves that they produce through photosynthesis are stored within their cells as minute globules of oil. As ancient diatoms died, they were buried by trillions beneath the sea. Geologic and biologic forces caused the globules to coalesce into pools that became petroleum. Much of the oil we use today probably began

Death comes in 12 hours after insects venture into diatomaceous earth. Their skins are pierced by sharp edges of the diatoms' siliceous shells, causing life's juices to flow out. Particles of this nonpolluting pest killer cover the rear of a cockroach (**lower left**) and are shown on an insect under extreme magnification (**below**).



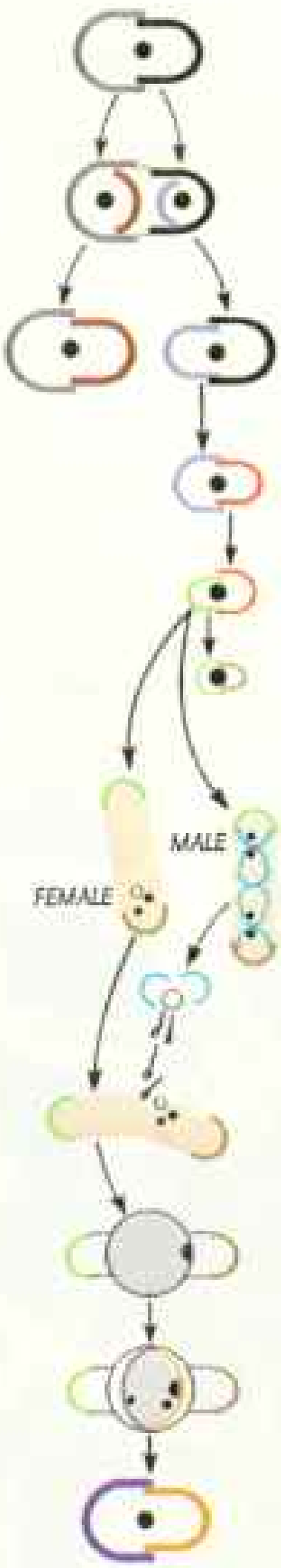


DIAGRAMS BY NATIONAL GEOGRAPHIC ART DIVISION

Like jeweled mandalas, 121 species of diatoms from a single fossil site in Haiti cover a rectangle measuring 1.2 by 1.8 millimeters (**right**), the work of German microscopist J. D. Möller in the late 19th century.

A fossil of the species *Stephanopyxis turris* (**left**) resembles a topsy-turvy pillbox. When alive, the halves—one smaller than the other—connect at their open ends. This species has both asexual and sexual phases, as illustrated by the diagrams at lower left, which are based on studies by the German diatomist Gerhard Drebes.

Diatom long division



ASEXUAL REPRODUCTION of the Centrales species Stephanopyxis turris *begins with a single diatom, its centered nucleus and interlocking shells.*

The shells push apart as the nucleus splits, and new shells form on the inside of each original half.

One offspring (far left) is the same size as the original parent. But the smaller offspring (left) produces descendants successively smaller with each generation.

The shrinking process continues until a descendant is 60 to 80 percent smaller than the original parent. Then, if the right environmental conditions prevail, the sexual cycle begins. If conditions are not favorable, offspring continue to get smaller until reproduction becomes impossible and the line dies out.

SEXUAL REPRODUCTION. Diatoms entering the second reproductive cycle can be either male or female. Both sexes have elongated capsules tipped by shells connected by membranes. Within the female, three eggs are produced but only one lives. Within the male, sperm is produced within each of several components called spermatogonia.

The mating starts as motile sperm from any of the spermatogonia reaches the mature female. Bending, she separates her membrane and makes the opening for penetration.

The fertilized egg swells into a globular shape containing a nucleus.

Within the envelope, shells develop around the nucleus and a cell forms.

The envelope ruptures, liberating the mature diatom which closely resembles the original parent; thus the cycle is complete.

millions of years ago when the sun shone on diatoms drifting in prehistoric seas.

Diatoms were discovered in 1702 by the early pioneer of microscopy Anton van Leeuwenhoek, who thought they were tiny animals. Not until the 19th century did biologists conclude that, since these organisms perform photosynthesis, they are plants.

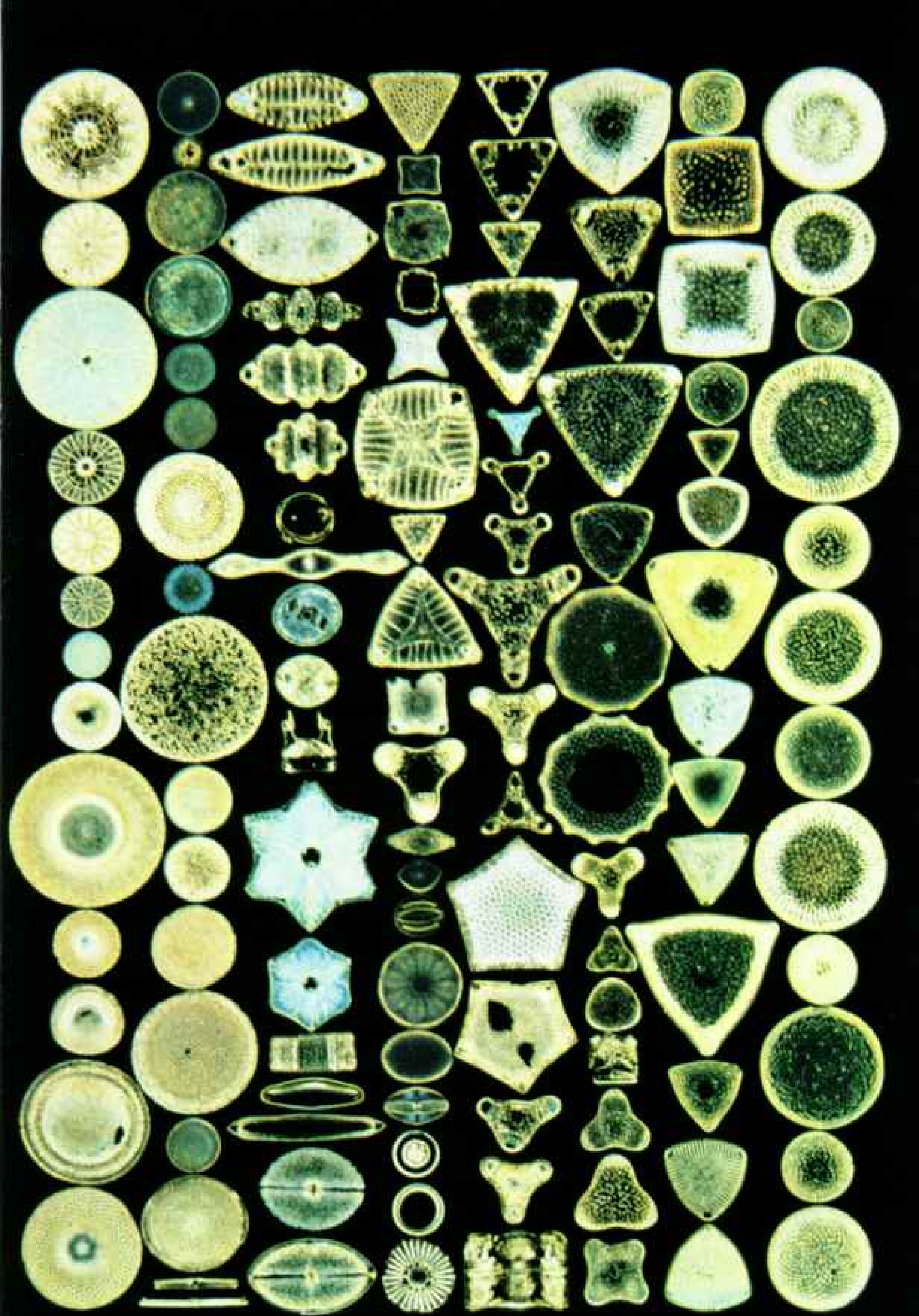
Later in that century, as oceanographic vessels began dragging plankton nets through distant oceans, diatom collecting became a fashionable pursuit, and many names have been given to the same species.

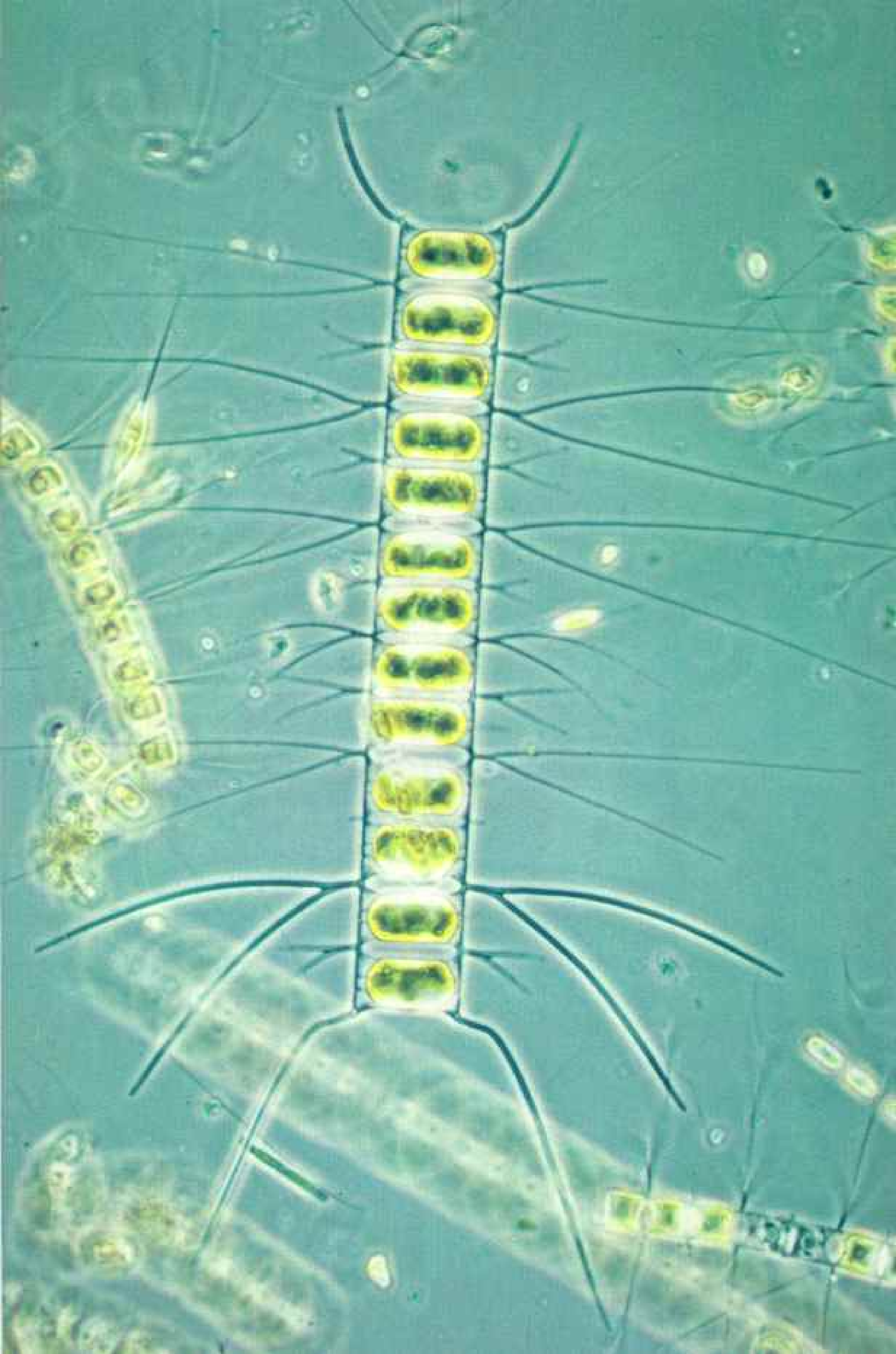
To help clarify the resulting chaos in diatom classification, a German microscopist, J. D. Möller, spent 15 years mounting on a single slide 4,026 of the diatom species then recognized. At the Henri Van Heurck Museum in Antwerp, I was given the rare privilege of examining Möller's slide. That was like an art lover having a Rembrandt all to himself. Four thousand shells in a space the size of a postage stamp! I sat transfixed at the microscope all afternoon.

