DOUBLE MAP SUPPLEMENT: NATIVE AMERICAN HERITAGE

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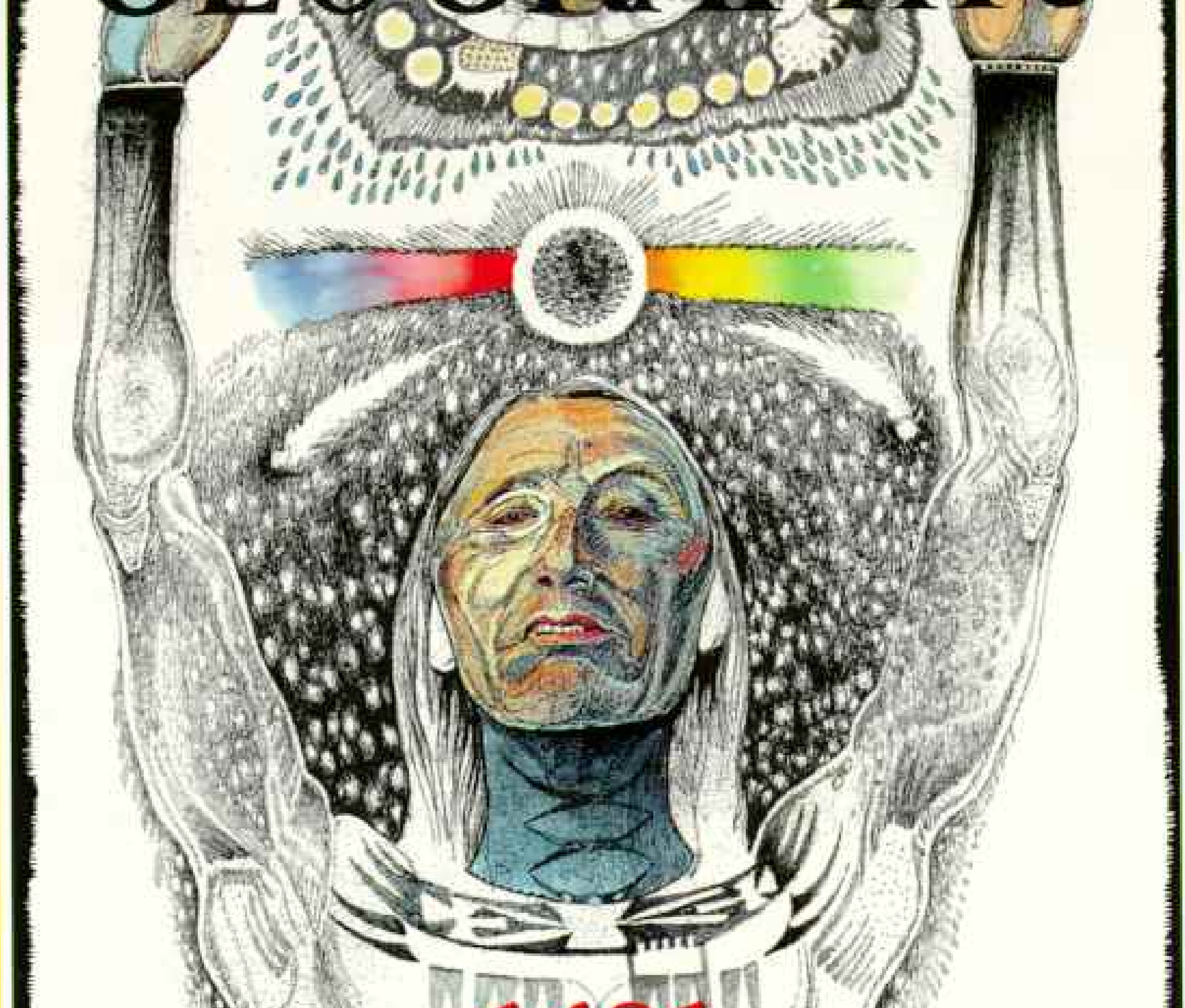

1491

AMERICA BEFORE COLUMBUS

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AMERICA BEFORE COLUMBUS

For thousands of years before the "discovery" of the New World, scores of peoples and cultures flourished in North America. In this issue we take a close look at some of them—on the eve of cataclysmic change. A double map supplement illustrates the heritage of Native Americans.

Ancestral spirits of the Tewa origin myth.

Rubies and Sapphires

Article and photographs by Fred Ward

Dazzling even in industrial uses, crystals of corundum sparkle brightest as popular gemstones. Most pour through Thailand before reaching the world market.

Lord Howe Island

Text and photographs by David Doubilet

Named a world heritage site in 1982, this volcanic remnant in the Tasman Sea east of Australia is a refuge for rare flora and fauna.

COVER: An Iroquois leader offers the Prayer of Thanksgiving for the world he knew in 1491, as yet untouched by European influence. From a painting by Jack Unruh.

TODAY

INDIAN PERSPECTIVES

His name was James A. Garfield Velarde, and he was a 19th-century Jicarilla Apache. His name was a legacy of Spanish missionaries and a tribute to the 20th President of the United States. In a sense both of Velarde's namesakes betrayed him and his people: Long before his death, at the reported age of 108, the Apache ancestral homeland and distinctive culture had been decimated by the impact of European civilization. Yet remarkably the Apache heritage and identity survive, as do those of more than 300 other Native American tribes. The following pages are devoted to American Indian life in 1491—before the arrival of Europeans. These portraits are presented largely through the words and images of Native Americans themselves. It is their story, as only they can tell it.

—THE EDITOR

PHOTOGRAPH ATTRIBUTED TO WILLIAM HENRY JACKSON, CA 1900. COLORADO HISTORICAL SOCIETY

Unchanging features and recurring cycles of the natural world have embodied divine spirits for generations of Native American peoples.

MOON OVER SOUTH DAKOTA BADLANDS. PHOTOGRAPH BY JIM BRANDENBURG

Yonder in the north. . . . Cloud maidens dance. . . . There we take our being.

—TEWA PUEBLO CHANT

ANCESTORS OF TODAY'S PUEBLO PEOPLES PECKED OUT IMAGES OF A KACHINA, AN ARROW-SWALLOWER, AND A SHIELD NEAR GALISTEO, NEW MEXICO, ABOUT A.D. 1400. PHOTOGRAPH BY IRA BLOCK

THROUGH TEWA EYES

Origins

I do not remember the day, of course, but I know what happened. Four days after I was born in the Pueblo Indian village of San Juan in the Rio Grande Valley in New Mexico, the "umbilical cord-cutting mother" and her assistant came to present me to the sun and to give me a name. They took me from the house just as the sun's first rays appeared over the Sangre de Cristo Mountains. The cord-cutting mother proffered me and two perfect ears of corn, one blue and one white, to the six sacred directions. A prayer was said:

Here is a child who has been given to us. Let us bring him to manhood. . . . You who are dawn youths and dawn maidens. You who are winter spirits. You who are summer spirits. . . . Take therefore. . . . Give him good fortune, we ask of you.

BY ALFONSO ORTIZ

PAINTINGS BY FELIPE DAVALOS

Now the name was given. It was not the name at the head of this story. It was my Tewa name, a thing of power. Usually such a name evokes either nature—the mountains or the hills or the season—or a ceremony under way at the time of the birth. By custom such a name is shared only within the community, and with those we know well. Thus, in the eyes of my Tewa people, I was "brought in out of the darkness," where I had no identity. Thus I became a child of the Tewa. My world is the Tewa world. It is different from your world.

Consider the question of the origin of Native American peoples. Archaeologists will tell you that we came at least 12,000 years ago from Asia, crossing the Bering land bridge, then spreading over the two American continents. These archaeologists have dug countless holes in the earth looking for spearpoints, bones, traces of fires; they have subjected these objects to sophisticated dating analysis—seeking to prove or disprove a hypothesis or date. I know of their work. I too have been to Soviet Asia and seen cave art and an old ceremonial costume remarkably similar to some found in America. But a Tewa is not so interested in the work of archaeologists.

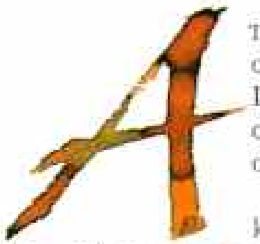
A Tewa is interested in our own story of our origin, for it holds all that we need to know about our people, and how one should live as a human. The story defines our society. It tells me who I am, where I came from, the boundaries of my world, what kind of order exists within it; how suffering, evil, and death came into this world; and what is likely to happen to *me* when I die.

Let me tell you that story:

Yonder in the north there is singing on the lake. Cloud maidens dance on the shore. There we take our being.
Yonder in the north cloud beings rise. They ascend onto cloud blossoms. There we take our being.
Yonder in the north rain stands over the land. . . . Yonder in the north stands forth at twilight the arc of a rainbow. There we have our being.

Our ancestors came from the north. Theirs was not a journey to be measured in centuries, for it was as much a journey of the spirit as it was a migration of a people. The Tewa know not when the journey southward began or when it ended, but we do know where it began, how it proceeded, and where it ended. We are unconcerned about time in its historical dimensions, but we will recall in endless detail the features of the 12 places our ancestors stopped.

We point to these places to show that the journey did indeed take place. This is the only proof a Tewa requires. And each time a Tewa recalls a place where they paused, for whatever length of time, every feature of the earth and sky comes vividly to life, and the journey itself lives again.



T THE BEGINNING of all beginnings our ancestors came up out of the earth, until they were living beneath Sandy Place Lake to the north. The world under the lake was like this one, but dark. Spirits, people, and animals lived together; death was unknown.

Among the spirits were the first mothers of all the Tewa, known as Blue Corn Woman Near to Summer and White Corn Maiden Near to Ice. These mothers asked one of the men present to go forth and explore the way by which the people might leave the lake.

After many adventures and struggles he returned to the people, announcing his arrival with the call of a fox. He came now as Mountain Lion or Hunt Chief. The people rejoiced, saying, "We have been accepted."

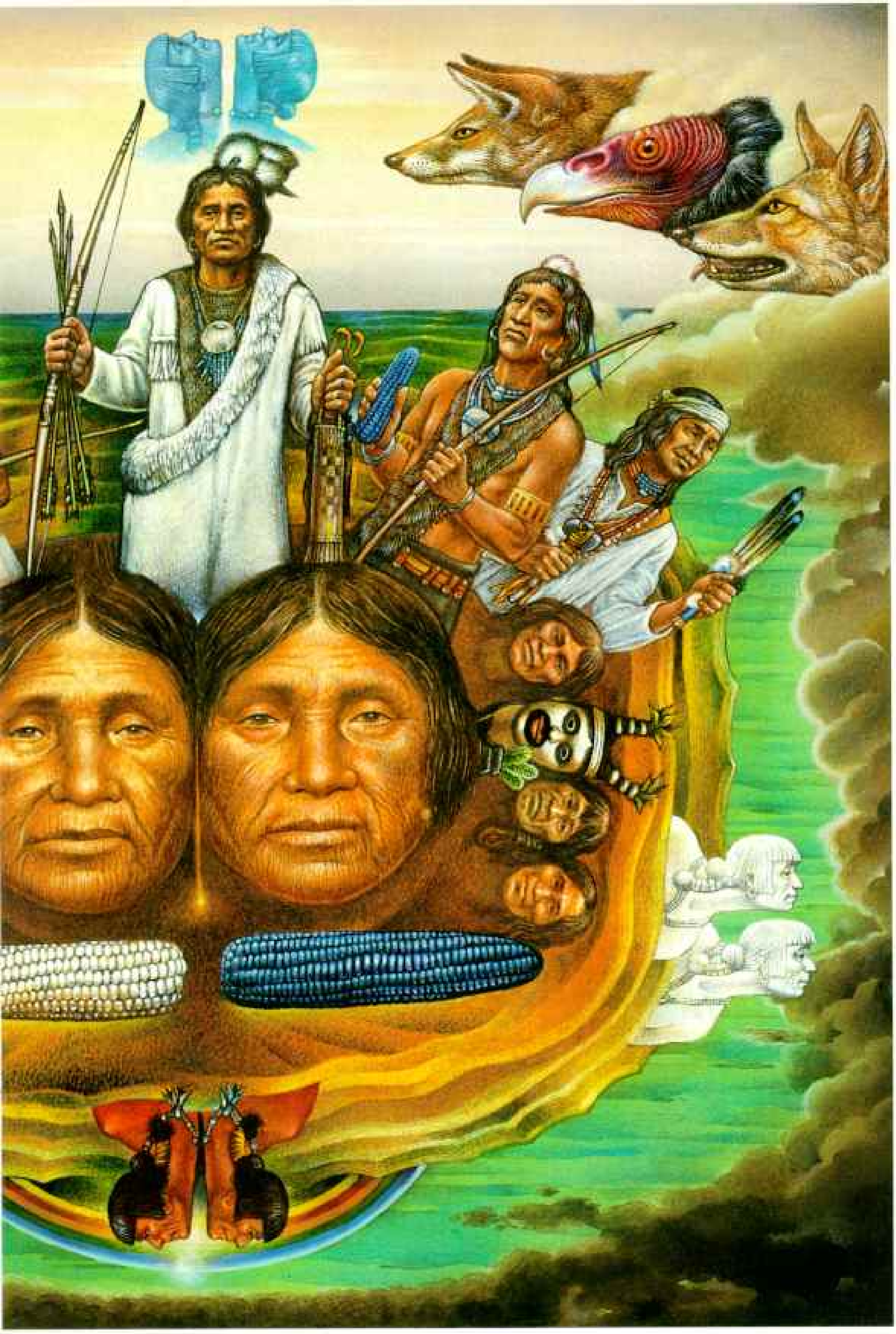
They left the lake and entered the land.

That the Tewa see all life as beginning within the earth, like the corn plant

In a distant time and place—a lake "far to the north"—our ancestors originated, the Tewa tell their children. Artist Felipe Davalos transformed the vivid oral tradition into this imaginative painting.

The story proceeds: In the dark within earth, Blue Corn Woman Near to Summer and White Corn Maiden Near to Ice ask a man to explore how the people might emerge. When he travels to the "above," predatory birds and animals attack but then befriend him. With their gifts of weapons and clothing, he returns to his people as the Hunt Chief and creates a Summer (Blue Corn) Chief and a Winter (White Corn) Chief, here flanked by war gods. Each chief will lead the people part of the year. (And so it is today.)

Next, pairs of brothers are sent to explore in all directions: The two who move upward find a rainbow and guide their people to the light. But the people must return to the lake for essential help: a medicine man to counter evil, sacred painted clowns to banish sadness, and a scalp chief for success in war, with a women's society to assist him.



that has sustained us for centuries, is manifest in our sacred places: The kiva, the ceremonial center, which represents the primordial home under the lake; the "earth mother earth navel middle place" in every village; and our mountaintop shrines—"earth navels"—shaped of stones or boulders.

These trace back to the first permanent habitations of the Pueblo people.

The canyons, cliffs, and mesa tops of the Four Corners area of the Southwest hold evidence that, at least by the fifth century anno Domini (as the white man reckons time), the Pueblo people did, indeed, begin life within the earth. The habitations they constructed were circular pit houses, dug wholly or mostly underground and covered with branches and dirt. Entrance ramps opened to the southeast, the direction of the rising sun during the colder months of the year. To enter the pit house, then, was to enter the earth, and to enter the earth was to return to one of the two sources of all life through the opening that connected it with the other source, the sun.

These pit-house people lived within the womb of mother earth while also drawing sustenance from the sun father. A small round hole was also dug and carefully protected on the floor of their pit house to remind them of their original emergence from within the earth. They termed such a hole "earth germinating mother earth navel middle place"—the origin of the sacred place in the plazas of our villages today.

From the outside these pit houses resembled nothing more than giant rounded anthills. Yet their form would take on profound meaning.

IN TIME the pit-house people emerged to build, aboveground, rectangular house blocks, but they retained the basic shape of their pit house by building kivas, or ceremonial chambers, one of which was always attached to each house block. These were built underground and to the southeast. The kiva was no longer entered through a sloping ramp but through a hole in the roof. The old rampway was now represented by a deeply recessed wall, still located in the southeast part of the kiva. This new structure resembled an old-fashioned keyhole so much that it is called a keyhole-shaped kiva by archaeologists.

Southeast of the kiva was the refuse depositing place, where the dead were buried. The positioning of the dead closest to the direction of the sunrise reflects a recognition by the Pueblo people that the sun father is both the giver and the taker of life. What he gives he also takes back, eventually. The three parts—house block, kiva, and refuse dump/cemetery—became standard.

And the kiva, in its central position, came to mediate between the living and the dead. Here the living may perform rituals addressed to the dead and, hence, communicate with them. In later times there were great dramatic performances in which the living personified the spirits of the dead in these kivas.

Finally the villages became multistoried house blocks resembling fortresses. This presented a dilemma to the people: The buildings blocked the rising sun's rays from the dead buried outside. The old keyhole kiva must give way.

Today the kiva may be a rectangular room in the house block, but the old form is retained; an opening provides an unobstructed channel toward the sunrise, representing the lifeline into the village.

The people also took the shape of the pit house and old kiva to the mountaintops, creating a keyhole form with stones, with the lower end of the keyhole opened toward the sunrise. Only the form reminded one that it represented what was once an underground habitation and later a religious sanctum. The Tewa continue to make pilgrimages to the mountain earth navels, for these are places of great power: They provide the Tewa with a way of rediscovering who we are and of renewing our ties to our beginnings. They

represent ongoing lifelines to sustain all creation. And—through the centuries when the Spanish and other peoples dominated the Tewa—these places have provided a tenacious symbol of survival.

Our genesis story establishes another vital aspect of our lives. Remember my naming ceremony: There were two women attending, two ears of corn offered with me to the sun. This duality is basic to understanding our behavior.

When the Tewa came onto land, the Hunt Chief took an ear of blue corn and handed it to one of the other men and said: "You are to lead and care for all of the people during the summer." To another man he handed an ear of white corn and told him: "You shall lead and care for the people during the winter." This is how the Summer and Winter Chiefs were instituted.

The Hunt Chief then divided the people between the two chiefs. As they moved south down the Rio Grande, the Summer People traveled on the west side of the river, the Winter People on the east side.

The Summer People lived by agriculture, the Winter People by hunting.

From this time, the story tells us, the Tewa have been divided during their

THE KIVA IS CENTRAL TO PUEBLO WELL-BEING AND SPIRITUAL LIFE. AT SAN ILDEFONSO, NEW MEXICO, A STAIR RATHER THAN THE USUAL LADDER EASES THE WAY TO A ROOFTOP ENTRY HOLE. PHOTOGRAPH BY IRA BLOCK

lives into moieties—Winter People, Summer People. Still today a Summer Chief guides us seven months of the year, during the agricultural cycle; a Winter Chief during the five months of hunting. There are special rituals, dances, costumes, and colors attached to each moiety. Everything that has symbolic significance to the Tewa is classified in dualities: Games, plants, and diseases are hot or cold, winter or summer. Some persons or things, like healers, are of the middle, mediating between the two. This gives order to our lives.

A child is incorporated into his moiety through the water-giving ceremony during his first year. The Winter Chief conducts his rite in October; the Summer Chief in late February or March. The ceremony is held in a sanctuary at the chief's home. There are an altar, a sand painting, and various symbols; the chief and his assistants dress in white buckskin. A final character appears, preceded by the call of a fox, as in the creation story. It is the Hunt Chief.

A female assistant holds the child; the moiety chief recites a short prayer and administers a drink of the sacred medicinal water from an abalone shell, thereby welcoming the child into the moiety.

The third rite in a child's life—water pouring—comes between the ages of six and ten and is held within the moiety. It marks the transition from the

carefree, innocent state of early childhood to the status of adult, one of the Dry Food People. For four days the boys are made to carry a load of firewood they have chopped themselves, and the girls a basket of cornmeal they have ground themselves, to the homes of their sponsors.

A sponsor instructs each child in the beliefs and practices of the village. On the fourth night, the deities come to the kiva, and the child may go to watch. Afterward, the sponsor bathes the child, pouring water over him. From this time, the child is given duties judged proper for his sex.

A finishing ritual a few years later brings the girls and boys to adulthood. For the boys it is particularly meaningful, for they now become eligible to assist and participate in the coming of the gods in their moiety's kiva. Thus the bonds of the moiety are further strengthened.

IT IS AT DEATH that the bond of moiety is broken and the solidarity of the whole society emphasized again. This echoes the genesis story, for after the people had divided into two for their journey from the lake, they came together again when they arrived at their destination.

When a Tewa dies, relatives dress the corpse. The moccasins are reversed—for the Tewa believe everything in the afterlife is reversed from this life. There is a Spanish Catholic wake, a Requiem Mass, then the trip to the cemetery. There the priest completes the church's funeral rites: the sprinkling of holy water, a prayer, a handful of dirt thrown into the grave. Then all non-Indians leave.

A bag containing the clothing of the deceased is now placed under his head as a pillow, along with other personal possessions. When the grave is covered, a Tewa official tells the survivors that the deceased has gone to the place "of endless cicada singing," that he will be happy, and he admonishes them not to let the loss divide the home.

During the four days following death, the soul, or Dry Food Who Is No Longer, is believed to wander about in this world in the company of the ancestors. These four days produce a time of unease. There is the fear among relatives that the soul may become lonely and return to take one of them for company. Children are deemed most susceptible. The house itself must not be left unoccupied.

The uneasiness ends on the fourth night, when relatives gather again to perform the releasing rite. There are rituals with tobacco, a piece of charcoal, a series of four lines drawn on the floor. A pottery bowl, used in his naming ceremony long ago and cherished by him all his life, is broken, or "killed." Then a prayer reveals the purpose of the symbols:

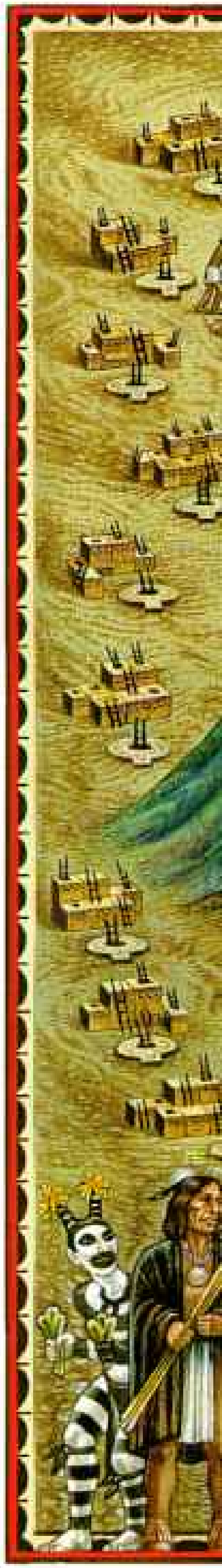
> *We have muddied the waters for you [the smoke]. We have cast shadows between us [the charcoal]. We have made steep gullies between us [the lines]. Do not, therefore, reach for even a hair on our heads. Rather, help us attain that which we are always seeking: Long life, that our children may grow, abundant game, the raising of crops. . . . Now you must go, for you are now free.*

With the soul released, all breathe a sigh of relief. They wash their hands. As each finishes, he says, "May you have life." The others respond, "Let it be so." Everyone now eats.

The Tewa begin and end life as one people; we call the life cycle *poeh*, or emergence path. As a Tewa elder told me:

"In the beginning we were one. Then we divided into Summer People and Winter People; in the end we came together again as we are today."

This is the path of our lives.



After their emergence the Tewa journey south, with planters, the Summer People, traveling on the west side of the Rio Grande, and hunters, the Winter People, on the east. At the 12th stop, the groups merge to found the pueblo of Posi. In the cardinal directions, each associated with a color, lie sacred mountains, mesas, and stone shrines. Here live the ancestors and other spirits. Ceremonies on the plaza, like this basket dance, mark the four seasons and provide a sense of renewal. □

A PORTFOLIO

THE LAND THEY KNEW

BY JIM BRANDENBURG

The beat of a wing, the rustle of branches, the rumble of thunder: Native Americans listened and spoke back. The dialogue flowed unbroken between humans and rushing rivers, flocks of ravens, and constellations of stars. The following pages capture moments in one photographer's search for that world—before Europeans entered it.

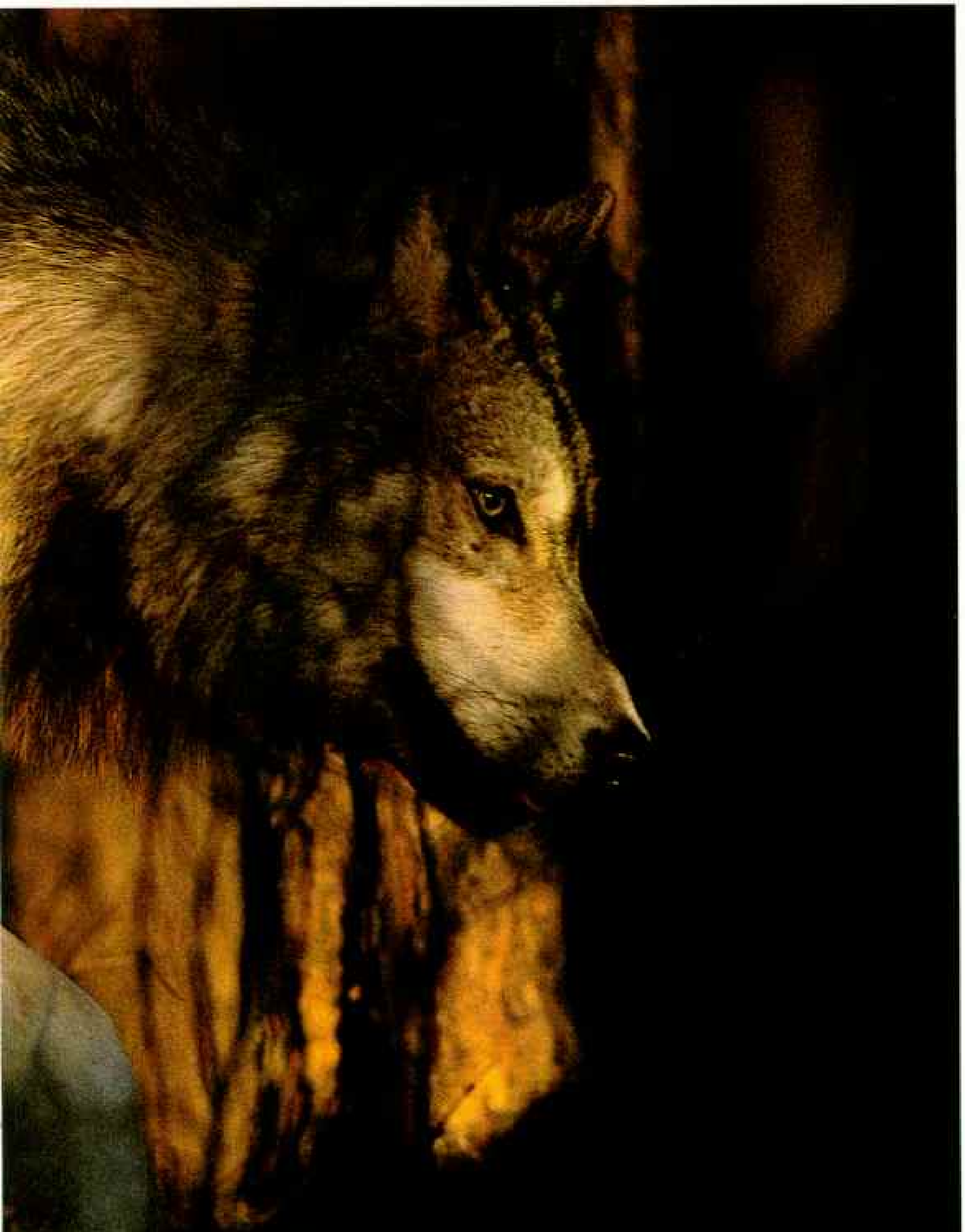
Singing with the images, selections from the works of contemporary Native American poets carry on their forebears' conversation with the world around them. "Remember," admonishes the Creek poet Joy Harjo, "that you are this universe and this universe is you."

At sundown a bison pauses near the Oglala Sioux Pine Ridge Reservation in South Dakota's Badlands.

A great blue heron stands alert at a wildlife refuge on Sanibel Island, Florida; the New River crosses Sandstone Falls in West Virginia.

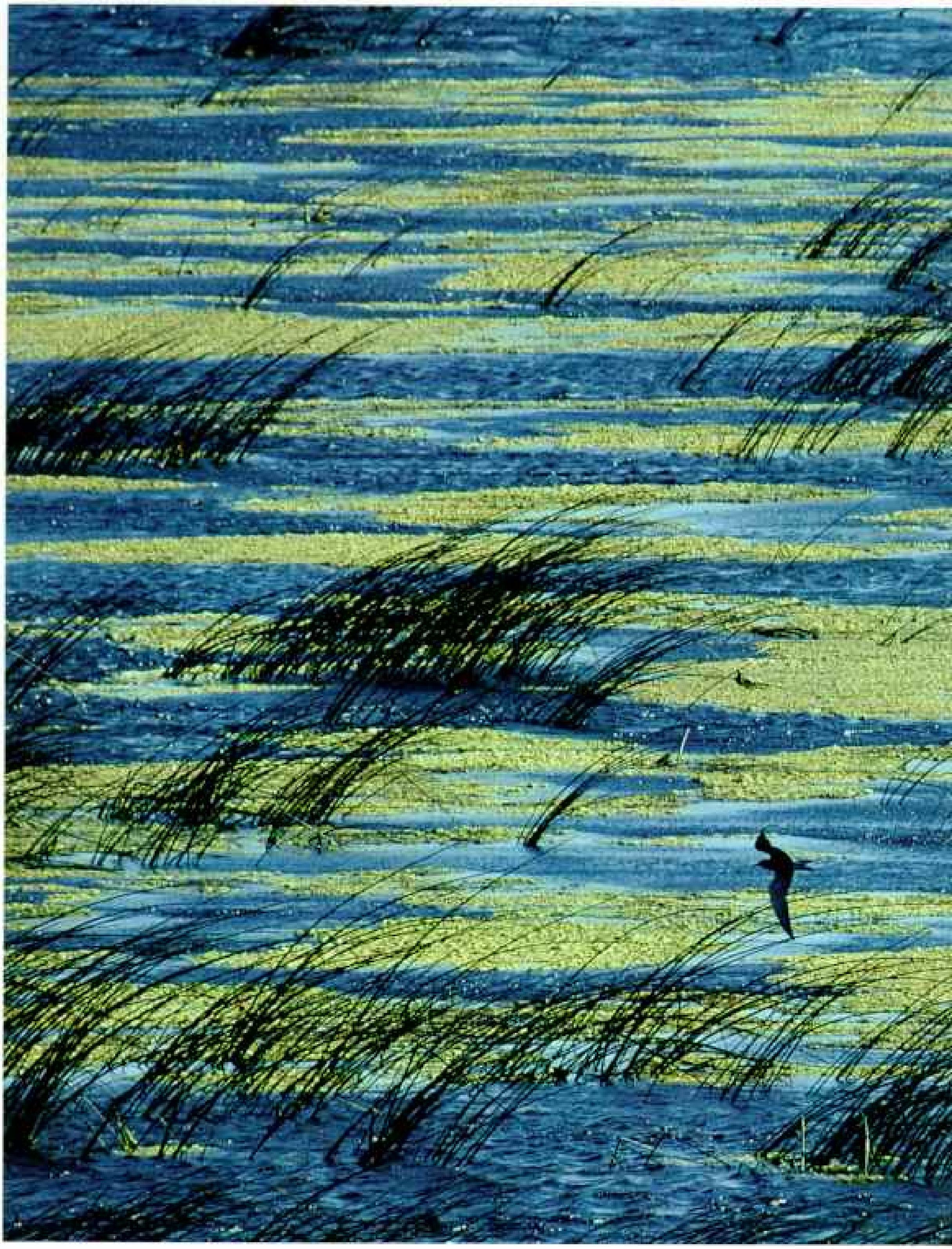
Look: the long-necked herons / in the green-billed water / are pewter. Their wet-ash wings wear / medallions of patience. We drift on, / buoyed by the tiny currents between us, / the light long-legged, the wind / full of hearts that beat quick / and strong. —ANITA ENDREZZE, YAQUI

A timber wolf steals through underbrush in northern Minnesota.



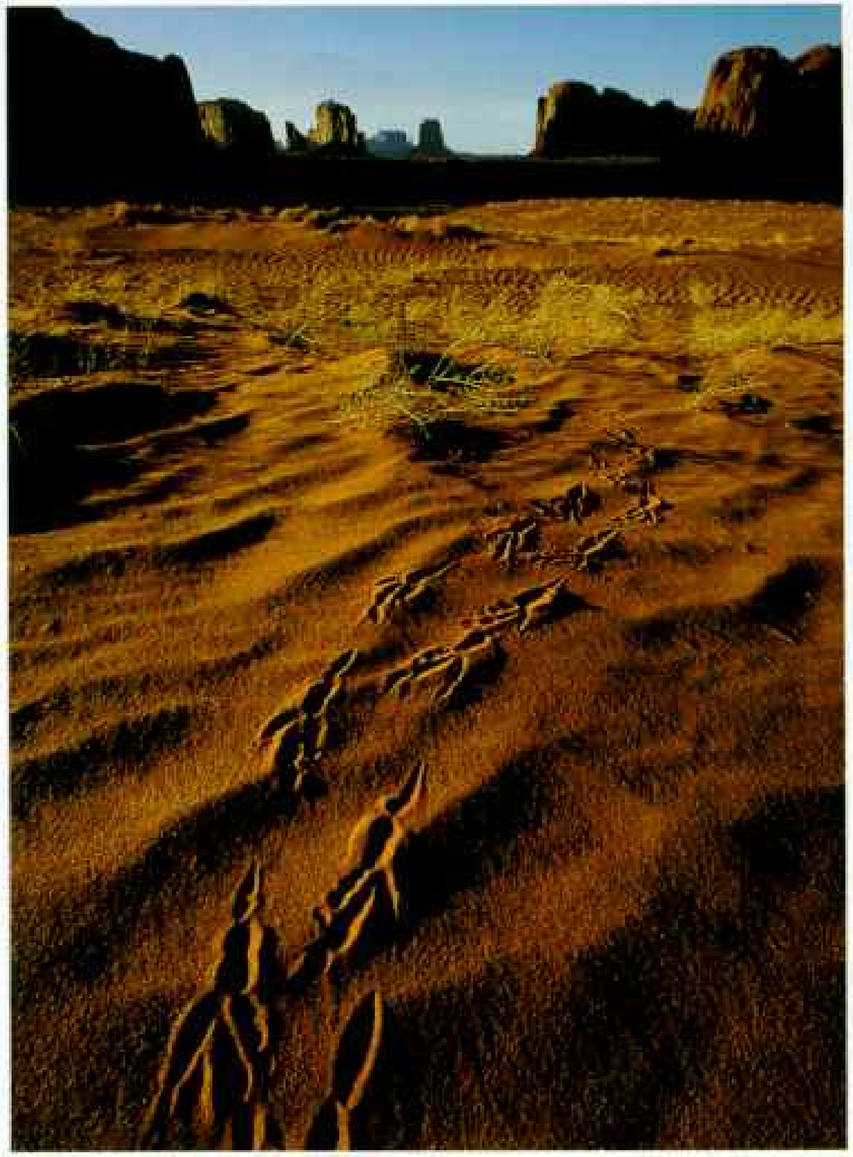
Nashoba. *This my father taught*
me how to sing: Wolf, I look long
for you—you know how to hide
your scrawny hide behind the darkest wind.

—JIM BARNES, CHOCTAW



A tern sweeps over prairie wetlands near Woodworth, North Dakota.

