

VOL. 160, NO. 1



JULY 1981

NATIONAL GEOGRAPHIC

SATURN
RIDDLES OF
THE RINGS 3

COSTA RICA
STEERS THE
MIDDLE COURSE 32

TROUBLED TIMES
FOR CENTRAL AMERICA 58

LIVING WITH GUANACOS 63

BUFFALO BILL AND THE ENDURING WEST 76

BOMBAY, THE OTHER INDIA 104

SLIME MOLD—THE FUNGUS THAT WALKS 131

IN THE HEAT of El Salvador's civil war, a leftist leader told reporters that the death of a journalist would "clearly advance the struggle here . . . so long as it was a member of the U. S. press. You are more powerful, more visible."

A few months later, photographer Olivier Rebot, a free lance working for *Newsweek*, was killed by a sniper bullet. He was the eighth journalist known dead or missing in covering that war since April 1980. It may have disappointed his murderers to find that he was French, not American.

Half a world away, Senior Assistant Editor Robert Jordan was deliberately fired upon by a Somalia Liberation Front unit while preparing an article for our June issue.

In Nicaragua in 1979, the point-blank murder by a government soldier of ABC-TV reporter Bill Stewart was filmed by his own crew. Covering the world has always had its risks, but these incidents stand as tragic testimony that the loss of so many reporters in recent years is more than a twist of fate.

Not long ago most developing nations—sensitive to the power of pen and camera—courted the foreign press. Today many still see it as a powerful force, but one to be controlled.

The International Press Institute counts only 20 countries in the world with a truly free press. Even UNESCO fired a volley at press freedom when a study it commissioned recommended licensing reporters and issuing ID cards in order to "protect" them. This idea, favored by Third World nations, has been dropped for now, but it reflects increasing hostility toward a free press.

This especially affects the *GEOGRAPHIC*, since we often require access to an area for long periods of time. Increasingly, this has become difficult or impossible.

The Third World may justifiably feel that some articles distort its problems, may be insensitive or even inaccurate. We can only hope it learns that a less-than-perfect free press is better than none and can come to agree with Thomas Jefferson, who said—when we were a developing nation:

"The basis of our government being the opinion of the people, the very first object should be to keep that right; and were it left to me to decide whether we should have a government without newspapers, or newspapers without a government, I should not hesitate a moment to prefer the latter."

Wilbur E. Garrett
EDITOR

NATIONAL GEOGRAPHIC

THE NATIONAL GEOGRAPHIC MAGAZINE VOL. 181, NO. 1
COPYRIGHT © 1981 BY NATIONAL GEOGRAPHIC SOCIETY
WASHINGTON, D. C. INTERNATIONAL COPYRIGHT SECURED

July 1981

VOYAGER 1 AT SATURN

Riddles of the Rings 3

From a billion miles out, an unmanned NASA spacecraft sends home spectacular views of the haloed planet. Rick Gore relates why the images astounded and edified scientists. A double supplement shows Saturn full face and to scale in our solar system.

Costa Rica Steers the Middle Course 32

Kent Britt reports on a peaceable land of prosperous optimism where democracy works and armies are illegal—a true rarity amid Central America's mosaic of strife.

Troubled Times for Central America 58

Political turmoil and violence still wrack most of the nations of the tropical isthmus, whose promise and problems are detailed on a foldout map.

Living With Guanacos 63

Tens of millions of these furry wild camels roamed South America until meat and pelt hunters devastated their herds. Wildlife ecologist William L. Franklin and his family spend months studying them in remote Tierra del Fuego.

Buffalo Bill and the Enduring West 76

A man whose nickname became a legend really was the quintessential Westerner—Pony Express rider, Army scout, buffalo hunter, and master showman. By Alice J. Hall, with photos by James L. Amos.