Mounting individual diatoms requires patience. I use a hog's eyelash on a toothpick mounted on a dowel rod attached to my microscope. I once asked one of the modern masters, the late G Dallas Hanna, how long he thought it would take me to learn the mounting technique.

"It took me about six weeks," he said, "but you should be fairly proficient in three." I asked why I should learn faster. "Well, I started out in the Pribilof Islands off Alaska," he explained. "It was thirty below zero, and my hands shook a lot!"

One of the most fascinating sights a diatomist can *(Continued on page 878)*





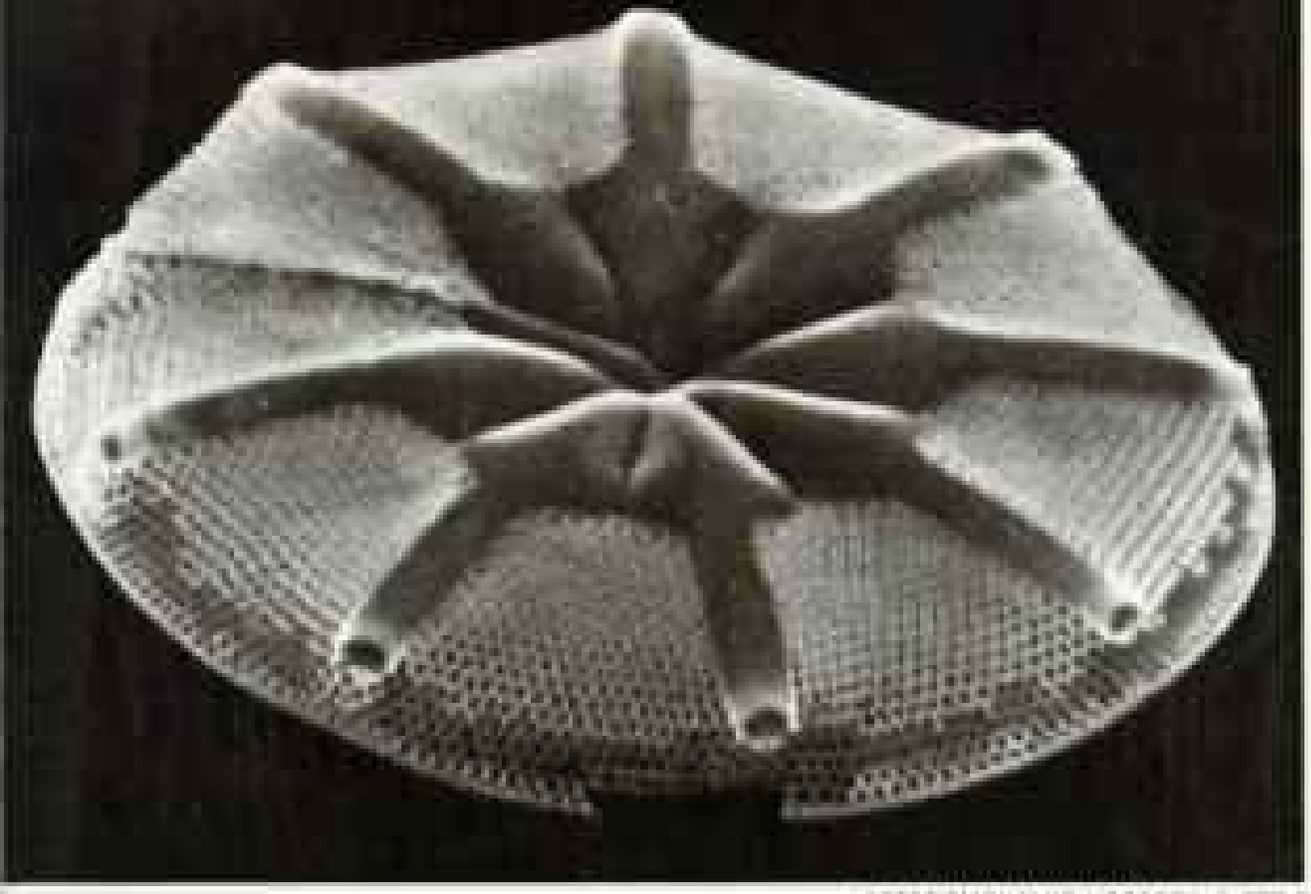
Wispy spines help *Chaetoceros* (**left**) float near the surface of the sea, where photosynthesis takes place. With death, such life forms rain ceaselessly to the ocean floor, creating mines of diatomaceous earth.

Hundreds of diatoms gleam like sequins on strands of algae (**below**).

Millions of years before man took to the air, *Rutilaria epsilon* anticipated the design of the propeller (**right**).

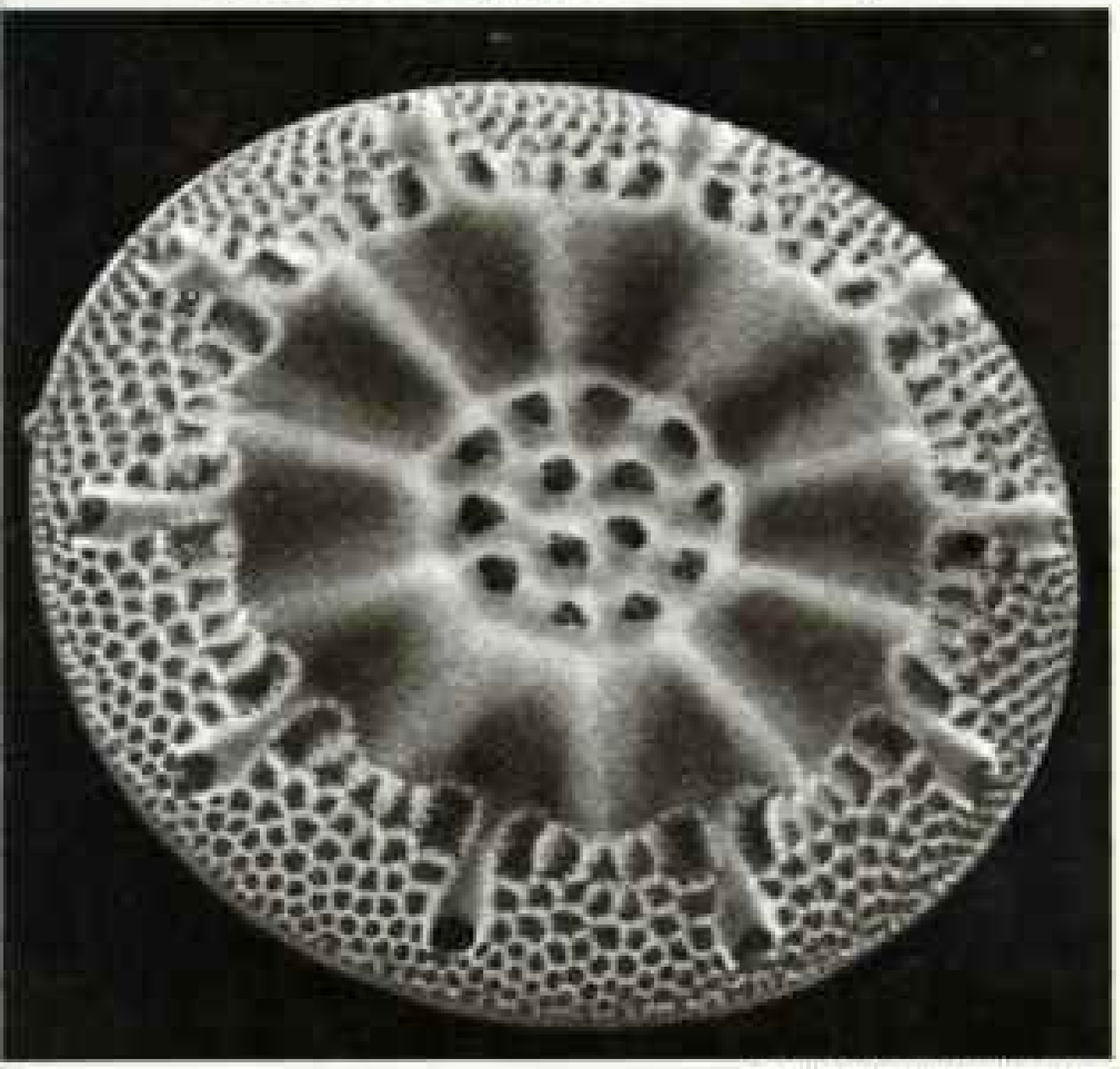
Enthusiasts have collected diatoms as a hobby since the early 18th century when the organisms were discovered by Anton van Leeuwenhoek, a pioneer in the use of the microscope. Some Victorian gentlemen liked to impress their ladies with painstakingly assembled diatom collections.

CHAETOCEROS, 1,180 X, J. ROBERT WAALAND, UNIV. OF WASHINGTON (LEFT); RUTILARIA EPSILON, 1,240 X (RIGHT); ARACHNOIDISCUS EHRENBERGII, 60 X