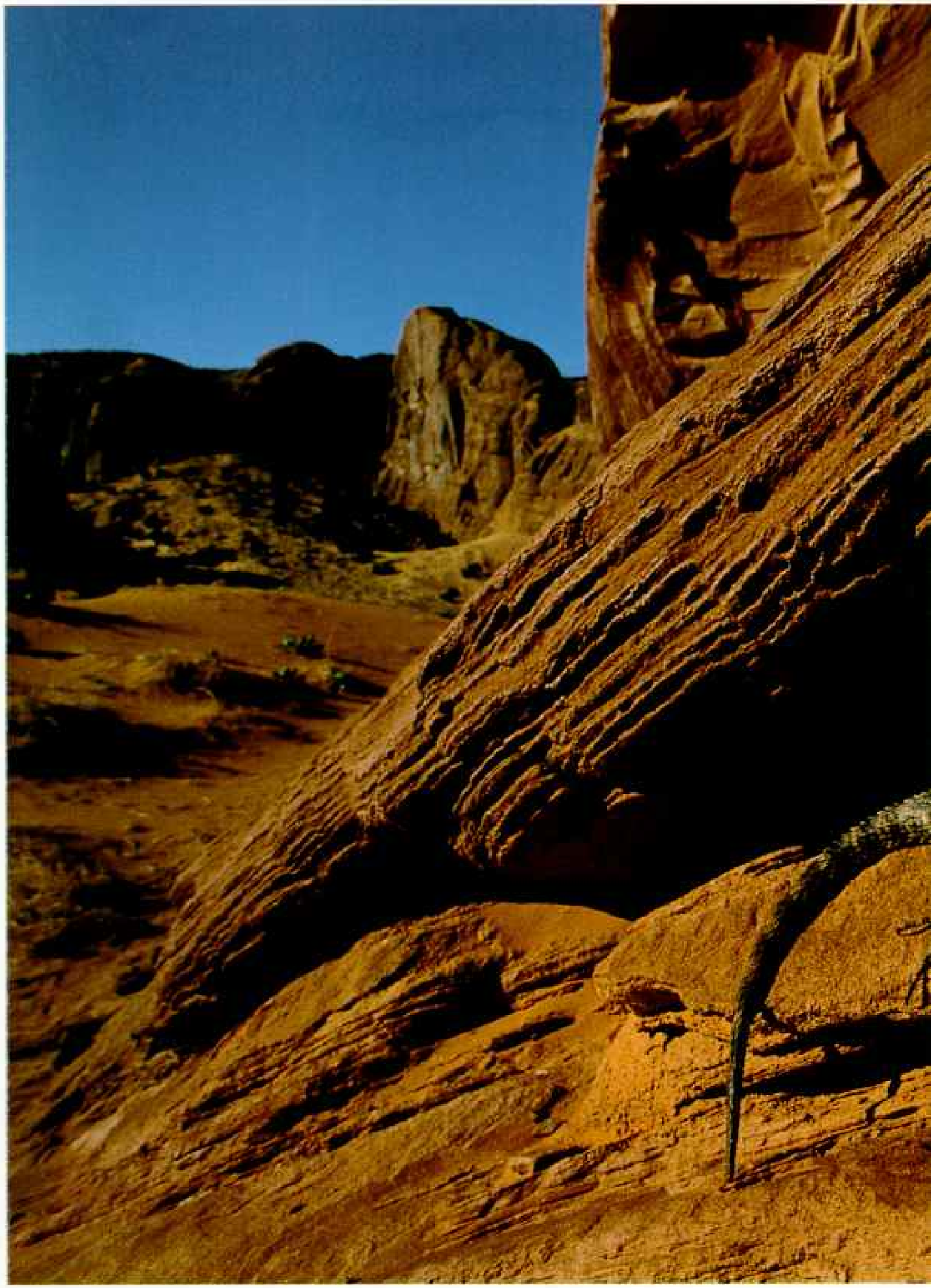
All the dark birds, / but one, /
rush from the river / leaving only the stillness /
of their language. —ANITA ENDREZZE, YAQUI

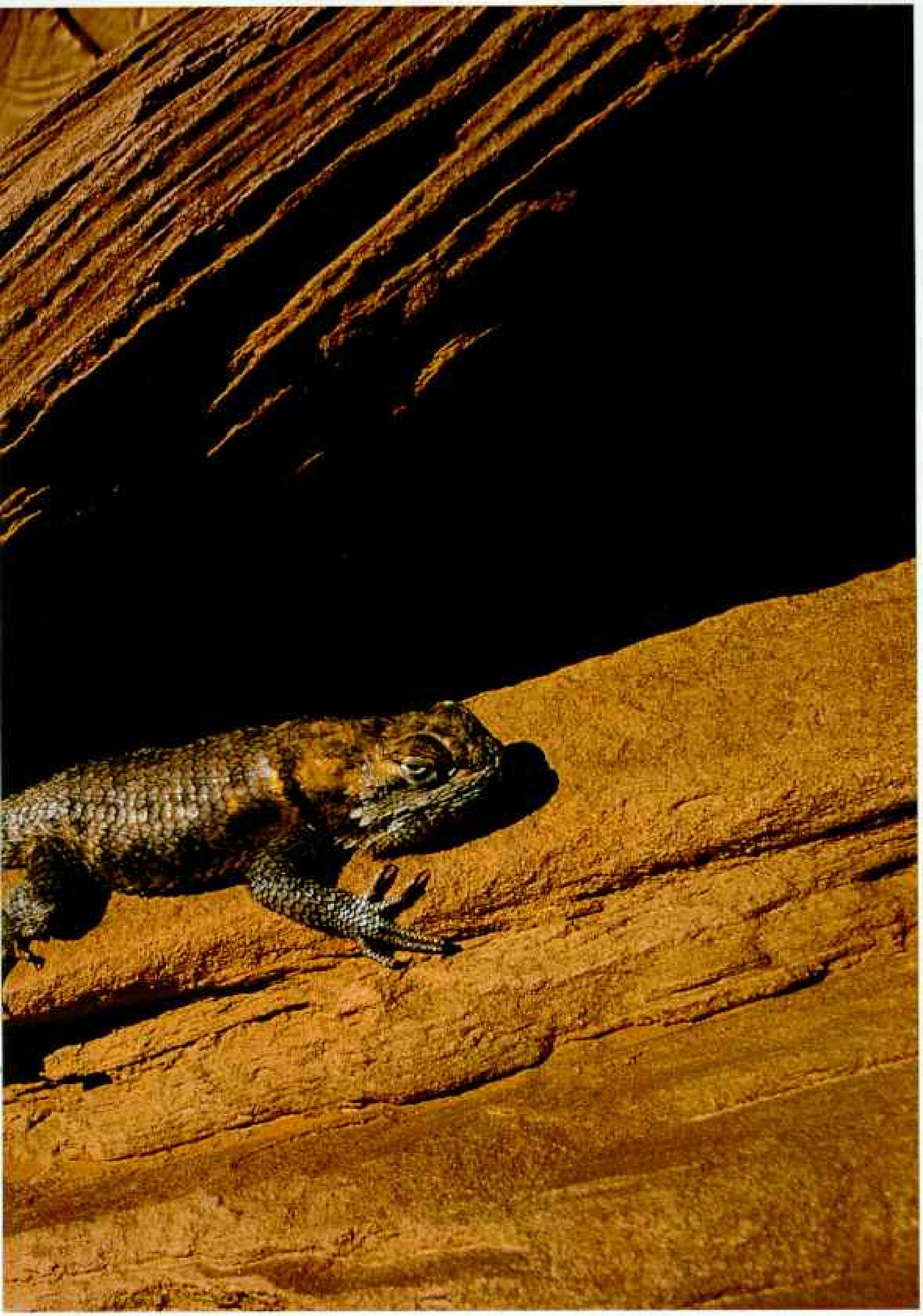


< Bison pass near the Missouri River outside Pierre, South Dakota.

Raven tracks run through Monument Valley, Arizona, on the Navajo Reservation, where a lizard warms up in April sun.

The animal in me crouches, poised immobile, / eyes trained on the distance, waiting / for motion again. The sky is wide; / blue is depthless; and the animal / and I wait for breaks in the horizon. —SIMON J. ORTIZ, ACOMA PUEBLO





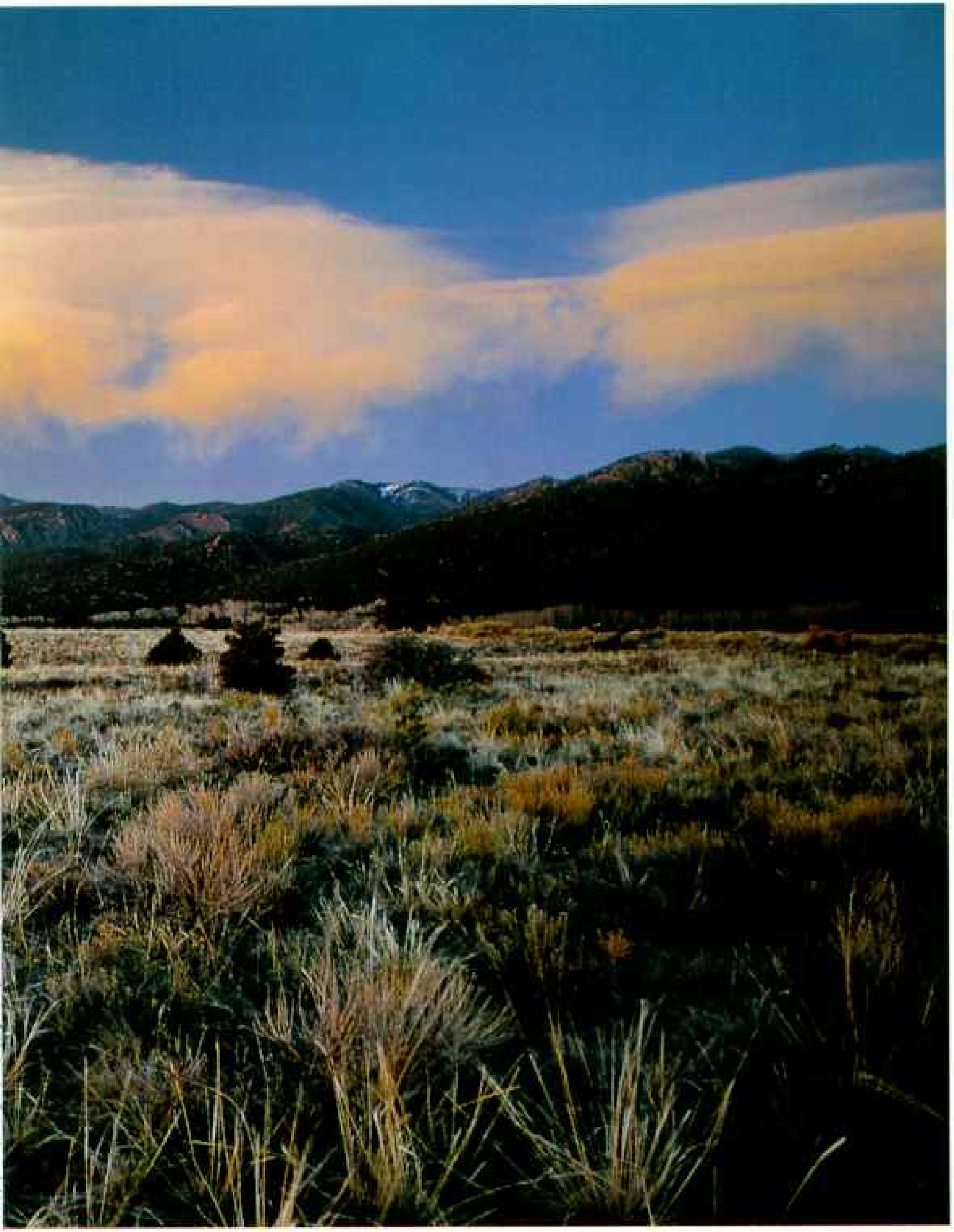
And after a long time
traveling / you will enter a silence /

you will know it is winter /
by the way your dreams /
tremble like stones / when the
wind comes / through

—LANCE HENSON, CHEYENNE

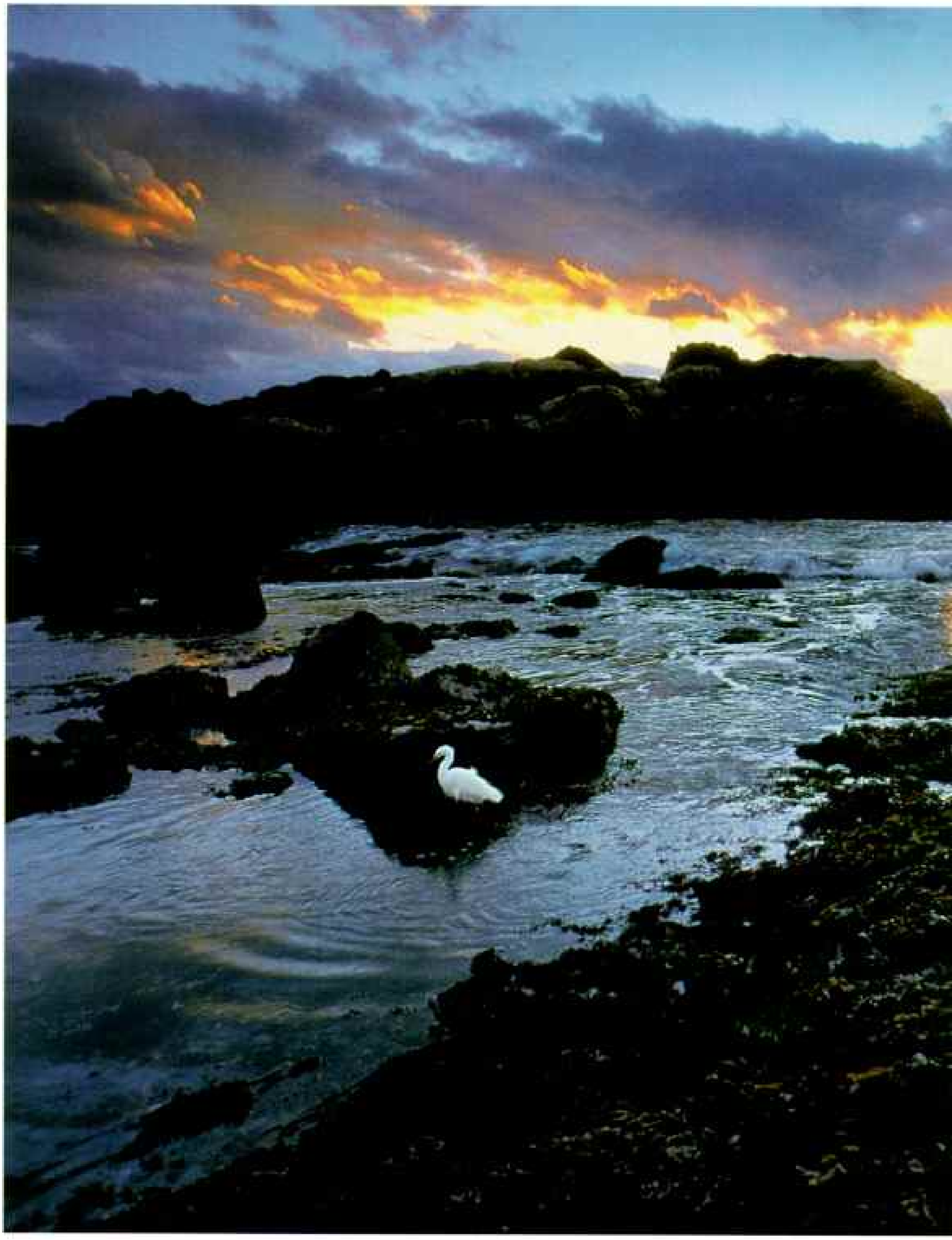
Snow slides from a conifer in Sequoia National Park, California; ravens near Ely, Minnesota, move in on a dead deer.

Falling daylight strikes a cloud over the Great Sand Dunes National Monument in Colorado.

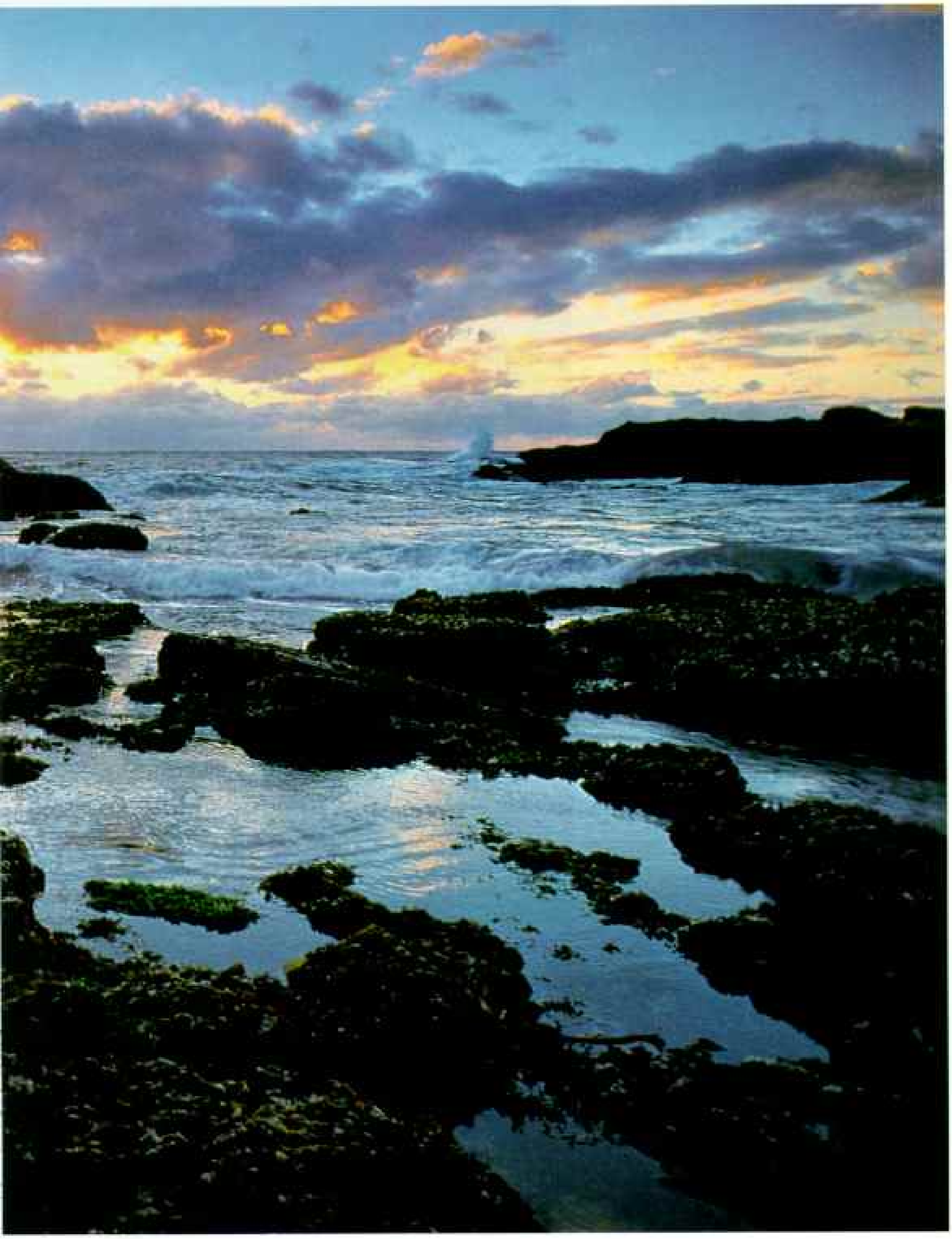


. . . there are no clocks to measure time
but the beating of our singing hearts

—HAROLD LITTLEBIRD, SANTO DOMINGO/LAGUNA PUEBLO



Pacific Ocean tide pools fill outside Monterey, California.

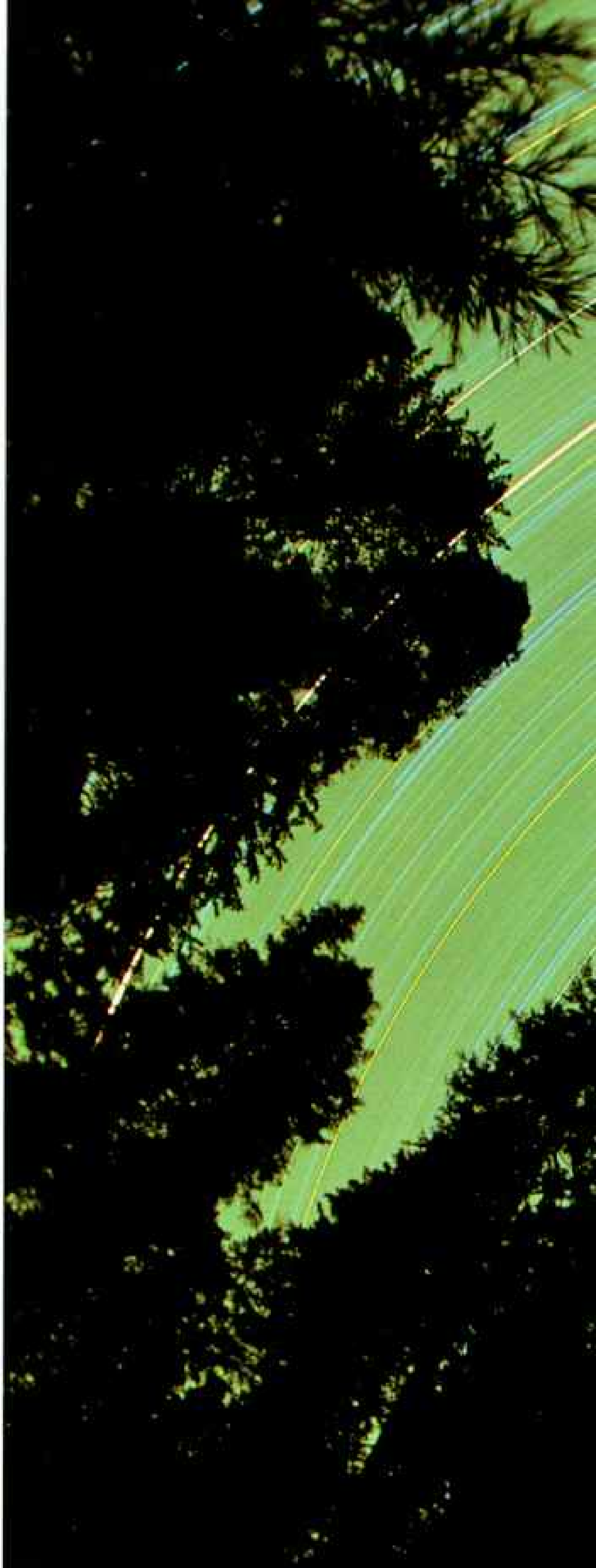


We have stories / as old as the great seas / breaking through the chest / flying out the mouth, / noisy tongues that once were silenced, / all the oceans we contain / coming to light. —LINDA HOGAN, CHICKASAW

The winds are dark passages among the stars, / leading to whirling void pockets / encircled by seeds of thought, / life force of the Creation.

—PETER BLUE CLOUD,
TURTLE CLAN MOHAWK

Stars make tracks in a night-long image through sequoias in California's Kings Canyon National Park.



Whale, I have given you what you wish to get—my good harpoon. Please hold it with your strong hands. . . . Whale, tow me to the beach of my village, for when you come ashore there, young men will cover your great body with bluebill duck feathers, and the down of the great eagle. —MAKAH TRIBAL SONG

HUMAN FACES AND A KILLER WHALE, CARVED UNTOLD CENTURIES AGO, MARK A ROCK NEAR OZETTE.

A MAKAH VILLAGE IN 1491

OZETTE

When I was a girl, I often wondered about my ancestors. I lived then, as now, in the village of Neah Bay on the Olympic Peninsula in the northwest corner of Washington State, where the sea and the forest surround us. I knew that in times past the most powerful men in our Makah tribe were whalers. My great-grandfather Wilson Parker was a whaler, as were his father and grandfather. Stories of the rituals that had empowered them filled my childhood.

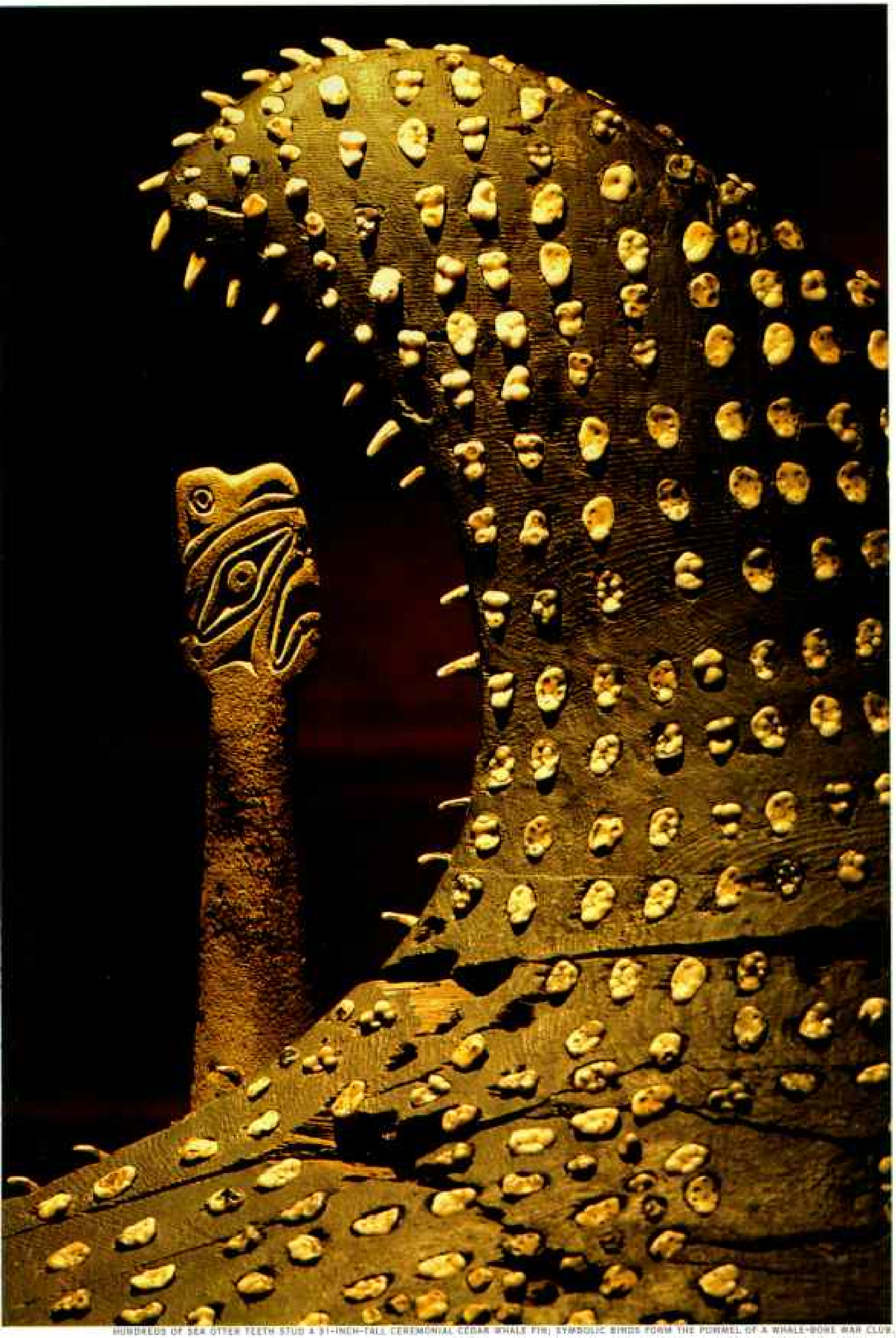
But growing up in the 1960s, I never saw a harpoon, or a lance, or a buoy made of the skin of a hair seal. The last whale hunt took place in 1913, and the hunters' gear was packed away.

And then, as if in answer to a prayer, the past returned. In early January 1970, Pacific storm surf began to expose wondrous things at the abandoned

BY MARIA PARKER PASCUA

PHOTOGRAPHS BY LYNN JOHNSON
BLACK STAR

PAINTINGS BY RICHARD SCHLECHT



HUNDREDS OF SEA OTTER TEETH STUD A 31-INCH-TALL CEREMONIAL CEDAR WHALE FIN; SYMBOLIC BIRDS FORM THE PORWEL OF A WHALE-BONE WAR CLUB. ALL ARTIFACTS FROM THE MAKAH CULTURAL AND RESEARCH CENTER, NEAH BAY, WASHINGTON

village of Ozette, 30 miles away. Those artifacts had been buried when a mudslide covered a cluster of cedar longhouses about A.D. 1500. A decade-long excavation by Washington State University archaeologists, in cooperation with the tribe, recovered harpoons, lances, implements of daily life, and precious ceremonial objects that I could see and sometimes even touch.

Then later, as an employee of our local Makah Cultural and Research Center, I was asked to collect the songs and stories of our elders so that these and the Makah language itself might not vanish. The words poured over me, giving further substance to the past.

We first knew ourselves as Qwidicca-atx (Kwee-DITCH-chuh-aht): "people who live on the cape by the rocks and seagulls." The name Makah, "generous with food," is what we were called by neighboring Klallam Indians, one of whom served as translator when we signed a treaty with the U. S. government in 1855. Federal agents found Makah easier to pronounce, and we now use it when speaking English. But we know who we are.

British and Spanish explorers made brief contact with us at the end of the 18th century, but we had little dealings with whites until the mid-1800s. Soon after, two-thirds of the tribe was dead from smallpox, measles, and other diseases brought by the traders we had welcomed. Our bodies lined the beaches, and they buried us in trenches.

Today about a thousand Makah live at Neah Bay. The people began to leave Ozette and other villages in 1896 when the U. S. government said our children must attend school in Neah Bay, where federal agents had set up office.

But in 1491 Ozette, with its long beach on the Pacific, was the most important Makah sea-mammal-hunting village. No site was better for launching the spring hunts. It had then been occupied—and defended against competing tribes—"since the first Daylight." Let us go back to that time, before the sails of "people who live in houses on the water" came over the horizon.

I want the sea. That is my country.
—OZETTE CHIEF TSE-KAW-WOOTL AT THE 1855 TREATY NEGOTIATIONS

Like the hearts of the Makah, the doors of Ozette's longhouses in 1491 face the sea. The sounds are the wash of the surf, the sea gulls' chorus, a sea lion's bark, the sighing of hemlock, spruce, and cedar, and the voices of a thousand people.

The women are wearing soft skirts woven from shredded cedar bark. When they laugh, they toss back long tooth shell earrings. The men too have pierced ears and noses but save their jewelry for special occasions. There is no word for shoes, nor is there any footgear. Both men and women bear tattoos on legs and forearms.

Behind Ozette's longhouses towers the rain forest, lush with ferns and mosses, that gives the wood from which nearly all Makah possessions are made. Especially in winter, "the time for wind," the ocean and forest seem to talk to each other—the song of the waves answered by the song of the boughs.

The woods and the water are mystically linked. Because a cedar can become a canoe, Makah can harvest the sea. Because an elk's antlers can be carved to hold a harpoon blade of sharpened mussel shell, gray whales can be captured. Because the cry of the wolf so echoes the cry of the killer whale, the Makah understand that this is the same animal, using one body for land and another for sea.

Even in the sky the Makah see the ocean; they call the Big Dipper the Skate. Every type of wave and current, every rock and navigational landmark, has been given a name. There are a dozen words to describe the varying tides. In deep fog the hunters navigate by reading the sea's currents, swells, and sounds, as if tracking a living creature.

The whale always gives our people something. The whale always helps someone who needs him.
—JOHN THOMAS (NITINAHT), 1913-1990

Of the sea's creatures, the gray whale is the most important. Its gifts are meat and oil for food, sinew for binding harpoons, giant bones that can be shaped into war clubs. But it has given the tribe something greater—it has shaped Makah society.

The first Makah men bold enough to pursue the gray whale became chiefs and created a hereditary rulership. Only a chief or his sons can harpoon a whale, and these sons must marry the daughters of whalers. Their marriage must be a deep spiritual kinship marked by preparatory fasting and prayer, or the whales will not come.

At Ozette there are as many as six chiefs,

ranked according to wealth. Beneath them and allied to them are the commoner families. It is the quality of his allies' skills—sealing, fishing, canoe carving, basketry, a woman's closely guarded recipe for berry cakes—that helps bring a chief wealth.

The chief in turn offers protection, and commoners gain status according to his status. Whales caught by the chief and seals and fish caught by commoners are shared among a chief's allied families. Highly skilled commoners, if they feel unappreciated, can shift their allegiance to another chief. But however great their talents, commoners can never rise into the elite. In Makah society, you are who you are the day you are born.

I have come to see how your house is. Is it prepared for large crowds?

—SONG OF THE WHALE, SUNG BY WILSON PARKER, 1855–1926

When the gray whales reach Ozette in early spring, the chiefs and related crewmen are prepared. For months their entire beings have focused on the day when the sentry atop the pinnacle across from the village gives his cry.

They and their wives have fasted, bathed in secret prayer ponds, flogged themselves with stinging nettles, and entered the mind of the whale.

When you're in the woods take water at every creek. Blow it, and start praying while spraying mist from your mouth.

—CARL HUNTER, MAKAH ELDER

Several canoes leave Ozette together and reach the feeding grounds a few miles offshore before dawn. The harpooners' wives lie still in their longhouses, a bodily prayer that the whale will also be docile.

A yew-wood harpoon is not thrown but pushed into a whale's shoulder behind the flipper. This does not kill the whale, but the wound and inflated sealskin buoys attached to a hundred-foot-long harpoon line slow it down. Then the men begin singing to the whale to encourage it to swim toward shore.

When the whale slows, a crewman may leap onto its back to kill it with a lance. Then another crewman dives and threads its mouth closed with cedar-bark rope so water will not fill the whale's stomach. The singing continues all the way back to Ozette.

The Makah knew their lives depended on the Great Spirit Above, and they prayed in secret at sunrise. Each had their own way of praying, of finding a spirit helper. My stepfather held a black rock in his hand, that he would be strong like the rock. You can see the imprint where he held it in his hand.

—HELEN PETERSON, MAKAH ELDER

With tender reverence a Makah elder cradles a carved figure in a mussel shell. This 500-year-old artifact unearthed recently at Ozette matches a story handed down by generations about the creation of life: Mucus from a weeping mother's nose falls on a mussel shell and becomes an infant.

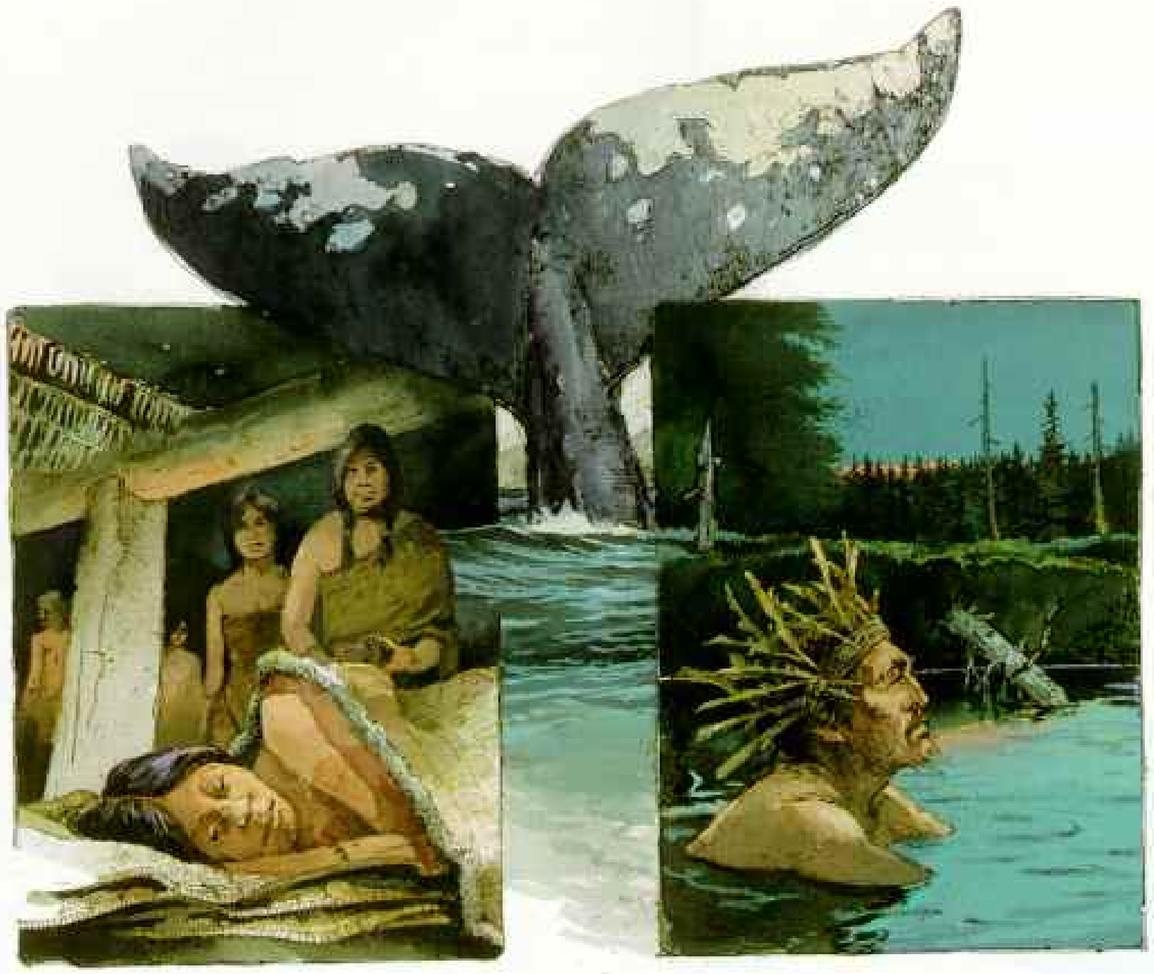
In the narrow margin between ocean and forest the Makah flourished. Setting out from Ozette and other villages on the western tip of today's Washington State, they gathered wild plants and took the creatures of rivers, tide pools, and the open sea.