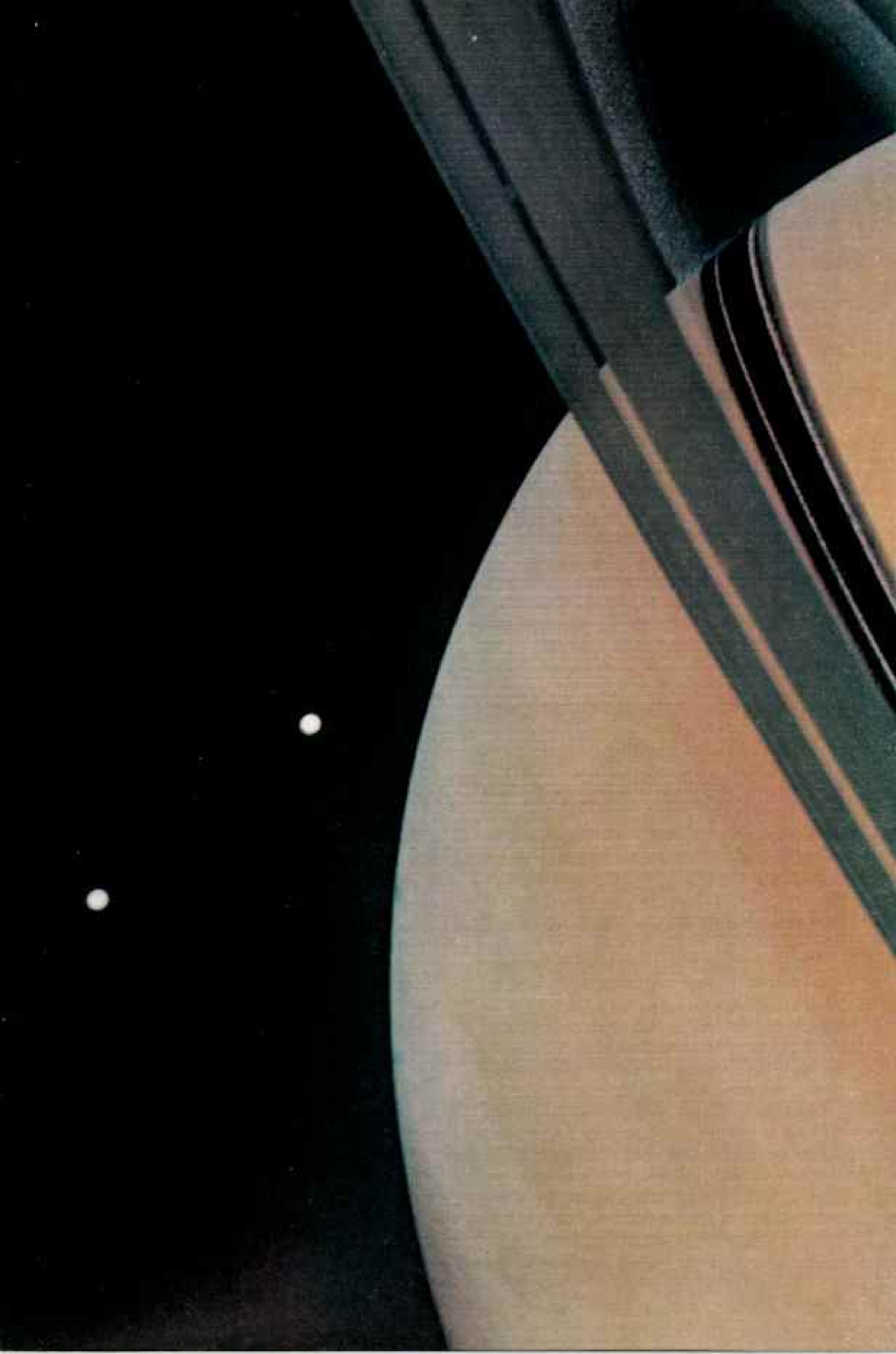
Bombay, the Other India 104

From glittering skyscrapers to desperate slums, India's commercial capital is one big paradox. John Scofield and Raghubir Singh discover.

The Fungus That Walks 131

An oft beautiful something called slime mold lives among us, behaving like both plant and animal and creating micro-sculpture in the wild. Text by Douglas Lee, photographs by Paul A. Zahl.

COVER: Multiringed Saturn glows with bands of color in a far-off springtime. Voyager 1 image with colors added by NASA.





VOYAGER 1 AT SATURN

Riddles of the Rings

Still 13 million kilometers away, Voyager 1 takes a portrait of Saturn and two of its moons, one casting its shadow on the cloud tops below the rings. Shortly, Voyager would find the bizarre reality—puzzles in the rings and enigmas on the moons. With worlds yet to reveal, the unmanned Voyager spacecraft have proved themselves instruments of wonder on the frontier that forever recedes.