ASTERIOMPHALUS HOOKERI, 1,800 X

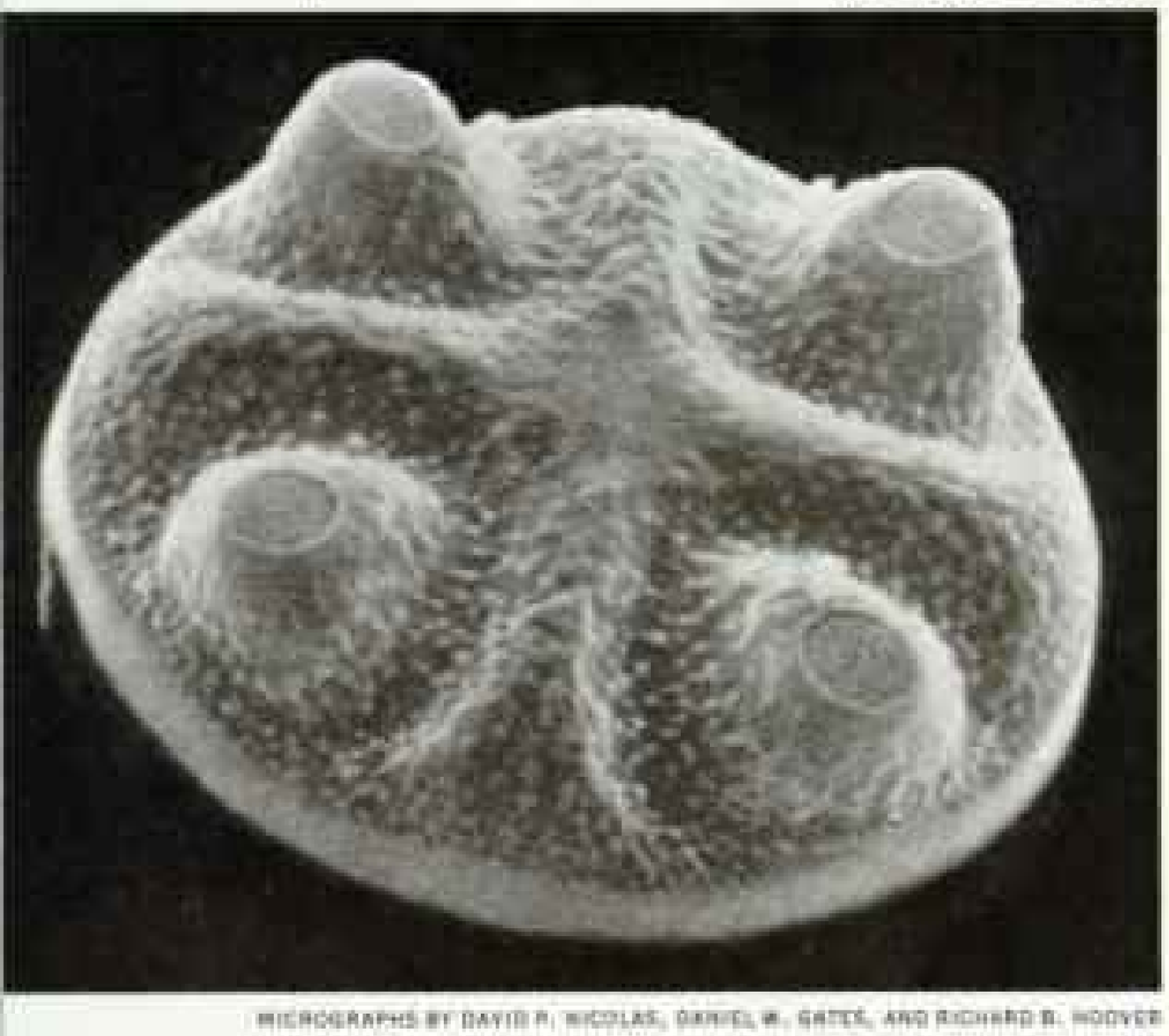
Supreme designers: A mini-superdome. . .



ASTEROLAMPRA VULGARIS, 1,185 X

A space station. . .

ACTINOPTYCHUS SP., 1,055 X



MICROGRAPHS BY DAVID P. NICOLAS, DANIEL M. GATES, AND RICHARD B. HOOVER

A fantasy from outer space.

observe under his microscope is reproduction. First, the two halves of the pillboxlike shell push apart. The diatom's nucleus then divides, and each new nucleus migrates into one of the half shells. The new diatoms then secrete a new inner half.

But a problem remains: The diatom formed from the inner half of the pillbox is slightly smaller, and when *it* divides, one of its offspring will be smaller still. Eventually the shells would become too small to house the necessary cell parts.

So, for most species, occasional sexual reproduction is essential. I have watched two Pennales come together and envelop themselves in a gelatinous material while they exchanged chromosomes. Later the fertilized protoplasm breaks out of its parent shell and develops into a new full-size diatom.

In Ten Days, a Billion Diatoms

Diatoms can reproduce at phenomenal rates, some even dividing every four to eight hours. These could become a billion in only ten days' time. Their immense blooms can change the ocean's color for hundreds of square kilometers. Eventually they deplete the available silicon and other nutrients. Great numbers die and sink, carpeting the seafloor with a layer of diatomaceous ooze as deep as 300 meters. Some thirty million square kilometers of the northern Pacific and Antarctic sea bottoms are buried beneath mantles of dead diatoms. Over the aeons, as oceans rise and continents shift, this ooze fossilizes into rich deposits of diatomaceous earth, or diatomite.

Diatomaceous earth is mined in the American West for use in industry. Its light weight and a multitude of pores make diatomite an ideal filter. Beer and wine pass through its microscopic sieves. It is a fine abrasive, in demand for space-industry components, and a filler for paint, insecticides, and many other products.

We reap a legacy from diatoms, living and dead. And it is not just that these inconspicuous pieces of glass-wrapped protoplasm make the earth a hospitable place on which to live. They fill our minds with wonder and teach us to look more closely.

I know now I can find perfect beauty any day in almost any mudhole, and in every new clump of brown slime, an adventure. □

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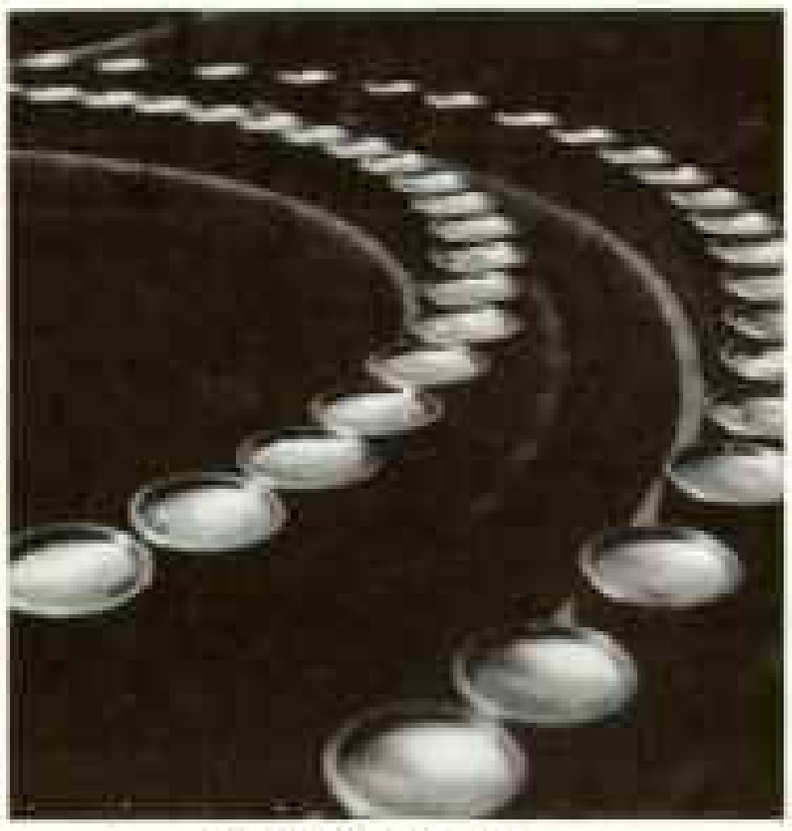

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Recycling is growing fast. In the last seven years, thousands of civic groups and individual collectors have earned over $180 million through recycling. And recycling has added an estimated 15,000 new jobs to the economy—jobs that didn't previously exist.

For additional information about this exciting new industry that saves more and more energy as it grows, write Aluminum Company of America, 359-F Alcoa Building, Pittsburgh, PA 15219.

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We can't wait for tomorrow.

National parks: a photographic odyssey

FOR NATIONAL GEOGRAPHIC photographer David Alan Harvey (right), it was the year he saw America, the year he crisscrossed a continent to help chronicle our national parks—subject of next month's issue.

The assignment was as big as the country itself. "One minute," says Harvey, "it seemed I was sitting in hundred-degree heat talking to a woman who ran a café in lonely Guadalupe Mountains National Park. The next I was in Glacier National Park with a road-clearing crew in freezing weather with the threat of an avalanche hovering over us. And the next I was in Brooklyn recording a cerebral palsy victim's first splash in the ocean."

Such wide-ranging images, captured in photographs and words, bind together a year's efforts to depict the problems and prospects of the national parks. Small wonder that what started as a single article ballooned to fill an entire issue.

Share the celebration of a land that naturalist John Muir called "rich beyond thought." Nominate a friend for membership below.

B. E. GARRETT, NATIONAL GEOGRAPHIC STAFF

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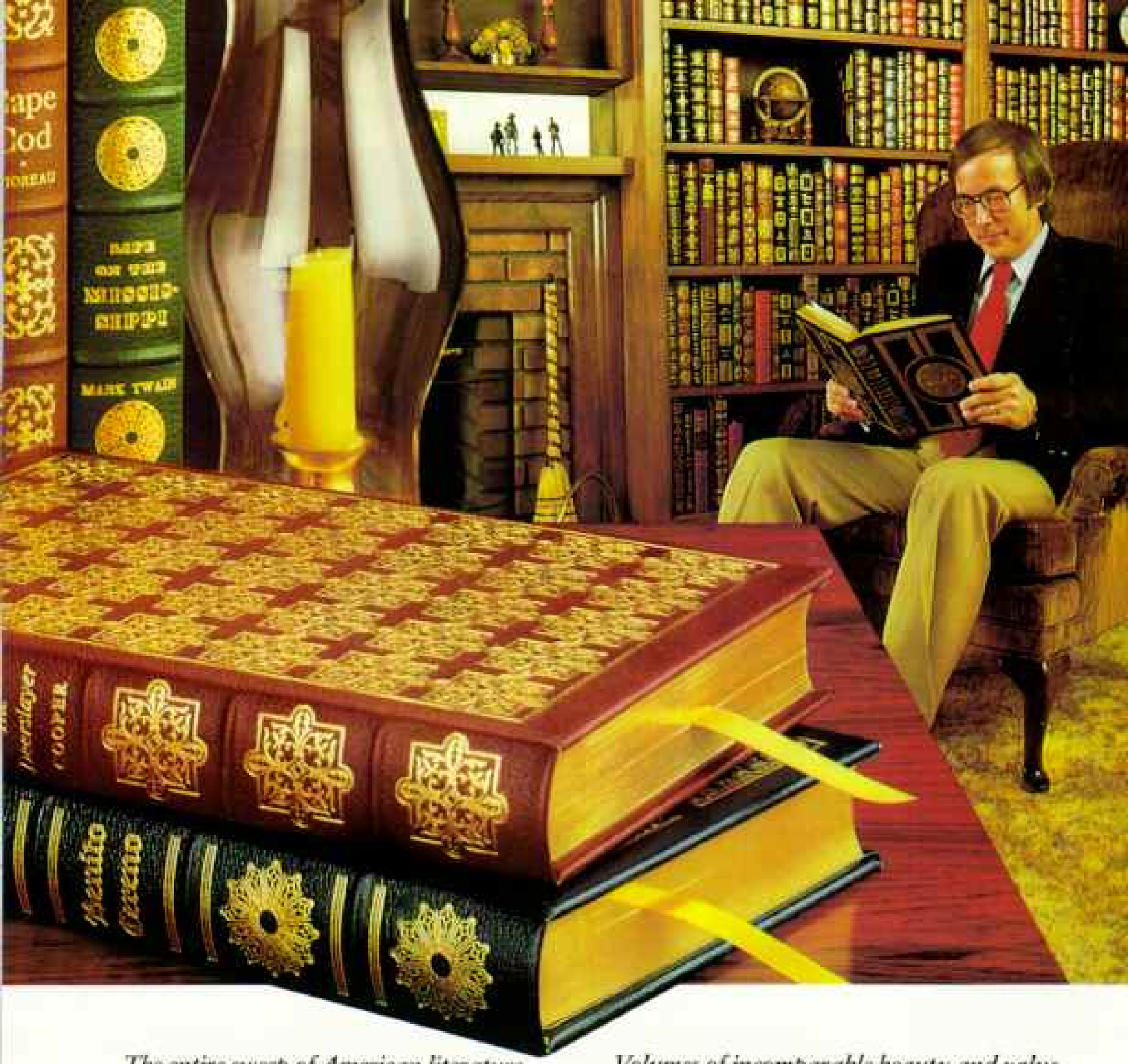

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(Continued on next page)

(Continued from previous page)