In April herds of migrating northern fur seals pass only three miles off Ozette. Their lean, dark meat is the villagers' favorite food. But no man hoists a harpoon—or combs a bone-toothed rake through the shallows for herring—without praying to the Creator of Daylight to be worthy enough to have these animals give themselves to him.

In 25-foot canoes the hunters search for fur seals floating on their backs asleep. Whoever spots the seals slightly shakes his thumb in their direction. To point is a taboo and would wake the seals. The canoe paddles part the sea so quietly that the men are nearly on the seals before they start.

The bowman hurls his harpoon, almost twice his body length. If he strikes the heart or lungs, the fatally wounded seal can be swiftly pulled in by the cedar-bark line that leads from the shell or bone blades. A less decisive hit and the hunters are pulling in an enraged animal. A heavy yew-wood club is swung; the seal dies. A seal's face is carved on the club to show respect.

Fur seals must be gutted at sea, or their weight will swamp the canoe. On the beach women have changed into disposable, cattail reed skirts. They cut the meat into strips for smoking. To render the oil, they fill canoes and wooden boxes with water and



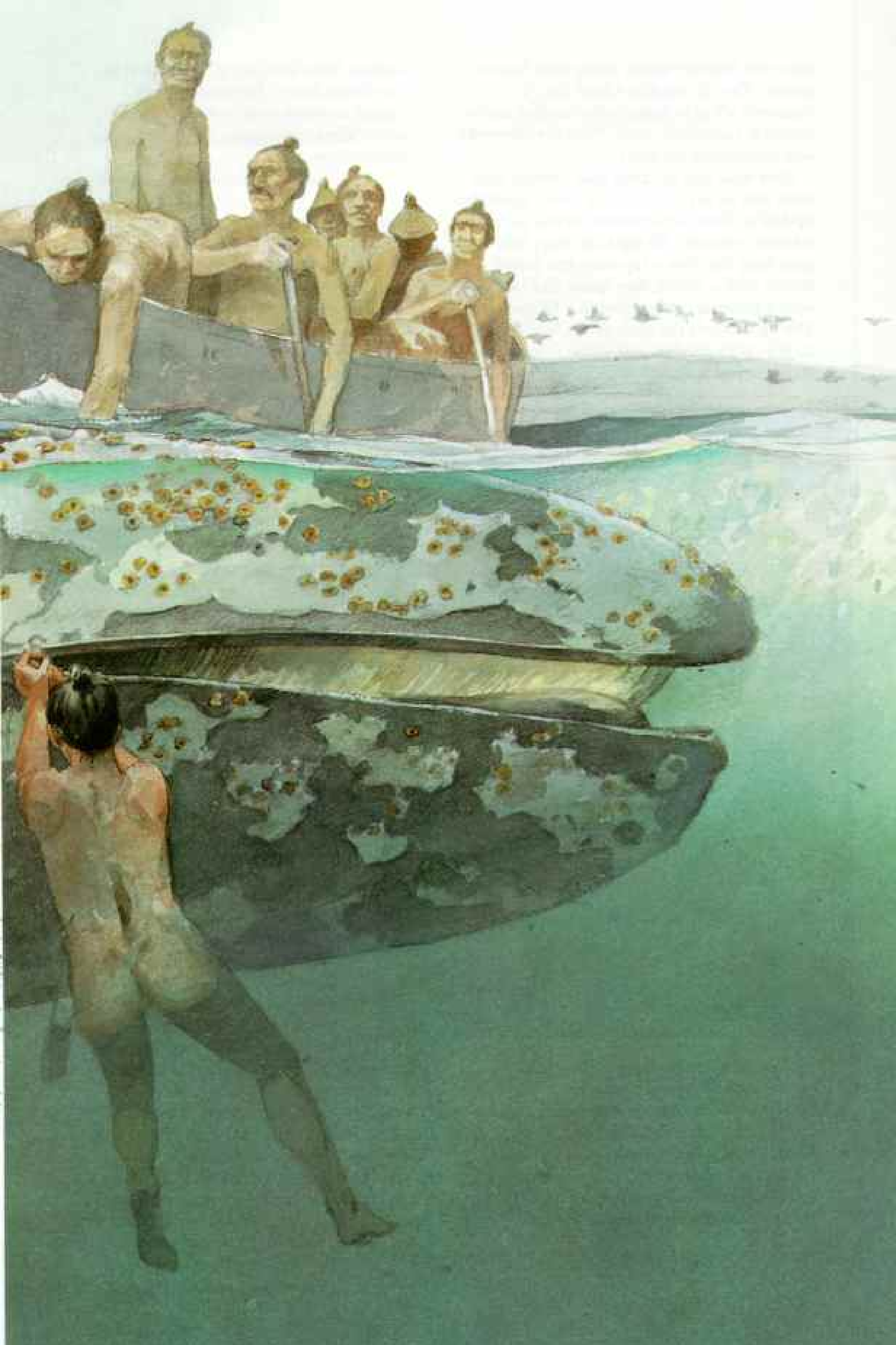
Whaling was the most dangerous of endeavors. It demanded spiritual readiness, the best equipment, skill, strength, and great courage. Few took up the quest; few enjoyed the prestige of a successful hunt.

Each whaler prepares himself alone in the forest at night. Swimming slowly and gently in a secret pool (above right) encourages the whale to do the same. Other rituals ensure that the whale will consent to be taken, giving the Makah plenty to eat and enough oil to trade.

The pursuit begins as the first whales pass by on their spring migration north. While her husband is at sea, a harpooner's wife lies still (above left) so the whale won't thrash about; she faces inland so the harpooned whale will head to shore.

Strong, silent paddling brings the 36-foot cedar canoes alongside the whale, where the harpooner takes aim. Embedded, the harpoon head anchors sealskin floats that slow the whale as it races away. Finally exhausted, the whale is killed with the thrust of a lance.

Sewing the mouth shut (following pages) seals in buoyant gases and keeps water from sinking the carcass as canoes tow it to shore. Whalers float their catch right onto Ozette's sandy northern beach (opposite). Villagers meet them with songs and ceremony, welcoming the whale as an honored guest so it will come again.



place the blubber inside along with heated stones. The oil, used as a food dip, is skimmed off as it floats to the surface and is stored in containers made from the stomachs and bladders of sea lions.

Hair seals live in caves near Ozette; their meat and oil are excellent. A canoe would be dashed in these surf-charged caves, so hunters must swim in. To light the way, they twist their long hair into a top knot and insert spruce sticks, which they ignite like candles with a glowing coal carried in a hinged shell. The light blinds the seals as the hunters climb up the rocky perches and strike them with clubs carved in their image.

Arched like fish fighting a line, large hooks landed halibut; smaller straight-shanked ones with twin barbs caught bass and lingcod. The Makah made this gear from materials such as steam-bent wood and cherry bark, linking land and sea—parallel realms that also had mystical ties.

Salmon traps were set off the mouth of the Ozette River. The leading men caught as many as they desired, then said, "Here, my people, come and get as many as you want."

—CHESTER WANDERHARD, BORN 1875

The Makah word for fish is the Makah word for food. Ozette's fishing grounds are without peer: There are sweet rock cod (a breakfast favorite), halibut, and salmon—steelhead, coho, blueback. From spring to fall, thousands of pounds of fish are caught each day. Much is eaten fresh—roasted, boiled in a water-filled box with heated stones, or steamed in a wrapper of salal leaves.

But most is filleted and dried to see the tribe through the winter. White flags of halibut wave atop longhouse roofs on drying racks 25 feet high. By the time the highest tide of autumn washes the afterbirths of hair seals out of their caves—the surest sign of winter's approach—families will have set aside enough fish and seal and whale meat so that there is a surplus to trade for exotic shells and woods.

Do not think for a moment that you can defeat us, for we own slaves from all other tribes, even from the coast tribes to the north.

—FROM A SONG PASSED DOWN TO YOUNG DOCTOR, 1851–1934

Slaves are a small group at Ozette in 1491, but their labor makes the Makah system possible. Some of them are newly captured, others born into families that have worked for the Makah for generations. Male slaves gather firewood and fell trees; females help Makah women clean fish, a task no man will perform.

Slaves have no rights; they can own nothing. But in a secret society called Klukwali (Kloo-KWAH-lee)—the Wolf Society—male slaves can be initiated into a world where chief, commoner, and slave are temporarily equals. With howling and ceremonial singing and dancing, members meet several times in

midwinter. At these gatherings the Klukwali can bring complaints against members—or against anyone in Ozette. In this way the three social groups of the village are accountable to one another. If someone is not living right, he or she can be punished. If a husband and wife quarrel too much, their skin may be pierced with curved bones.

All social levels gather under the high slanting roof of a longhouse, 60 feet long and 30 feet wide. As many as 30 people might live within its cedar-plank walls. The rough planks are lashed with cedar withes to poles of hemlock. Sometimes a woven cedar mat covers the door.

If this is the home of a chief, he and his immediate family occupy the most comfortable corner. A brother, a male cousin, or other relatives live in other corners or along the walls. Commoners and slaves may live here also. Low partitions set off a family's area.

At night mattresses of cattail reeds are laid down on benches, which are sometimes covered with cedar boughs to keep fleas away. The blankets have been woven on a two-bar loom from softened cedar bark mixed with down, cattail fluff, and the spun hair of small dogs the Makah breed for their fleecy coats. Infants are laced into body-hugging, woven-cedar cradles and soothed with pacifiers of whale blubber. Their mothers sing lullabies that came to them in dreams while they were pregnant:

> *Take your basket*
> *and fill it with kelp fish.*
> *My canoe is full of kelp fish.*
> *But I threw out the bull-*
> *heads.* —BOY'S LULLABY BY FANNIE PARKER, BORN 1862

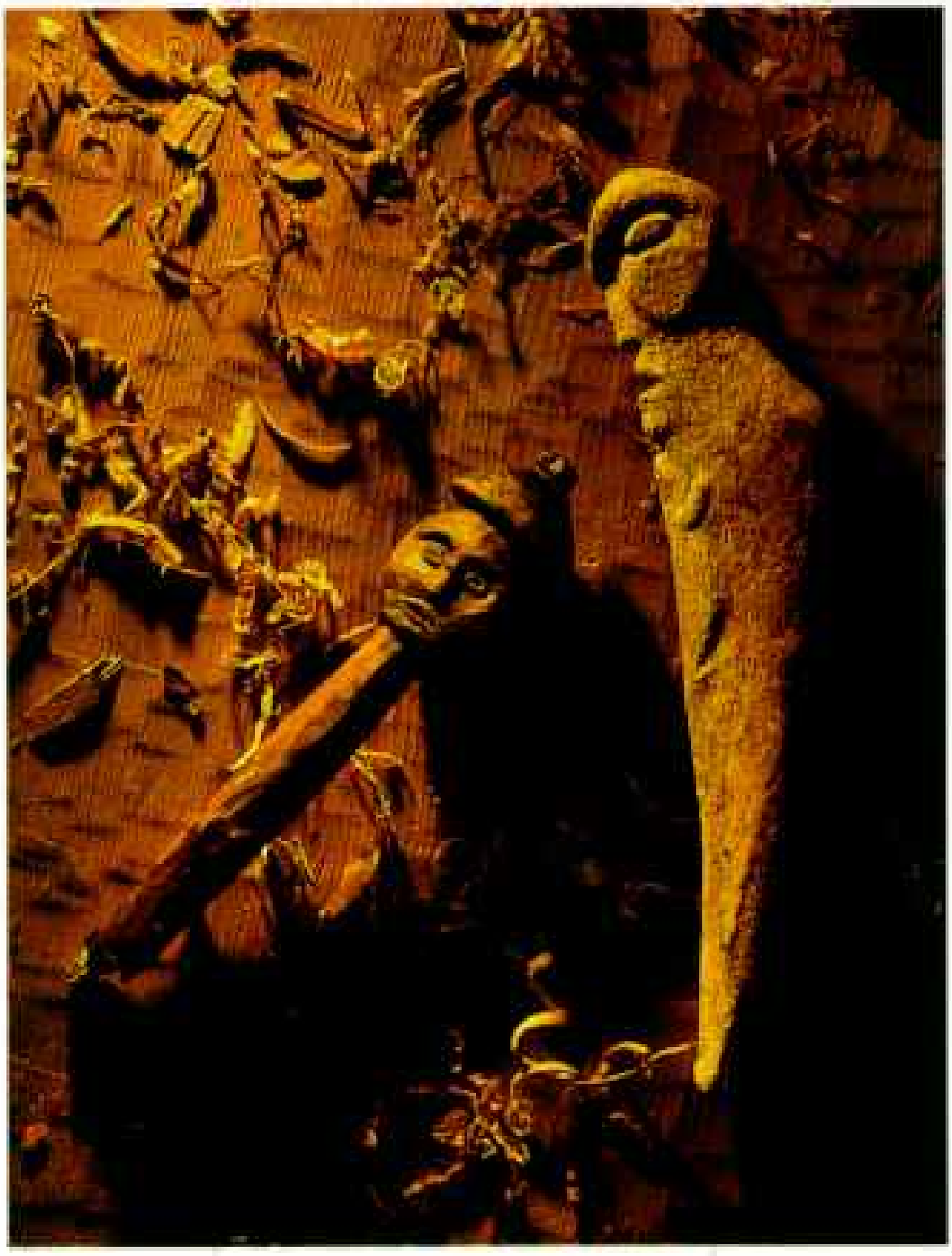
Everyone has something to do, and it is a disgrace for anybody to sleep late. Older relatives, as much as parents, teach Ozette's children the Makah ways. Boys are given miniature canoes and harpoons; girls receive tiny baskets and cradles—not just as toys but for training too.

A boy may start out carving play canoes and paddles. If he shows aptitude, he'll begin carving the one-man fishing canoes, then the sealing canoes. Then, as a man, he will be prepared to shape 36-foot whaling canoes and larger war canoes from a single red cedar log.

In summer women and girls walk the beach at low tide gathering clams, mussels, periwinkles, limpets, barnacles, and sea urchins. They also walk the woods and bogs picking salmonberries, huckleberries, salal berries, and cranberries.

During the winter women weave baskets, clothing, canoe mats, pouches for fishing equipment, and diapers—mostly out of the cedar bark they gather with orange-stained hands in late spring.

Normally there is more than abundant



Almost every aspect of life depended on wood, which the Makah worked masterfully. An artist needed special tools like this whale-bone chisel, at right, now bladeless, and a beaver-tooth knife with a wooden whaler-head haft to fashion objects of great spiritual power.

Wooden wedges hammered with stone mauls split a plank cleanly from a soaring straight-grained cedar. The Makah take only what they need, often leaving enough of the trunk to sustain growth.

Superb craftsmen, the Makah could bend a plank into a box by grooving and steaming the corners. One such container bears a singular image, perhaps a supernatural being that came in a dream to a whaler, who then had it carved on his box to protect the ritual objects stored inside.

food, but famine sometimes strikes. One Makah story recalls a hard winter when it was impossible to fish, there was no game to be found, and the food-storage baskets became empty. One man went up on the mountain to pray. Hearing a noise, he looked up:

> *There was the Thunderbird, so huge it darkened the sky. He made the thunder sound with the beat of his wings. His eyes were flashing lightning. Then he flew straight down. Just as he was about to hit the water, he swooped back up carrying a whale in his talons. He flew toward the village. He flew close to the beach, and there he dropped the whale. Then he flew away. The man who saw all this said to the people, "We're saved, we're saved."* —MAKAH TRIBAL STORY

The Thunderbird is a supernatural being, a giant man who changes into his bird nature to hunt. He has appeared in visions and dreams and has taught people many things.

By both the creatures of the physical world and the creatures of the supernatural, the Makah are shown how to take care of what they have been given, how to take care of one another, how to respect the One who has given them these things.

> *Women prayed, "Make me better, let me live, let me be healthy." They prayed to the One up in the Sky.*
>
> —KATIE HUNTER, 1886-1985

The medicines of Ozette are gathered from the forest. A tea of thimbleberry leaves strengthens the blood. The bark of a salmonberry bush numbs a toothache. Head lice are doused with powdered hemlock mixed with seal oil, and a poultice of chewed hemlock stops bleeding. The sea contributes too. The heads of lingcod, their bodies eaten by sharks and seals, wash up on the beach in the winter. They are boiled into a delicious broth that is soothing for colds.

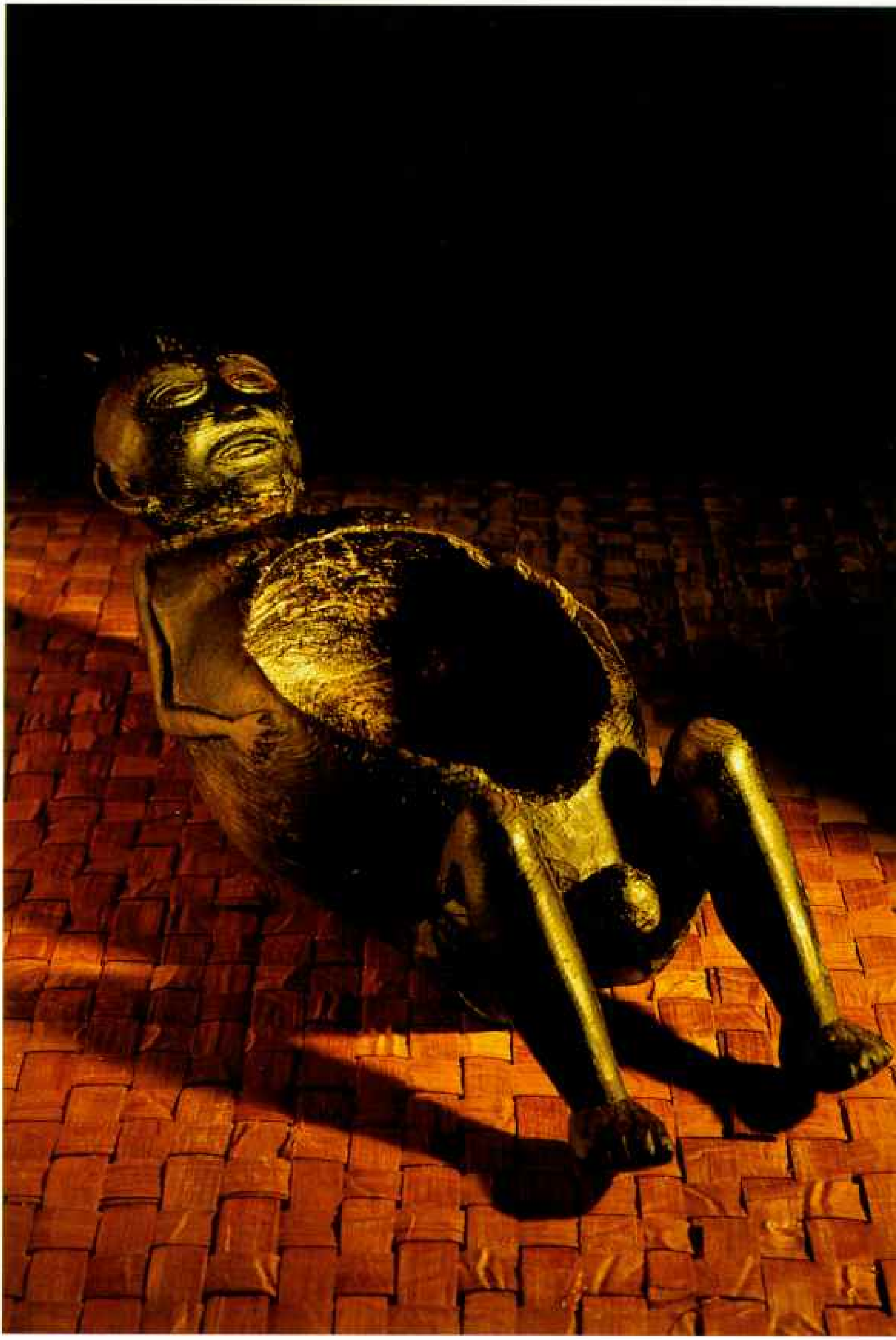
For illness beyond common remedies, a doctor is called. No one can choose to be a doctor. The Creator of Daylight chooses, male and female alike. This election crosses class boundaries and, like the Wolf Society, balances the life of the village. A doctor may be assisted by members of a secret healing society who have received powerful songs of prayer in visions. The ceremony proceeds for hours.

Of course, in time death comes to all:

> *The people believed that when you die, your spirit leaves your body. Sometimes they believed that some of your people come to meet you. They are waiting there to take you with them. People were not afraid to die. Long before, they used to talk about how they were going to be wrapped in a certain blanket or shawl.* —HELEN PETERSON, MAKAH ELDER

More valuable than a family's material possessions are its songs. Most songs are received in visions or dreams. Their verses are brief, woven in and out of a chanting melody as a box drum keeps beat.

Songs are a privilege and must be cared for, honored, and properly sung and danced. Their origin and history must be learned, repeated, and passed down to each generation.



A song can be sung only by its owners, though others may be asked to learn a song to help perform it. If the owner of a song dies before passing it down at a potlatch, the song dies also, unless permission was given for someone to carry it on.

There are songs of joy, of war, and of love:

No matter how hard I try to forget you,
you always come back to my mind, and
when you hear me singing you may
know I am weeping for you.

—RECORDED BY YOUNG DOCTOR, 1851–1934

When a chief hosts a potlatch, families are invited to dance their songs and to display the ceremonial dress and masks they usually keep hidden. Important occasions call for a potlatch—a wedding, a daughter's coming of age, the end of a year of mourning.

But the primary purpose is to validate a Makah chief's ownership of his family songs, his ceremonial names, the crests that decorate his robes and possessions. To repay his guests for witnessing and validating his claims, the host will give away virtually everything he owns.

Messengers fan out in canoes to invite families from the other Makah villages and from neighboring villages where other languages are spoken. Several interpreters are needed.

How much a chief is able to give away will affect his standing. His guests will be fed the best food, given the finest blankets and the most handsome boxes. The chief knows that his gifts will be reciprocated with interest at future potlatches.

The families are called by rank to perform their songs. This is their great gift to the host, to which they add presents for his family and fellow guests.

If a family is in mourning and therefore unable to sing and dance, it will ask another family if it can "ride in their canoe." In this way the mourning family can be spiritually present in the other family's song. Then, finally, the host's family performs its songs.

The Makah elders alive in 1991 remember potlatches that went for two weeks without a song being repeated. Today a potlatch lasts but a night. We have no way of knowing how many songs were lost in the epidemics, how many were lost through the persistent efforts of missionaries and federal Indian agents to suppress our language and culture.

I am a Christian; I am not sorry the missionaries came. But I wish they had known how to let their news change peoples' lives from the inside, without imposing their culture over our ways.

We have lost so much. But when we needed it most, the 15th century came back to us. We have the artifacts of our ancestors. And, more important, we still have songs that are carried in the hearts of the people. □

A graceful bone comb crowned with a bird and an intriguing wooden figure still slick with the oil it held offer evidence of a people who appreciated art, had the resources, skill, and inspiration to give it wide expression, and incorporated it into their spiritual and secular lives alike.

They became conscious of a murmuring in the silence of the night as if people were near, and proceeding a little farther . . . they saw lights and heard the barking of dogs, the crying of children, and the chatter of men and women.

—SPANISH ACCOUNT OF A SOUTHEAST INDIAN VILLAGE IN THE 16TH CENTURY

A SOUTHEAST VILLAGE IN 1491

Etowah

The discovery came late on a rainy June afternoon, barely a week after I had joined Lewis (Lew) H. Larson's excavation team at Etowah, Georgia. Lew's first exploratory trench had penetrated one of three great earthen mounds at the site. We had just finished troweling its sidewalls to the smoothness required for my drawing the cross sections when the rain came.

While we hurriedly wrestled tarpaulins over the excavation, a small portion of dirt suddenly fell away from the south wall—a minor and familiar event in dirt archaeology. But this time was different, for a slump of no more than a bucketful of earth had exposed what was obviously a painted stone ear! And it was attached to a stone head.

I quickly fetched Lew, who was working nearby. The young archaeologist knelt down to examine the stone ear and partially exposed head. "Wonderful. Wonderful," he said softly. "We're not too late."

Others had dug into this mound in the past. They had unearthed a trove of artifacts: plates of sheet copper embossed with images of mythical bird men, engraved shell ornaments portraying weapon-wielding figures in elaborate costumes. But these early diggers of Etowah had walked away with almost no information on the people who had made those things. They had also left the mound a shambles, apparently beyond salvage—or so we had feared as we began our work.

Now we were encouraged to believe that we could offer new knowledge of the people who flourished here centuries ago. There was much to learn. The site—like similar ones from Georgia to Oklahoma to Illinois—was marked by great mounds. Yet no Native American tribe could remember who built them or why. The scattered artifacts found presented a sketch of an elegant society with a clearly established elite class. And the mounds themselves indicated huge efforts by hundreds of people guided by a central authority. Yet the

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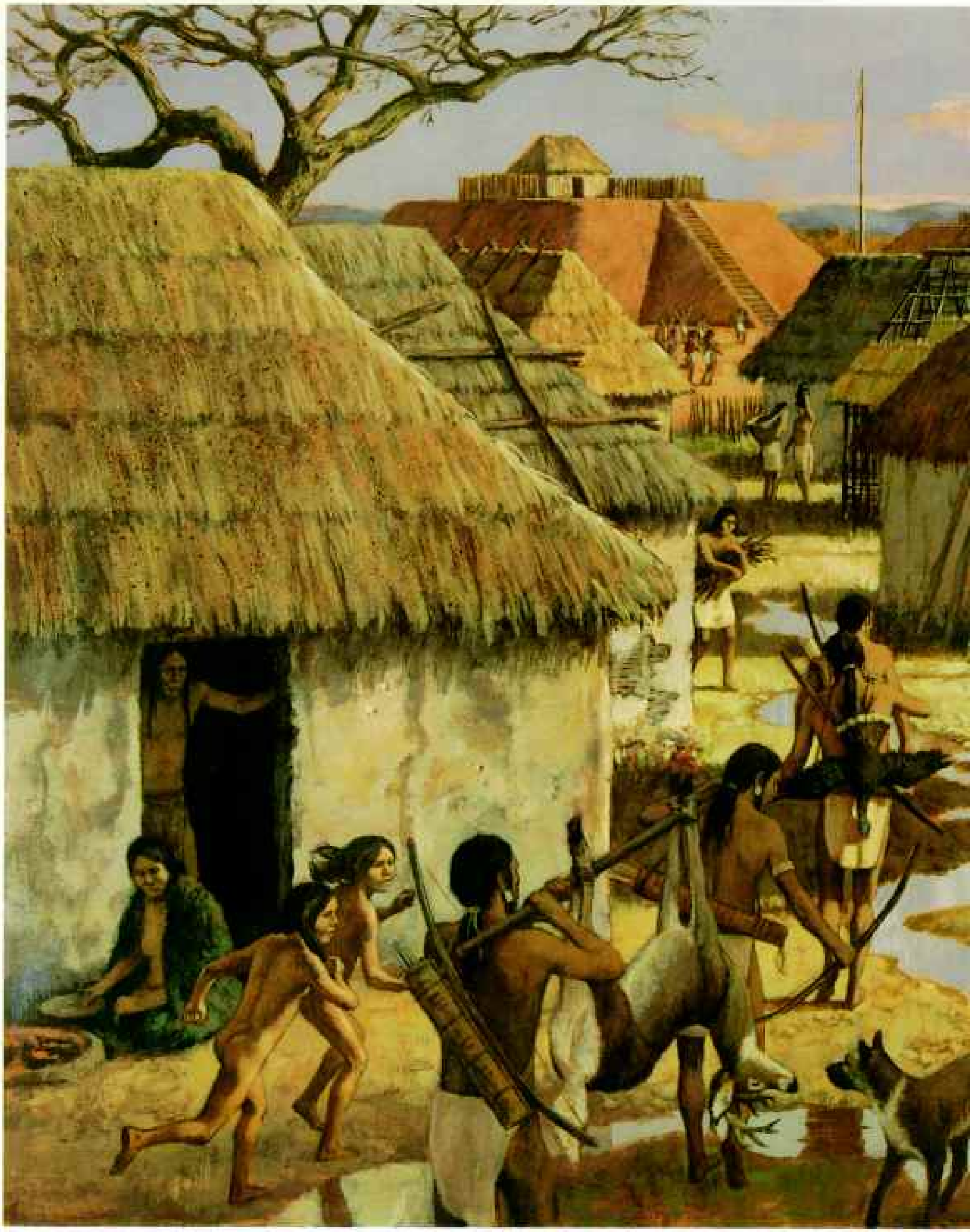
SENIOR ASSISTANT EDITOR

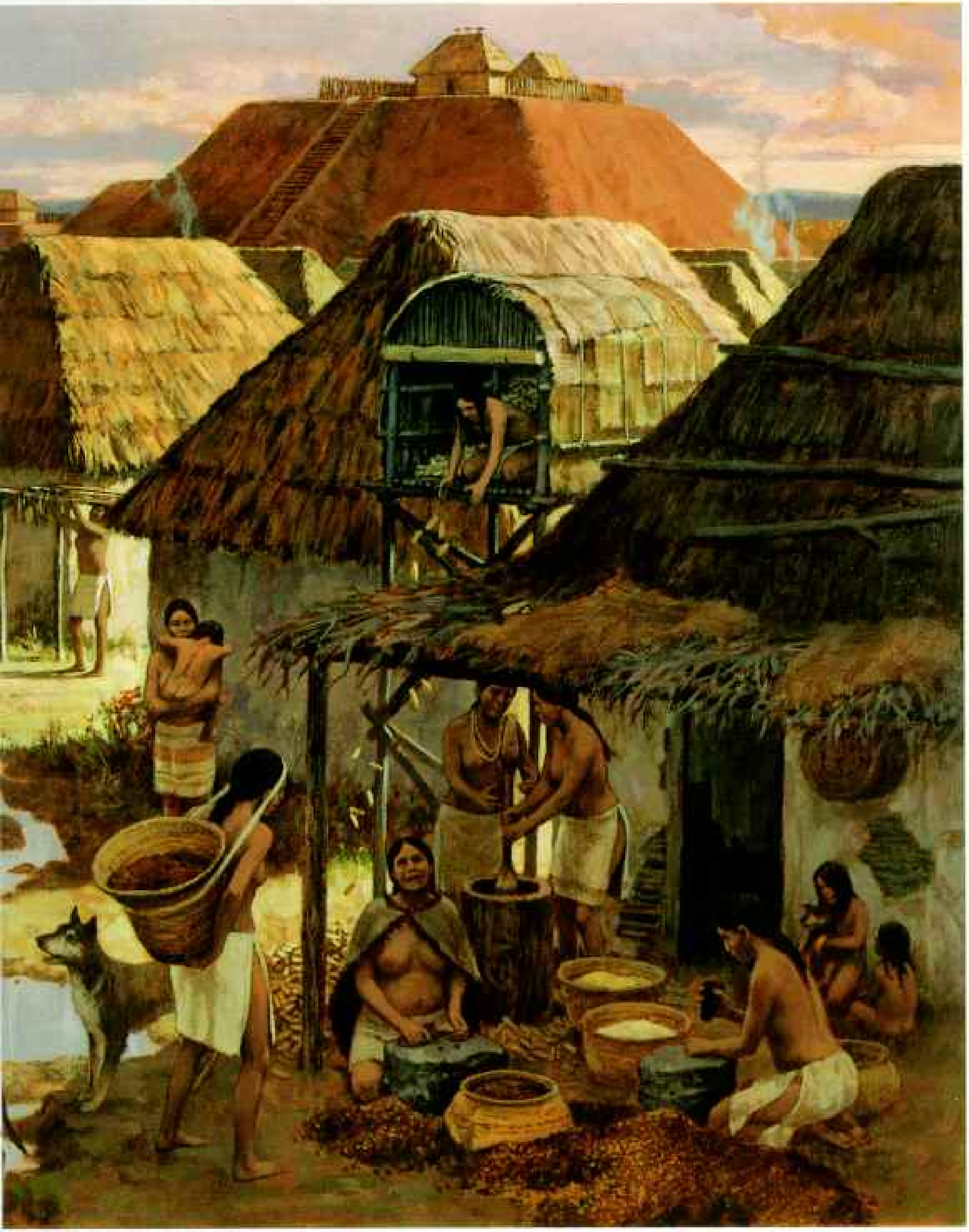
PHOTOGRAPHS BY LYNN JOHNSON
BLACK STAR

PAINTINGS BY H. TOM HALL

FIRELIGHT GLOWS ON MARBLE BURIAL FIGURES WHOSE FATE FORESHADOWED THE END OF A HIGHLY ORGANIZED SOCIETY AT ITS HEIGHT 800 YEARS AGO.
ALL ARTIFACTS FROM GEORGIA DEPARTMENT OF NATURAL RESOURCES



Winter's approach quickens the pace of daily life at Etowah, as villagers gather and store autumn's game and grain. Dogs yap as hunters return from nearby woodlands shouldering white-tailed deer and wild turkey. Laughter and singing rise above the dull thump of wooden pestles on mortars, as women pound corn stored in elevated bins into meal and grind basketfuls



of acorns on flat-topped boulders. Inside wattle-and-daub houses cooking fires send smoke and the aroma of roasting venison through thatched roofs. Wafting on the afternoon air, the pungent wisps curl up toward sacred mounds, where, high above the bustle of activity, a class of priests and chiefs rules with pomp and ceremonial majesty.

Part of the Southeast's Mississippian culture, characterized by a reliance on agriculture and the construction of platform mounds, Etowah became a major ceremonial center by A.D. 1200, comprising temples, plazas, a town, and a defensive palisade.

mystery of these people remained as dense as the morning fog that often rolls off the Etowah River to cover the site.

In the weeks after our discovery we painstakingly excavated and recorded the entire burial unit, which we labeled Burial 15. The ear belonged to a two-foot-high painted marble statue of a woman (page 55, at left). She wore an inexplicable backpack-like object apparently tied to a topknot of hair and sat, hands on knees, on the floor near one end of a ten-foot-long crypt with log walls and ceiling. Another surprise came as our trowels clicked against more stone—another statue, marble, male, and broken. Following the floor line to the opposite end of the crypt, we exposed scattered beads and other ornaments and the remains of four dismembered bodies.

The discoveries accumulated over five summers, from 1954 through 1958, as Lew and his crew systematically peeled away the mound's lower portions. We documented each layer of ancient tombs and staircase ramps, each pattern of dark stains that revealed the positions of wooden buildings and pole stockades. We found more than 200 burials—of men, women, and small children.

In one crypt containing an adult male lay a matched pair of copper-covered wooden disks rimmed with seed pearls, once attached to the

PAINTING BY RICHARD SCHLECHT

Attended to like gods, members of Etowah's elite class prepare for a ceremony by donning the trappings of rank and power. Ocher and other pigments ground on stone palettes emblazon their bodies. Pearl and shell bands embellish arms and legs. Feather capes and headdresses with embossed copper plaques complete their transformation into emblems of political and spiritual leadership.

ear lobes by wooden pins. Two large flat beads, also covered with copper and set with tiny pearls, had evidently been threaded onto his hair, creating the distinctive "beaded forelock" of the Southeast warrior elite.