By RICK GORE
NATIONAL GEOGRAPHIC SENIOR WRITER

Photographs by NASA



CO-ORBITAL MOONS (SEE PAGES 20-21)

F RING SHEPHERD MOONS (SEE PAGES 8-9)

A RING SHEPHERD MOON



Saturn's rings

SATURN, largely hydrogen and helium with a rocky Earth-size core, is the second largest but least dense planet.

D RING, confirmed by Voyager i, extends from 12,700 kilometers above Saturn perhaps to the planet's atmosphere.

C RING, composed of dozens of ringlets yet relatively transparent, has at least one eccentric (noncircular) ringlet.

B RING shows spokes, perhaps small particles affected by electromagnetic or electrostatic forces, that form and fade away.

NOVEMBER 10, 1980. The Voyager 1 spacecraft is a billion miles and more than three years from home. Deep in the outer solar system, it is rapidly approaching Saturn. In this super-cold, alien domain, where perpetual ring glow has banished night, Voyager is photographing a pale yellow giant, a turbulent ball of primordial gas that more resembles a star than the inner planets we know.

In two days Voyager will fly within 50,000 kilometers (30,000 miles) of those three bright rings that astronomers refer to simply as A, B, and C. It will explore the faint, recently discovered outer rings, E and F, and try to confirm sightings of a tenuous D ring close to the surface of the planet.

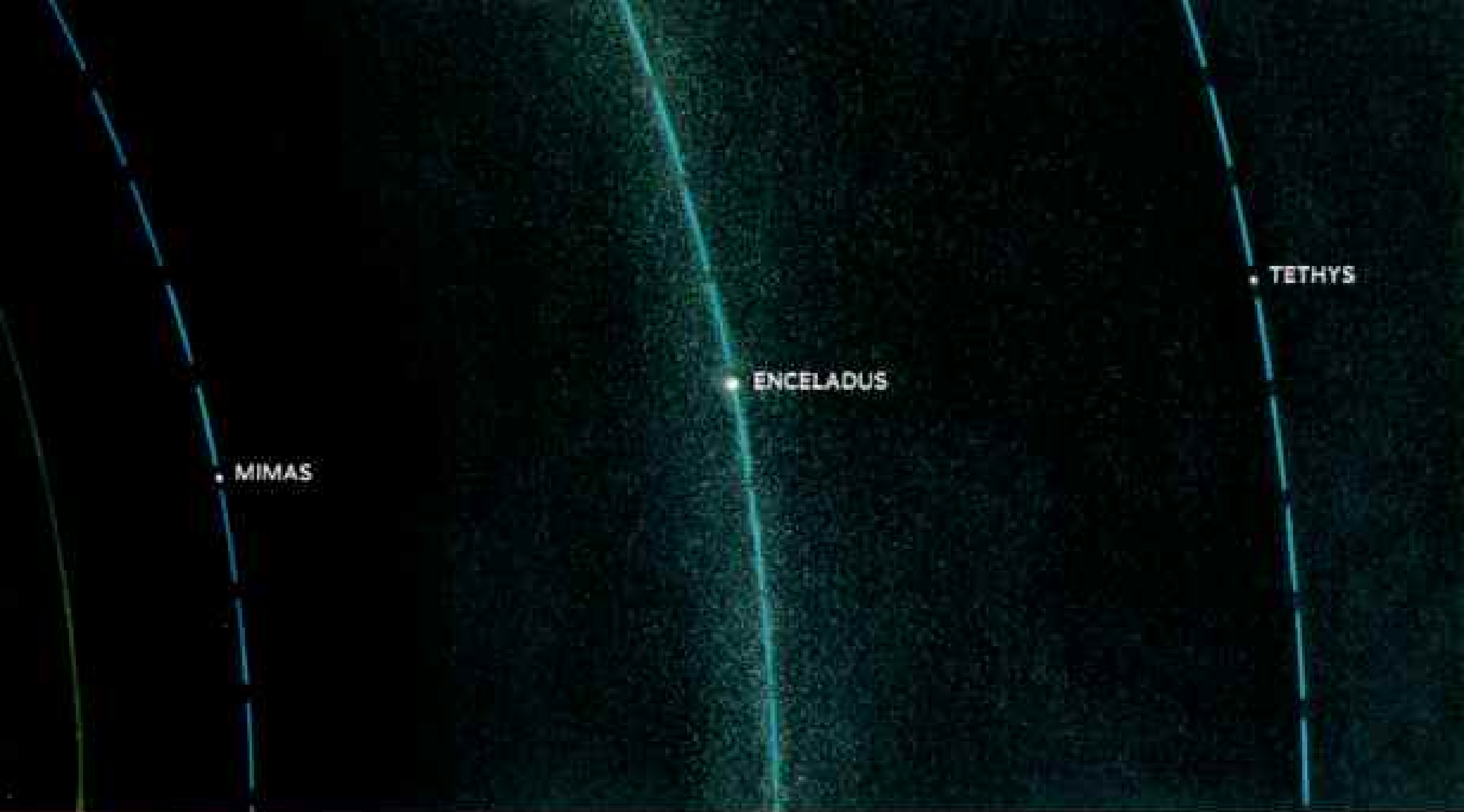
Voyager is also ready to unveil Saturn's moons, which range from the size of a small asteroid to mammoth Titan, larger than the planet Mercury. Most of the 15 known are mid-size—200 to 1,500 kilometers across—and made not from sand and stone and ores but from the icy stuff of comets. Big, mysterious Titan is known to have an atmosphere,