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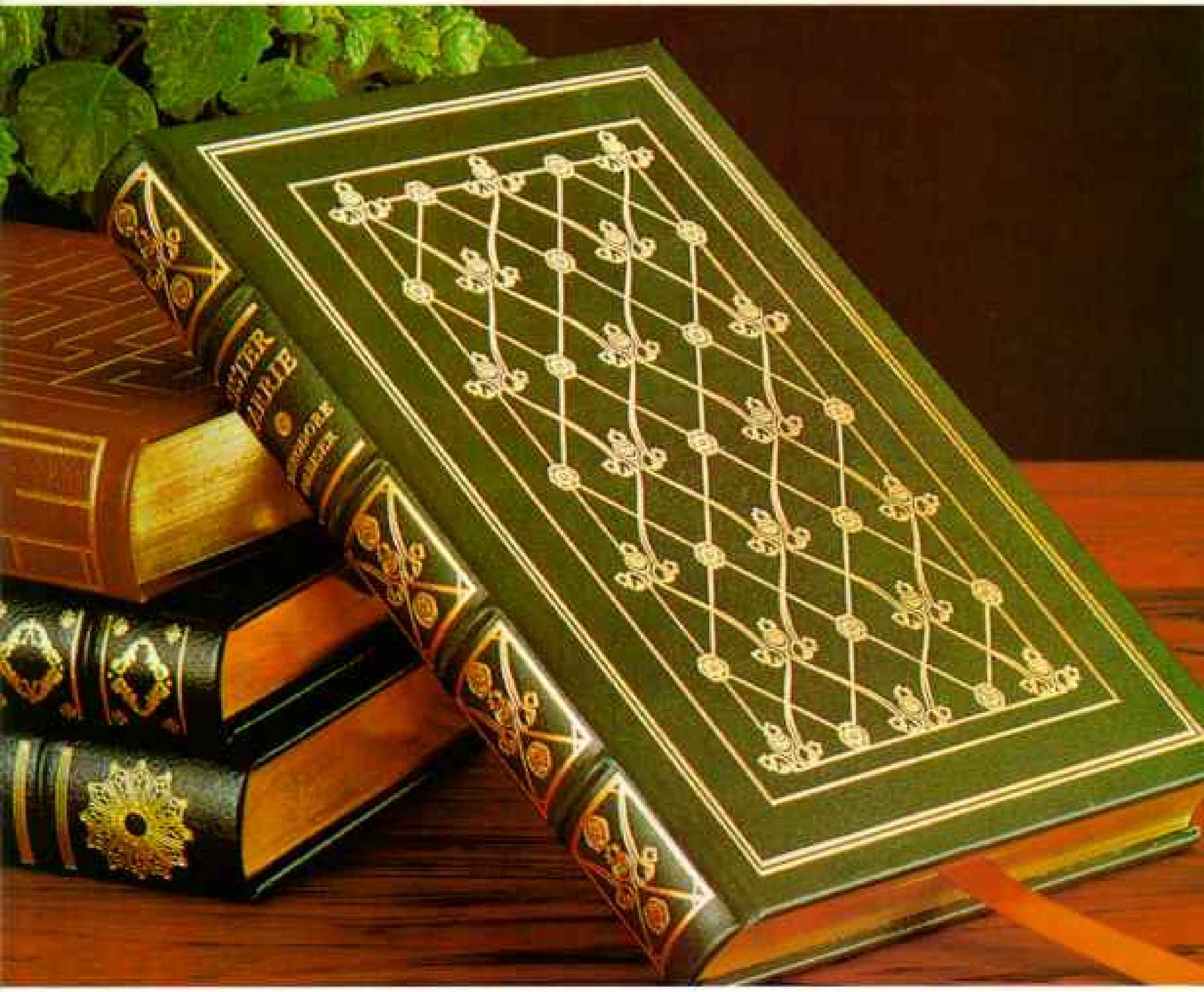

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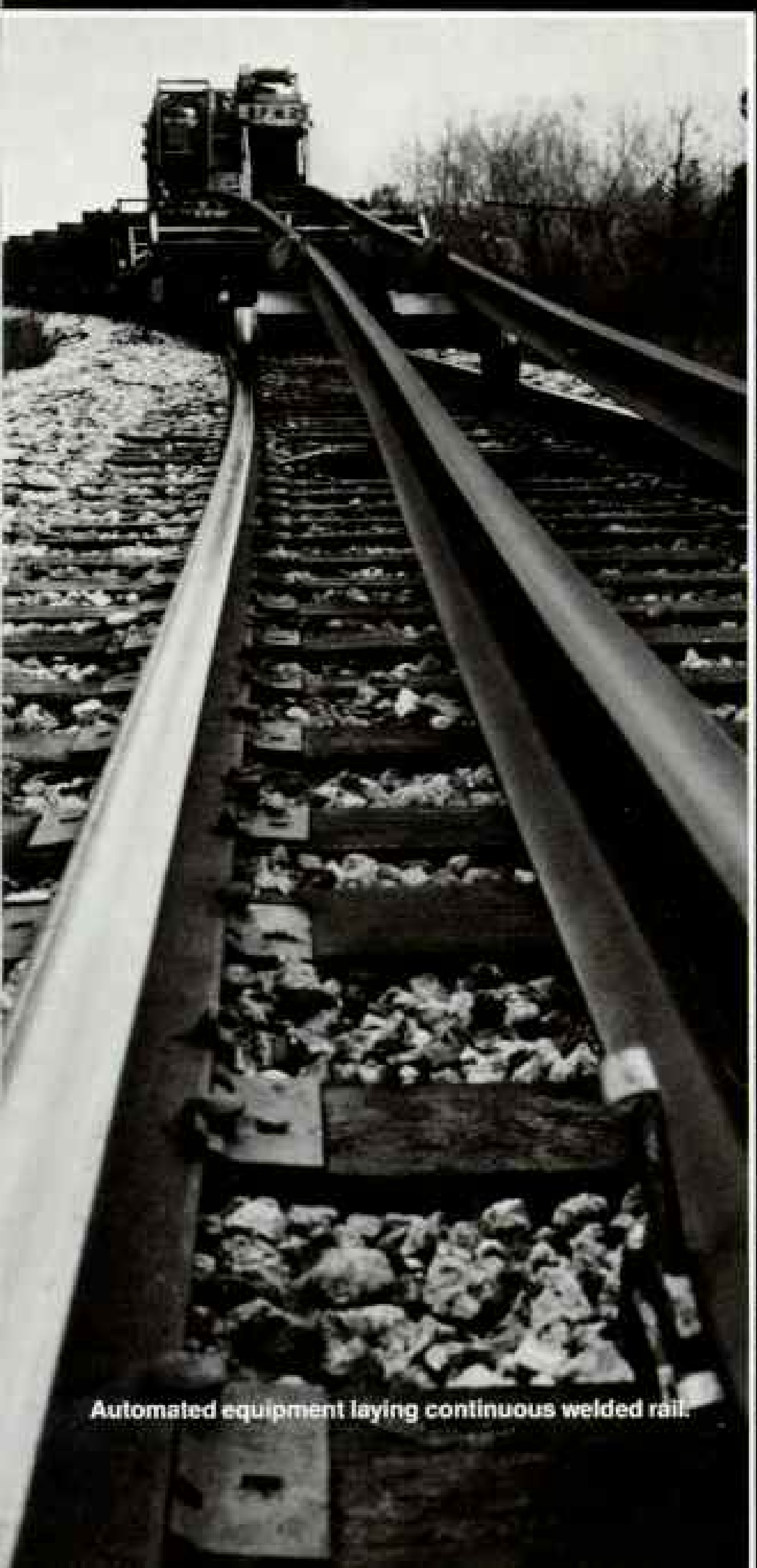
Myth:
Railroads run on legends and old tracks.



Automated equipment laying continuous welded rail.

Fact:
America's freight railroads spent a record $10 billion in capital improvements and maintenance in 1978.

The only thing legendary about today's freight railroads is their record investment in track and rolling stock last year. 1979 plans call for increasing even those massive expenditures by about 20%.

In 1978, the railroads put more than 1,300 new and rebuilt locomotives into service and ordered more than 125,000 new freight cars. In addition, more than 4,700 miles of track has been replaced with new rail in each of the last two years—some 58% more than the yearly average in the previous ten years. And new crossties installed averaged more than 27 million in 1977 and 1978—36% above the 1966-1975 average.

These huge investments help increase efficiency and improve service. Just as important, they help improve safety. Even though rail traffic has increased substantially, total deaths and injuries from rail accidents continue to decline and have reached the lowest levels since record-keeping began in 1891.

Additional investments by railroads and suppliers in continuing research provide other benefits as well—development of better, stronger track and even safer cars for moving vital hazardous materials. Railroads provide 70% of the transportation for the commodities classified as hazardous, excepting only petroleum, but they are involved in less than 9% of the accidents involving hazardous materials.

For more information about America's surprising freight railroads and their multi-billion dollar investments in safe transportation, write to: Association of American Railroads, American Railroads Building, Washington, D.C. 20036.

Surprise:
America's freight railroads provide the safest, most efficient transportation on wheels.

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In 1976 we introduced the Honda Accord® Hatchback. With its stunning array of standard features, it was an instant success. But some of you told us you'd like to have an Accord that was even more luxurious. We responded in 1978 with our elegant Accord LX.

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That gives us a complete line of Accords. And, more important, the way we equip our cars, every Accord is in its own way a complete Accord.

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Of course, we realize that some car makers might say that three models aren't enough to qualify as a complete line. But we like it this way. After all, by giving you just three Accords to choose from, perhaps we've made your life just a little bit simpler.

HONDA

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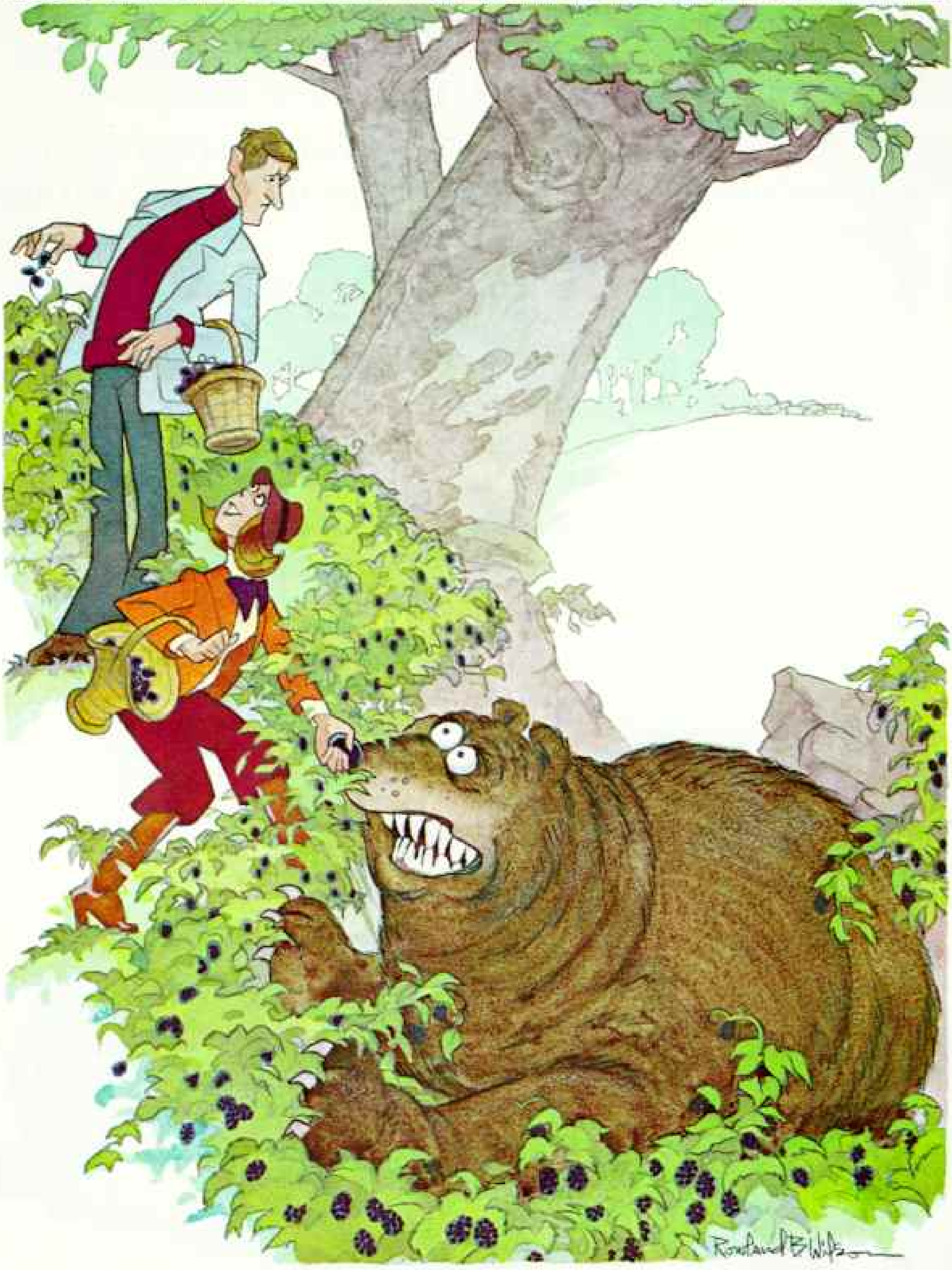