I still remember vividly the opening of Burial 20, which held another male. He wore a heavy necklace of solid shell beads the size of golf balls. From it hung a slender foot-long pendant crafted from a whole conch shell. Wide bands of shell beadwork encircled his wrists and upper arms. Around his head lay more insignia of the highest status—among them copper-covered wooden coils fastened to a plate of sheet copper cut and embossed in the image of an open bird's wing to form an imposing headdress. Across his chest lay a splendid ceremonial ax, its blade and handle carefully wrought from a single piece of greenstone. The weapon, much too delicate for practical use, served as an emblem of power.

In death, as he must have in life, the man evoked both awe and respect. From the very beginning we referred to him simply as Eagle Warrior—for birds of prey were a favorite motif on the artifacts we found. We would encounter more Etowans—a boy possibly felled by an abscessed tooth, whose remains lay on a blanket of pearls; a child accompanied by miniature versions of a copper plate and other adult trappings of high status; and a multiple burial—perhaps retainers watching over a dead master or warriors killed in battle. There was also a woman adorned with a beaded collar and an elaborate mica headdress.

Even an archaeologist must pause to wonder about the lives of such individuals: Did they know more joy or sorrow? How did they see their place in the world? They cannot speak to us, for they possessed no written language. So answers must come from archaeology, from the accounts of early Spanish and other European explorers, and from the incredibly rich oral traditions of the Creek and other Southeast Indians.

Lewis Larson believes that the main period

of occupation at Etowah began around A.D. 1200 and that the town reached its peak with as many as 3,000 people at the end of the 1400s. Tradition holds that their forebears arrived in this part of the great southeastern forest from the west. With a kindly climate, an abundance of game, and high agricultural yields, their numbers increased. In time the population coalesced into large communities. Lew's studies show that those who chose the site of Etowah acted with great wisdom.

The fine sandy loam was eminently suitable for hoe cultivation; its fertility was renewed periodically by the river's floods. Most of the year was free of crop-killing frost. River shoals at the site abounded with freshwater mussels, fish, and turtles. Nearby forested hills formed perfect ranging ground for white-tailed deer and smaller animals.

South and east of Etowah lay the Piedmont, holding a mineral treasury: galena, graphite, and an array of ochers to provide pigment for painting buildings, bodies, and works of art; greenstone and marble to furnish raw material for tools, weapons, and ritual objects. From the Cumberland Plateau and the Blue Ridge, only two days away by foot, came mica, pure copper, and other exotic materials.

Careful excavation revealed much of the outline of the town that grew here: the sweeping defensive stockade, the clusters of houses, the location of the plazas where dances and other ceremonies were held. But three great mounds dominate the site today as in the past. The largest holds over a million basketloads of earth and rises as high as a six-story building. The burial mound, excavated by Lew, and a companion mound, almost identical, stand nearby.

What was the meaning of these mounds? According to anthropologist Vernon James Knight of the University of Alabama, they served as "earth islands"—physical metaphors for the sacred landscape of mountains, caves, hills, and other world symbols so intimately tied to the beliefs of these people. In one Creek account, mounds invoke supernatural assistance and protection, and their

Sharp talons and a crossed circle that signifies the four corners of the universe adorn a pendant resting on a copper ornament (top), while a mythological figure with antlers and feathers decorates a shell gorget. Such ornaments and their powerful symbols lent meaning and drama to rituals at Etowah.

summits are places for the rites of purification preceding battle, when the "black drink," the emetic tea of the *Ilex vomitoria*, is taken by warriors from conch-shell cups.

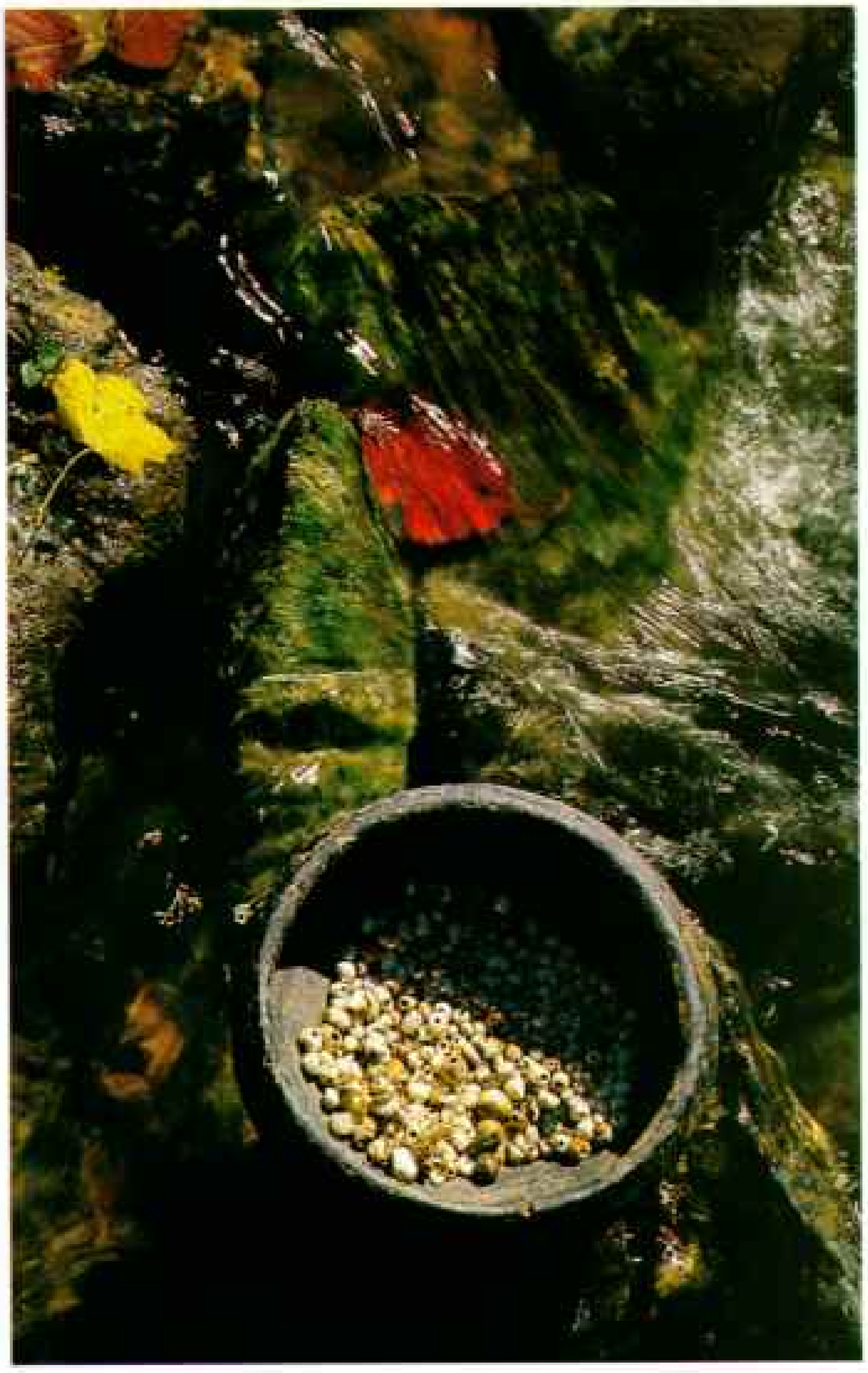
In another myth Creek warriors, concealed inside a hollow mound for purification, "poured up from the bowels of the earth" to defeat attacking Cherokee. The Mississippi Choctaw tell of a great platform mound called Nanih Waiya, or "slanting hill," which they regard as the Great Mother of the tribe. At its center the Great Spirit created the first Choctaw, and they crawled forth into the light of day.

Such oral traditions illuminate the world view of the ancient Etowans. The forest and its animals figure prominently. One fable links the eternal sequence of day and night to the striped tail of Raccoon. A creation myth tells how Crawfish piled mud above the primordial water; then came Buzzard, who dried it with his soaring wings. Then, tired, he flapped his wings, making hills and valleys.

Those early people organized themselves in clans, extended family groups. One tradition says that when the people came to know anything of themselves, "it was to find that they had been for a long series of generations completely buried . . . in a dense fog."

As they searched for food, the people became separated. Each group was aware of the existence and location of its neighbors only by calling to them through the fog.

Then: "After a great while there arose a wind from the east that gradually drove the fog from the land. The group of people who



first saw clearly the land and the various objects of nature . . . were given the name of the Wind clan." As other clans emerged, each took the name of the first animal it saw—the Bear clan, the Bird clan, the Panther clan.

Among the Etowah River's many offerings, pearls from freshwater mussels, made into beads (above), graced the bodies of the elite. The river also provided drinking water, transportation, recreation, a defensive barrier for the village, and, through periodic flooding, replenishment of soils. Rock weirs for penning and channeling fish (left) helped assure the community a reliable supply of drum, gar, and catfish, which were trapped inside split white-oak baskets.

ON A RECENT AUTUMN visit to Etowah, I found the site again wrapped in morning fog. Only the tallest mound rose above it. I climbed to the summit and, as the sun burned off the fog, played a mental game I often do at ancient places. I tried to envision the town as it was at its height 500 years ago.

I could almost smell the acrid wood smoke from hundreds of cooking fires. Cool air seemed to carry the barking of dogs, the clicks and thumps of firewood cutting, and

many voices. Would Eagle Warrior have stood here often? Surely. As a member of Etowah's elite, he would have come to the lodges here, perhaps even lived on this acre-size summit, where the activities of the town could be observed.

NATURE'S CYCLE determined what there was to see. In July came the four-day Green Corn Ceremony, the new-year celebration of fertility and renewal. Pavilion walls and colonnade poles were freshly repainted in red and white, the colors of war and peace. Groups of men and boys swept the square and tamped new mantles of earth to restore the mounds themselves.

Fasting and purification preceded the lighting of the new living fire, fueled by brambles, four huge logs, and small ears of green corn.

The stomp dances in the plaza took place under the direction of managers, who supervised every move. During night dances the new living fire reflected off dozens of copper headdress plates and weapons wielded by Eagle Warrior and the other costumed bird and animal impersonators. Their movements followed the rhythmic beat of drums made of hollowed logs and large pottery vessels covered tightly with deerskins, the low tones of cane flutes, the shrill wail of bird-bone whistles, the staccato rasp of rattles made of polished gourd and tortoise shell.

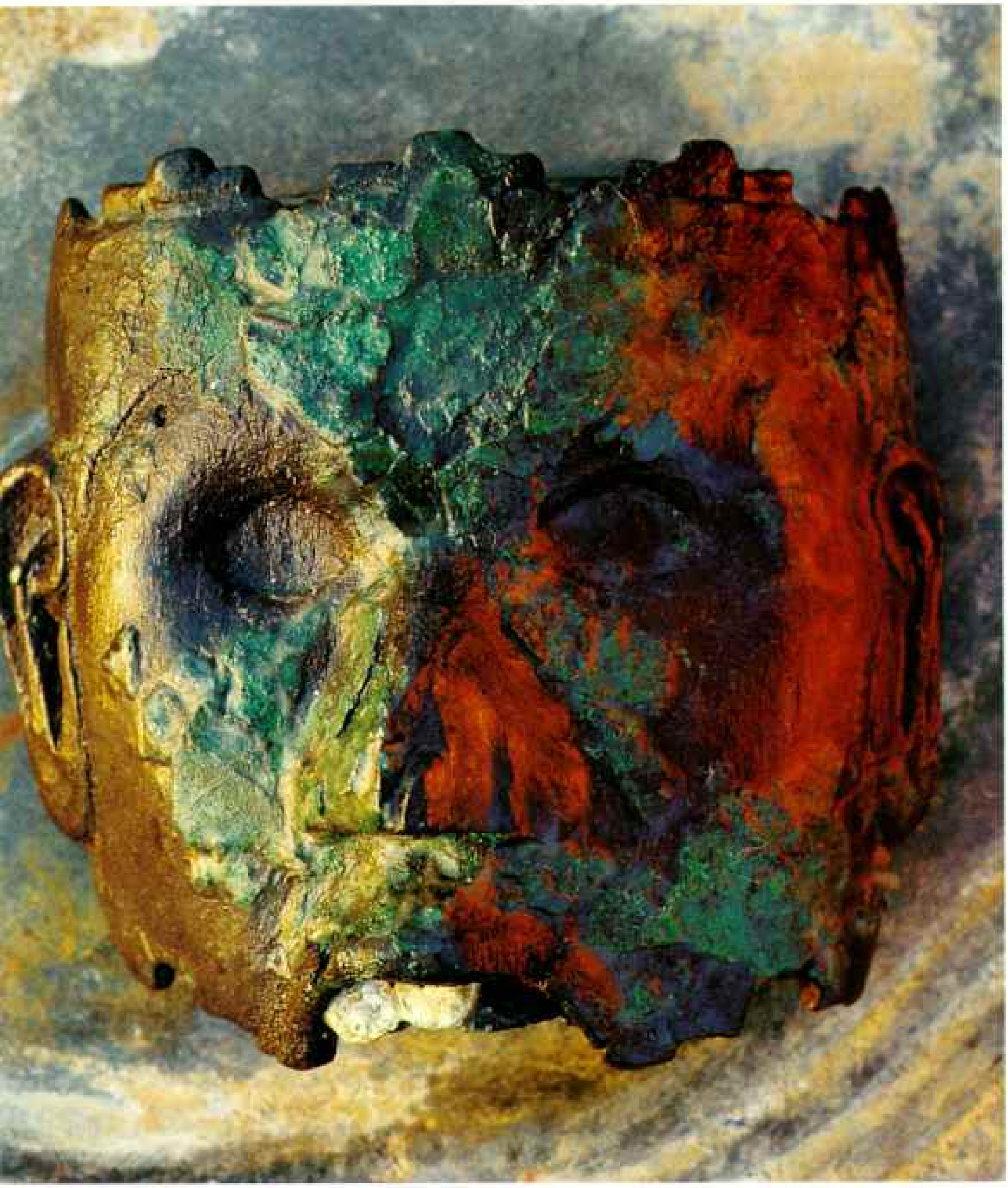
In October came Big Chestnut Month, three lunar periods into the new year. This was the time to harvest the dried corn and gather fallen acorns. Soon the wild turkeys would emerge from the forests to feed on nettles in the clearings, a signal for the hunters to leave with their families for the biggest of the annual food quests.

The last of the hunters would not return till spring, when the mussel-shell blades of hoes would break the valley soil for planting corn.

Spring was also a time for fighting. War was endemic, as attested by the great palisade of tree trunks the size of telephone poles. This was a bountiful region, but some groups always had more than others. Ancient enmities, a quarrel over land, the need to avenge injuries, all could lead to conflict.

The warriors went into battle almost naked, their faces and upper bodies painted red and black. Each man carried a war club, knife, and bow and arrows. One early Spanish expedition found such fighters to be "warlike and nimble. . . . Before a Christian can make a single shot [with crossbow or harquebus] . . . an Indian will discharge three or four arrows; and he seldom misses of his object."

After a successful campaign there would be festivities; newly bloodied young men would strut. Older men such as Eagle Warrior



would count the gains, the losses. Trophies of war, including the severed heads of enemies, would be placed on wooden poles as year-long reminders of victory.

And what about the boy found with the pearls? He would have lived with the elite in a house raised above others, on a low mound. By day he would have gone down to the river to catch turtles and collect mussels. He would

Resting on a stone palette, a rattle in the form of a human head with shell teeth stares vacantly. Carved from wood and covered with a thin copper sheet, this hand-size pebble-filled ornament shaken by a dancer during rituals may represent the head of a supernatural being.

have played chunkey, hurling stick "spears" at a rolling wooden disk. Men played it too, both for sport and as a display of prowess.

At night, when the stars hung low and fires flickered, he would have listened to favorite stories about Owl and Turkey, Panther and Rattlesnake, Opossum and Skunk. And, above all, about Rabbit, the trickster. Once Rabbit swam into a pond with a cord attached to him. Submerging, he tied the cord to the legs of the ducks resting there. When he surfaced, the ducks flew off—taking him with them. Fortunately they flew over Rabbit's grandmother, who was rubbing a pot smooth. He called to her. She threw the pot over him, and it cut the string so that he fell down. Rabbit had escaped again! There would have been laughter, and it was easy to sleep after such stories.

And then one day the boy awoke with an aching jaw, the abscess. None of the known cures—medicinal forest plants or sacred rites—could stop it.

I WANDERED OVER to the burial mound. This site had served the Etowans from the beginning. After filling each series of slab- or log-lined tombs in the temple floor and around the base of the mound, they added more dirt to the top and sides. Thus the mound grew through the decades—each successive summit becoming the platform for a new mortuary temple.

I imagined myself in the past in late afternoon. The house of the dead begins to shade the plaza below. The odor of death mingles with wood smoke.

The half-light inside the temple reveals a wooden shelf; on it painted statues of wood and stone portray dead ancestors seated on folded legs, hands on knees, eyes staring, and mouths open. Age-darkened basketry chests hold pearls, sacred copper plates, slate paint palettes, and other objects of high ritual power. From the rafters of the temple hang strands of pearls, colored headdresses of dyed turkey feathers, pendants of copper and shell.

Corpses of the recently dead lie on litters of cedar. Clan members and kin have meticulously painted the faces, placed necklaces, and dressed the bodies in robes of feathers and fur. Copper plates, wooden coils, and other headdress items of mica, wood, and feathers have been fastened to the heads.

When it comes time for interment, relatives gather at the base of the mound for the mourning. Bearers shoulder the heavy litters with the corpses and carry them in solemn procession down the stairway to new log-lined crypts at the base of the mound.

Such a scenario was repeated year after year. But Burial 15, where we uncovered the marble statues and the body parts, was different. Lewis Larson's evidence shows that it marks the last use of the burial mound.

The marble statues had been carried from the temple down to the tomb; the female statue was placed in it without incident. Then the 120-pound male statue slipped from the grasp of its handlers, clanked against the shoulder of the female figure, and broke. The shattering of the sacred image serves as a metaphor for the fate of Etowah.

Chaos appears to have marked the ceremony. As well as we can reconstruct events, this burial coincided with the final emptying of the mortuary temple. Pendants, pearls, and other sacred objects lay all along the log stairway between the temple and the tomb, seemingly scattered in haste. We can only speculate on the reason: Perhaps the Etowans had lost a war and were fleeing, or perhaps disease had struck.

In any case, the ceremonial cycle was broken; never again would the Etowans use or renew this mound. Some would continue to live at the town site for perhaps two more centuries. In that time the mounds would gradually degrade, losing their symmetry.

My last visit to Etowah ended at sunset, when the long shadow of the largest mound darkened what had been the ancient plaza. Hard facts about life here in 1491, I mused, are as elusive as Rabbit, the mythical prankster. But we do know that five centuries ago Etowah was but one of many such places in the region, larger than most, perhaps, but alike in terms of human accomplishments and human stories.

The seeds of true disaster came in the succeeding generation, when the wooden ships of strangers appeared on the distant eastern water. I thought of all that has happened since to the original inhabitants of America, including the forced removal of the southeastern Indians from their ancestral lands to the more arid and alien West. Perhaps the most profound message of these deserted mounds by the Etowah River is their enduring witness to the human spirit. □

Accident turned to ominous incident when villagers dropped and broke a male effigy statue during a burial ceremony. Etowah's burial mound was then abandoned. When a white man first reported seeing the mounds, in 1818, even his Cherokee guides had no idea of their origin, saying only: "They were never put up by our people."

We return thanks to our mother, the earth, which sustains us. . . .
to the wind, which, moving the air, has banished diseases. . . .
to our grandfather He-no, that he has protected his grandchildren . . .
and has given to us his rain. . . . to the sun, that he has looked upon the earth with a beneficent eye. —IROQUOIS PRAYER OF THANKSGIVING

A MOHAWK VILLAGE IN 1491

It is wintertime in the big longhouse of the Turtle clan. Not far away the waters of New York's Mohawk River flow beneath the ice. You can count more women and children in the village than young men, for it is not the Mid-winter Festival, or the time to "thank the strawberry," or the Green Corn Thanksgiving. Many men are out, ranging far to hunt and trap and trade.

This village at Otstungo is sited on a neck of land whose walls of shale fall away to a creek on three sides. A trench and a stockade protect the landward entrance. The 50 or so inhabitants of each of the dozen closely packed long-houses are not afraid. True, in 1491 enemies might still lurk about. But the women of the three Mohawk clans—Turtle, Bear, and Wolf—are able-bodied and self-reliant. The life of the village revolves around its women. So does the political life of the Mohawk people—or as they call themselves, Ganiengehaka, "the people of flint," or simply Onkweh-Onweh, "real human beings." For among the 3,000 people at Otstungo and several other Mohawk villages in a 20-mile strip along the valley, the women are the ones who choose from their clans the men who will represent their nation in meetings at Onondaga with chiefs of the four other Iroquois nations.

When a man of the Turtle clan marries, he must come to live with his wife's family, either of the Bear or the Wolf clan. No one may marry someone from his own clan. Within the longhouse the word for "mother" means all women of the same age group. The Turtle, Bear, and Wolf clans are also found among the four sister nations. Whenever a Mohawk man travels to the Oneida, Onon-daga, Cayuga, or Seneca, he can, in principle, go to the longhouse of his clan and be welcomed as a brother. Thus the network of clans links longhouse to longhouse, fostering family relationships that strengthen the peace and keep one clan or one nation from dominating the others; you will always have rela-tives in other clans. The network also fosters trade.

BY JOSEPH BRUCHAC

PHOTOGRAPHS BY LYNN JOHNSON
BLACK STAR

PAINTINGS BY JACK UNRUH

FEATURES STILL PROUD AFTER 500 YEARS, A CLAY EFFIGY PIPE FOUND AT OTSTUNGO RESTS IN MOSSES NOW COVERING THE SITE.
STATE UNIVERSITY OF NEW YORK, ALBANY

THE TURTLE CLAN LONGHOUSE in Otstungo, more than 120 feet long and 20 feet wide, with six central hearths, is home to 12 families. The women do not have many children, usually three. Infant mortality is far lower than in Europe—where childhood diseases yet unknown in America take a dread toll—and nutrition is excellent. Maize, the Indian corn, is a food close to ideal for both young and old. The women, valuing their freedom, would not like to be tied down with more children than they, with the help of other clanswomen, can conveniently care for. So they practice abstinence while nursing and take medicinal birth-control herbs.

Family compartments line the longhouse walls. A blanket of skins may be drawn across the front, though the fire's warmth is preferred to privacy when the winds are cold. Beneath the elevated sleeping benches one places personal items one does not wish to share—a tool, pouch of medicine, a special clay pipe. No one, not even the smallest child, will disturb them.

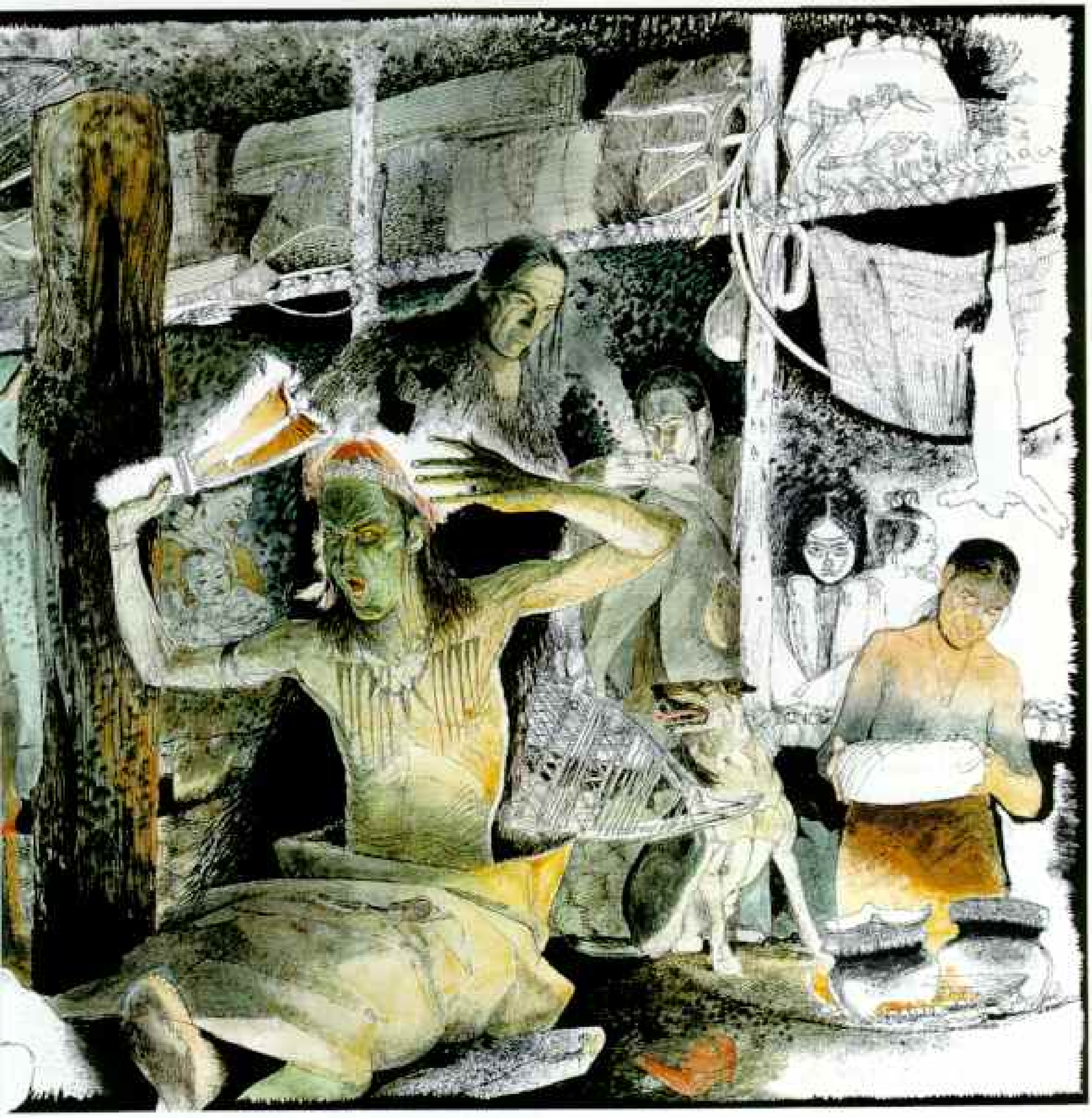
Over the sleeping berths hang storage racks and long strings of dried corn and crescents of dried squash. On shallow soil, this longhouse has no storage pits dug into the floor to hold corn, though such granaries are commonly found in other Iroquois villages. This year's harvest was good, and deer the hunters will bring in will supplement the diet and also provide the primary source of clothing. The number of deer is as much a limiting factor to village growth as the number of acres that can be planted. The forest, fields, and population maintain a delicate balance.

The beams that hold up the longhouse are only a little bigger than a large man's calf. Peeled and sunk into the earth, they will last many seasons. Over the framework of poles overlapping shingles of elm bark are lashed to keep out wind and wet.

The five united Iroquois nations will see their league itself as a great longhouse—with the Mohawk as Keepers of the Eastern Door and the Seneca as Keepers of the Western Door. When a people is brought into this league, voluntarily or by force, "the rafters are extended." No Native American nation will stand successfully against the People of the Longhouse, whose clan links and sophisticated governing style enable them quickly to field a large, united body of warriors.

Not until the 1600s will a strong enemy threaten the Iroquois and lead them to seek shelter behind higher and stronger walls and pack more warriors behind their palisades. That new enemy—the French—will come from Canada with gunpowder and shot to breach those walls and destroy a number of Iroquois towns in bitter warfare.

But that European type of warfare in which many die in battle is still distant. In native warfare, few on either side die in an average skirmish. A good war leader brings his men home unharmed along with captives. If a captive is too badly injured to recover and be useful, he is tortured to death in



revenge for a death in the clan. If sound of body and willing, he may be offered adoption as a full member of the tribal nation.

In this village there are several such men. Two moons past, before deep snows discouraged travel, three captives were brought back from a raid on an Algonquin village whose young men struck here several seasons ago, killing one man and capturing another. The captives were able-bodied; women of the three clans adopted them. One was taken by the same Bear-clan woman who had lost a son in that Algonquin raid. She gave him the name of her lost son. The young man went with her, knowing he would be treated as a

Fires of hearth and imagination light the inside of a longhouse in Otstungo as a tattooed storyteller enlivens his tale with a turkey-feather fan. Elsewhere in the house, home to 12 families sharing six hearths, others stow household goods or cook while they listen. The longhouse serves as a studio for an artist carving an effigy pole and as a storehouse for bundled corn hanging from the rafters.

Like giant overturned canoes, Otstungo's longhouses cluster by a creek. This Mohawk village is one of many such sites (map) found in the northern domain of the Iroquois people, including the Mohawk, Seneca, Oneida, Onondaga, and Cayuga.

son. He can be seen sitting in front of the fire in her section of the longhouse, his new brothers laughing as they help him learn to speak their language as a real human being speaks. After adoption, there is no thought of resistance or escape. It would be better to die than to break this sacred bond.

In contrast, two centuries from now a Frenchman will be adopted in the same way but will flee from his captors after more than a year as an Indian. His two Indian "sisters" will follow him to Fort Orange (later the city of Albany) and walk the streets weeping and calling out for their lost brother. They will return to their village in confusion, not understanding how lightly a non-Indian can take the bonds of adoption.

THE GREAT LEAGUE BEGAN, Iroquois tradition explains, with the coming of the Peacemaker. He was a human messenger sent by Tharonhiawakon, the Creator, at a time when the Five Nations were engaged in blood feuds—cousin killing cousin—worse than the man-eating monsters in stories. The Peacemaker joined forces with a woman named Tsikonsaseh, an elder who always tried to counsel her people toward peace, and the man Aiontwatha, known to later generations as Hiawatha. Together they

PAINTING BY RICHARD SCHLECHT

Beneath a harvest moon, women and girls gather corn amid tree stumps, left after the men set fires to clear the fields. Master horticulturists, the Iroquois planted the mutually sustaining Three Sister crops—corn, squash, and beans. Besides harvesting, women also tilled fields using hoes made of wood and antler. As land lost fertility, the village would change location, taking its name with it.

went from nation to nation, bearing the Creator's message of peace.

The greatest enemy of peace was the Onondaga leader Atotarhoh. So twisted was his mind toward evil that snakes grew from his hair, and his body was bent in seven places. His magic was so great that they could not approach him until a Hymn of Peace was composed for them to sing as they came close. Hypnotized by the song, Atotarhoh sat still while Hiawatha (Aiontwatha means "he who combs") combed the snakes from his hair. They then straightened Atotarhoh's body and set him up as one of the Peace Chiefs.

Because of his power, now transformed from evil to good, he was made the head of the league. And under Atotarhoh, the Longhouse of the Five Nations grew strong.

NOW, AS THE DARKNESS and cold deepen at Otstungo, the fires at the center of the Turtle-clan longhouse seem warmer and more inviting. It is especially so this evening, for the clan has a respected visitor. He is a Rakarota, a master storyteller.

Today he has walked ten miles from a place toward the sunrise, the Village of the Quartz Crystals (the Herkimer "diamonds" for which this valley will be famed). He brushes the snow from his clothing as he stands before the southeast door and calls to the people within the lodge.

"Come in," calls the clan mother. The people greet him by name, give him corn soup and pine-needle tea and a place close to the fire. With the tobacco they offer him, he fills his pipe, a pipe made from the local clay and given him when he visited here five winters past. Its bowl depicts a face seen in a dream, a face that looks at him as he lights his pipe. He takes a few puffs, then looks around. The longhouse is filled, including dwellers from the other longhouses. The Rakarota's right eye twitches—a good omen.

"Onen tsi ne'i nakkara," he says. "This is my story. Do you wish to hear it told?" He holds up the pipe in the gesture of one long practiced at commanding attention.

As one, the people answer, "Yes! Tell us your story." And he begins the oldest of tales.

The woman in Skyland dreamed that the great sky tree must be uprooted. She was expecting a child, and her dream was strong. So her husband, the Skyland chief, had the tree uprooted. The woman looked through the hole left by its roots and saw the earth far below—unlike the earth of today, for there was no land, only water. As she looked in wonder, she slipped. She clutched at a tree branch that lay near the hole but only stripped away a handful of seeds . . . and fell.

The storyteller pauses. "Are you awake and listening?" he asks.

"Yes!" all answer, and he continues.

Animals and birds of the water looked up and saw the woman falling. "Someone comes," they said. "We must help her."

The geese flew up and caught her between their wings. The other birds and animals, seeing she needed a place to stand, dived down to bring up earth from the bottom. All failed till the muskrat tried. The Great Turtle offered its back as a place to spread the earth the muskrat brought up. The woman from the sky stepped onto this new moist earth and dropped the seeds from the sky tree into her footprints. From these seeds grew the first plants. And when her child was born—first on the new earth—that child was a girl, a girl who would marry the west wind. . . .

It is a strong, good story. The old women nod as they listen, for it speaks of the way

things began and continue and emphasizes the central role of women. The women are the ones who foster life, as when the Society of Women Planters nurtures the corn, beans, and squash—the Three Sisters who sustain human life.

His tale finished, the Rakarota looks around. No sleep weighs down eyelids yet. He tells another story, and another, until finally there is no answer to his question, "Do you want to hear a story?"

AROUND the fire pit small, long logs radiate in a circle. He pushes enough of them in so that the fire will burn strongly through the night, warming him as the wind whistles outside and snowflakes drift down through the smoke hole. As he leans back, he presses on his forgotten pipe and it breaks. He sighs. It was a good pipe, but it lasted more seasons than expected. And when word goes around that the storyteller needs a new one. . . . He smiles at the thought of the new pipe and leaves the broken one lying in a small depression in the longhouse floor. In the morning he intends to toss it over the cliff edge into the midden, with its broken pots, mussel shells, and other refuse. Somehow, the pipe is not picked up. Earth is brushed over it, and it remains there until a day, five centuries hence, when it again will see the light.

It is spring, and the early morning sun creeps into the Bear-clan longhouse. The girl called Katsitsaroroks, "gathering flowers," wakes as her younger brother tickles her nose with grass. "Were you gathering flowers in your sleep?" he laughs. "Or perhaps you do not want to go with the Society of Women Planters today?"

Katsi sits up quickly. As she pulls on her moccasins, she recalls words spoken the morning before when Satekariwadeh, the "even tempered," began the Planting Thanksgiving Ceremony:

Tharonhiawakon, Holder of the Heavens, hear the words of the people here assembled. The smoke of tobacco rises. Give attention to our words as they rise to you in this smoke. We thank you for the return of this season of planting. Grant us a good season so that our harvest will be great. . . .

After the morning meal by the central fire, the women fill their aprons of twined and woven fiber with seed corn. These seeds, only the fattest and best-shaped kernels taken from the center of the ears, have been soaking the past several days in herbal teas that only the women know how to mix, potions that soften the kernels and keep away crows and insects.

When they step outside, Katsi's favorite Little Mother, her mother's younger sister who is only a little older than Katsi's own nine winters, hands her a seed container of bark. Katsi is to carry the spirit of Onenhste, the Corn Maiden, the eldest of the Three Sisters. Only the women are entrusted with the corn, for plants are female and thus responsive to the powers of women.

BROWN COLLECTION

A crooked man is set straight in the Mohawk legend of Atotaroh—a snake-haired, physically twisted leader so evil that he made birds fall from the sky. Calmed by a Hymn of Peace, his hair combed free of snakes by Hiawatha, he became head of the Five Nations. "That is how we do it today," says an Onondaga chief. "We take the worst ones and make them leaders so that energy can be transformed into doing good." Dual faces on a comb fragment (above) represent good and evil, a favorite Iroquois theme.

As Katsi walks along the path, she notices that the leaves on the oak trees are now the size of a squirrel's ear, a confirming sign that it is time to plant. Around her the Society of Women Planters sings praise to the fruits of the earth. She adds her small voice to the chorus of 40 women, young and old.

Soon they see the fields spread below them, punctuated by blackened spars. Those trees, girdled by the men the past spring, were scorched when the brush was fired in the fall, the ashes providing nutrients for the soil. When fertility wanes after many seasons, other fields must be cleared, farther and farther away, until the time comes to move again.

Katsi looks with pride at the rows of hills, each twice the length of a man's foot and as high as a man's calf, three feet apart. Those hills remain year after year, the corn stalks buried back into them at the end of each harvest. That organic matter improves the tilth of the soil, allowing air and water to move through it more easily.