and scientists are hoping that clouds will not totally hide its surface. Some even speculate that life could have evolved on Titan.

Voyager has been paying most attention, however, to the celebrated rings. When Galileo first saw the rings, he thought God was playing a trick on him. Today scientists could well be thinking the same thing.

Hundreds of unexpected ringlets within the rings are emerging before Voyager's electronic eyes. The Cassini Division, a supposedly clear zone between the outer A ring and the middle B ring, is alive with at least three dozen ringlets. Curious spokes radiate across the B ring. The close-in C ring looks dark and different.

Voyager is watching two small moons that seem to be playing tag as they race around Saturn in almost the same orbit. The trailing moon is traveling faster than the leader, and should catch up with the leader in January 1982 (pages 20-21). The two presumably have been playing this game for billions of years. Through what sleight of physics do they avoid colliding?



PAINTING BY DAVID MELTZER

G RING
2.8

3.5

E RING

CASSINI DIVISION is seen from Earth as an empty space; it contains several evenly spaced bands of ringlets.

A RING has at its outer boundary a newly discovered moon.

F RING, bounded by shepherd moons, has an eccentric shape and irregular pattern; two of its strands appear intertwined.

G RING, narrow and diffuse, probably is accounted for by gravitational forces of undiscovered shepherd moons.

E RING is a broad, diffuse band of small particles that may be fed by material escaping from Enceladus.

Voyager has also spotted three "shepherd moons." Two of these moons orbit along the inner and outer edges of the F ring (pages 8-9), which wreathes the three bright main rings like a ribbon. Using odd gravitational tricks, these moons herd back in bounds particles trying to escape the F ring.

These F ring moons, along with a third little moon just 800 kilometers outside the bright A ring, seem to be shepherding the entire main ring system. These unimpressive chunks of ice apparently hold in place countless trillions of ring particles, spanning 63,000 kilometers.

AN AURA OF ASTONISHMENT pervades the Jet Propulsion Laboratory in Pasadena, California. Twenty months earlier this same Voyager had discovered so many marvels at Jupiter—a complex, storm-tossed atmosphere, a thin ring, volcanism on one moon, and evidence of ancient Earth-like crustal movements on another—that its Saturn encounter had threatened to be anticlimactic.*

"We were afraid Voyager's Saturn encounter was going to be a bust," one project scientist confides.

But Saturn is *not* a bust. The JPL press-room teems with reporters—far more than came for the Jupiter encounter. This space mission has clearly excited the public. Why? For one thing, the flawless performance of this little-spacecraft-that-could is a national pride. Space exploration is something the United States is very good at.