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Announcing

The Garden Birds
THIMBLE COLLECTION

by Peter Barrett

For just $9.75 each—a complete collection of 25 exquisite collector's thimbles in fine bone china, hand-decorated in 24kt gold, and portraying the world's best-loved garden birds.

A limited edition
Advance subscription deadline:
July 31, 1979.

THE BIRDS that visit us in our gardens are among the most delightful of all the creatures of nature. Soaring gracefully among the trees and flowers, they provide untold pleasure and inspiration with the richness of their color and the melody of their song.

Now, to remind us of the great joy birds bring into our lives, Franklin Porcelain will create *The Garden Birds Thimble Collection*. Delicate collector's thimbles in fine bone china designed by Peter Barrett, one of the world's most outstanding and gifted nature artists.

The beauty of birds—captured in remarkably detailed miniatures

Each individual thimble is small and delicate. Yet, every feature of each bird is accurately portrayed—in rich, natural color. This is the remarkable art of miniaturization, and Peter Barrett is a master of this most demanding art.

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The scientific name of the bird—in a graceful script—will be a part of the design of each thimble. And the finishing touch will be a pure 24kt gold border, skillfully applied to the thimble by hand.

One of the greatest pleasures of owning this collection is to display the thimbles in your home. And, to enable you to do so, a handsome, hardwood wall frame will be provided at no additional charge.

Available only for a limited time

These fine bone china thimbles will be made available for a single year only. Thus, the collection will be offered *solely* during 1979 and will be permanently withdrawn at the end of the year. The original designs for the thimbles will then be retired, and this collection will never be offered again.

THIMBLES SHOWN ACTUAL SIZE

A Certificate of Authenticity, attesting to the limited nature of the thimbles, will be provided. And an informative folder about the bird depicted will be included with each thimble. The price for each thimble is $9.75, and the collection will be issued at the rate of one per month.

Since it will take time to craft these bone china thimbles, it is important that the advance subscription application below be mailed no later than July 31, 1979.

This elegant wall frame will be provided to every subscriber

ADVANCE SUBSCRIPTION APPLICATION

The Garden Birds
THIMBLE COLLECTION
by Peter Barrett

Must be postmarked by July 31, 1979
Limit: One subscription per person

Franklin Porcelain
Franklin Center, Pennsylvania 19091

Enter my subscription for The Garden Birds Thimble Collection, consisting of 25 fine bone china thimbles, hand-decorated in 24kt gold. My thimbles will be sent at the rate of one per month, and a custom-designed hardwood display frame will also be sent to me without additional charge.

I need send no money now. Bill me $9.75* for each thimble in advance of its shipment.

*Plus my state sales tax

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Graz	316
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Namur	81
Ostend	59
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Dangriga	05
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Tantung	89
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Pasto	301
Pereira	61
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Kyrenia	81
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Limassol	51
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Manta	4
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Kavala	51
Larissa	41
Patrai	61
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Ting Kau	12
Tsun Wan	12
IRAN	**98**
Abadan	631
Ahwaz	61
Esfahan	31
Hamadan	281
Kermanshah	431
Mashad	51
Rasht	231
Shiraz	331
Tabriz	41
Teheran	21
IRAQ	**964**
Baghdad	1
Basrah	4021
Derwaniya	3682
Hilla	3022
Mosul	6081
Najaf	3333
IRELAND, REP. OF	**353**
Cork	21
Drogheda	41
Dublin	1
Dundalk	42
Galway	91
Kilkenny	56
Sligo	71
Tralee	66
Waterford	51
Wexford	53
ISRAEL	**972**
Afula	65
Akko	4
Ashkelon	51
Bat Yam	3
Beer Sheva	57
Dimona	57
Hadera	63
Haifa	4
Holon	3
Jerusalem	2
Nazareth	65
Netania	53
Rehovot	54
Tel Aviv	3
Tiberias	67
ITALY	**39**
Bari	80
Bergamo	35
Bologna	51
Catania	95
Florence	55
Genoa	10
Milan	2
Naples	81
Padua	49
Palermo	91
Rome	6
Trieste	40
Turin	11
Venice	41
Verona	45
JAPAN	**81**
Amagasaki	6
Chiba	472
Fuchu	423
Fukuoka	92
Higashi	98043
Hiroshima	822
Kanazawa	762
Kawasaki	44
Kirakyushu	93
Kobe	78
Kumamoto	963
Kyoto	75
Nagasaki	958
Nagoya	52
Naha	988
Okayama	862
Osaka	6
Sakai	722
Sapporo	11
Sasebo	956
Sendai	222
Tachikawa	222
Tokyo	3
Yokohama	45
Yokosuka	468
KENYA	**254**
Kabete	2
Kiambu	284
Kikuyu	283
Kisumu	35
Mombasa	11
Nairobi	2
Nakuru	37
Shanzu	11
Thika	151
Uthiru	2
KOREA	**82**
Inchon	32
Jeon ju	52
Kwangju	62
Masan	73
Mokpo	63
Pusan	72
Seoul	2
Taegu	82
Taejeon	42
Ulsan	74
KUWAIT	**965**
All Points	*
LIECHTENSTEIN	**41**
All Points	75
LUXEMBOURG	**352**
All Points	*
MALAYSIA	**60**
Alor Star	4
Baronang	3
Dengkil	3
Ipoh	5
Kajang	3
Kuala Lumpur	3
Port Dickson	6
Semenyih	3
Sungei Besi	3
Sungei Penggam	3
MONACO	**33**
All Points	93
NETHERLANDS	**31**
Amsterdam	20
Arnhem	85
Breda	76
Eindhoven	40
Enschede	53
Groningen	50
Haarlem	23
Heemstede	23
Hillegersberg	10
Hoensbroek	45
Hoogherk	50
Hoogvliet	10
Leiden	71
Loosduinen	70
Nijmegen	80
Oud Zuilen	30
Rotterdam	10
The Hague	70
Tilburg	13
Utrecht	30
NETHERLANDS ANTILLES	**599**
Bonaire	7
Curacao	9
Saba	4
St. Eustatius	3
St. Maarten	5
NEW ZEALAND	**64**
Auckland	9
Christchurch	3
Dunedin	24
Hamilton	71
Invercargill	21
Napier	70
Palmerston North	63
Rotorua	73
Tauranga	75
Wellington	4
NICARAGUA	**505**
Chinandega	341
Diriamba	42
Granada	72
Jinotepe	41
Leon	31
Managua	2
Masatepe	44
Masaya	71
Matagalpa	6
Rivas	61
NORWAY	**47**
Bergen	5
Drammen	3
Fredrikstad	32
Haugesund	47
Oslo	2
Sarpsborg	31
Skien	35
Stavanger	43
Tonsberg	33
Trondheim	75
PAPUA NEW GUINEA	**675**
All Points	*
PERU	**51**
Arequipa	542
Callao	14
Chidoyo	7423
Chimbote	4432
Cusco	8423
Huancayo	6423
Ica	3423
Lima	14
Piura	7432
Trujillo	44
PHILIPPINES	**63**
Angeles	55
Bacolod	34
Baguio	442
Cebu	32
Davao	35
Iloilo	33
Manila	2
San Fernando, Pampanga	45
San Pablo	43
Tarlac	47
PORTUGAL	**351**
Almada	19
Baneiro	19
Braga	23
Coimbra	39
Evora	69
Guimaraes	23
Lisbon	19
Moniijo	19
Porto	29
Setubal	15
SAN MARINO	**39**
All Points	541
SAUDI ARABIA	**966**
Abha	7
Al Khobar	31
Dhahran	31
Jeddah	21
Khamis Mushait	7
Mecca	22
Medina	41
Najran	7
Riyadh	1
SINGAPORE	**65**
All Points	*
SOUTH AFRICA	**27**
Bloemfontein	51
Cape Town	21
Durban	31
East London	431
Johannesburg	11
Pietermaritzburg	331
Port Elizabeth	41
Pretoria	12
Umtahoge	422
Welkom	17
SPAIN	**34**
Barcelona	3
Bilbao	4
Cadiz	56
Granada	58
Igualada	3
Las Palmas/de Gran Canaria	28
Leon	87
Madrid	1
Malaga	52
Palma de Mallorca	71
Pamplona	48
Santander	42
Seville	54
Torremolinos	52
Valencia	6
SWEDEN	**46**
Boras	33
Goteborg	31
Helsingborg	42
Linkoping	13
Malmo	40
Norrkoping	11
Stockholm	8
Sundsvall	60
Uppsala	18
Vasteras	21
SWITZERLAND	**41**
Aarau	64
Baden	56
Basel	61
Berne	31
Biel	28
Davos	83
Fribourg	37
Geneva	22
Interlaken	36
La Chaux-de-Fonds	39
Lausanne	21
Lucerne	41
Lugano	91
Montreux	21
Neuchatel	38
St. Gallen	71
St. Moritz	82
Solothurn	65
Winterthur	52
Zurich	1
TAHITI	**689**
All Points	*
THAILAND	**66**
Bangkok	2
TURKEY	**90**
Adana	711
Ankara	41
Bursa	241
Diyarbakir	8311
Eskisehir	224
Gaziantep	851
Istanbul	11
Izmir	51
Kayseri	3511
Konya	334
UNITED ARAB EMIRATES	
ABU DHABI	**979**
Abu Dhabi Town	2
Al Ain	3
Jebel Dhana	5
AJMAN	**971**
All Points	5
DUBAI	**978**
Awer	*
Falaj Amala	96
Khawanij	*
FUJAIRAH	**971**
All Points	1
RAS-AL-KHAIMAH	**971**
All Points	7
SHARJAH	**971**
All Points	5
UMM-AL-QUWAIN	**971**
All Points	69
UNITED KINGDOM	**44**
Belfast	232
Birmingham	21
Bolton	204
Bournemouth	202
Bradford	274
Brighton	273
Bristol	272
Cardiff	222
Coventry	203
Durham	358
Edinburgh	31
Glasgow	41
Ipswich	473
Leeds	532
Leicester	533
Liverpool	51
London	1
Manchester	61
Newcastle upon Tyne	632
Nottingham	602
Portsmouth	705
Prestwick	292
Sheffield	742
Southampton	703
VATICAN CITY	**39**
All Points	6
VENEZUELA	**58**
Barquisimeto	51
Cabimas	64
Caracas	2
Ciudad Bolivar	85
Cumana	93
Maracaibo	61
Maracay	43
San Cristobal	76
Valencia	41
YUGOSLAVIA	**38**
Belgrade	11
Ljubljana	61
Maribor	62
Mostar	88
Novi Sad	21
Rijeka	51
Sarajevo	71
Skoplje	91
Split	58
Zagreb	41

*No city codes required

HOW TO ORDER SOUP IN CANNES

DIAL DIRECT

Does your area have International Dialing? If so, you can call around the world in less time than it takes to hum "La Marseillaise." Because you can dial yourself, without Operator assistance. And without waiting. Here's how to dial Cannes:

INTERNATIONAL ACCESS CODE		COUNTRY CODE		CITY CODE		
011	+	33	+	93	+	LOCAL NUMBER

Dialing direct saves more than time–it also saves you money–75¢, about 11% on a 3-minute call to Cannes. Très bien!