THE WOMEN place seven seeds carefully in the top of each hill. They plant two long rows in the field that belongs to one longhouse and then move on to plant two rows in another field. The work goes quickly, the women talking and joking. Only when each field has some rows planted will they return to the first field. Thus no one feels her field has been favored, and the harvest will be staggered.

Later in the season the women will sow beans and squash around the hills. The Bean Sister will twine up about the stalks of the Corn Maiden, and the Squash Sister will spread across the soil, choking out weeds and shading the earth to keep it moist.

Through the summer boys will camp near the fields to drive away birds and animals. In the fall Katsi will return with the women for the harvest. Older men will come along to tell jokes and help with the husking, pulling the husks down so that the ears can be braided together. These wide braids of corn, along with squash cut in circles, will be strung to dry from the longhouse rafters. Beans and dried corn kernels will be placed in elm-bark containers or buried in lined granaries, ending another season of the Three Sisters.

An early snow has whitened the woods. The boy, whom friends have nicknamed Okwaho, "wolf," moves cautiously to make little noise. The snow is light, the sort his uncles call "tracking snow," and it is easy to see the deer paths. Deer are creatures of habit—as men are. Okwaho smiles as he thinks of the midsummer day when he sat next to a trail from sunrise to sunset, the wind in his face. He saw the same doe and her twin fawns three times, as she followed her route to her feeding ground, then down to the river to drink, then back to her feeding ground again. He had his bow and arrows but did not use them. He remembered well what his father and uncles stressed: One must not kill a mother animal when she is still caring for her young ones.

"We are like our brothers, the wolves," his uncle said. "We hunt the deer, but we do not wipe them out. If there are too many, they will starve. If we hunt them in the right way, the Deer People will be stronger and their children's children will survive to support our own children to come."

Okwaho stops. The trail, climbing toward a high ridge, swings to the east. If he follows it, the wind will carry his scent toward the deer he is tracking. Without seeing it, he knows his quarry: a buck with several winters and much meat on it. He can tell this by the size and depth of its tracks, and the way the snow still falls from the edges of the track shows that it is not far ahead.

The buck knows how to catch the scent of anyone following; it will half-circle ahead to look back on the trail below. So Okwaho leaves the trail to make a large half circle, one that will come out above where the buck is waiting. Now, as he walks, he clears his mind, for a deer may hear a hunter's thoughts if they are on the deer. Soon Okwaho looks down on the trail. Just out of bow range, the deer stands, looking back along the trail, alert to any sound below.

The boy waits until the deer turns and begins to come up the trail again. Softly he asks the deer to forgive him, notches his arrow, and draws the string. He hears the deer's feet shuffling the snow, the whuff of the deer's breath. As the buck passes below, Okwaho lets out his breath and looses the chert-tipped arrow. It dives straight and true into the middle of the deer's side, just behind its front leg. The deer leaps high and bounds downhill into the brush.

Okwaho slides down the slope. The blood in the snow is light-colored and has bubbles

in it. His arrow has struck through the lungs into the heart! Walking down the hill and crossing a small ridge, he finds the deer dead. Okwaho kneels and places his hand on it.

"Brother," he says, "thank you for giving your life to me and to my people so that we may survive. We will use you well." With a sharp-edged, dark chert blade he cuts open the deer's belly and spreads the entrails on the snow.

"Little brothers of the forest," Okwaho says, "I share this with you." He remembers the story his grandmother told of Red Hand, the good hunter who was slain by enemies but brought back to life by the forest animals because he always respected them and shared the game he killed. Okwaho places the heart and liver in his pouch; when he has walked halfway home, he will make a small fire and cook them. Then he loops a rawhide thong around the deer's antlers. Too heavy to carry, the buck will be easy to drag. No need to fashion a sled of bark, for the snow is not that deep.

The sun is only a hand's width from the western edge of the sky when Okwaho sees the stockade. It is not guarded now. Most of the men are home, for it will soon be the Midwinter Festival. In another moon they will be gone, hunting on snowshoes after moose farther north, and once more sentinels will be placed from among older men and boys like Okwaho who have less than 12 winters. Such boys hunt closer to the village while the men range farther, thereby avoiding extinction of animals in their own area and teaching the boys vital skills.

Okwaho hefts the deer onto his shoulders. He will not leave it at the forest edge and ask his mother or his sisters to bring it in, thus reserving it for their longhouse; he will carry it proudly into the village. It is the first deer he has killed alone, and it is right that it should be a gift for all.

As he carries the buck, he thinks of how he has followed the traditional procedures in killing his first deer. His people believe that sickness results from imbalance. A mistake in ritual practices—such as forgetting to ask the deer's spirit for forgiveness before killing it—can result in the hunter's coming down with boils or sores. Similarly, a person may fall ill because of unfulfilled wishes. Such an illness, which might take the form of deep depression, can only be cured by recognizing what it was that a person truly wanted and either obtaining it or purging it from the person's system through herbal medicine.

As Okwaho nears the entrance to the stockade, he sees his uncle Satekariwadeh leaning against the great pine tree built into the stockade wall, a symbol of the strength of his people. Satekariwadeh has been waiting for his nephew's return. Seeing the deer, he holds up

MONTGOMERY COUNTY HISTORICAL SOCIETY, NEW YORK

Collared rim and incised patterns give distinctive Iroquoian touches to potsherds excavated at Otstungo and rinsed in the nearby creek waters that once filled them. Iroquoian pots dating from a thousand years ago have been found in the Northeast.

both hands in delight. Just as Okwaho enters the village, he looks back one last time, saying a silent prayer of thanksgiving to the forest.

FIVE CENTURIES HAVE PASSED. As we walked through a dip in the meadow toward a farm pond, a blue heron flew out, its wide wings flapping in a slow beat. Looking down at my feet, I saw the late summer whiteness of thistle seeds—the same thistle that Hiawatha and the Peacemaker placed on the earth as a cushion for those who would gather in the shade of the Tree of Peace of the Iroquois League. Next to it I spied a solitary hawk feather with brown and white bands across it. As I held it, the wind rustled its breath-like edges. A hawk feather like this stood atop the cap of each chief who lived in this Mohawk village.

Walking through the woods, I saw jewelweed, balm against the sting of nettle and poison ivy, the mottled orange-and-yellow blossoms bobbing above seedpods that burst at a touch to spin out their seeds; the three-leaved raspberry; the fox grape; and on one slope above the stream that flows into the Mohawk River, the leaves of ginger. All these plants, used then and now, are honored in the traditional Prayer of Thanksgiving.

> *And this is what our Creator decided. There will be plants growing on earth and each will grow and mature according to its own season. They will come from the earth and will mature and will be available as medicines for the people who move about on this earth.*

So go words spoken here long ago, thanking in turn the people, the earth, plants, water, trees, animals, birds, the Three Sisters; the Thunderers—seen by the Iroquois as powerful beings guarding the earth from evil; the sun, moon, stars, and the Creator.

So were those words spoken in this same place when Jake Swamp, a Mohawk clan chief, came

Silent capture, swift retreat mark a raid by Abenaki Indians from the east, lying in wait for Otstungo women along a path to the creek. Despite the momentary terror of such abductions, victims —especially women—were generally welcomed as new members of the communities to which they were taken, sometimes hundreds of miles away. Most captives accepted their new roles, replacing tribe members lost to disease, nature, or battle.

recently at the invitation of Dean Snow, an archaeologist from the State University of New York (SUNY) at Albany. Snow brings Native Americans here to help him excavate in a way both scientifically sound and respectful of their ancestors.

We stroll to the point where the creek makes a graceful loop. Here, over the edge of the cliff, people would throw their trash. They kept the village grounds and longhouse aisles clean and neat —which explains why archaeologists found so few large artifacts when they excavated the longhouse. With one notable exception: the storyteller's magnificent effigy pipe.

We climb the slope, finding in the loose soil a shiny white fragment of freshwater mussel shell —one with a hole drilled in it, indicating it was worn in some fashion— as well as fingernail-size pieces of clay pots with characteristic Iroquois crisscross and parallel markings and notches.

Dean Snow remarks on how few arrowheads and lance tips he has found in the longhouse —an indication of the priorities of domestic life in the domain of women.

As I grasp a handhold, a thumb-size triangle of chert slips into my hand. I give it to doctoral student Susan Bamann.

"A Madison point," she says, smiling. The chert was quarried some distance from here. The local chert, good for larger implements, does not have the hairline fractures that break it into small pieces. Clay pipes from many sites throughout the Northeast are also silent witnesses to the wide range of trade among the people here five centuries ago.

Leaving Otstungo, I reflected on that life in 1491—not perfect, but happy on the whole, and like present-day American society in many ways. Some historians say the Iroquois League influenced the United States Constitution and in certain respects even went beyond it.

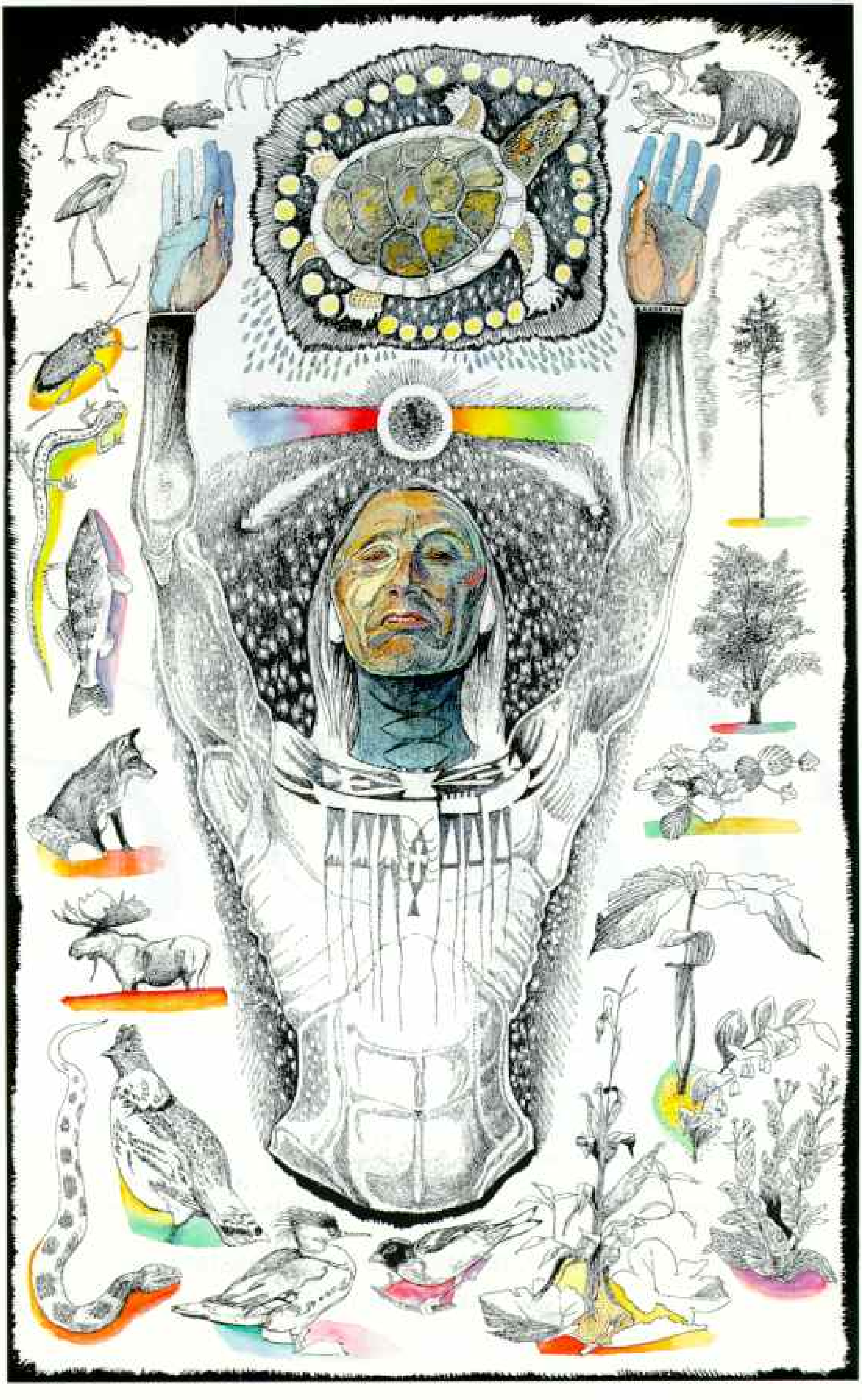
Governance was through the consent of the governed, and women played a crucial role in family, clan, and nation. Food was nutritious, and the Three Sister plants would be an inestimable gift to the newcoming Europeans. The Iroquois had few of the sicknesses that plague us, and with herbal remedies close at hand, their life expectancy was greater than Europeans of their day.

Most of all, there was balance, balance with the land, between the sexes, within the political life, in the diet, in the healing arts. Balance and the giving of thanks. Balance that transformed grief into new life, that transmuted even the worst of their people into the best of their leaders, that adopted their enemies and made them brothers. It is a balance that our modern world desperately needs to remember. It is a balance that Iroquois still speak of and, despite the pressures of modern life, that many still manage to find. And I thought again of the Mohawk words of thanksgiving:

Our Grandparents of old, they are saying, "Listen to her, all, to the Earth our Mother, to what she is saying." People, listen all. □

STATE UNIVERSITY OF NEW YORK, ALBANY

Spread on and above the back of a great turtle, all creation is embraced in the Iroquois Prayer of Thanksgiving. Oneness with nature is symbolized by animal effigies, such as a clay bird fragment from Otstungo (above), and by ritual thanks for everything in earth and sky. The prayer, so all-inclusive it can last hours, is still recited at longhouse ceremonies that keep alive the ancient faith of the Iroquois.



15TH-CENTURY WARRIOR WITH BEAR-CLAW SHIELD, NEW MEXICO

SEARCH FOR THE ANCIENT ONES

Pueblo

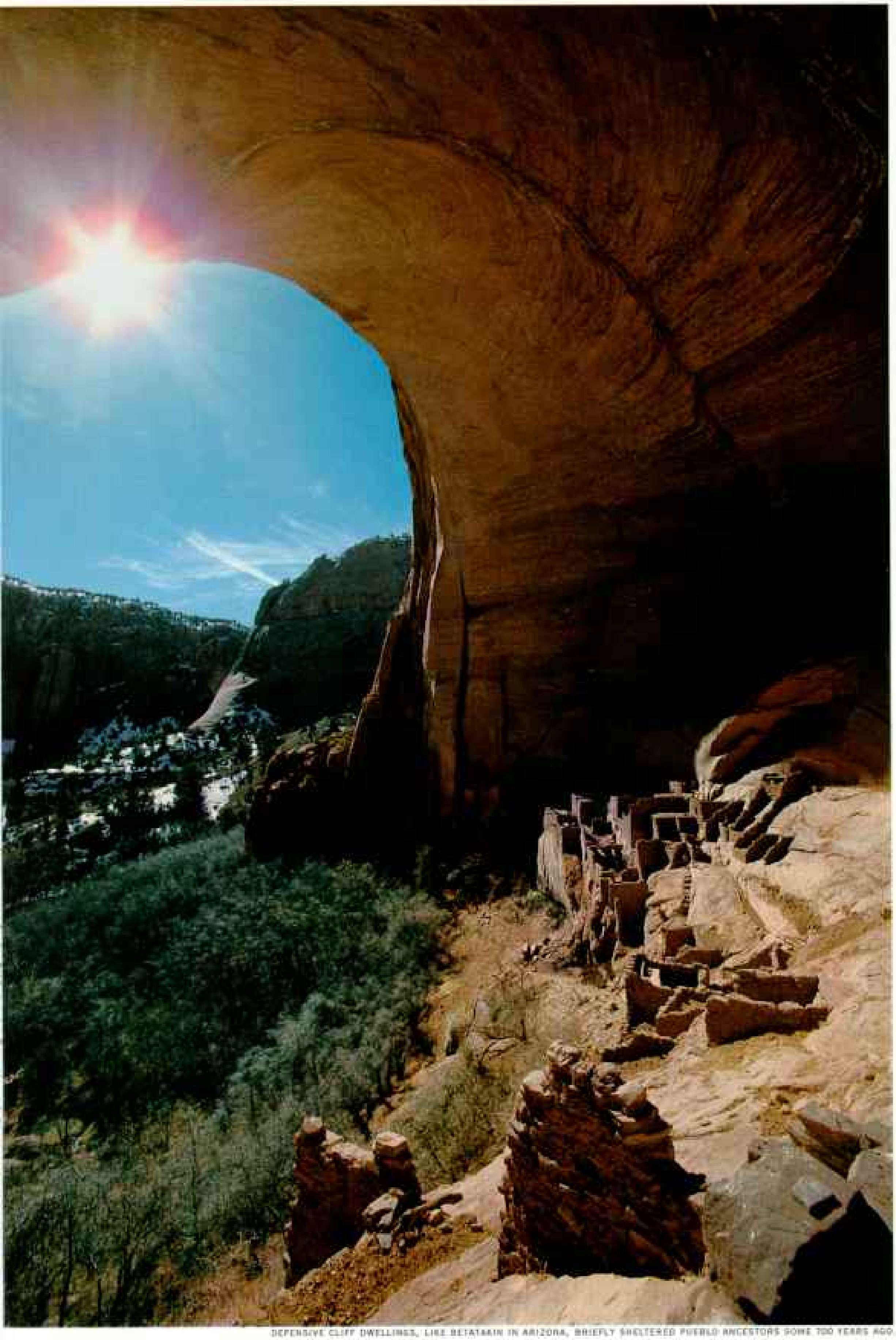
The distance from Colorado's San Luis Valley to the modern Tewa pueblos along the Rio Grande in New Mexico is but a hundred miles, yet it is also a journey of 12,000 years or more through North America's human history.

This lofty valley is closed in by Great Sand Dunes National Monument. Floored with an ocean of shrubs, sparse grass, barley fields, and small lakes, and ringed by snowcapped peaks, it is a cradle of the Pueblo peoples, particularly the Tewa, whose origin myth refers to a "Sandy Place Lake far to the north" (pages 4-13). It also was haven to some of the earliest big-game hunters known in the New World.

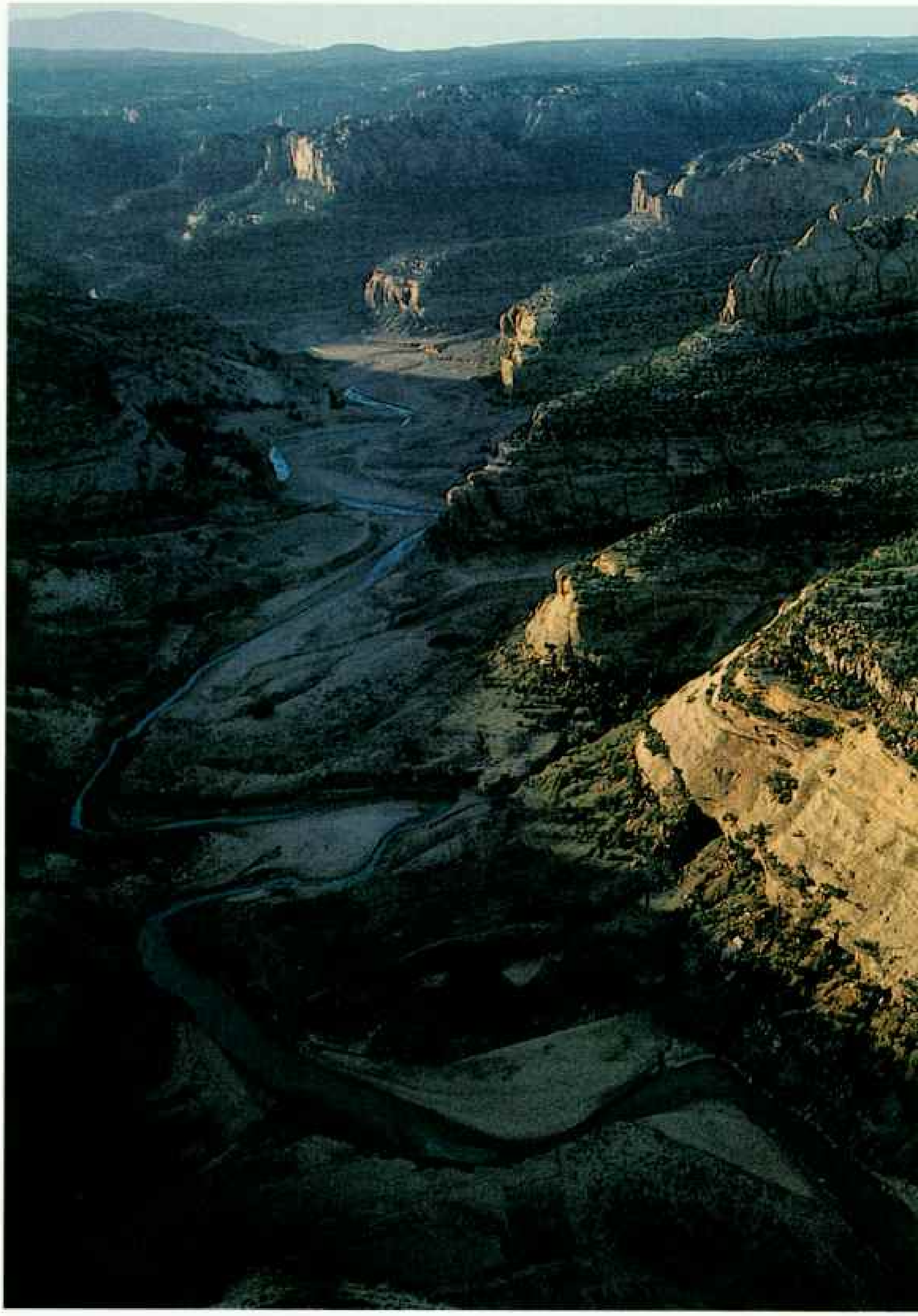
The story of these hunters begins in an Ice Age America unrecognizable today. Climatic forces in the Pleistocene had buried the northern half of the continent under sheets of ice more than a mile thick. They held so much water

BY WINIFRED CREAMER AND JONATHAN HAAS

PHOTOGRAPHS BY IRA BLOCK



DEFENSIVE CLIFF DWELLINGS, LIKE BETATAKIN IN ARIZONA, BRIEFLY SHELTERED PUEBLO ANCESTORS SOME 700 YEARS AGO



Rugged last resort, mesa tops above Tsegi Canyon in Arizona made a final home for Pueblo ancestors who, beset by drought, overcrowding, and raiding, left the

Four Corners region. The authors found 15 such sites, including Six-Foot Ruin on the scrub-covered mesa point at lower right, dating from A.D. *1250 to 1300.*

that the oceans dropped some 300 feet, exposing the seafloor that links Siberia and Alaska. With little precipitation in this corner of the Arctic, no great buildup of ice blocked the way eastward.

Woolly mammoths and other giant herbivores moved from Asia onto this undulating plain to graze, stalked by saber-toothed cats, dire wolves, short-faced bears, and, eventually, the most dangerous of all predators—humans. Clad in sewed skins, warmed by fire, wielding bone- and stone-tipped spears, and perhaps aided in hunt by domesticated dogs, the nomadic first Americans filtered southward along ice-free corridors.

Emerging on the Great Plains south of the ice sheets, bands of these early big-game hunters began spreading across the continent about 12,000 years ago. Named for Clovis, New Mexico, the place where their chipped-flint spearpoints were discovered, the Clovis people depended on the mammoth, which became extinct as the climate warmed. The later Folsom people, named for the New Mexican findspot of their fluted spearheads, hunted the huge *Bison antiquus* in the increasingly dry Southwest.

Excavations at a number of Folsom sites in the San Luis Valley reveal small groups, perhaps three or four families, staying in one location only long enough to track down and butcher a bison or two. Likely they also gathered berries, nuts, seeds, herbs, and roots to supplement their diet.

Over the next several thousand years the Folsom culture in turn divided into regional groups, leading to a proliferation of tribes and languages.

Bison antiquus became extinct, but the smaller *Bison bison* thrived; the San Luis Valley, which also abounded in elk, deer, and antelope, continued to attract hunters and gatherers.

FIGURE 25 INCHES HIGH, THE ART INSTITUTE OF CHICAGO

My husband, Jonathan, and I, archaeologists at Chicago's Field Museum of Natural History and De Kalb's Northern Illinois University, respectively, spent our summers from 1980 to 1986 working in this area and other parts of the Southwest. We found the number of sites increasing with time, indicating overall population growth, although individual bands remained small. Amid their scattered stone tools and debris we saw manos and metates—stones that could grind wild seeds into flour—and hearths, filled with fire-cracked rock, where meat or plant foods (prickly pear and yucca, for example) were cooked.

As big game died out and these groups developed more sophisticated tools—enabling them to hunt smaller animals such as rabbits—they were not compelled to constantly wander. They left evidence of brush and mud shelters, some built on the surface, others with shallow scooped-out floors. Some people even lived in the 7,500-foot-high valley year-round, despite subzero winter temperatures.

But around 3000 B.C. the pressure of a rising population on limited wild resources forced people out of the San Luis Valley into other areas, including the Four Corners region. Here Arizona, New Mexico, Colorado, and Utah join in an extravaganza of wide plateaus, sharp mesas, and deep canyons. This was to become the heartland of the Pueblo ancestors, known to archaeologists as the Anasazi, whose spirits seem to pervade their many ruins.

Beginning around 1000 B.C., the Anasazi peoples experimented with horticulture. Over the next millennium they evolved from nomadic hunters and gatherers into farmers. By A.D. 500 they were growing corn, first domesticated in Mexico, along with beans and squash. They settled in villages of from two to twenty families, each living in a small

pit house roofed with beams, thatch, and mud. They learned to make beautiful baskets, to weave cloth of cotton and strips of fur, and to craft distinctive pottery.

They also carved elaborate petroglyphs—rock art—into the smooth stone walls of canyons and made subterranean ceremonial kivas. In these communal rooms people gathered for joint religious dances or ceremonies.

Typical of these prehistoric peoples were the Kayenta, who occupied what is today the northeastern part of Arizona. Surrounded by other branches of the Anasazi—including the peoples of Mesa Verde, Chaco, Virgin, and Little Colorado—as well as the Sinagua, the Kayenta flourished from 700 to 1200. Tilling their fields and peacefully trading with other groups of the Anasazi, their population grew rapidly. Large families were an advantage, and children helped tend crops.

In return for their widely favored black-on-white pottery, they acquired obsidian for arrowheads, macaw feathers and turquoise for decoration—even bracelets of shells from the Gulf of California made by the Hohokam people in southern Arizona.

We saw signs of villages almost everywhere there was arable land with a water source nearby. Families moved into surface rooms; the pit houses evolved into small kivas shared by several groups for meetings and activities such as weaving. But these farmers rarely stayed put for more than a generation. In their need for wood to roof pueblos and feed fires, the Kayenta used up stands of piñon and juniper and had to scour farther or resort to sagebrush. Also, without livestock to provide fertilizer, it was difficult to keep plots productive.

Life soon became even more difficult. Changing rainfall patterns, soil erosion, and a severe drought—which peaked in the 1260s—prompted the abandonment of many villages in the Kayenta *(Continued on page 93)*

HILLEL BURGER, PEABODY MUSEUM, HARVARD UNIVERSITY

Evoking summer's fields, painted sunflowers and a bird were packed in a clay jar and buried in a cliff dwelling near Kayenta, Arizona, about 1200. Cached near Cliff, New Mexico, an ancient wooden altar deity with feathered necklace (opposite) is ancestral to Pueblo religious images.

Rainbow bands clock the Pueblo peoples from nomadic hunters to settled town dwellers, a reconstruction based on archaeological excavations.

Until about 6000 B.C., big-game hunters armed with flaked-stone spearpoints killed giant bison to feed and clothe their small bands. As these large animals disappeared, families were left to forage for wild plants and seeds; they also hunted smaller animals, among them antelope and rabbits.

After 1000 B.C., corn, beans, and squash were introduced from the south. People began to

farm, developing multistoried pueblos with ceremonial kivas, irrigation canals, far-flung trade networks, and distinctive basketry and pottery. Population exploded, and the next prolonged drought brought hunger. Scarcity led to raiding, and many villagers in the Four Corners region moved into cliffside dwellings and onto mesas.

(Archaeologists call these people by the Navajo word Anasazi—"alien ancient ones"—which Pueblo Indians consider derogatory.)

The Pueblo groups fled west to what is Hopi and Zuni country and east to the Rio Grande, where Spanish conquerors found them in 1540. Today more than 50,000 Pueblos, speaking six languages, live in Arizona and New Mexico.

PAINTING BY KINUKO CRAFT

The first families of Posi raised a double row of adobe rooms near a hot springs above the Ojo Caliente River about 1350. As more settlers arrived, the pueblo grew to more than 2,000 rooms. From here the Tewa moved to their present pueblos (map).

(Continued from page 89) heartland. People began moving higher up the arable valleys and canyons. They clustered in satellite villages around pueblos of 75 to 400 rooms, housing 25 to 100 families. They built reservoirs to collect the increasingly scarce water and, in the center of each pueblo, raised a massive communal food storage room. It was rarely full of food, for malnutrition shows in the skeletal remains. Age at death drops; child mortality rises.

THEN CAME WAR, transforming Kayenta society. In recent fieldwork Jonathan and I focused on this traumatic period. We discovered one late 13th-century pueblo after another in remote, improbable locations undetected during more than a century of archaeological research. Almost every one occupies a defensive site—a mesa, butte, cliff cave, or rock outcrop.

How did we find them?

With a computer we scanned topographic maps to identify potentially defensible locations. We then sent crews to examine each one—hard, dangerous work with frequent disappointment.

PAINTING BY RICHARD SCHLECHT

Early in the survey we'd blame the computer. But, as predicted, formidable sites began to appear, high off the valley floor. "Sky houses," we called them.

One day we faced the walls of an isolated mesa rising 500 feet from the floor of the south side of the Kayenta Valley.

With Jonathan muttering about the demands of science, we labored up the loose debris of a steep slope. Above it a 40-foot cliff forbade access to the flat top. We clambered around once without finding a way up, and then again with no luck. It was getting dark. Frustrated, we returned to camp.

Give up? Or have another go at it?

Tackling that talus slope again was daunting. But the computer had indicated that this was the right place for a site. We'd have to see the mesa top ourselves.

Next day, after we'd finally made it up the talus, we searched the cliff face for any clue to a site on top. "We're in luck, Jonathan!" I stooped to examine a scatter of ceramics—pots discarded from above, all of a distinctive type made between 1250 and 1300.

We scanned the cliff with heightened interest. In the shadows Jonathan spotted a promising crack. It turned out to be a cleft that revealed a hand-and-toe trail. Cresting the mesa in triumph, we were greeted by the tumbled walls of a 50-room pueblo abandoned 700 years ago.

Perched atop this remote mesa, we felt a growing respect for the people who once lived here. We were struck by the enormity of their feat and the depth of their fear. What extraordinary measures they took—abandoning their homes to move their families and stored foods off the valley floor to protect them from raiders.

The computer helped us find 14 more such retreats, among them Six-Foot Ruin in Tsegi Canyon (pages 86-7). Significantly, the Kayenta lined up the principal pueblos in sight of one another, overseeing primary access routes. We even discovered a deep notch excavated in a hillslope to allow visual contact between pueblos.

The threat to their lives was real. We found skeletons with no skulls, skulls with foreheads bashed in, and signs of fire in those few sites not strategically located.

Why this violence among people whose life for centuries had been peaceful? The prolonged environmental crisis, leaving no food to share, drove groups of the Anasazi to raid their neighbors. The pattern of retreat from valley floor and canyon terraces to virtually inaccessible shelters is repeated throughout the Four Corners region.

The renowned cliff pueblos of Betatakin and Keet Seel in Navajo National Monument were both built at that time. So were the cliff dwellings in Canyon de Chelly National Monument, the haunting towers at Hovenweep National Monument, and Balcony House at Mesa Verde National Park, perhaps one of the best examples of a defensive stronghold in the Southwest.

The pressures ultimately proved too great for the Kayenta people and their neighbors—confined to their redoubts, fields and firewood depleted, their children dying. By 1300 the entire region was abandoned. Seeking havens, these groups left for the homelands of the modern Pueblo Indians, including those of the Hopi, the Zuni, and the Tewa.

AN IMPORTANT way-stop for Pueblo peoples leaving the Four Corners was Posi, near present-day Ojo Caliente. This village in northern New Mexico was built in the 14th and 15th centuries by ancestors of the Tewa.

Posi, or Poseuinge, which means "village at the place of the hot springs," was situated on a bluff overlooking the springs that gave the Ojo Caliente River its name. Settlers—perhaps several families camping out while planting, then building during the warm, dry days of late spring—raised the first double row of rectangular rooms in the 1300s.

As new groups arrived, blocks of rooms were added, giving rise to a sprawling three-story settlement of interconnected chambers—more than 1,400 on the ground floor, with hundreds more on the second and third stories. A couple might build one or two rooms, while extended families might end up with a dozen or more. Demands of upkeep—replastering the walls with mud and replacing the brushwood roofs—were so great that only about half the rooms seem to have been occupied at one time. Older rooms, which provided storage space, were sometimes refurbished for use as guest quarters.

The distorted rectangular shape of the site is still discernible. Mounds as high as 15 feet indicate where room blocks once stood, their adobe and cut-stone walls weathered down

A masked lightning god, birds, and catfish: Powerful symbols on a restored 15th-century mural solicit rainfall—and fertility. The scene lines walls in a rebuilt kiva in the ruins of Kuaua Pueblo. Lisa Enos (right) of Santa Clara Pueblo joins a corn dance to encourage a good crop.

CORONADO STATE MONUMENT

to half their original height or even less.

The ground is littered with potsherds, stone chips, and obsidian slivers from arrowheads, knives, and scrapers; with fragments of ground stone once used as axes; with manos, metates, and farm tools; and with small grinding stones for crushing colored rock for pigment. Bone awls and broken tools, tucked away in the rafters of rooms long collapsed, speak of crafts such as leatherworking. Similar items have been excavated from middens, some over six feet deep, where people on the rooftops casually tossed trash into unused plaza corners.

Rows of post holes, deposits of turkey dung, feathers, broken eggshells, and fragments of water dishes delineate turkey pens. Botanical and pollen samples disclose the contents of food storage rooms: piñon nuts and amaranth as well as corn and beans.

Today the ground is not cleared but covered with shrubs. Walking over the adjacent terraces, we noticed straight lines of rough cobbles. Closer inspection revealed that the stones outline squares and rectangles several yards on a side, filled with gravel. Archaeologists now recognize them as gardens whose gravel covering served as mulch to hold moisture in the dry ground, protecting young plants from extremes of heat and cold. Today the quilt of green-gray plots at Posi—the mass of sage, snakeweed, lichens, tumbleweed, and cholla cactus that explodes with bright yellow or rose pink blooms in the spring—testifies to the ingenuity of the Pueblo peoples in increasing the range of arable land and the yield of crops.

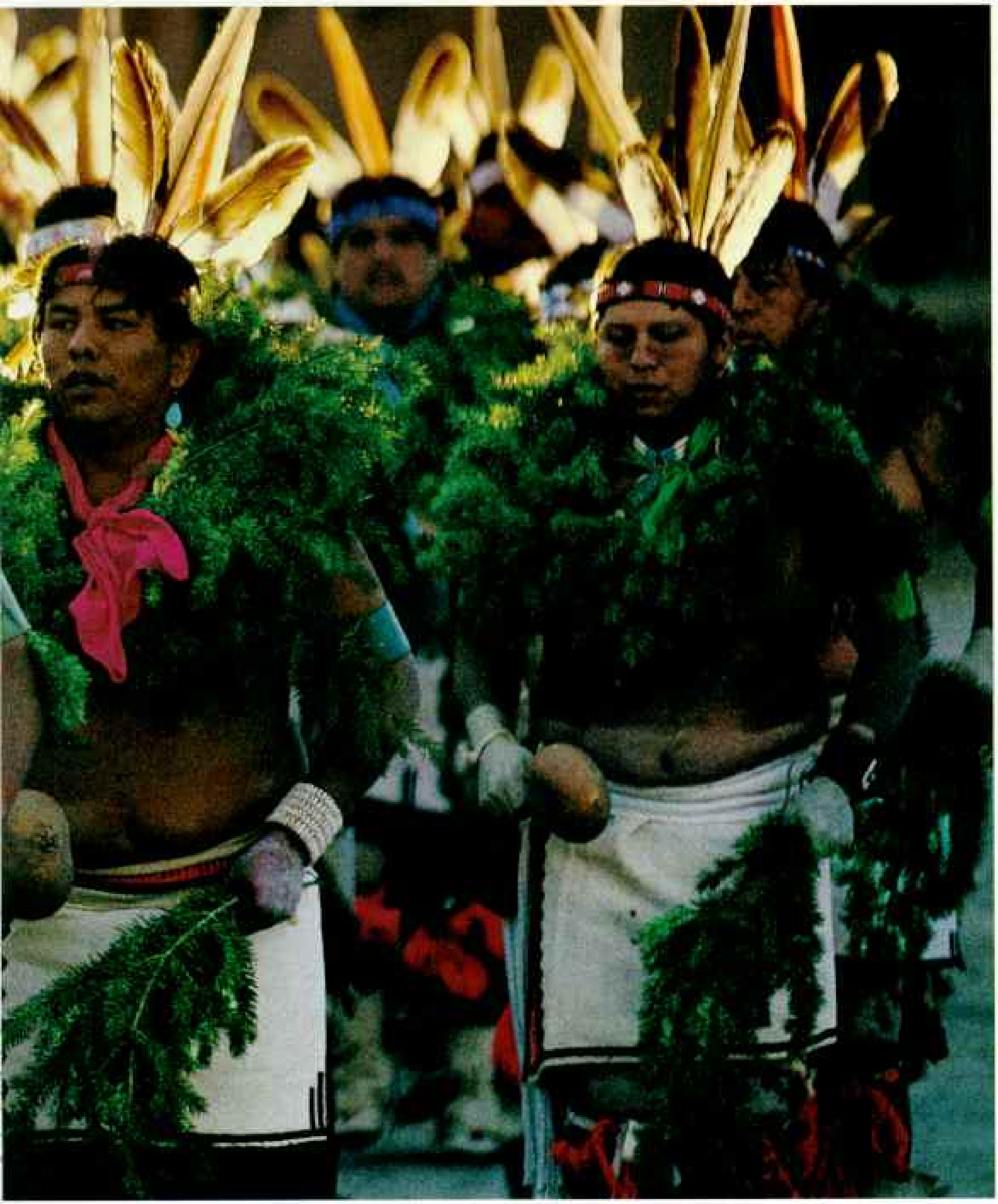
Jonathan and I excavated sections of the large plazas of the ancient town, unearthing many artifacts, including glazed pottery and bone tools that offer glimpses into Tewa life.

On the last day of the excavations, after the crew had gone, the two of us sat on a high pile of stone rubble. Enjoying the end of a summer day and the spectacular view of the Sangre de Cristo Mountains, 25 miles to the east, we talked about what life must have been like for the people here in 1491.

We envisioned wisps of smoke curling up from the tan smudge of houses at dawn, men already out scouting for game, women carrying jars of water up from the river, the

With feathers and evergreens, men of Santa Clara dance in flock formation to honor the arrival of geese in February. Thus the Tewa keep ancient ways that recognize the debt humans owe to the world around them.

morning meal of corn gruel bubbling. The kaleidoscope of life on the rooftops, in the rooms, in the plazas, and in the fields passed before our eyes as the day's activities got under way: women grinding corn, children feeding turkeys, men weaving cotton in the kiva, and potters, leatherworkers, and toolmakers all busy at their crafts.



At day's end we imagined the villagers stirring fires to brightness, telling stories under the starlight, and meeting in the kiva to plan ceremonies or trading visits to other villages. Finally a lone figure checks the rooftops to see that all the ladders are up, to protect Posi until a new day.

The surface remains indicate that Posi was abandoned soon after 1500. The village was likely silent, adobe walls crumbling, when the first Spanish entered the valley in 1540. But its life, reflecting thousands of years of human presence in North America, is carried forward in the six Tewa pueblos—San Juan, Santa Clara, San Ildefonso, Tesuque, Pojoaque, and Nambe—that we know today. □

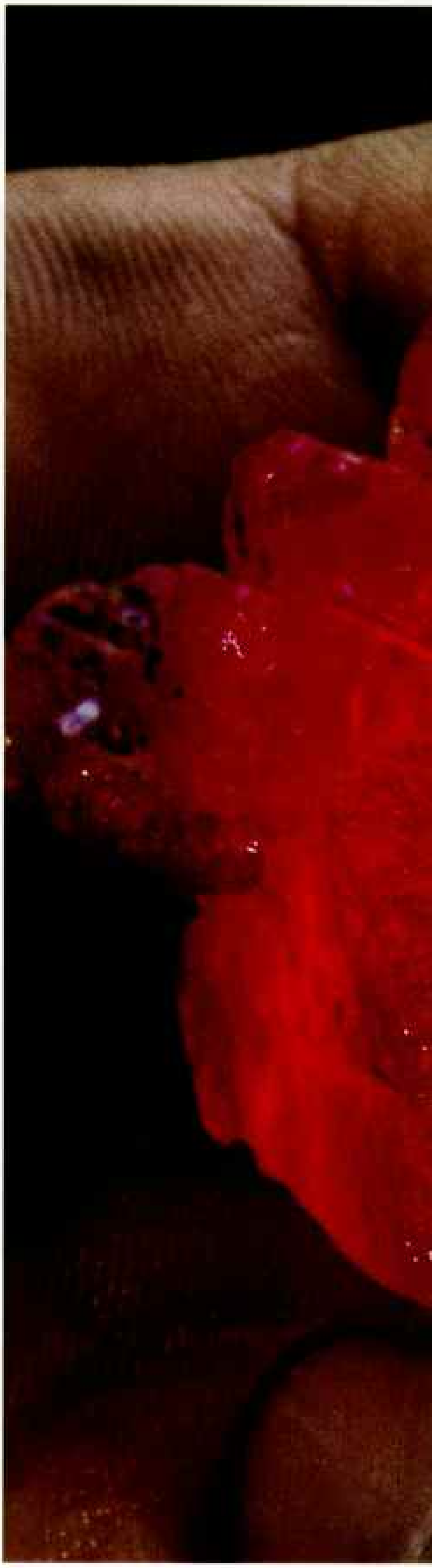
RUBIES AND SAPPHIRES

Treasure of royalty and object of thousands of years of global quest, rubies remain the rarest and most expensive of the world's great gemstones.

They and their sister gems, sapphires, account for more than half the world's glittering trade in colored stones. Sapphires adorn such regal favorites as Cartier's panther brooch (above, shown actual size), custom-made for the Duchess of Windsor. Red as Kipling's thunderous dawn, a priceless 500-carat Burma ruby filled my palm (right). "We will not cut it," a government official told me. "It is a national treasure."

Balanced perfectly between beauty and utility, rubies and sapphires are

ARTICLE AND PHOTOGRAPHS BY
FRED WARD
BLACK STAR



Cobalt, canary, and blush, sapphires shimmer in colors across the spectrum, while red stones are distinguished as rubies. The finest quality gems have historically come from southern

Asia, where it was once believed that rubies were simply sapphires that had ripened. This blazing collection, mined in Sri Lanka, is worth approximately 2.5 million dollars.

different colors of corundum, the crystalline form of aluminum oxide. Pure aluminum oxide is colorless, but minute amounts of trace elements create every conceivable color. Titanium together with iron makes blue. A light touch of chromium causes pink. Iron produces both green and yellow. A combination of chromium and iron creates orange. They're all sapphires. When a corundum crystal has enough chromium to be red, then it alone is called a ruby.

Among the world's most versatile crystals, rubies and sapphires have become indispensable for industry. Today we can even manufacture them—in the United States, Japan, Switzerland, the Soviet Union, France, and elsewhere—for such diverse uses as watches, medical equipment, and aerospace fibers. Synthetic sapphire plates protect grocery store check-out counters from scratching so that laser scanners can read bar-code prices. Rubies and sapphires are also at the heart of lasers and satellite intelligence systems. Man-made replicas of billion-year-old crystals extend our quest for the stars.

SOME ANCIENT PEOPLES "replanted" sapphires in the belief that they needed more time to ripen into rubies. The people of Myanmar, formerly Burma—who call rubies *ma naw ma ya*, "desire-fulfilling stones"—consider all other stones mere attendants to the king of gems. Many believe that wearing rubies assures sexual appeal and guards against danger and ill health. As demand for colored stones surged in the 1980s, ruby prices soared faster than others. Although they are among the most prized of all gems, their high price does not fully reflect their rarity.

"Large gem-quality rubies are 30 to 50 times more rare than diamonds," says ruby specialist Jack Abraham. "A ten-carat top-quality ruby can sell for more than $200,000 a carat." A flawless white diamond might bring a fourth that amount.

Early admirers and buyers commonly misidentified attractive stones because, unaware of chemistry, they grouped gems by color. Many ancient references to blue gems, for instance, were to lapis lazuli, not sapphire. And when biblical authors wrote that wisdom "is more precious than rubies," or that a virtuous woman's "price is far above rubies," they probably were referring to

Searching for gems begins at the end of high-pressure hoses at the central washing plant of the Pansho Mine, one of seven government-operated mines in Mogok, Myanmar (formerly Burma). Water jets into a wash box (above) and flushes away clay, dirt, and sand, leaving gravel and rough gemstones. When the log gate is opened, the gravel and gems—mainly sapphires—tumble over jigs.

Later, workers take trays from vibrating racks, which have concentrated the heavier sapphires at the bottom (right). A flick of the wrists, and trays are turned over to reveal the blue gemstones that are prized the world over for their rich color.

Faceted to perfection, Australian sapphires show off variation in cuts and colors. These gems retail for $350 to $3,700 a carat. Australia's darkest blue stones are normally sold wholesale, for $8 to $50 a carat, and are often made into matched bracelets, necklaces, and brooches.

carbuncles, a term for any crystals the color of glowing embers. Eleventh-century Arabs used weight to differentiate rubies from less valuable red spinels. Yet medieval kings often believed their spinels were rubies.

Great sapphires once came from Kashmir, and they, along with fine rubies, were found for centuries in Myanmar and Sri Lanka. Now Thailand, Cambodia, Australia, Tanzania, Kenya, and Nigeria are large suppliers, and new mines have opened in Vietnam and China. Unsung celebrities, virtually unknown outside the United States, are the small, vibrantly clear, steel blue sapphires that come from Yogo Gulch, Montana. To pursue corundum from mines to finished jewels took me literally around the world.

ONE OF THE FIRST WESTERNERS permitted to visit Myanmar's legendary ruby and sapphire mines since the military takeover in 1962, I was granted safe passage to the fabled Mogok Stone Tract. No other gem source is so steeped in mystery and lore. Many of the spectacular rubies collected by India's maharajas, Persia's shahs, and Turkey's sultans originated at Mogok.

FRED WARD, a graduate gemologist, has contributed many articles to the magazine, particularly on precious stones and the environment.

This region produces the storied "pigeon's blood" rubies, a unique red found in only a few gems a year. The distinctive glow, caused mainly by chromium's fluorescence, once inspired an old Thai trader to declare, "Asking to see the pigeon blood is like asking to see the face of God."

Unlike Kipling, I traveled on the road *from* Mandalay. The trip to Mogok is a five-and-a-half-hour bump-thump-bounce ride over 128 miles once paved by the British. While Yangon (formerly Rangoon) is an unimproved colonial relic and Mandalay continues to use barely functional World War II Army jeeps for taxis, Mogok has grown to 100,000 people whose Japanese cars and motorbikes are brand new. Clearly, this is a town with money.

Practically everyone in Mogok is associated with the gem trade, an obvious fact that few admit. Officially Myanmar's gems belong to the state, which operates five open-pit and two underground ruby and sapphire mines. Theoretically all stones go to Yangon, where first-quality ones are set aside for the foreign-currency-only sales at the annual Myanma Gems, Jade, and Pearl Emporium. Second- and third-quality gems are made into jewelry by the government and private citizens. These are intended for domestic

Found frequently in alluvial deposits, rubies and sapphires are little affected by weathering. Both are corundum—the crystalline form of aluminum oxide. While Myanmar produces the most valuable stones, Sri Lanka, Thailand, Tanzania, and Montana also offer superior gems.

consumption. However, most gems are diverted by smugglers and black marketeers who operate throughout 400 square miles of gem-bearing mountains.

In an effort to quell smuggling and capture a bigger share of the gems and foreign currency pouring into Mogok, the Myanmar government in 1990 hatched an unprecedented joint-venture scheme. "We knew people were mining. We wanted to make them legal," said U San Lwin, manager of Myanmar's gem mines. "Now citizens can bid on two-year leases and keep just under half of what they find. We take the best gems and pay miners half after the stones are sold. Then we return the unused stones, which they are not supposed to smuggle." The first part of the scheme seems to be working. In seven months, 200 operators reported producing 432,909 carats of stones.

ENTER THE THAIS. Anyone from miner to dealer to cutter will tell you plainly, "The Thais own the corundum business." Wherever I went, I heard incredible stories of bribery, collusion, and high-pressure tactics. The dilemma is that while some miners are being squeezed by the Thai monopoly, buyers worldwide seem to prefer the convenience of one-stop shopping.

In addition to cutting and marketing Myanmar's smuggled goods and their own rubies and sapphires, Thais pay off both the Khmer Rouge and Thai Army to allow them to mine in Cambodia. Exclusive contracts at first guaranteed that Thai dealers got Vietnam's new rubies. Traveling Thai buyers scoop up Australia's sapphires, either on the spot or by attempting to buy a miner's entire annual production. Long-standing contracts ensure that Sri Lanka's gems end up with the Thais. Only the miners in Montana resist exporting their sapphires, and even they know that their buyers are either reselling the rough material to Thai dealers or having their stones cut in Thailand.

Gem factories line the streets of Bangkok and Chanthaburi. Cutting begins after a skilled worker assesses a rough crystal to determine its potential. Sometimes crystal edges are sawed away, but usually stones are preformed into round, oval, octagon, or other shapes with diamond-impregnated grinding wheels.

Changing to a wheel with finer particles, a cutter typically grinds dozens of facets into the surface. Placement and angles are critical for maximum beauty and brilliance. Finally, using extraordinarily fine diamond grit, facets are polished to a mirror surface.

Thai dealers and foreigners find local cutting prices of only 30 cents to two dollars a carat highly attractive. Workers, who earn two to five dollars a day, collectively cut rubies and sapphires worth more than half a billion dollars each year.

How did it happen that the vast majority of rubies and sapphires end up in Thailand for processing and marketing as either loose stones or jewelry? "We're ambitious," one Bangkok gem dealer told me. True, the Thais saw an opportunity and made the most of it. Gem dealers persuaded the government to drop import and export taxes to create a climate for growth. Then they systematically built a market to supply global buyers with a huge variety of polished stones and finished jewelry. Combined with luxury hotels and a nonstop entertainment district catering to every whim, the selling package is irresistible.

Some gem dealers also augment their profits by false labeling. Inside one office I examined remarkably clean deep red rubies from the newly opened Luc Yen mine in Vietnam. Sent to Europe, the never-before-seen stones were misidentified by a gem lab as Burma rubies. The dealer then relabeled these Vietnamese gems Burmese, thereby ensuring an instant—and unwarranted—profit.

Labyrinthine canyons were hand-dug at Kenya's Aqua Mine. Worked by a crew of 50, the two-acre pit reaches down some 60 feet and is a steady ruby producer.

Dealer Abe Suleman casts a trained eye on sapphires from the Umba River Valley in Tanzania, source of a wide variety of colors.

Brisk bartering on Ratnapura's streets gets the Sri Lankan gemstone trade off to its daily start (opposite page). The buyer, at right, spends the morning accumulating and sorting rough stones into packages of like color, quality, and size. He hopes to double the price when he sells them to dealers from Thailand, who control the world market. Most stones, like this Sri Lankan sapphire (above), are cut in Bangkok.

Bucking Thai domination, one Sri Lankan company uses modern equipment (top) to offer its own cutting and polishing services.

Such fraud is possible because the controversial origin tests are usually not done on small stones, and no one can consistently name sources accurately. More important, dealers trade on the romance (and therefore value) associated with gems from Myanmar, Kashmir, Sri Lanka, and even Thailand. They see little commercial appeal in stones from Africa, Australia, or Montana. So some dealers all too often single out the best of the world's corundum and label it Burma or Kashmir. The next-best lots they represent as Sri Lankan or Thai, and the rest go as African or Australian.

Sam Speerstra, Montana's largest sapphire producer, laments, "My mine produces wonderful colors, but no one knows it because my gems are sold as being from everywhere else but here."

I ARRIVED IN SRI LANKA, the "gem island," in the middle of a government-level standoff with Thailand. Sri Lanka's southern two-thirds has been blessed with a profusion of colored gemstones and some diamonds, all washed down from a core of central mountains. People find gems in their yards and fields, in streams, even on walkways after it rains.

There are also large amounts of geuda, a pale or colorless sapphire. The Thai dealers wanted it.

"They said it was almost worthless, useful only for cutting cheap gems," recounted Tom Ellawala, a noted dealer in Colombo, Sri Lanka. "The Thais convinced Sri Lankan officials they should have a buying exclusive. We sold geuda to them for peanuts until we finally discovered we'd been taken. Simple heat treatment turns the bland sapphires brilliant blue or yellow. We got only 10 to 30 cents a carat for gems the Thais were selling for hundreds to thousands of dollars apiece."

In August 1990 the Sri Lankan government withdrew Thai dealers' exclusive-buyer status for geuda, imposed a modest 5 percent export fee, and slightly raised the bond put up by every buyer.

"We have to get control over our own gems," admitted Lester Fonseka, chairman of Sri Lanka's State Gem Corporation. "That means buying furnaces and training people to heat, cut, and sell gems here instead of letting the Thais make all the value-added profits." Such independence will prove very difficult as long as Thais control the market.

KENYA'S RUBY MINES produce everything except efficiency and profit. Even with some German, Swiss, and Israeli buyers, many of the country's gems go directly to Bangkok.

I asked dealers in Nairobi and buyers in Bangkok how it can be that although Tanzania bans unlicensed rough gem exports and Kenya locked its mines for two years, everyone's safes are still full of East African gems. "Old stock," they said.

I crossed the border to meet dealer Abe Suleman for the trip to the remote Umba River Valley mine in far northeastern Tanzania. Here the Thai manager told me they had been prospecting for two years. Their license has recently been upgraded to a 20-year mining license, which currently costs a mere $10,000 a year. The Thais have opened numerous trenches and are bulldozing a gaping hole 200 feet wide and 100 feet deep beside the original pit, which produced what are generally considered some of the world's finest colored, or fancy, sapphires. In all my years of visiting mines, the largest test drilling I had ever seen was three feet across, not even a close second to this monstrous excavation.

Expecting kilos of gorgeous material, I

was astonished to see none. I later asked the company's chairman, Watana Keovimol, where the stones were. "So far, we just haven't been lucky," he replied. "We only pray some day we'll hit a pocket and make some money. We're just doing this to help Tanzania." If the Thais ever report finding any gems, they will pay a 5 percent export royalty and 55 percent of any profits the company might earn.

After dodging elephants, lions, giraffes, and zebras during an all-night drive, Abe and I arrived at the isolated Mahenge ruby mine in southern Tanzania. Gazing into the forest, our Thai translator waxed philosophical. "Why would anyone do this?" he asked. "Only for women and money. Any other kind of mining is safer and more businesslike. But gems are more exciting." Referring to the Tanzanian government official who accompanied us, he added, "As I tell my socialist friend here who worries about outsiders profiting from his country's treasure, we never exploit the poor in the gem trade. We only exploit the rich."

One of the rich is Longido mine owner Tony Ferro, who is being exploited by his own workers. "Local smugglers are especially brazen," he said. "Not long ago we found coffee cans on their way to Bangkok with rubies packed in false bottoms."

Located in northern Tanzania near Arusha, a dusty town whose streets have almost as many potholes as dogs, Longido is unique—the world's only source of large hexagonal ruby crystals growing inside a rind of green zoisite. The effect is much like a watermelon, but the opaque rubies, which can weigh several kilos, are suitable only for carving. Longido is a source of contraband rubies headed for dealers in Hong Kong and Germany as well as in Thailand. Area

dealers estimate that thieves steal about half Ferro's output.

AUSTRALIA'S dark blue sapphires are the backbone of the lower-priced market. Thai dealers buy Australian corundum for an average 30 cents a carat. About 20 percent of it will be heat treated and cut, selling wholesale in the United States for $8 to $50 a carat.

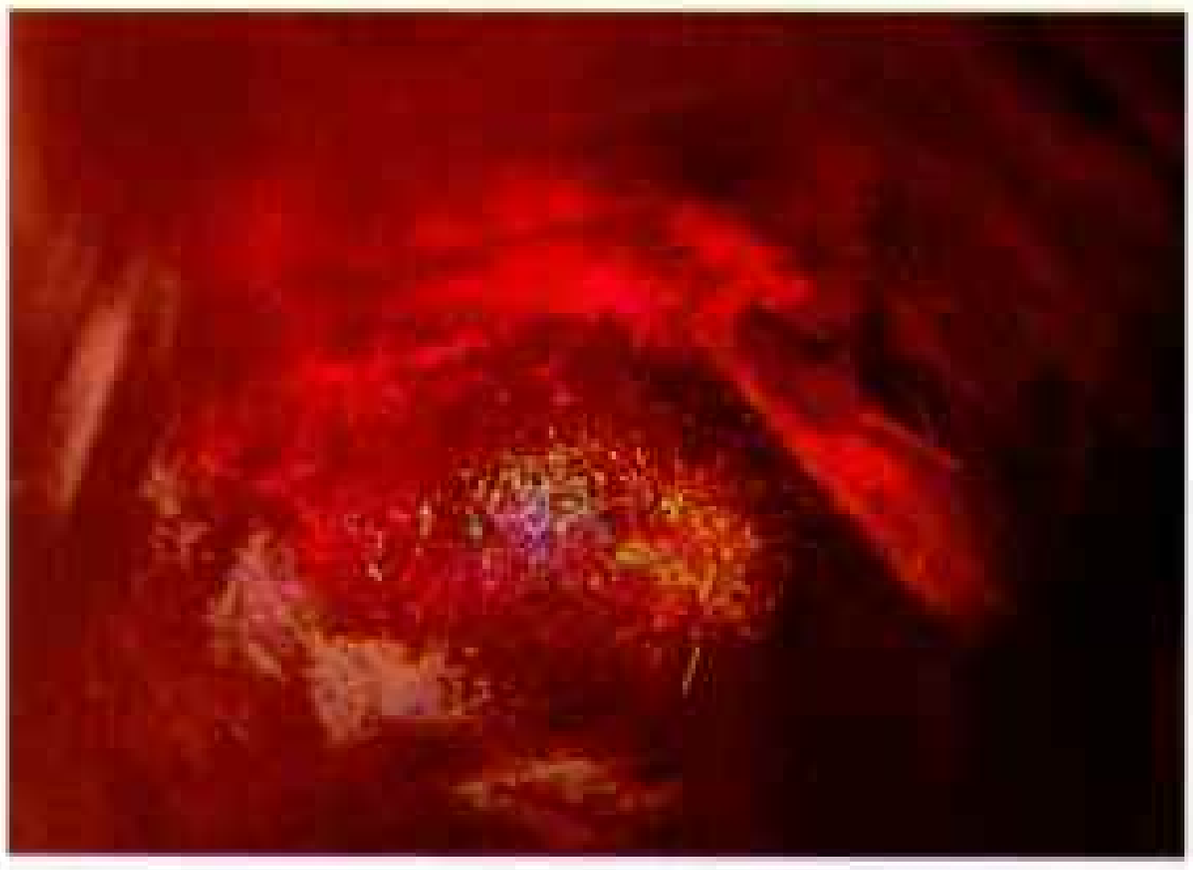
Tom Nunan claims to be the world's largest producer of sapphires; his mines average 12,500 carats of cuttable sapphire a day. As Tom and I walked over some of the 7,500 acres he had leased in Rubyvale for a new operation, he showed me a handful of stones from a test hole. "One thing you can say about Australian sapphires is they're consistent. Manufacturers want lots of matching stones for jewelry lines. This property has a 16-year supply."

Perseverance and a strong pick took Lanny Perry 55 feet beneath Montana's surface, where he chips his way through the Vortex Mine in search of cornflower blue sapphires at Yogo Gulch. "My partners and I have had this dream since we were big enough to pack rocks around," Perry says.

Profits are slow—underground mining is an expensive venture. But the five miners eliminate Thai middlemen by selling their stones mainly in the United States.

Unlike Yogo sapphires, which come out of the ground a vivid blue, stones from Montana's Eldorado Bar on the Missouri River are often pale and greenish in their natural state (below). But after being heated in a furnace by temperatures approaching 2000°C, the sapphires radiate dazzling colors (center). The finished gems (bottom) are fine enough to successfully compete on the world market.

Suspended as if in their own universe, star sapphires and rubies form a galaxy of pulsating color (right). The translucent stones, cut in the rounded fashion called cabochon to reveal their gleaming stars, are most often found in Sri Lanka and Myanmar. Inclusions of microscopic rutile crystals (below), intersecting at 60-degree angles, reflect light and cause the six-pointed star effect.



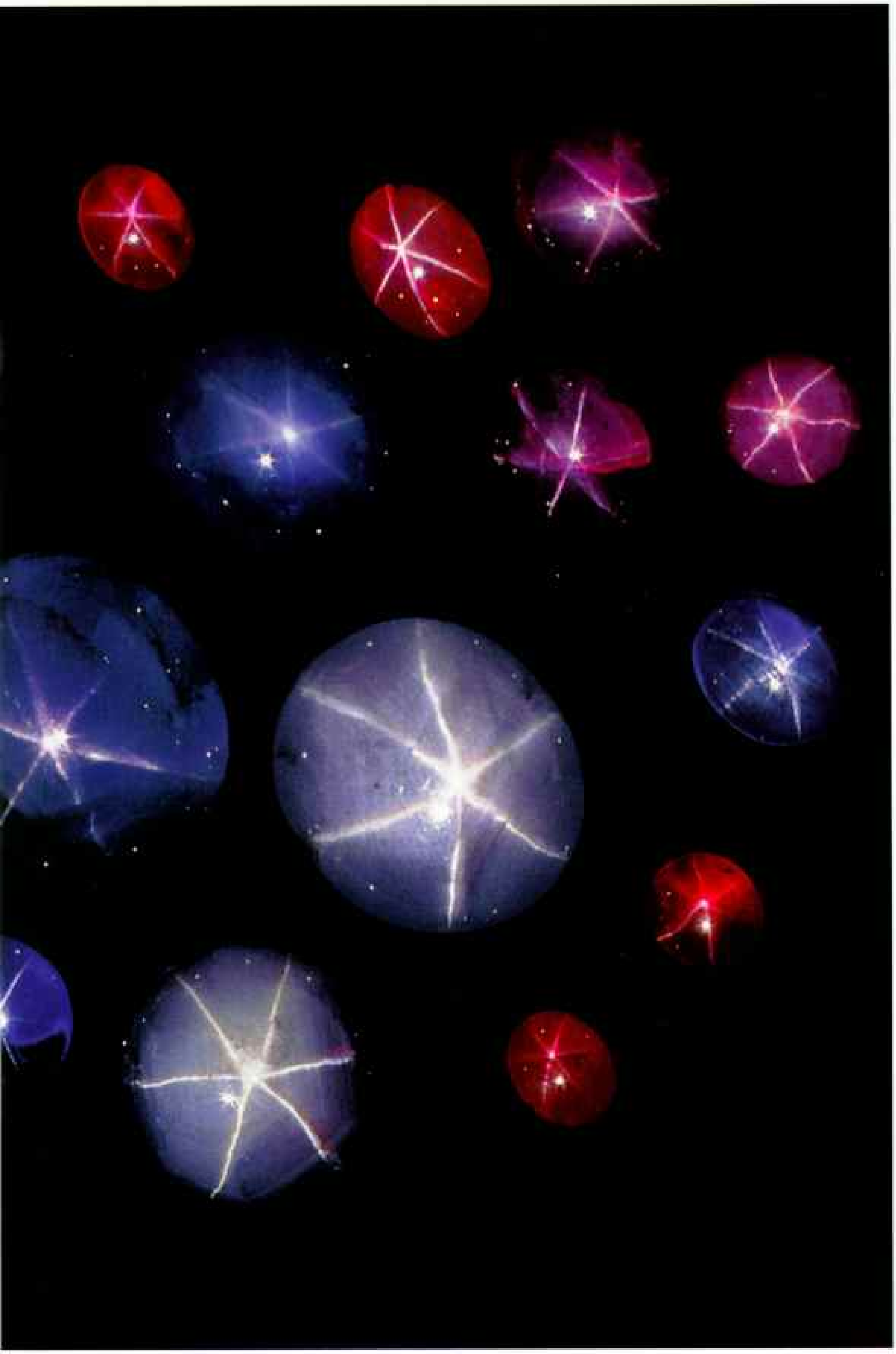
But Tom can't start until he gets out of Thailand's grip. New low-priced supplies from Nigeria and China make Thailand less dependent upon Australia. About a year ago, just after he announced plans to open a heat-treating and cutting operation in Sri Lanka, the Thai buyers dropped the prices they paid for his sapphires 30 percent overnight.

"I've been mining sapphires for 14 years, and I'm almost out of business," he continued glumly. "The Thai market is now the only outlet for Australian corundum."

In fact, the Thais don't look kindly on expansion plans from any quarter. A few years back, one story goes, a prominent Bangkok gem dealer announced that he intended to heat treat sapphires in Sri Lanka. After learning that jealous dealers had taken out a contract on his life, he quickly dropped the project.

FEW AMERICANS REALIZE they have local sources for corundum. There are operations in North Carolina and Montana where tourists buy buckets of gravel and keep the gems they find. Montana yields fine sapphires along the Missouri River, at Gem Mountain, and at Yogo Gulch.

The Yogo deposit was discovered in the late 1800s when strange, heavy blue pebbles



Enhancement or deception? Diffusion treatment has the gem industry concerned about some treated stones being retailed as naturally colored. The clear sapphires (top) were packed in titanium and iron oxide powders and heated for 600 hours near 2050°C—their melting point. Emerging rough and mottled (second from top), they were polished to a brilliant blue (third). Titanium and iron atoms penetrate the gems a mere 0.4 millimeter, evident in a cross section (above) but otherwise difficult to detect.

Stoking coke and kindling, a Thai heater "cooks" sapphires in an outdoor furnace to heighten their color, a long-accepted practice.

(called riffle clutter) kept clogging the gold miners' sluices. Today the two firms mining at Yogo charge far more than the world sapphire price. They manage to bypass the Thais by selling their superb stones—loose and in jewelry—primarily in the United States.

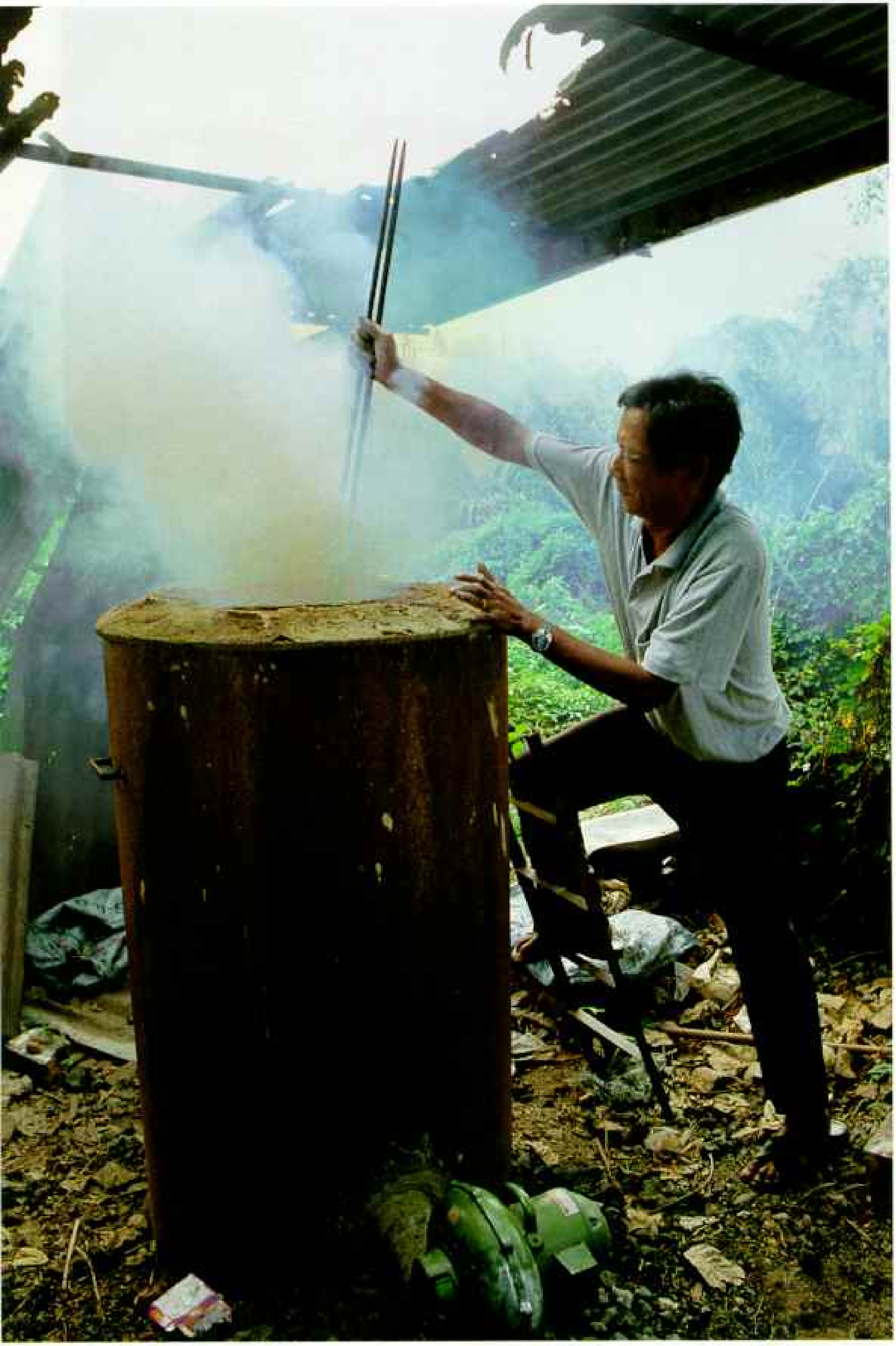
Ben Duffey, an expert colored-stone cutter who specializes in sapphires, knows Montana material well. In Lump Gulch, outside Helena, Ben has been busy the past few months cutting and polishing stones I sent him from every gem-producing country I visited. Comparing them, Ben says, "Yogos are great right out of the ground. And heated Montana sapphires can stand up to most anyone's. With the right cut Gem Mountain's fancy yellows and oranges shine like the sun."

Unlike Yogo's niche marketers, sapphire miners at Gem Mountain and on the Missouri River near Helena are competing internationally. Sam Speerstra, the king of Montana's gem miners, says he accounts for more than 80 percent of the state's output. Overlooking a huge bend in the Missouri, Sam swept his arm toward a five-mile-long ancient riverbed of stepped terraces. "I'm mining the Eldorado Bar. I often get 10,000 carats a day—about a million last year—of three- to five-carat stones from this one giant deposit. My bigger washing plant will increase production to two to three million carats this year."

I later asked Sam whether Montana sapphires could ever earn name recognition. The lanky miner flipped open a lapidary magazine. "Here's my new approach—advertising uncut material for a dollar a carat. Suddenly every cutter in the country wants Montana sapphires. I can't keep up with the orders."

TO PRODUCE CLEAN, SALABLE GEMS, almost all rubies and sapphires (and many other colored gems) are heated to enhance their color and clarity. In the first century A.D., Pliny the Elder described how Romans "cooked" agate. An A.D. 1240 Arab treatise on ruby heating in Sri Lanka describes almost exactly what I saw there last year. Today, for predictable results, no one can match U. S. technology.

"Heating sapphires redissolves the titanium, which reacts with iron to make the gems look blue," explains John Emmett,



former associate director of the Lawrence Livermore National Laboratory. "With rubies we mainly want to clarify the interior. That's why the heat treater's motto is, 'We finish what nature forgot.' "

Heating is so common that it is seldom disclosed to wholesalers or consumers. Montana treater Dale Siegford says, "Heating permanently maximizes a stone's potential. Without it, there would be few beautiful sapphires."