ALMOST DIRECT

This is the next best way to save time if your area doesn't have direct dialing yet. Dial 0, and be ready to give the Operator the country, city and local telephone number you want. Specify Station-to-Station or Person-to-Person. The fewer questions the Operator must ask, the faster you'll reach your party. And on Station calls not requiring special operator assistance, you can get the same low rates as International Dialing.

P.S. Everyone can dial direct to Canada, the Caribbean, Alaska, Hawaii, and parts of Mexico–just as you dial direct to cities inside the continental U.S.

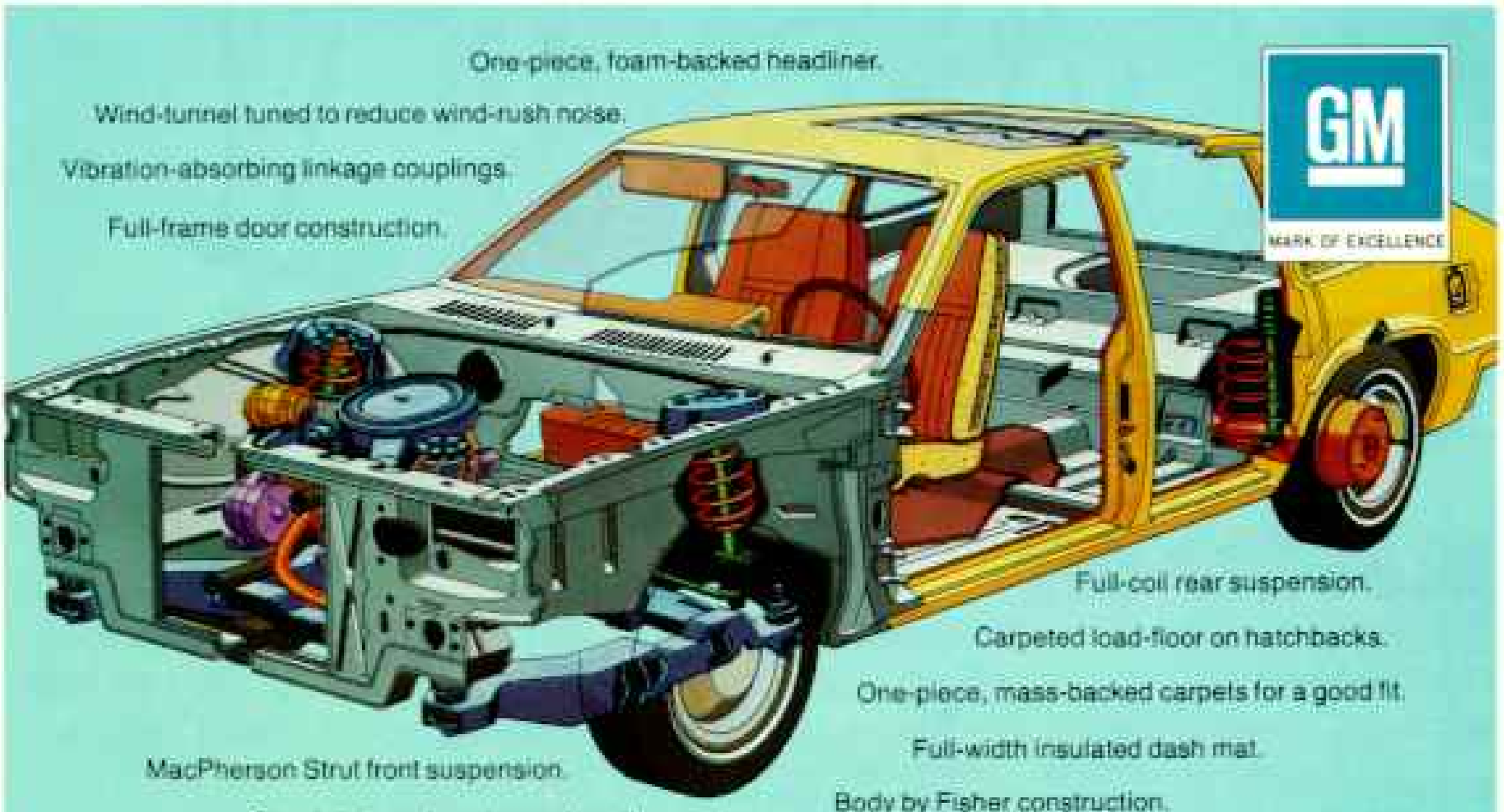
Phoning the family or fixing the franc, keep a record of the country and city codes you use and use them to call the world–fast!

CODES FOR PRINCIPAL CITIES IN FRANCE (33)

Bordeaux	56	Lille	20	Reims	26
Clermont-Ferrand	73	Lyon	78	Rennes	99
Dijon	80	Marseille	91	St. Etienne	77
Grenoble	76	Nice	93	Strasbourg	88
Le Havre	35	Paris	1	Toulouse	61

Bell System

GM's New Front-Wheel-Drive Cars
Engineered for quiet. And with a solid, comfortable feel.



From the day the new Chevrolet Citation, Pontiac Phoenix, Oldsmobile Omega and Buick Skylark first started taking shape on the drawing board, a prime design objective has been to please the ear as much as the eye.

Noise control through isolation.

One of the ways we went about this was an all-out effort to isolate the passenger compartment from the engine, suspension and other chassis hardware.

Body and engine mounts are specifically tuned to dampen or eliminate vibration frequencies that might prove annoying inside.

There are vibration-absorbing couplings between mechanical components running from the engine compartment to the passenger compartment—transmission linkage, acceleration pedal linkage, you name it. Even the MacPherson Strut front suspension and full-coil rear suspension have special cushioning devices that let you get a firm feel of the road without harshness of ride.

Noise fighters.

But isolation is just one form of controlling noise. To help cut down on wind-rush noise, these cars were extensively tested in the wind tunnel. All models feature Body by Fisher construction with fully framed doors and new door seals to help keep noise out. Hatchback models have auxiliary seals in back. There are one-piece, mass-backed carpets and foam-backed headliners. And special acoustical-insulation packages are available on certain models.

If "quiet" engineering and a good ride are important in your selection of a car, we'd like to recommend that you test-drive these.

You're in for a thoroughly delightful experience.

Look into buying or leasing at your GM dealers today.

GM's Front-Runners for the '80s.

Chevrolet Citation, Pontiac Phoenix, Oldsmobile Omega, Buick Skylark.

COME SEE FOR YOURSELF WHY WE ARE SO PROUD OF OUR LAND.

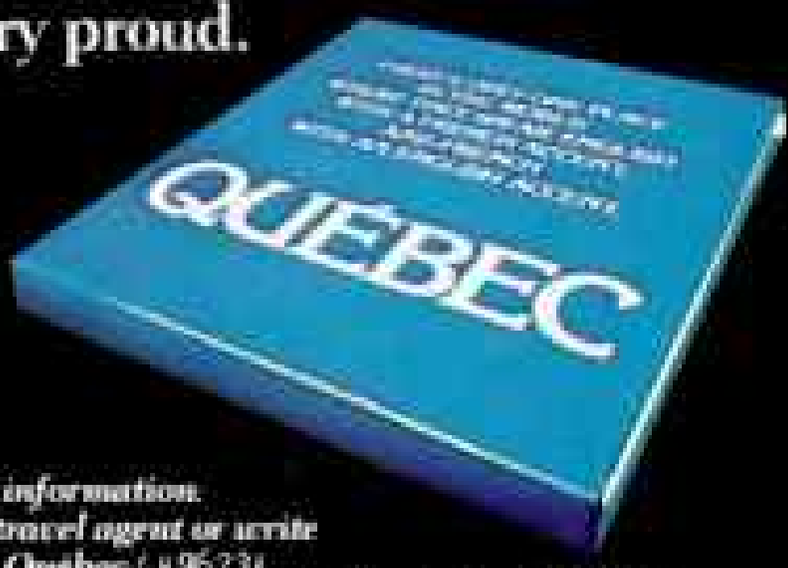
Sure Québeecers are a proud people. But we have good reason to be. Our land is one of the most breath-takingly beautiful in all of nature.

Against this fabulous backdrop, we have lovingly carved out a civilization that anyone would be proud to call home. Beginning with the only walled city in North America—Québec City (started as a fort twelve years before the Mayflower landed.) And nine years before William Penn laid out Philadelphia, Montréal already had its own street plan.

Yes, we're proud of our land. And we're proud of our food. And we're proud of our music. And of our roads and excellent recreation facilities. And of our world famous reputation for hospitality.

But especially, we are proud to have so many holiday visitors who keep coming back to Québec to share it with us every chance they get.

Very proud.



For more information
See your travel agent or write
Tourisme Québec (49623)
150 est, boul. Saint-Cyrille Québec, QC., G1R 4Y3
IN U.S.
Québec Government House (49623)
17 West 50th Street
New York, N.Y. 10020

QUEBEC, A WHOLE DIFFERENT WORLD NEXT DOOR.

CASH IN ON THE SUN.

The Grumman Sunstream™ solar system.

It will help you cope with the high cost of producing hot water. Whether you use electricity, oil or natural gas, it will protect you from rate increases that are becoming ever more frequent.

TAX CREDITS CAN PAY BACK 30% OF THE COST.

As a homeowner, you can recover up to 30% of the cost of this system through substantial savings on your Federal income tax. And the tax credits you receive represent dollar-for-dollar savings. Regardless of your tax bracket, you can benefit from these very special tax incentives.

YOUR FUEL SAVINGS OFFSET THE REST.

You'll be surprised at how the Grumman Sunstream solar system can pay for itself by cutting your energy use. In fact, depending upon your location and water usage, it can provide up to 80% of the energy you require for making hot water.

Best of all, after the solar system pays for itself, it keeps right on paying you cash dividends in the form of continuing savings on your fuel bills. And it protects you from higher and higher energy prices.

THE RIGHT SYSTEM AT THE RIGHT TIME.

The advanced Grumman Solar Module offers you an excellent combination of convenience and energy efficiency. It's compatible with your existing electric, oil or gas hot water system, as well as ideal for the new home you may be planning. It comes to you with a 5-year limited warranty, supported by a national dealer network. And you can use it with confidence because it's made by Grumman—a company that has earned a reputation for performance and reliability.

For complete details on how you can cash in on the sun for domestic hot water, space or pool heating, write **Grumman Energy Systems, Inc.**, Dept. NG-100, 4175 Veterans Memorial Highway, Ronkonkoma, Long Island, New York 11779.

GRUMMAN *Sunstream*™

The reliable source

CASH IN ON THE SUN WITH GRUMMAN.

YOU CAN'T EXPECT A MERE CAR TO DO ALL THE THINGS A SCOUT® CAN.

Scout II. *Carries big loads into little spaces . . . a good combination for fishing trips.*

Scout SSII. *Built to enjoy heavy four-wheelin'.*

Snowdrifts, bumpy roads, big loads—those are just some of the times that anything less than an International® Scout® just won't do.

Outfitted to out-perform ordinary cars. Scout *does* more because it *has* more. Like 4-wheel drive for muddy back trails and snow-packed neighborhood streets. And the same extra-strong engine we use in our 2½-ton trucks—so pulling a boat or trailer is no problem.

Guts from the ground up. Scout is designed especially as a sports/utility vehicle. The all-welded steel box frame resists distortion better than riveted frames. Heavy-duty axles permit Scout to carry heavier loads than any station wagon. And even with that big inside cargo space, Scout's outside dimensions permit easy maneuvering in tough spots.

A solid selection. Choose from four different Scouts. The basic, versatile Scout® II. The Scout Traveler,® with extra space and towing power. The sporty Scout® SSII. Or Scout Terra®—our hard-drivin', do-it-all pick-up.

So don't send a car to do a Scout's job. Visit your International Harvester Scout Dealer and test drive a Scout soon. Because anything less is just a car.

SCOUT.®
Anything less is just a car.

INTERNATIONAL HARVESTER

The Royal Canadian Mint announces the 1979 Canadian $100 22 karat gold proof coin

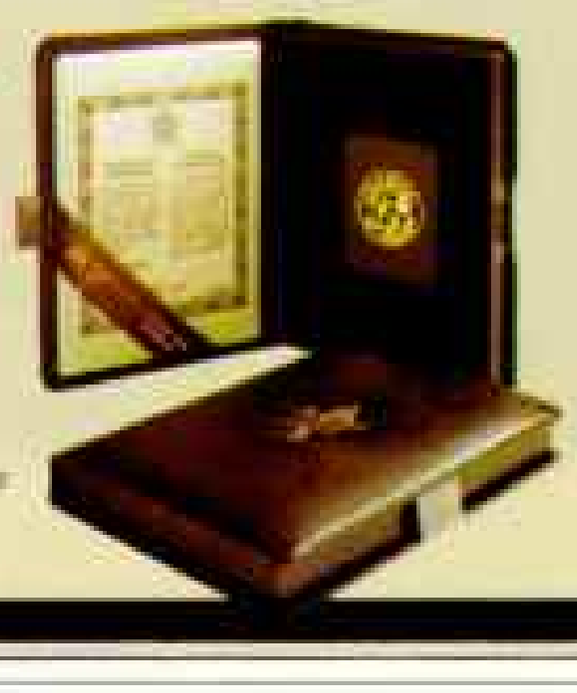
The Royal Canadian Mint, by authority of the Government of Canada is striking a limited issue of the 1979 'International Year of the Child' $100 22 karat gold proof coin, the fourth $100 denomination gold coin issued by Canada. It is now being offered for world-wide sale.

With a diameter of 27 mm, this precious metal legal tender coin weighs 16.965 grams of which 15.551 grams (1/2 Troy ounce) are fine gold. It contains 91.66% fine gold and 8.34% fine silver.

The obverse carries Arnold Machin's effigy of Queen Elizabeth II and the reverse a symbolic design by Ottawa artist Carola Tietz depicting six children linking hands to encircle the globe in the spirit of unity and communication inherent in the rights of children everywhere, it is especially appropriate to 1979, the International Year of the Child.

Presentation Case and Certificate of Authenticity

A certificate of authenticity will accompany each coin attesting that it is a legal tender 22 karat gold proof coin struck by the Royal Canadian Mint and authorized by the Government of Canada. Both coin and certificate will be presented in a dark brown, genuine leather case lined with brown velour and decorated with an antique gold-coloured maple leaf.



Royal Canadian Mint / Monnaie royale canadienne

Important notice

In order to fulfill as many orders as possible, the Mint reserves the right to limit the number of coins per order if, for any reason, it should be found necessary to do so.

The Royal Canadian Mint shall replace any coin found defective due to manufacture or workmanship, if the defects are reported to the Mint within 30 days after receipt of same. If, however, no replacement coin is available, the Mint shall refund to the purchaser the purchase price of such coin.

Orders which must be postmarked not later than 31st October, 1979 will be considered on a 'first come first served' basis until all 250 000 coins have been sold.

Coin is shown in actual size

Return to: Royal Canadian Mint
P.O. Box 457, Station 'A', Ottawa
Ontario, Canada K1N 8V5

Please allow six to eight weeks' delivery.

I wish to purchase the 1979 International Year of the Child Canadian $100 22 karat gold proof coin.

_____ (Qty) at $185.00 (CAN.) each $

Add Sales Tax where applicable $

Total $ _____

Sales Tax exempt number:

Name

Address

City

Province/State

Postal Code / Zip Code

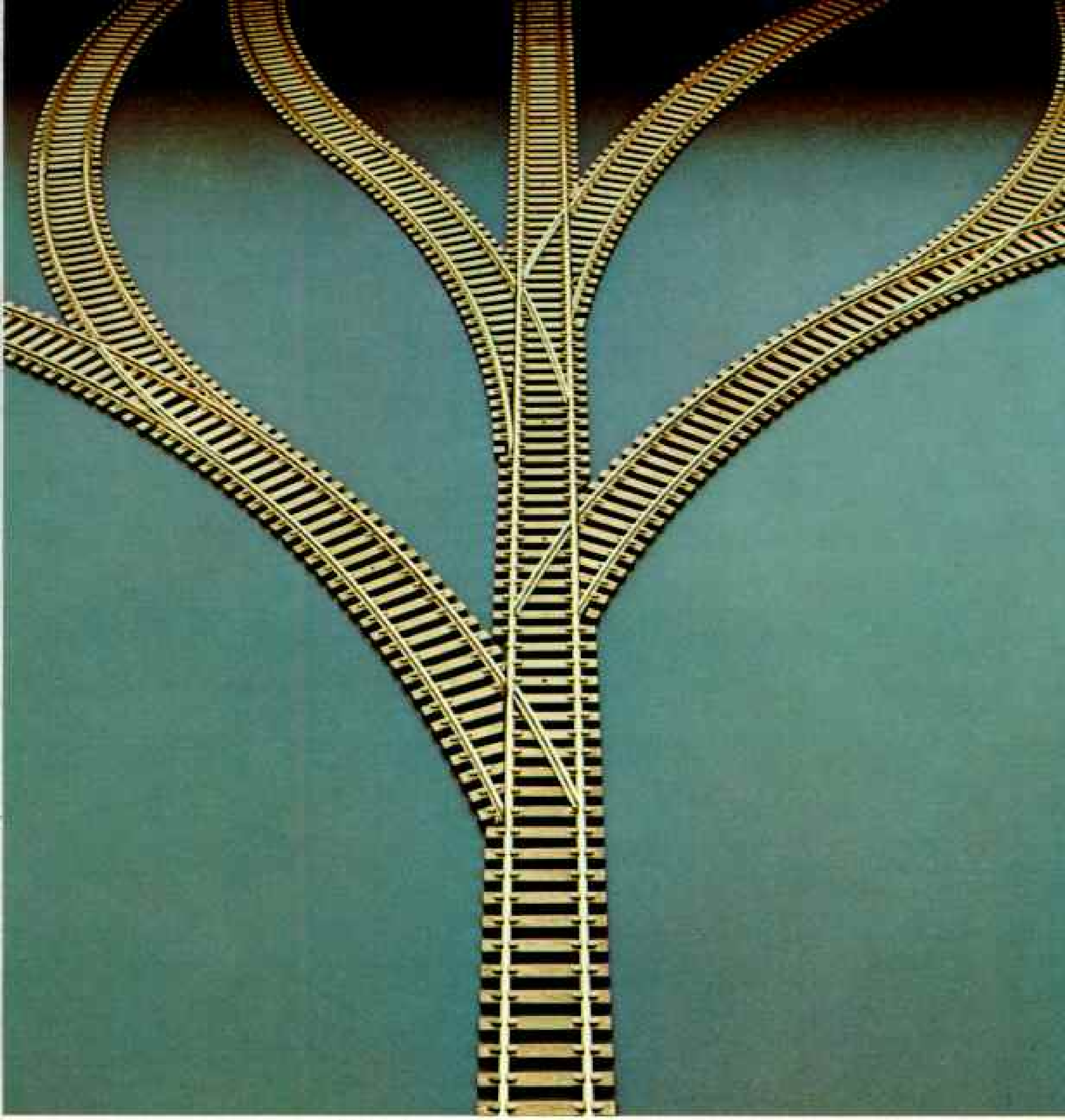
Signature (Application must be signed to be accepted) (valid in Canada and the U.S.A. only)

Method of payment (Check one only) N.B. Allow 30 days' delay for processing personal cheques non certified. ☐ Enclosed is my certified cheque/money order made payable to the Royal Canadian Mint.

OR Please charge my Credit Card Account, as indicated. ☐ Master Charge ☐ Chargex/Visa ☐ American Express

Credit Card Number | | | | | | | | | | | | | | | | | | | | Expiry date of the card | | | |

CM-79



To develop more energy takes more than a one-track mind.

There are numerous paths to more energy for America—and Conoco's people are exploring many of them.

Because we're active in oil, natural gas, coal and uranium, our 43,000 people have a wide variety of skills. As they work together, and sometimes cross over from one energy project to another, they develop "multi-track" minds.

For example, consider Jim Davis, one of our petroleum engineers.

First, Jim helped adapt oil production techniques to drill horizontally into coal seams before mining, to remove potentially hazardous methane gas. So more coal can be produced, more safely.

Now Jim is helping apply this same horizontal drilling system to get at petroleum deposits that were previously too difficult to tap. So more oil can be produced.

At a time when some people are trying to limit the activities of energy companies, we think it's worth noting what individuals like Jim Davis can do—if they're allowed to switch tracks and produce more energy.

conoco

Doing more with energy.

PPG believes windows should become working parts of your home's energy system.

Whether your home is in the south or the north, PPG has an energy-saving environmental glass for your windows and sliding glass doors.

Where the climate is blistering, you can reduce your air-conditioning costs with Solarcool® Bronze reflective glass. It cuts heat gain through the glass by almost 50 percent, compared to clear glass.

Newest in the PPG line, Solarcool cuts way down on ultraviolet light, too, which is a major cause of fading. Its beautiful mirrored face provides comparative privacy, and by reducing glare makes it a lot nicer to look out on a summer's day.

Up north, PPG Twindow® insulating glass uses two sealed panes to bring breathtaking winter scenes indoors while you breathe in comfort. Since it reduces heat loss through the glass more than 40 percent, it obviously saves energy. It cuts messy condensation. And if you want to save even more, add storm windows for triple glazing.

Let PPG glass become part of your energy-saving system. Ask your builder or architect. Either one will be glad to help you. PPG Industries, Inc., Dept. N-169, One Gateway Center, Pittsburgh, Pa. 15222.