But Richard Hughes, editor of the *Gemological Digest*, vigorously disagrees. "Nowadays, in the ruby and sapphire market, the ridiculous is reality. Naturally colored diamonds cost more than treated. But with rubies and sapphires, heated material fetches more than humble naturals."

Computer-controlled electric and gas furnaces reach temperatures near 2000°C. Heating and cooling cycles and the addition of various gases affect results as much as temperature, although, as Emmett notes, "Turning Sri Lankan geuda blue, which the Thais brag about, is so easy it can almost be done by tossing it into a fireplace."

THE LATEST WRINKLE in sapphire enhancement is diffusion treatment. American dealer Jeffery Bergman of Gem Source in Bangkok buys and facets what used to be relatively worthless clear or off-color Sri Lankan sapphires. Then he sends them to the United Radiant Applications laboratory in Del Mar, California, where they are packed in titanium and iron oxides. During 600 hours of cooking near sapphire's 2050°C melting point, the titanium and iron diffuse about 0.4 millimeter into the stones. The gems, mottled by the heat, go back to Bangkok, where workers are very careful not to repolish through the thin blue layer.

"I sell 10,000 carats a month as diffusion-treated sapphires," says Bergman. "There's a disclosure on every invoice."

He cannot control how many of his stones are unethically retailed as naturally colored gems. The effect of this new technology on the sapphire market is clearly alarming some dealers: So far, Bergman has received ten death threats.

Gem enhancement and outright trickery are as old as commerce. Pliny wrote 19

Duplicating the work of nature, Judith Osmer pours molten flux from a platinum crucible to reveal the ruby crystals inside. Her Los Angeles company, J. O. Crystal, produces gem-quality synthetic rubies. Chatham Created Gems in San Francisco used the flux process to form this 2,134-carat stone, the world's largest flux-grown ruby.

centuries ago that glass, a favorite gem fake, would "glitter like fire" when backed by hammered metal foil. Throughout Africa many of the gem "bargains" offered to tourists turn out to be glass, very cheap synthetics, or man-made cubic zirconia. There was a period in Myanmar when red glass taillights were knocked out of military jeeps, tumbled in gravel, and sold to foreigners as ruby crystals. Without training and equipment, accurate identification is impossible.

A REMARKABLE NUMBER of famous gems remain mislabeled—some of the errors passed down from times when a stone's chemistry was unknown.

One exception is the 170-carat Black Prince's Ruby, worn on King Henry V's helmet into the Battle of Agincourt. It is actually a much less valuable red spinel, and the British Crown Jewels display in the Tower of London notes the truth. Not everyone else is so forthright. Some curators cite risk or cost as excuses for not testing. To reveal their relics as lesser stones or fakes might diminish the collection's prestige and discourage tourism.

In France I sought the Talisman of Charlemagne, a pendant set in gold for the great ninth-century emperor. In its center are said to be two large sapphires pressed together to hold visible splinters of the True Cross. At the Palais du Tau next to the Cathedral of Reims one chill autumn morning, the curator reverently removed the relic from its heavily secured case. As I photographed it, I became more and more skeptical. Finally, I asked to examine it with my loupe. Without further testing, my impression was that the front cabochon is pale blue glass and the rear is quartz. The curator asked, "How can you be sure?"

"By the color, clarity, general look, and the tiny bubbles," I said.

"Well," he sighed, "we once had a student here who suggested the same thing."

After five minutes viewing the famous "ruby" jewelry at Bavaria's Munich Residenz, a former palace, I told the curator I felt there were few rubies in Queen Therese's tiara, necklace, earrings, and armlets. "You know," she remarked, "I never thought all the stones looked like rubies." I offered to have the jewelry analyzed at my expense, but the museum declined.

There was a similar mislabeling at Dresden's long inaccessible Green Vault. When I viewed the 18th-century full uniform garnitures, ruby and sapphire decorations created for King Augustus the Strong, I particularly questioned some of the rubies. A curator searched the original inventory to find them listed as "balas rubies." In Europe until the 1800s, "balas" usually meant spinels.

At London's Victoria & Albert Museum, I became suspicious of two "ruby" rings because of their particular color and clarity; the curator confirmed that one was a spinel and the other a synthetic. Apparently some European heir switched a tsarina's ruby with a flame-fusion synthetic worth less than $50.

Splinters of the True Cross they may hold, but author Fred Ward suspects that the "sapphires" housing the relic in the Talisman of Charlemagne (left) are glass and quartz.

The 19th-century armlet (right) of Queen Therese of Bavaria also triggered Ward's skepticism. Second only to diamonds in hardness, rubies are unlikely to suffer deep scratches as on the center stone. His conclusion? Glass.

CATHEDRAL TREASURE, BERNS, 7.3 BY 6.3 CM (FACING PAGE); TREASURY OF THE MUNICH RESIDENZ

SYNTHETIC RUBIES AND SAPPHIRES are an enormous industry, useful to price-conscious jewelry shoppers and vital to technologies like lasers and integrated circuits. Tom Chatham, probably the world's most successful grower of synthetic gem material, says, "No one is entirely happy with the word 'synthetic,' but it's scientifically correct." In 1959 Chatham's father became the first to market corundum made by the flux process, which re-creates the roiling magma found in nature.

We walked past rows of electric furnaces containing flux material (a liquid metal they call "mother liquor"), aluminum oxide, and—for making rubies—chromium. The mix is heated well above 1000°C; ruby seed crystals are placed inside the glowing mass, and for almost a year ruby crystals grow on the seeds.

"Business is booming," Tom said happily. "Say our biggest client has an order for 1,000 'tennis' bracelets with 23 rubies each. There's no way to mine 23,000 matched naturals, and good colors could cost $5,000 a carat. My deep red created rubies wholesale for $25 to $450 a carat."

Tom's only U. S. competition is Judith Osmer, a former aerospace research crystal grower who now produces about 7,000 faceted ruby carats annually in her small Los Angeles lab. "Unlike Chatham, I don't use a seed crystal," she explained.

Opening the furnace door to expose a white-hot inferno, Judith used long tongs to carefully lift one of six glowing pure platinum crucibles. She quickly poured a lava trail of the molten flux into a box of sand, revealing a few new synthetic rubies attached to the crucible walls. Judith was delighted—the outcome is never certain.

"When everything's just right, the atoms line up in a perfect hexagonal lattice and crystallize into rubies, just as they do in nature. My runs take only three months apiece, and they grow great rubies."

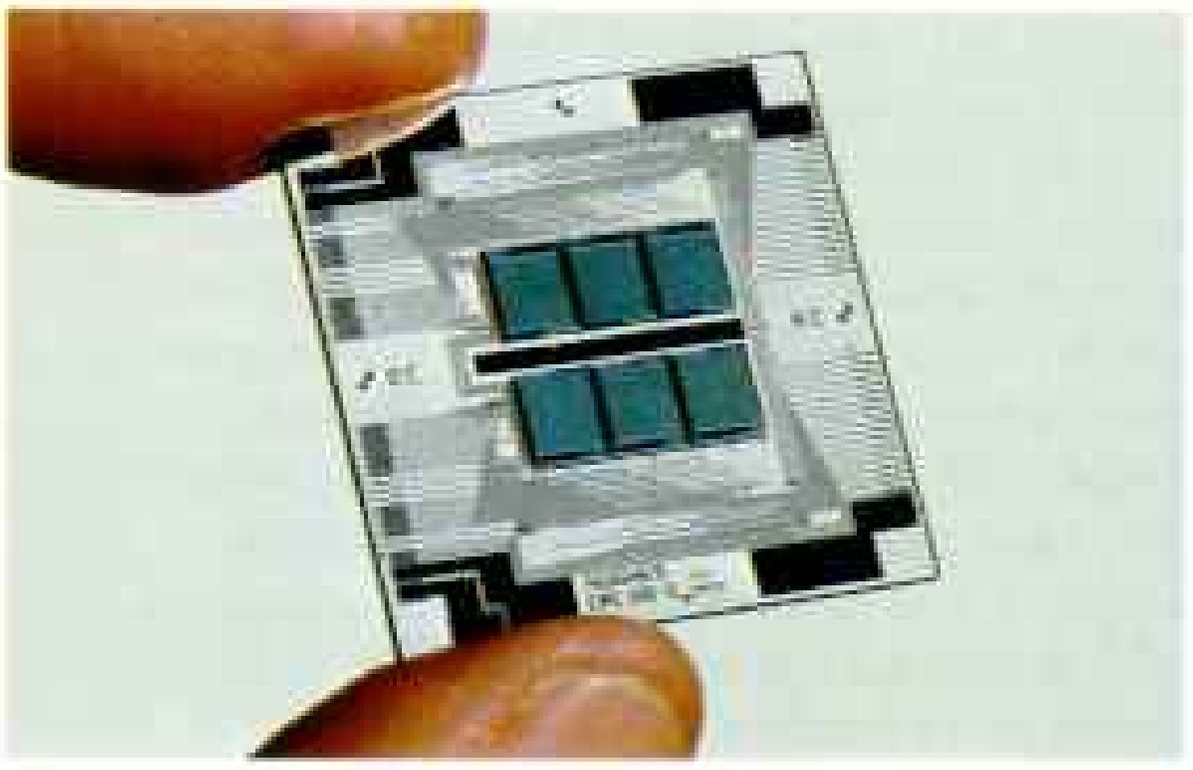
Some experimental work is being done in the U.S.S.R. on hydrothermal ruby crystal growth, but the majority of high-priced synthetic rubies are flux grown. That is because they are relatively rare and look like naturals, with their own customary set of inclusions and color variations. At the opposite extreme, one of the world's largest producers of synthetic corundum uses an entirely different process called Verneuil, or flame fusion, which was developed in the 1890s.

TO SEE THIS TECHNIQUE, I traveled to Monthey, Switzerland, tucked between the Alps and Lake Geneva. Here octogenarian Vahan Djévahirdjian operates 2,000 furnaces, fueled mainly by hydrogen from the Ciba-Geigy factory next door.

"My Armenian uncle started this business in France in 1902," he said. "We moved here just before World War I to be near a hydrogen source and have been producing ever since."

"We turn out 80 tons of rubies and sapphires a year, 400 million carats," said his daughter Katia. "We start with colorless aluminum oxide powder. For red we add chromium oxide; for blue we use titanium and iron. But to get green, we add cobalt, and for yellow we use nickel instead of iron."

Giant crystals of synthetic sapphire grown at Union Carbide in Washougal, Washington, will be cut into thin radiation-resistant wafers, many of which will be used as substrates for microcircuits in satellite systems. Nearly ten metric tons of the clear boules are produced each year.



Dropped from a hopper, the powder liquefies in its fall through a flame. Landing on a seed crystal, it solidifies. In five and a half hours, a ruby or sapphire cylinder, called a boule, grows to seven centimeters high and two centimeters wide—remarkably fast for large crystals. At least six flame-fusion producers plus several other firms using different techniques synthesize more than a billion carats of corundum every year.

What do people do with this much synthetic ruby and sapphire? A third of Djéva's production becomes colorful faceted stones that wholesale for under five dollars a carat. The largest single gem market for flame-fusion sapphires is the U. S.—for class rings. Djéva joked, "It seems Americans are always graduating from something."

Some 40 tons of Djéva's sapphires are sliced into one product: watch crystals. Almost every watch that costs more than $400—between half a million and one million produced every month—has its face covered with sapphire. No acids or other chemicals affect sapphires, and they are virtually scratchproof.

Most of Djéva's remaining production goes into bearings. Harder than steel, corundum will not wear out when anchoring spinning steel shafts. Synthetic bearings are used in quartz watches, compasses, electric meters, and as thread guides in textile machines. Fine mechanical watches still have 17 or 21 jewels, usually rubies.

Bow tie askew and crew-cut hair pointing to noon, Hans Klingenberg takes the corundum advantage to the limit with his Swiss company, Century Time Ltd. Knowing the

Millions of U. S. class rings start at Hrand Djévahirdjian S.A. in Monthey, Switzerland. Stones for the rings are just one product of the world's largest manufacturer of industrial rubies and sapphires. Every day 2,000 furnaces are fired around the clock to create flame-fusion corundum for inexpensive costume jewelry, watch crystals, and watch bearings.

Man-made sapphire has even found its way to grocery counters. Layered over glass, it virtually eliminates scratches that can cause the laser to misread prices.

material to be beautiful as well as durable enough for bearings, he set about making sapphire watches—trouble-free timepieces that can even be used underwater.

The most advanced sapphire applications are developed in the U. S. Holding up a perfectly pure synthetic ruby rod, Bob Hill, Union Carbide's crystal products manager, explained, "This was the heart of the world's first laser. We're capitalizing on three superior corundum qualities: hardness, high melting point, and ability to allow free passage of all waves from ultraviolet through visible to infrared. The leading edge of laser technology is our tunable titanium-doped sapphire rod. By matching wavelength to task, one laser can do the work of many. And we're the only people in the world who pull 20-centimeter-diameter sapphire boules," which is what today's leading circuit makers may ultimately need for the wafers that support their chips.

Holding several of the transparent silicon-on-sapphire (SOS) wafers, Larry Rothrock, a Union Carbide technology expert, said, "In high-radiation environments, such as space or nuclear reactors, every now and then a radiation particle penetrates a conventional silicon chip. If it moves through a traditional silicon substrate, the charged particle can upset the chip's operation. But with a sapphire substrate, the whole chip naturally resists stray radiation, because sapphire is an almost perfect insulator."

One seamless hemisphere of synthetic sapphire tips the nose of a missile. The dome (top) resists abrasion and allows passage of optical wavelengths to the sensors behind it.

Beauty rivals durability in a faceted watch with a case and crystal made entirely of sapphire (above). The cost: $7,000.

Honed to precision, the ruby heart of a medical laser (right) passes final inspection.

Researchers are only beginning to tap the potential of sapphires and rubies. Their future value to technology? Priceless.

OTHER REMARKABLE sapphire characteristics contributed to U. S. success in the recent Persian Gulf war. Frank Reed, the genial manager of strategic technology at Saphikon, Inc., in Milford, New Hampshire, explained how his company's crystals helped maintain air superiority. "Our sapphire tube," he said, "placed near a warplane's engine, houses the IRCM [infrared countermeasures] device programmed to emit very strong signals that exactly match the fingerprint of the engine of an enemy's plane, tank, personnel carrier, or whatever. The IRCM confuses the enemy missile, which 'sees' our vehicle as friendly and doesn't target it."

Reaching for a transparent hemisphere, Frank continued, "This is our most amazing achievement—a missile nose cone, grown as a single crystal. Sapphire doesn't abrade even racing through a sandstorm, and it allows in unimpeded the radiation that missile sensors need to lock on to a target. It's ideal."

The appeal of rubies and sapphires bridges human history. As space-age tools, their usefulness is only now beginning to be realized. Two of the universe's most perfect creations, these gems are also among the most enduring. With a sparkle as fresh and bright today as when they formed a billion years ago, they offer a color for every taste.

"When you buy rubies and sapphires," says dealer Roland Naftule, "you own the rainbow." □

Australian Haven in a LORD HOWE

Text and photographs by DAVID DOUBILET

DAMSELFISH, *CHROMIS ATRIPECTORALIS* AND *ABUDEFDUF SEXFASCIATUS*; WRASSE, *THALASSOMA LUTESCENS*

Distant Sea ISLAND

Oceanic brew—wrasses and damselfish—froths in the lagoon of this lonely Pacific outpost.

In the forest of pilings under the island pier, venomous catfish gather in a writhing ball for protection, communicating by rubbing against one

PLOTOSUS LINEATUS

another. Spines in their fins can inflict painful wounds. At night such schools separate, and the catfish hunt along the lagoon floor.

An island woodhen, once prized by hungry sailors, strolls back from the edge of extinction. Resident Lisa Hutton rides the meadow below 2,549-foot Mount Lidgbird (foreground) and Mount Gower, peaks that catch the endless breath of the Pacific. About 280 people inhabit the secluded island.

SOME ISLANDS are merely dreams of land in the mist of distant oceans. Lord Howe Island is such a place, a seven-mile-long sliver in a strange and empty quarter of the sea.

The remnant of a shield volcano that began erupting seven million years ago, the island rises from a sunken plateau that stretches from New Zealand some 1,600 miles into the Coral Sea (map, page 135). It lies on the edge of the chilly Tasman Sea, 370 miles off eastern Australia, yet it is bathed in a clear, warm, equatorial current. It is less steamy than the jungle islands of the South Pacific, but still delicately tropical, and it is fringed by the world's southernmost coral reef.

Lord Howe became a garden, colonized by drifting spores, seeds, and other castaways that formed its meadows and rain forests in their own slow time. Much of that garden is a virtual laboratory for naturalists; one-third of the island's plants—thin howea palms and cathedral-like banyans—and a few of its birds, including woodhens, are endemic.

The sea also harbors native species, for the island's flanks provide a self-contained environment isolated by distance and temperature. As deserts have oases, oceans have islands. Australian naturalist Neville Coleman told me that since 1973 he has found 60 species of fish never documented at Lord Howe Island.

The twin peaks that dominate the island were first seen by the crew of the tiny British Navy tender H.M.S. *Supply*, commanded by Henry Lidgbird Ball, en route from Australia to Norfolk Island in 1788. On the return trip Ball and crew anchored there and found an uninhabited land where creatures had no fear, a peaceable kingdom. But the crew was hungry, and the island was well stocked with turtles, fish, and flightless fowl. Ball named it in honor of the First Lord of the Admiralty, Richard, Lord Howe, and for the next 80 years the island was an oceanic larder, a stop for scurvy-ridden ships and sailors heartily sick of British naval cooking.

In 1834 the first settlers arrived—former whalers with their Maori wives, who traded meat and vegetables to passing ships. By 1900 the economy had turned to palm seeds for the indoor-plant industry, and the first tourists had begun to arrive. But a nightmare horde invaded in 1918 when the ship *Makambo* ran aground. Its cargo was set adrift, and hundreds of rats rode onto the beach in style. They too found a paradise, and their population soon dominated the island, destroying many bird species. Only after World War II were the rats brought under control, by poison baiting.

TRICHOLIMNAS SYLVESTRIS

Flying boats brought more tourists, beginning in 1947, but no high-rise hotels or casinos were developed, only guest cottages. Then in 1981 Australia protected the island as a permanent park preserve, and the following year the area was placed on the World Heritage List. Today there is a stable population of about 280, and beds for 390 tourists, a restricted number.

Although I have photographed in Australian waters for a decade, Lord Howe Island was a new experience—a jump into open

ocean away from the weight of a continent. After a two-and-a-half-hour flight from Sydney my family and I were met at the narrow airstrip that almost bisects the island by Jeff Deacon, Lord Howe's dive master. "It's your lucky day, David," he said. "The wind has stopped, and it's been blowing for three weeks. You're in the middle of the ocean, you know, so there's no place to hide, but it looks like the weather came good."

The next day we dived at the foot of Malabar Hill, a 686-foot sheer cliff alive with red-tailed birds. The water was ice-blue, the reef subdued, but with flashes of unexpected color: A red polka-dot hawkfish rolled in the surge; morwongs, ridiculously striped, lay on the bottom in large groups; pairs of black-and-yellow butterflyfish pecked at the plate coral.

We dived at a mysterious place called the Triangle, where the anchor line vibrated like a bass fiddle string in the ocean current. We explored around rock islets where the sea swell would send us flying through huge, coral-covered hallways, over ridges and reefs. Yet I could never lose the sense that we were diving in the open ocean, huddled against the side of an island. At times the sea would be calm, flat calm. But I could always feel the swell. It was like lying on the stomach of a huge sleeping creature, its breathing a hidden, inescapable rhythm.

And the island itself seemed lost beneath the dome of a vast Pacific sky—just a dream of land.

DAVID DOUBILET has photographed life in the sea all over the world for NATIONAL GEOGRAPHIC, most recently Australia's Northwest coast in the January 1991 issue.

With a battering-ram face, a 30-inch Lord Howe Island doubleheader wrasse has just flipped a sea urchin. With strong teeth and helmetlike bump, the wrasse will pulverize the underside of the urchin shell for the eggs and meat inside. Surrounding rainbow-hued wrasses hope for scraps.

DOUBLEHEADER WHASE. CORN MUNIMEQUE

VOLCANIC SUMMITS PIERCE THE SEA

A fertile crescent, Lord Howe Island looms abruptly in an empty sea (left). Fifteen miles distant, Balls Pyramid (top left) towers 1,811 feet, so sheer that it appears two-dimensional, dwarfing the 50-foot-long fishing boat in its shadow.

Part of a chain of seamounts that formed in the South Pacific, today's islands were born of shield volcanoes that erupted seven million years ago. Gradually building up some 5,900 feet from Lord Howe Rise, these islands were as large as 12 miles in diameter and perhaps a mile above sea level (above). Since then they have been battered by wind and water. Older, more eroded seamounts, Elizabeth and Middleton Reefs, are exposed only at low tide.

As recently as 40,000 years ago, according to paleontologist Eugene Gaffney of the American Museum of Natural History, five-foot-long armored horned turtles roamed here. Today the island is a gentle place with lush forests of ferns, banyan trees, and palms, where tourism and development are restricted. Part of Australia's New South Wales, the two islands and surrounding waters are a world heritage site.

In a carousel of silvery trevallies and drummers, young Shane Deacon, a resident, enjoys Neds Beach almost as a private bathtub.

SILVER DRUMMER (FOREGROUND), *KYPHOSUS SYDNEYANUS*; TREVALLY, *PSEUDOCARANX DENTEX*

Tourists and islanders have long fed these fish, which show no fear.
Lord Howe's first visitors found an unspoiled paradise.

CLOWNFISH, *AMPHIPRION* McCULLOCHI

MORWONG, *CHEILODACTYLUS EPHIPPIUM*

The royalty of Lord Howe reign in an unusual ocean kingdom, the world's southernmost coral reef. A pocket of tropical life at the edge of a colder sea, the region has a surprising mix of inhabitants, from

ANGELFISH, *CHAETODONTOPLUS CONSPICILLATUS*

HAWKFISH, *CIRRHITUS SPLENDENS*

a cooler water morwong
to a splendid hawkfish,
a bespectacled angelfish,
or a clownfish more con-
servatively dressed than
its warm-water cousin.
The clownfish and
hawkfish are both
endemic to these waters.

Like petals from a fallen rose, the eggs of a Spanish-dancer nudibranch cling to the reef (above). The foot-long sea slug preys on other invertebrates. Its vibrant color and slimy flesh may make it distasteful to predators. In the evening sea, the nudibranch undulates through its soundless lagoon ballroom (right).

HEXABRANCHUS SANGUINEUS

Barely awash at low tide, Middleton Reef, 140 miles north of Lord Howe, blooms like an orchid but poses a deadly surprise for careless navigators. A coral-covered seamount, six miles across, it is littered with shipwrecks such as the Runic *(right), a freezer ship that ran*

aground in 1961 with a cargo of mutton and lamb. Animal bones carpet the reef. Our 56-foot diving boat, Capella, *lies off her bow.*

Dark knight of Middleton Reef, a 150-pound black cod, or grouper, guards its steel castle, a sunken Japanese fishing boat. It showed no fear or aggression and peered over my shoulder as I photographed. It may never have seen a diver, and only I knew I was a dangerous intruder in its vulnerable domain.

EPINEPHELUS DAEMELII

OMMASTREPHIDAE

My daughter, Emily, wanders down to explore Lagoon Beach in the early morning with the swell whispering against the barrier reef. A dying squid, washed across the coral from the open ocean, glistens a cold midnight blue as its life comes to an end. A peaceful death, on this magic island, in a far and perfect corner of the sea. □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Diahann Carroll

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Report from the Editor

PLAINS INDIAN CHIEF CA. 1908, NATIONAL ANTHROPOLOGICAL ARCHIVES, SMITHSONIAN INSTITUTION

To Native Americans the European concept of "discovery of the New World" is both ludicrous and insulting. "We were here for about 15,000 years before you showed up," an Algonquin friend in Massachusetts once chided me.

He is right, of course. What many refer to grandly as the Age of Discovery was in fact the Age of Collision—an era of confrontation between cultures and continents from which neither the Old nor the New World ever recovered.

With this issue the NATIONAL GEOGRAPHIC begins an ambitious series of quincentenary articles focusing on one of the most momentous periods in the history of humankind—the pivotal decades before and after Columbus reached the Western Hemisphere.

We begin by re-creating Native American life in 1491. Three of the articles in this issue are by Native Americans, whose special knowledge sheds new light on an often misconstrued story. Theirs is the most intimate—and perhaps truest—perspective of all. We accompany their words with a map supplement, "Native American Heritage: A Visitors Guide."

Later in the series we will probe Columbus the man and his world and join an archaeological team excavating his doomed settlement of Isabela on the Island of Hispaniola.

Other articles will follow the tracks of the conquistadores, examine the rise of the barbaric African slave trade, and trace the global routes of the great Portuguese and Arab navigators. Another map supplement will focus on "The Spanish in America."

This was an age unlike any other, a crucible of encounters, conflicts, and exchanges that shaped the nations of our hemisphere—and of the world. Our hope is to bring a fresh understanding of the impact of that legacy on our lives today.

William Graves

National Geographic, October 1991

How do you improve on a symbol for qua

You make

The New LeSabre

Buick LeSabre has earned an enviable reputation for quality. Of course, that didn't stop the people at Buick from striving to make LeSabre even better.

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the car that became lity in America? it better.

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WILDLIFE AS CANON SEES IT

Crowned Lemur
Genus: *Lemur*
Species: coronatus
Adult size: Length, 31.5-35.5 cm; tail, 41-51 cm
Adult weight: Approx. 2 kg
Habitat: Dry seasonal forests, and humid forests at higher altitudes, in Madagascar
Surviving number: Unknown
Photographed by Michael Herzog

While an infant crowned lemur is curiously exploring its treetop home, an adult male stays dutifully by its side, carefully observing and guarding. Among crowned lemurs, the males and juveniles are the primary caretakers of the young, whereas the females play a dominant role in the group's social system. These rare lemurs are declining due to habitat loss and hunting. To save endangered species, it is essential to protect their habitats and understand the vital role of each species within the earth's ecosystems. Color images, with their unique ability to reach people, can help promote a greater awareness and understanding of the crowned lemur and our entire wildlife heritage.

NATURE

Watch "NATURE" on PBS, Sunday 8:00 p.m.
This program is funded, in part, by Canon U.S.A., Inc.

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Forum

Colorado River

In this well-done article (June 1991) I did not see discussion of the fact that the Colorado system carries one of the greatest loads of sediment among rivers of comparable size. The first Spanish explorers noted this in the name Colorado, "red" in Spanish. Each dam causes the river to drop its load at the head end of each lake. How long until the lakes fill with mud? Flying over Lake Mead, it is easy to see the beginning of a delta.

ROBERT WYNNE
Mercer Island, Washington

Most northern Californians are concerned about the degradation of their environment. Pumps of the California Aqueduct, which send Sacramento River water south, kill a large number of fish, contributing to the decline of a striped bass fishery. Reduced freshwater flows result in saltwater intrusion into the marshes, and an important salmon nursery and fishery is dying. San Francisco Bay is denied its periodic flushing. A new canal diverting more water will further endanger a major ecosystem.

HOWARD L. BLOOM
Alameda County Fish and Game Commission
San Leandro, California

There would be no shortage of water in the Southwest if most of it were not used to grow crops (cotton, corn, hay, wheat) that can be more efficiently grown in areas that get rain. With the present system the taxpayers spend billions of dollars to furnish water to farmers so they can grow crops that we don't want and cannot use. There is no shortage of water in the Southwest. There is a surplus of stupidity.

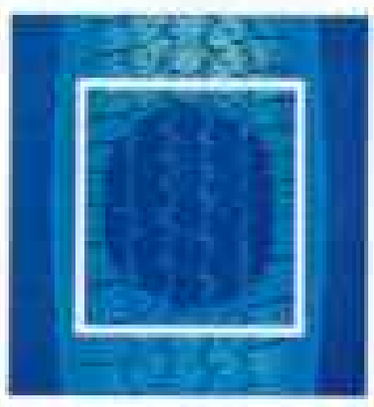
H. J. WELO
Alvin, Texas

Colorado waters have made it possible for man to produce food as well as habitat for millions of people. There are always problems to be solved and more reservoirs to be built. I felt that your writer would rather see the Colorado run straight to the ocean so a few fish could survive than use the river to help people.

CAROL SPENDLOVE
Salt Lake City, Utah

It has not been proven that "a coal power plant near Page . . . taints the air over the Grand Canyon and the Navajo Reservation." A recent University of Washington study indicates that

GOODYEAR INVICTA GS. BASED ON A SIMPLE BUT PROVEN HYDRAULIC PRINCIPLE.



Wet or dry, this is all that touches the road: the contact patch.

No one likes to drive in the rain.

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Invicta radials were chosen as original equipment for these cars after rigorous comparison with other makes of tires. For things like treadwear, noise. And wet traction.

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No one likes to drive in the rain. But you'll find it's when it rains that the Invicta GS really shines.

Chrysler Town & Country

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You'll find Invicta radials on some of the best vehicles available in America. One of the reasons they were selected is their wet weather capability.

GOODYEAR

THE BEST TIRES IN THE WORLD HAVE GOODYEAR WRITTEN ALL OVER THEM.

much of the smog over the canyon originates in Los Angeles.

VERONICA RAHORM
Mesa, Arizona

A study sponsored by the Page power plant itself shows that the plant contributes to the pollution.

There is a similarity between water use in California and the use of heating oil in New England in the early 1970s. Prior to the oil embargo, with oil selling below 20 cents a gallon, there was little incentive for conservation. When prices skyrocketed, most homeowners discovered the most effective method of saving was conservation. If the price of water was set to reflect its true value, green lawns in California would become as much an anachronism as the heated garage is in New England.

RICHARD J. DUQUETTE
West Springfield, Massachusetts

East Europe Pollution

Your article reminded me of years living in Donora, Pennsylvania, a small steel town with a large zinc works. Both industries employed thousands of residents from the late 1800s to the early 1950s. It was not unusual to see mill workers covered with red dust from a "slip" in the blast furnaces. The zinc works was the more devastating, as the fumes were highly toxic to man and plant life. In late 1948 an air inversion trapped fumes in the valley; some 20 residents died, and hundreds were made ill. Rather than clean up, industry moved elsewhere; Donora is now like a ghost town. I can sympathize with the occupants of those cities in East Europe.

JOHN E. BEISEL
Elizabethtown, Kentucky

In the mid-19th century Karl Marx described the utter hopelessness and bare subsistence level of the masses of working people in Europe's industrialized capitalist countries. I find it ironic that the nightmarish daily living after decades of socialism in Eastern Europe is more illustrative of the plight of the "downtrodden, wretched of the earth" proletariat than Marx could have ever imagined.

AARON HILLER
Nashville, Tennessee

Hungary suspended the building of the dam and hydroelectric station on the Danube in Nagymaros and is beginning the restoration of the original streambed so that the free flow can give good drinking water to three million people. Hungary also requested Czechoslovakia not to start the hydroelectric station of Gabčíkovo, but sorry, Czechoslovakia is sticking to it.

MIKLÓS KOVÁCS
Budapest, Hungary

Your piece covered very different countries, each of which has specific problems. It is wrong to present the worst of Romania as characteristic of the whole region. When the text talks about

Czechoslovakia, it is complemented with pictures from Bulgaria, a thousand miles away and at a lower stage of development. The report should have been split into sections, each devoted to one country. East Europe is not one land.

E. SLEZAKOVA
Prague, Czechoslovakia

Here in the U. S. we spend millions attempting to reduce minuscule risks posed by small amounts of environmental contamination. We need to transfer some of that money and manpower to an environmental Marshall Plan for Eastern Europe. As an environmental engineer, I volunteer.

JEFF JACKSON
Taylors, South Carolina

Animal Navigation

Unresolved questions about how animals can identify extremely small stimuli in their environment in order to navigate brought to mind a similar question we encountered when using dogs to locate hazardous chemicals during research funded by the Environmental Protection Agency. Our dogs detected plumes of chemicals (toluene or xylene) of very low concentrations, on the order of parts per trillion, and tracked them to their sources. This may be further proof that animals have additional senses we simply do not understand.

HERBERT S. SKOVRONEK
Environmental Services
Morris Plains, New Jersey

Let's see, the sun rises in the west and sinks in the east . . . no, it rises in the east and sinks . . . oh, I can't remember those complicated facts from geography class. But are you sure that the turtles on page 74 are headed east into the Atlantic at sunset?

DANA VISALLI
Winthrop, Washington

Thanks to all readers who followed the sun and caught us jumping to a conclusion: The turtles normally head into the sea at dusk, but these specimens were released by scientists at dawn.

I believe that scientists have not been able to replicate Baker's experiment (page 86) because it depends on the students themselves. There might be a hereditary strain that enables some humans never to lose their way. My father had an innate sense of good direction in strange surroundings. My mother didn't. I feel at home everywhere and like to explore fields and woods. I can "feel" a waterway without seeing it.

S. J. VERMEULEN BRAUCKMAN
Prilly, Switzerland

As a flux-gate compass engineer, I use a precision Helmholtz coil set and have observed a heron turn its head at the precise moment that I change the magnetic field direction on the coils. The bird seems to sense the magnetic field from a distance

and flies to my test site. It perches and "enjoys" the field changes for up to half an hour at a time.

BRUCE CARTER
Port Orange, Florida

Lewis Carroll

We knew about Alice and her adventures from our childhood, and we knew that Charles Dodgson was a don at the House when he wrote them, but you have created a bond between Alice, Dodgson, and Christ Church. Now ever so often when we walk past the Deanery, through the gardens, or eat in Hall, Alice and her admirer come to life again, making us see our College with different eyes.

MATTHIAS HAMMER AND KATY MALYON
Christ Church, Oxford

As a math student at Oxford I once heard a story (probably apocryphal) that Queen Victoria requested a copy of "Mr. Dodgson's little book," and he sent one on mathematics instead of the expected *Alice*.

WILLIAM F. GIBBONS
Crewe, Cheshire

We're sorry to report that this delightful story, which has been circulated for a hundred years, was denied by Dodgson himself.

Your beautifully illustrated article on Carroll is in itself a little literary gem.

VIVIAN M. GROVER
Kenmore, New York

Surely the Christ Church member quoted is under the Looking-Glass influence. Probably the sun does take five minutes to get from Greenwich westwards to Oxford, but as long as the earth keeps spinning the way we are used to, 10 a.m. in Greenwich will be 9:55 in Oxford, not 10:05.

DAVID J. BOGGIS
Orpington, Kent

To grin like a Cheshire cat was indeed a common expression in Dodgson's day. It came from the coat of arms of the Edgerton family, still used by many Cheshire inns and public houses. It was said by Lancashire folk that the lion's head on the arms looked like a Cheshire cat chewing gravel.

PETER H. GILLENEY
Stockport, Cheshire

Legend has it that the original Cheshire cat was one Thomas Caterlin, a forest warden in the Middle Ages noted for frightful grimaces as he tortured or killed poachers. "To grin like the Cheshire Caterlin" became abbreviated to "like a Cheshire cat."

KATHY A. DAVIES
Clwyd, North Wales

Letters should be addressed to FORUM, National Geographic Magazine, Box 37448, Washington, D. C. 20013, and should include sender's address and telephone number. Not all letters can be used. Those that are will often be edited and excerpted.

National Geographic, October 1991

Geographica

Halley's Comet Gives a Surprise Encore

The astronomers could not believe what they saw through their telescopes. Alain Smette and Olivier Hainaut, working in Chile, thought at first that they were looking at a galaxy. In Hawaii, Karen Meech wondered if her instruments were faulty.

Halley's comet (NATIONAL GEOGRAPHIC, December 1986), sailing away from earth, beyond Saturn and on toward Uranus—its bare nucleus a faint point of light—had begun to glow once more (right, bottom).

And what a burst! Meech, at the University of Hawaii, calculated that the dust cloud surrounding the comet was at least 2,000 times brighter than expected. It extended more than 270,000 kilometers across, according to an estimate by Hainaut and Smette, at the European Southern Observatory in Chile.

A comet is supposed to follow an elliptical orbit uneventfully through the solar system—Halley's 76-year orbit last took it past earth in 1986—until it passes near the sun. There, heat vaporizes the ice near the surface, and the gas pushes dust from the nucleus, creating a trademark tail. Then the comet goes on its way again and loses its tail.

Smette speculates that Halley's

PIERRE PERRIN, SYGMA

MARCH 1986

FEBRUARY 1991 ROYAL OBSERVATORY, EDINBURGH (TOP); EUROPEAN SOUTHERN OBSERVATORY

burst could have been caused by an explosive collision with another object in space or, as Meech also theorizes, by gases building up inside the comet's icy nucleus until they finally forced themselves through its outer crust. That seems more likely than a collision, says Meech, noting that the density of debris is quite low in the region where the outburst began.

A Gulag Prisoner Finally Goes Home

Bohdan Klymchak, whose gaunt yet defiant image (left) appeared in a March 1990 GEOGRAPHIC article about what is said to be the last Soviet labor camp for political prisoners, is home in his native Ukraine, free from the gulag.

The Ukrainian Supreme Soviet ruled that Klymchak had been wrongly convicted of treason and anti-Soviet agitation and that his 15-year sentence was excessive.

Klymchak, now in his mid-50s, crawled through barbed wire on the Soviet-Iranian border in 1978 and asked for asylum after protesting communist rule. Instead, he was returned to the Soviet Union and sent to Perm 35 in the Ural Mountains, 800 miles east of Moscow. His sentence was to expire in 1993.

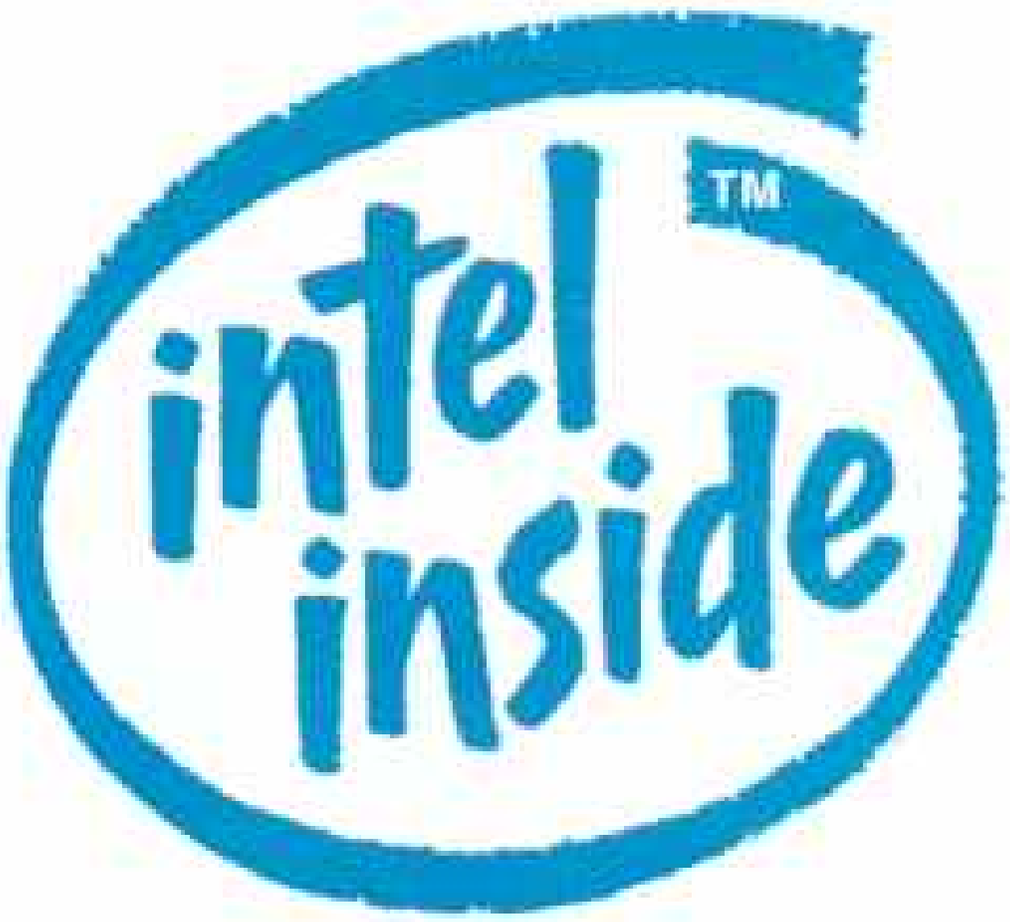
Amnesty International, a human-rights organization, began a letter-writing drive on Klymchak's behalf in 1987, when there were 600 Soviet "prisoners of conscience." Only about 30 remain today.

Adelaide Schroeder of Buffalo, New York, an Amnesty letter writer, said she was sure that the GEOGRAPHIC article "put enormous pressure on the Soviet government to effect Klymchak's release. You write letters and you never know anything about the person," she said. "But this time, the photograph brought it home."

National Geographic, October 1991

How to spot the

very best PCs.



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Geographica

Creating a Leonardo Statue in Pennsylvania

In 1482 Leonardo da Vinci's patron, Lodovico Sforza, Duke of Milan, commissioned a 23-foot-high bronze equestrian statue for his courtyard (GEOGRAPHIC, September 1977). Leonardo studied equine anatomy, drew sketches (below), and built a clay model of the horse. Then came war: The duke made cannon from the bronze, and invading French troops used the model as an archery practice target.

ROYAL LIBRARY, WINDSOR CASTLE

BILL CRAMER (ABOVE); D. TAB RASMUSSEN

The bronze horse was never cast.

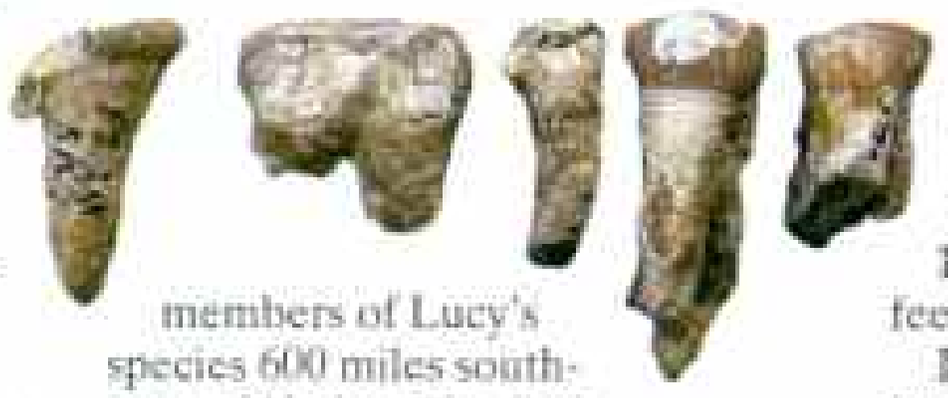
Enter Charles C. Dent, a retired airline pilot and art collector. Dent read the GEOGRAPHIC article and decided to create the horse as a gift to the people of Italy. He sought aid from scholars—one expert, noting Leonardo's drawings, called the plan "wholly possible and immensely exciting." Several artists, working with Dent in his Fogelsville, Pennsylvania, studio, fashioned a clay model (above right). If Dent's team can raise four million dollars to cast the bronze and ship the ten-ton statue to Italy, they hope to see it unveiled in Milan in 1993, 500 years after Leonardo showed his model to Lodovico.

Dent does not claim to be Leonardo. He says only that his horse will be "in the master's style." Unlike the original plans, Dent's horse will lack a rider.

Did Lucy's "Family" Wander East Africa?

The fossil remains of Lucy, the most complete of the earliest human ancestors known to walk on two legs, were discovered in 1974 at Hadar in northern Ethiopia (GEOGRAPHIC, December 1976). Some scientists think specimens found more than 1,000 miles away, at Laetoli in northern Tanzania, are also those of Lucy's species. Other researchers believe the Laetoli remains are of a different hominid.

Now a team of American and Ethiopian scientists supported by the National Geographic Society has discovered a handful of teeth from



members of Lucy's species 600 miles southwest of Hadar. The find lends credence to the notion that the species, *Australopithecus afarensis*, ranged extensively throughout eastern Africa.

The scientists, led by John Fleagle and Solomon Yirga of the State University of New York at Stony Brook, found seven teeth, including these five from one individual (above), at Fejij in the remote badlands of southern Ethiopia, near the Kenya border. They are between 3.7 and 4.5 million years old.

Waterfowl Return As Salt Lake Retreats

The waters of Utah's Great Salt Lake, which rose to record levels in the 1980s, now have dropped nearly ten feet below their peak.

From 1983 to 1985 rain and snow pummeled Utah, and the shallow lake rose. Without a natural outlet, it flooded highways, railroad tracks, wildlife refuges, and evaporating salt ponds used to mine potassium sulfate fertilizer (GEOGRAPHIC, June 1985). In 1987 the waters peaked: 4,211.85 feet above sea level.

Drought set in in 1988, and by last January the lake was down to 4,202.4 feet. Waterfowl enthusiasts cheered. The flooding had killed off vegetation that nourished millions of migrating birds. In earlier years as many as 60,000 tundra swans stopped at area marshes in the fall; by decade's end only 1,500 showed up. But with the lake level dropping and revegetation under way, some 6,000 swans appeared in 1990. Tom Aldrich, the state's waterfowl coordinator, expects another increase by the time this autumn ends.

Preserve Your World

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Still, cars are necessary and the question is, what type of car should one buy?

The answer: The best machine for you. Yes, machine. Let's get rid of all the marketing glamour about the automobile and see the car for what it really is. A machine, and in choosing a machine there are many things to keep in mind:

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After comparing cars and subjecting them to your checklist, we think you'll find a brand that always makes the finals—Subaru.

Subaru cars are, in short, intelligently designed machines. In fact, we've often been accused of "over-engineering." That's bad? To engineer something so it lasts longer and works better? We don't think so.

For one, we believe cars should have a longer life expectancy. That's why we try to do everything we can to help make sure the Subaru you buy now will be around for years to come. Case in point: 93% of all Subaru cars registered in the last 10 years are still on the road and running today.[1]

Secondly, we think a car should also be engineered to handle whatever occurs—bad weather, lousy drivers, crummy roads, etc. Which is why we offer All-Wheel Drive and why many of our vehicles come with the 4-Channel Anti-Lock Braking System which monitors each wheel to help prevent the car's brakes from locking-up during emergency stops.

Now which Subaru should you consider? Basically it depends on what you need. And how much you want to spend. To give you an idea of the breadth of our line, we'll briefly mention the cars that cover the gamut. The Subaru Justy, the Subaru Loyale, the Subaru Legacy and the new Subaru SVX.

The Justy* is for the person who just wants simple, dependable transportation. The Justy offers excellent gas mileage. "On Demand"** All-Wheel Drive. Rugged engineering. An Electronically

[1] Based on R.L. Polk & Co. registration statistics, as of July, 1990. [2] CYE 1990. [3] June, 1989. *Kelly Blue Book's Guide to the New SVX, May 1991. *Suggested Retail Price. Dealer's actual price may vary. **Suggested Retail Price without the Optional Touring Package, which is shown. Dealer's actual price may vary. For additional information, 1-800-284-8888. © Subaru of America, 1991.

ke to introduce a for '92. The truth.

Controlled Variable Transmission which provides the power of a 5-speed with the convenience of an automatic. And the Justy does everything in such a superior low-budget way that for two years in a row it was named *MotorWeek's* "Best Bargain Car of the Year."

Subaru Justy

The Loyale® is what's referred to as a subcompact. Which is misleading because every Loyale is designed to carry five comfortably and the Loyale wagon has more cargo space than the Corolla wagon (just one more reason why Subaru has become the #1 selling import wagon in America[2]). The Loyale also has the same basic engine design as a Ferrari Testarossa. Vented disc brakes. And rack and pinion steering.

Subaru Loyale

The Legacy™ is our luxury car. Starting at $12,999* (aren't luxury cars supposed to cost a lot more?) it offers the amenities you'd only expect from a much higher-priced automobile: over 90 cubic feet of passenger space. Air conditioning. 130 horsepower engine. Multi-point fuel injection. And the Legacy, too, has not gone unnoticed. *Car and Driver* stated: "The Legacy looks and feels like a quality piece. It makes us think Subaru's leap into the mainstream is going to create some surprisingly large ripples."[3]

Subaru Legacy

Lastly, the new SVX. With a 230 horsepower engine capable of producing over 220 pounds of torque, the SVX can do what you'd expect from a muscle car. Like travel from 0 to 60 in 7.3 seconds[4]. But it also has the features you'd only expect from an absurdly priced luxury sedan: Climate control. Driver's-side air bag. Room for four hefty adults. All-Wheel Drive. And priced around $25,500*, the SVX has the built-in reliability and durability all Subaru models are known for.

Subaru SVX

(The only reason we didn't quote several respected automotive sources about how exceptional a machine the SVX is, is simply because the car hadn't been introduced when this ad was written.)

Well, that covers about everything. And we'd just like to say and scream and shout again— That a car is nothing more than a machine. And may the best machine win.

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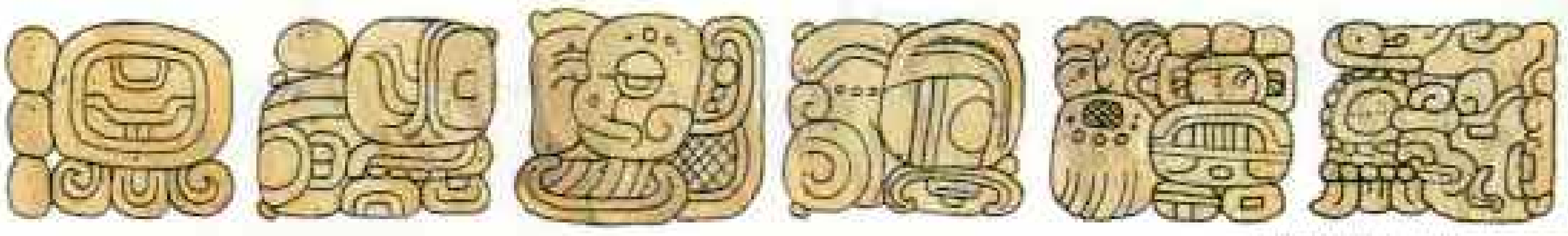
Geographica



CHRISTOPHER A. KLEIN, NGS STAFF

Glyphs Point the Way to a Maya Ruler's Tomb

"On October 30, 726, was buried . . . the three-katun lord, Ruler 2." That statement, part of a hieroglyphic text (above) on Stela 8 at the Maya site of Dos Pilas, Guatemala (right), was deciphered 13 years ago by Peter Mathews of the University of Calgary. But two glyphs in the sentence remained undeciphered. In 1987 glyph specialists Stephen Houston and David Stuart of Vanderbilt University realized that those symbols meant the burial spot was nearby.

This year, a team of Guatemalan and American archaeologists led by Vanderbilt's Arthur A. Demarest, working with National Geographic Society support, tunneled for weeks before finding the crypt, deep inside the ruined structure behind Stela 8. There lay the well-preserved skeleton of a male in his 50s—just right for the "three-katun lord" title, an honorific for rulers aged 40 to 60. Bedecked with a jade necklace and a headdress of cut shell, the body was laid out on the skin of a jaguar, a Maya symbol of royal power.

"We are relieved beyond measure," says Houston. "Now we know that what the Maya were telling us all along was right on."

A Tornado of Fire, a Record Death Toll

Intensely hot, uncommonly dry conditions seared the upper Midwest in the summer and early autumn of 1871. Smoke from fires filled the air over the prairies and the forests. Then, 120 years ago this month, twin calamities struck.

FEDERICO H. LAMPAYNARDI, NGS STAFF

Flames leveled Chicago and claimed 250 lives. The same night—October 8, 1871—a "tornado of fire" swept through northeastern Wisconsin (below). When the smoke cleared around the lumber town of Peshtigo and its surrounding forest, almost 1,200 people were dead—by far the worst fire death toll in U. S. history.

Survivors recalled "a whirling chimney of superheated air" sweeping across Peshtigo, stimulating the fire, which fed on wooden buildings, plank sidewalks, and streets covered with sawdust. The town's population, including hundreds of workers in a huge woodenware factory, was swollen by migrant railroad crews.

Many of the victims were buried in the Peshtigo Fire Cemetery. Among them were 350 bodies placed in a mass grave, their identities unknown.

STATE HISTORICAL SOCIETY OF WISCONSIN

Suggestions for GEOGRAPHICA may be submitted to Boris Weintraub, NATIONAL GEOGRAPHIC magazine, Box 37357, Washington, D. C. 20036, and should include the sender's address and telephone number.

The "Coop" Makes a Big Comeback

The future seemed precarious in the 1970s for predators like the Cooper's hawk. Because female hawks devoured prey that had ingested the pesticide DDT, they produced eggs with easily broken, paper-thin shells, and reproductive rates dropped. Hunters added to the bird's peril. "Can the Cooper's hawk survive?" asked the March 1974 GEOGRAPHIC.

Robert N. Rosenfield and John Bielefeldt, who have been studying the bird since 1980, say yes. "It's doing splendidly," they report. Rosenfield, a biologist at the University of Wisconsin at Stevens Point, credits a ban on DDT use and prohibitions on hunting for the turnaround. In Wisconsin today, pairs of the bird he fondly calls the "Coop" probably number in the thousands. The state has taken the bird off its threatened species list.

Coops seem adaptable, making nests in backyards as well as in woods. Once a pair has found a site, others follow. If the pioneers leave or die, new Coops take over, enabling authorities to identify and protect the sites.

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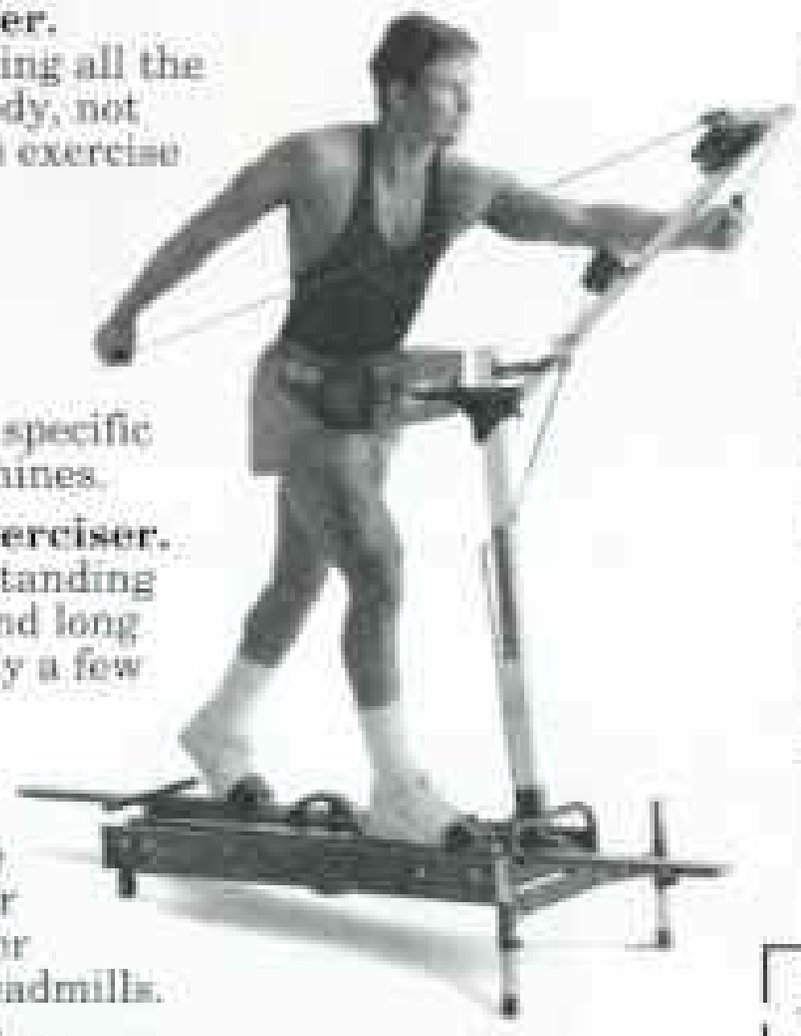

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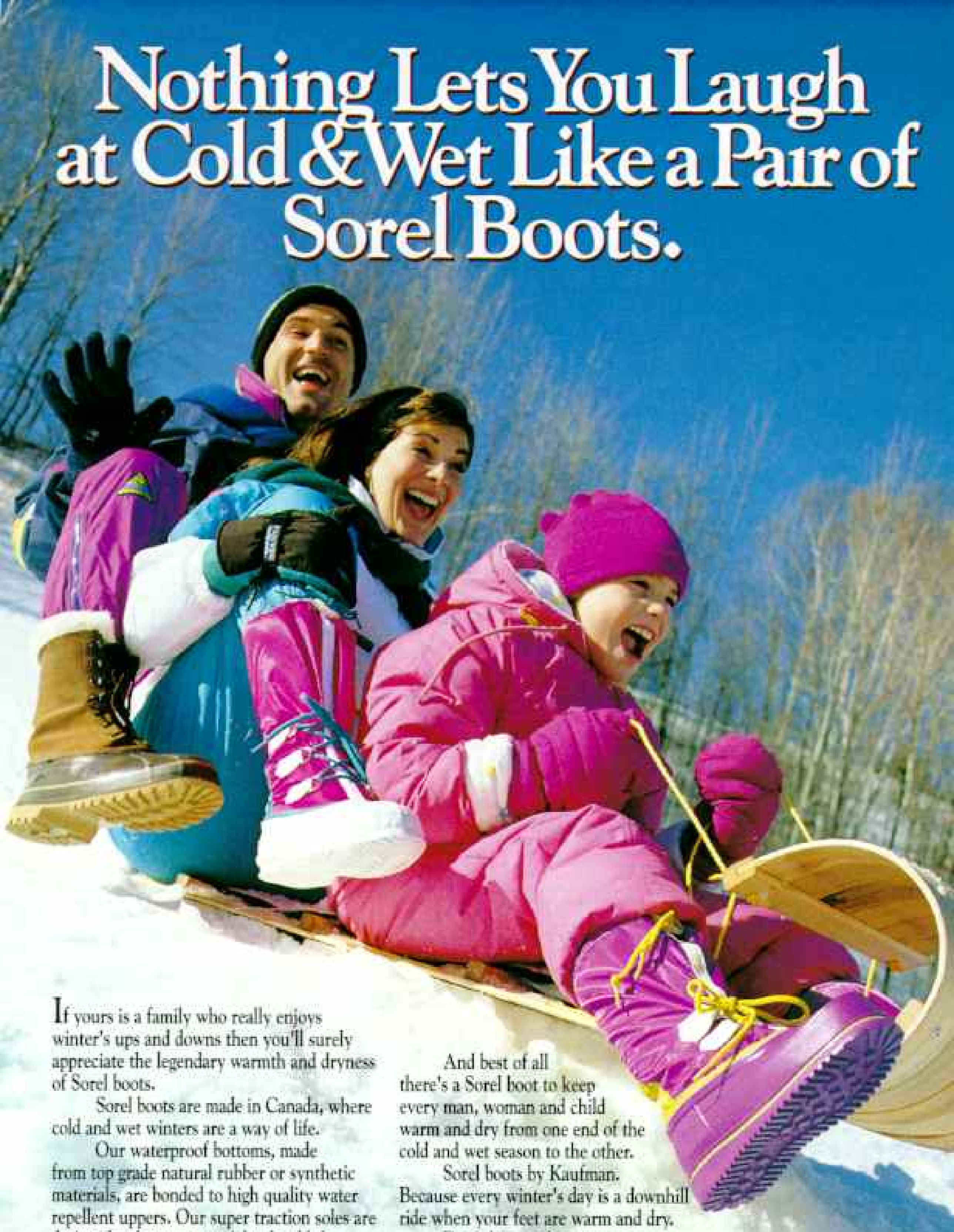

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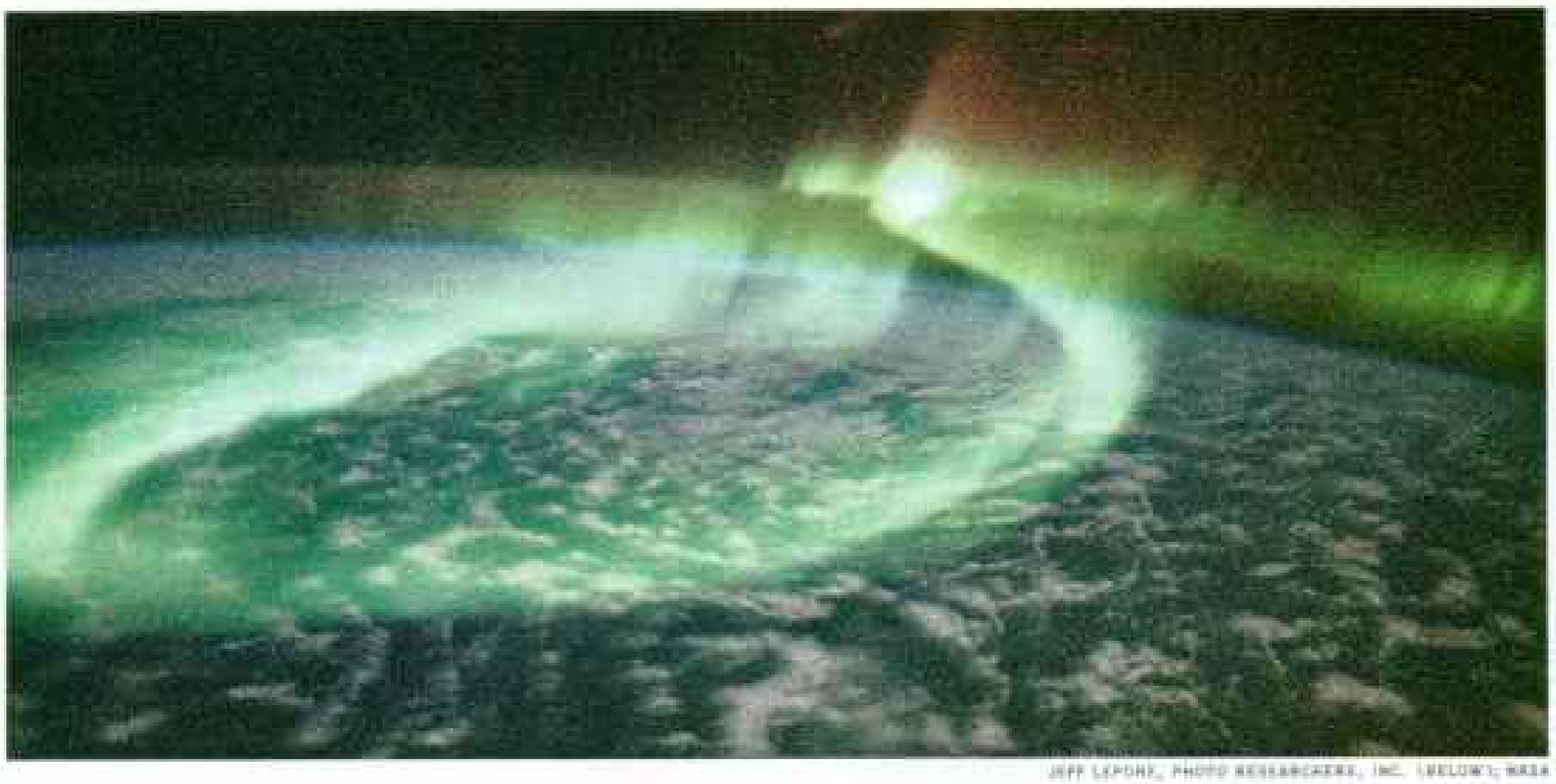

JEFF LEPORE, PHOTO RESEARCHERS, INC. (ABOVE); NASA

Fierce Solar Storms Spawn Dazzling Auroras

Last spring's giant flares from a stormy sun touched off spectacular displays of earth's auroras near both Poles. With a ringside seat over Australia, the crew of the space shuttle *Discovery* photographed this aurora australis—the southern lights—worthy of a hallelujah chorus or two.

Air Force engineers studied *Discovery*'s images for the Strategic Defense Initiative, or "Star Wars" program. They want to know how to detect an incoming missile that might be cloaked by an aurora.

Solar storms emit blasts of charged particles—the solar wind. Fierce bursts disturb the planet's magnetic field, creating arcs of light in the upper atmosphere. During the spring solar storms the northern lights flared as far south as Georgia, jamming radio broadcasts and threatening power grids.

Browsers Beware: Acacia Trees Can Kill

Tannin is fine as a tea flavoring, but it can be deadly to wildlife. The acacia tree uses tannin to repel nibbling nuisances, according to South African zoologist Wouter van Hoven. He found that the trees have an astonishing defense system and that some 3,000 kudu died as a result.

When these antelope browsers bite an acacia leaf, the tree steps up its tannin output and releases ethylene gas into the air. Acacias downwind sense the ethylene as a warning and increase their own tannin. Van Hoven's antelope—kudu fenced on game ranches during a drought—had little to eat but acacias and thus perished.

CAROL CAVATURA/ANIMALS, ANIMALS

Deceptive Orchid Creates Plight of the Bumblebee

A queen bumblebee spies a luscious pink orchid seemingly bursting with nectar. The bee lands on the inviting flower, called a pink lady's slipper, crawls inside, and can't back out. The imprisoned bee finds no nectar and can exit only through a narrow rear passage. Picking up pollen en route, most bees squeeze out with fire in their compound eyes and vow never to return.

Only 23 bumblebees in 1,000 are dumb enough to go through this again, thereby transferring the pollen to a second orchid, says Maryland zoologist Douglas Gill. "The bee is duped into the flower and gets nothing for its troubles but a rough time," says Gill. Playing so hard to get, how does the orchid survive? With longevity—most plants live 25 years—and fecundity—each pollinated orchid yields some 60,000 seeds.

National Geographic, October 1991

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Earth Almanac

ROBERT S. SCHEMENAUER

Milking a Cloud for All It's Worth—Water

In a thirsty world a cloud is a drink of water waiting to happen, and scientists have long tried to turn on the tap. Seeding clouds with silver iodide crystals to induce rainfall has been attempted for decades, with questionable results. Now, in a more direct approach, Chilean and Canadian scientists are catching ground-hugging clouds and milking them of water to aid a desert community.

Most days on Chile's arid coast windblown fogs called *camanchacas* stream in from the Pacific, promising rain to the fishing village of Chungungo but almost never delivering. To collect that moisture, researchers set up 50 fine-mesh nets, each 13 feet high and 39 feet long. When the fog blows through, the nets capture water droplets that add 2,500 gallons a day to a hilltop reservoir monitored by Canadian cloud physicist Robert S. Schemenauer (above right).

The cloud-strained water, now drawn straight from the reservoir, will soon be delivered by a four-mile pipeline. It should double the four gallons purchased daily by each of the town's 350 people. But Schemenauer adds, "Right now we're approaching this as both an aid project and a scientific venture."

Stunning New Primate Species Found in Brazil

With lion-like manes that frame tiny wrinkled faces, lion tamarins—monkeys the size of large squirrels—are considered highly endangered, since they live only along Brazil's Atlantic forest region, reduced by development to less than 5 percent of its original size.

Three species of lion tamarins—the golden lion, golden-headed lion, and black lion tamarin—were heretofore known to science. Then last year a fourth, christened the black-faced lion tamarin, was discovered improbably close to the teeming Brazilian metropolises of São Paulo and Curitiba.

"It's almost like finding a major new species in the Los Angeles suburbs," says primatologist Russell A. Mittermeier, president of Conservation International. Discovered on the 35,000-acre coastal island of Superagui by biologists from the Capão da Imbuia Natural History Museum, the new lion tamarin, known as *cara preta*, or black face, by islanders, was scientifically designated *Leontopithecus caissara*. The other members of the genus together total only about 2,000 in the wild, some provided by captive-breeding zoo programs around the world.

DAN KOCH

National Geographic, October 1991

Let's face it, it's an unsettling question. Especially when you're traveling alongside it at 55 miles per hour.

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You're passing a tank truck with one of those hazard signs on the back and it occurs to you that you have no idea how hazardous it really is, which gets you wondering whether the guy hauling it does either.

The statistics bear this out. Of the half-million or so hazardous materials shipments moving through the U.S. every day, 99.99% arrive at their destination safely, without incident.

Unfortunately, that leaves 0.01% that don't.

Which is why the member companies of The Chemical Manufacturers Association are schooling local firefighters, police and ambulance teams in the right ways to respond to accidents involving hazardous chemicals.

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Rusty Schweickart,
Astronaut, Apollo 9

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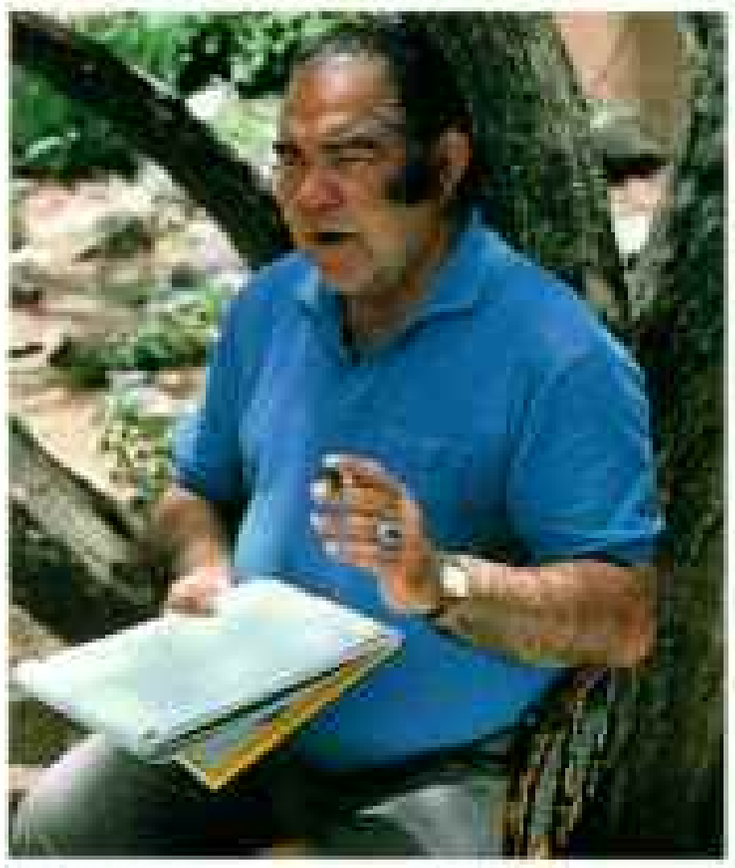
On Assignment

NATALIE B. FOBES

With roots in two worlds, three of our authors this month help bridge a centuries-old cultural gap to bring their Native American heritage to outsiders.

"I have a lot of respect for our elders and what they have been able to pass on to us in the face of huge social change," says MARIA PASCUA, whose father was Makah. She learned traditional basket weaving as a child, and when thousands of fragile baskets came to light at Ozette she made copies, such as this one, for the Makah museum in Neah Bay, Washington. Now Pascua herself is handing down what she knows of Makah culture in classes at the local elementary school.

Storyteller JOE BRUCHAC (below) lives in the upstate New York home where his Abenaki grandfather raised him, but he travels widely to storytelling festivals. "Tradition holds the tales are so powerful," he says, "that after the last spring frost the birds might listen and forget to feed their young, the corn forget to grow. So I tell them only in winter."



OTIS IMBODEN

Bruchac's latest book, written with Michael Caduto, is *Keepers of the Animals* (Fulcrum Publishers, 1991). His Iroquois name, Gahnehgoheyo ("the good mind"), was bestowed by a clan mother of the Onondaga. As for his distinctly non-Indian surname, Joe adds, "I'm half Slovak, and I can't tell you how often I'm asked what part of the country that tribe comes from!"

CYNTHIA ADAMS

Studying for a doctoral degree in anthropology at the University of Chicago, ALFONSO ORTIZ returned to his childhood home—the Tewa pueblos of New Mexico—to do his fieldwork. The result, *The Tewa World* (University of Chicago Press, 1969), is considered a classic. "The cultural legacy of the tribes should never be forgotten," says Ortiz, now a professor at the University of New Mexico.

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IT TAKES A LOT OF STAMINA TO KEEP GOING AND GOING AND GOING

Helen Thayer, at age 51, skied to the magnetic North Pole with her dog. She pulled a 160-pound sled for 27 days and 345 miles, surviving seven polar bear confrontations, three blizzards, near starvation and several days of blindness. Helen is wearing a very civilized watch from the Timex women's fashion collection. It costs about $40.

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