PPG: a Concern for the Future

PPG INDUSTRIES

IF YOU CAN NAME THE SUBJECT OF THESE MATHEW BRADY PHOTOS, YOU CAN NAME ONE OF THE LARGEST LIFE INSURANCE COMPANIES IN AMERICA.

Lincoln. It's a name you remember.

We're Lincoln National Life. We have nearly 4,000 agents who make us easy to remember—by preparing life, disability income, group, and retirement programs just right for you, your family, your business and your future.

That, plus 74 years of insurance experience, is just another of the reasons why we're among the top 1% of more than 1700 life insurance companies in America.

Lincoln National Life. For millions of Americans who buy life insurance, we're the name that's easy to remember.

LINCOLN NATIONAL LIFE

WE'RE EASY TO REMEMBER.

The Lincoln National Life Insurance Company, Fort Wayne, Indiana

"We're spending enough on roads."

America's roads. Some worry they're being destroyed. Others cite record budgets and say, "Is there truly a need to spend more?" Who's right?

Winter destroys roads. Heavy traffic is bad, too. We've 140 million vehicles beating on road surfaces, cracking pavement, crumbling shoulders, pounding out holes. Breaking up roads essential to everyday travel, delivery of goods and services. No wonder jolting potholes, vehicle wear and tear, prompt some to cry, "Our roads are in ruin. We must do something."

Others say, "Wait! Some problems are seasonal. Come spring and summer, road crews can make things right again." Our road system is not being ignored. Nearly $21 billion is spent yearly on road upgrading and maintenance. Highly organized highway departments are well aware of needs. Dollars spent on road work have doubled in ten years. So, many conclude, "We're spending plenty for now."

Both sides are partially right. Roads do wear out with time and use. And use is up 50% in ten years. We've more cars and trucks than ever. Yet available road miles have only slightly increased. Traffic on many roads exceeds design expectations. True, highway expenditures are up. But so are dollar costs. So much so, the actual road work carried out last year was less than in 1975, despite record spending. Consequently, highway deterioration is outpacing upgrade and repair. It's time everyone looked closely at our road situation and considered measures to bring revenues in line with need.

Caterpillar machines build and upgrade highways. Our engines power trucks. We believe good roads are essential to America's well being.

There are no simple solutions. Only intelligent choices.

CATERPILLAR

Caterpillar, Cat and ⊡ are Trademarks of Caterpillar Tractor Co.

"Our roads are in ruin."

GM

You have plenty of room to share this luxury with four other people.

Peace and quiet are yours. The Skylark Limited is endowed with generous acoustic insulation.

The Skylark Limited upholstery is especially posh. And note the pull-down center armrest.

You, comfort and the new Buick Skylark Limited.

It just might be the perfect car for you.

This Buick Skylark Limited will transport you and four others in serene comfort, with sound from road and engine marvelously muffled. There's roominess to relax in—with more room for hips and legs, in fact, than last year's Skylark. And the ride is remarkably smooth. Because between you and the road is a MacPherson strut front suspension and a completely new rear suspension. If you're comfortable with all this, talk to your Buick dealer about buying or leasing a 1980 Skylark Limited. It just might be the perfect car for you.

BUICK

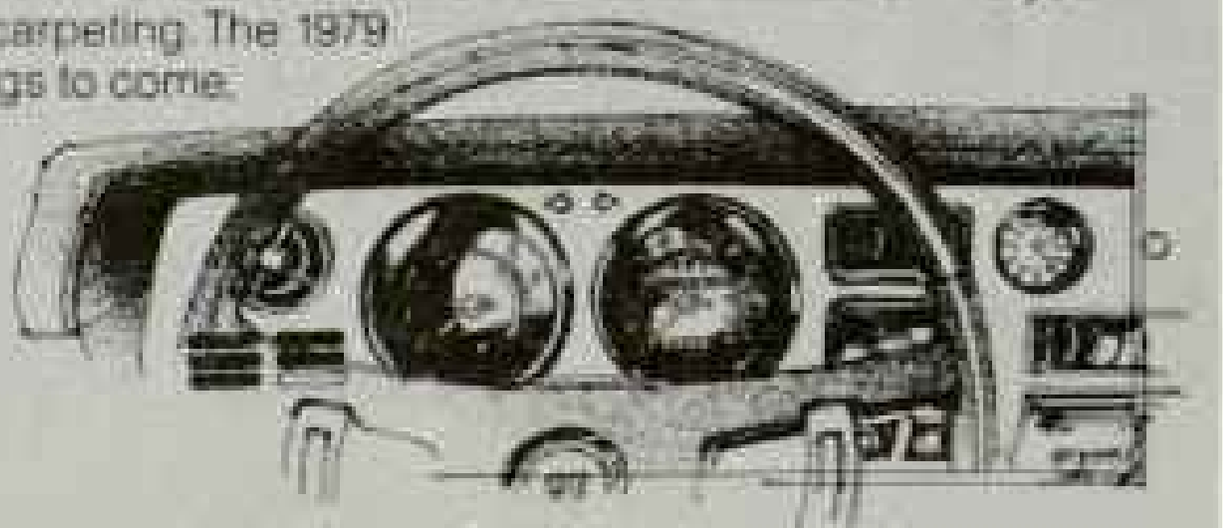
After all, life is to enjoy.

THE CAR OF THE 80'S IS STILL THE CAR OF THE 80'S.

The Toyota Celica. We introduced it last year as the car of the 80's. Since then the Celica has been praised, bought and, it seems, even copied. If you want your money's worth and more in a Grand Touring machine, see the car of the 80's. The Toyota Celica. It's a car you can live with for a long time.

A GT for the years to come. Not only is the Celica designed to carry you into tomorrow, it's built to last the trip. Welded unitized body construction helps keep it tight and practically rattle free. Extensive rust inhibiting processes help preserve body integrity. And the MacPherson strut front suspension, power assisted front disc brakes, and 5-speed overdrive transmission will make the trip to the future fun.

A car for today. The Celica is comfortable, dependable and very well equipped. The driver is cradled in a fully reclining bucket seat with an adjustable lumbar support. The Celica GT wows your ears with AM/FM MPX Stereo radio sound—all standard. And your feet are cushioned with wall-to-wall carpeting. The 1979 Toyota Celica. The excitement of things to come: a better standard of driving today. That's Toyota value.



YOU GOT IT.

THE CELICA GT LIFTBACK **TOYOTA**

Free. 11 ounces of potent medicine for companies sick of outrageous business travel problems.

It's a simple fact: the cost of business travel today is outrageous.

But there's something simple you can do about it.

Write or call for the free Beechcraft Business Flying Kit. It's the kit that's already provided first aid for hundreds of companies, large and small, that were sick and tired of seeing travel costs cutting deeper into their profits.

And this year the kit has been updated and expanded with pertinent new information to make it even more helpful. Information like:

Up-front answers to your most important questions about owning an airplane: Do I need one? What size should it be? Who will fly it?

An inside look at dozens of creative ways companies use business airplanes to solve problems and create new opportunities.

An independent study of the relationship between business flying and corporate profits.

And you can even figure the net capital cost of a company airplane, like the new T-tailed Beechcraft Duchess, shown here.

Truth is, a company airplane isn't always the answer. But with this kit you'll know the right questions. And that's the first step to making a rational decision on a company airplane.

Find out for yourself why the company airplane is the fastest-growing mode of business travel today.

Send for the Beechcraft Business Flying Kit. Ounce for ounce, it's the most potent information on business flying today.

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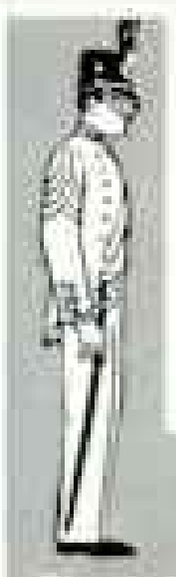

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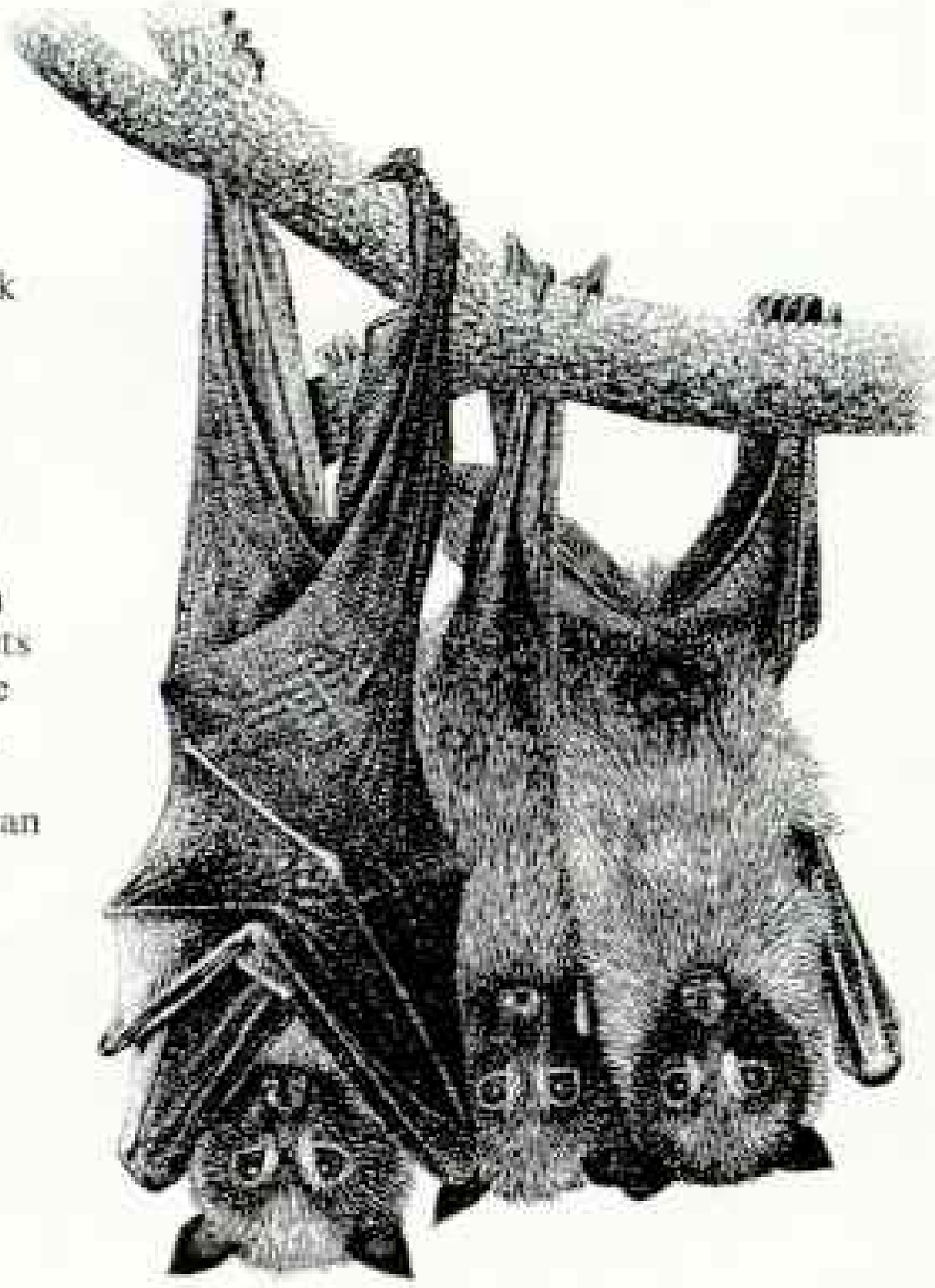

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