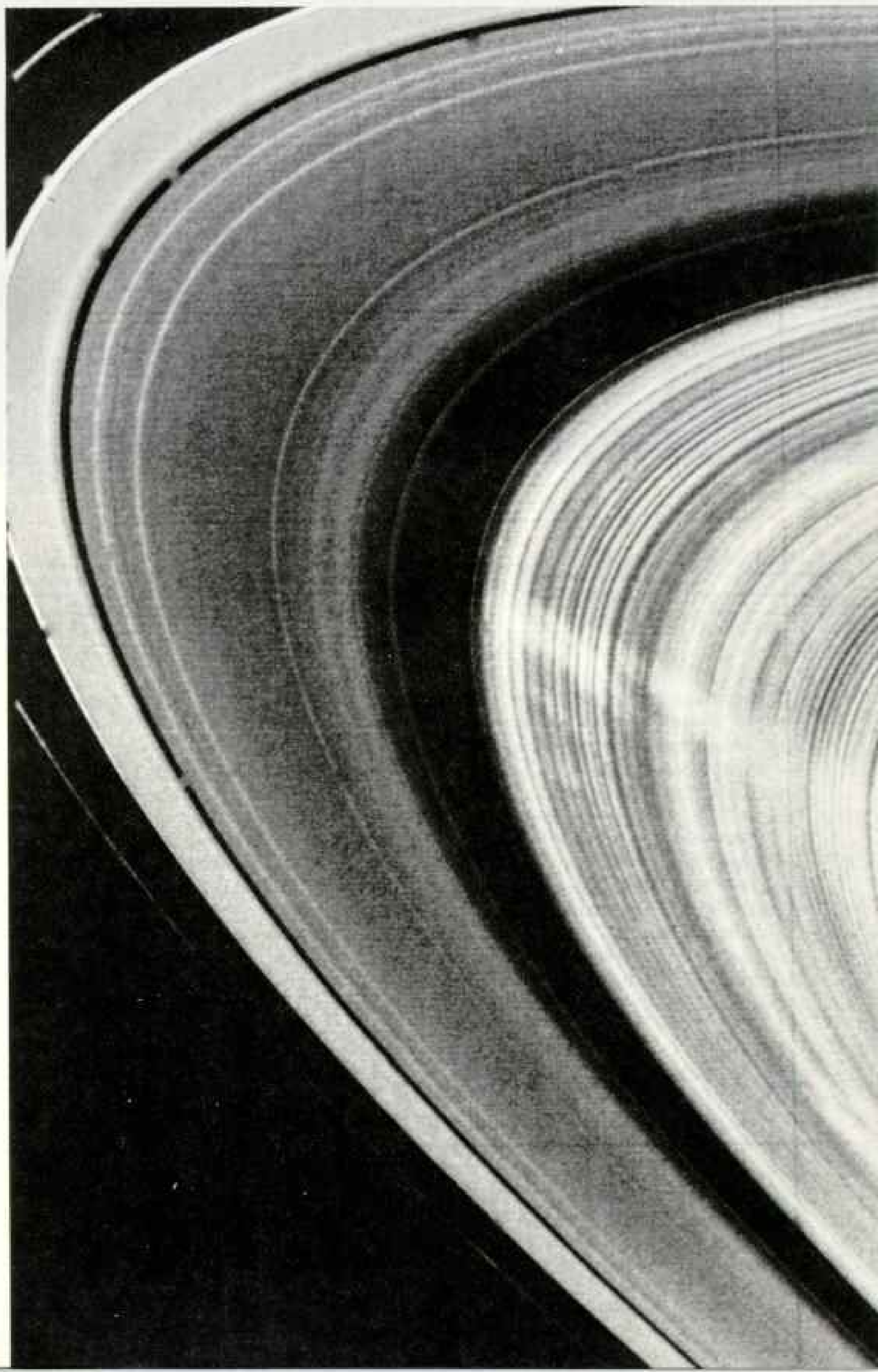
Then again, the pictures coming across the monitors speak directly to the imagination. Not fiery, chaotic, and psychedelic like those of Jupiter, they look cool, ethereal, and from a distance orderly enough to have been drawn with a celestial compass.

"Saturn *is* astronomy to many people," notes Reta Beebe, a mission scientist. "Through even a small telescope, it's the most beautiful thing in the sky."

Right now, to Brad Smith, the leader of Voyager's

(Continued on page 10)

*The author described what Voyager saw in Jupiter's dazzling realm in the January 1980 GEOGRAPHIC.



The rings: spoked, tilted, and eccentric

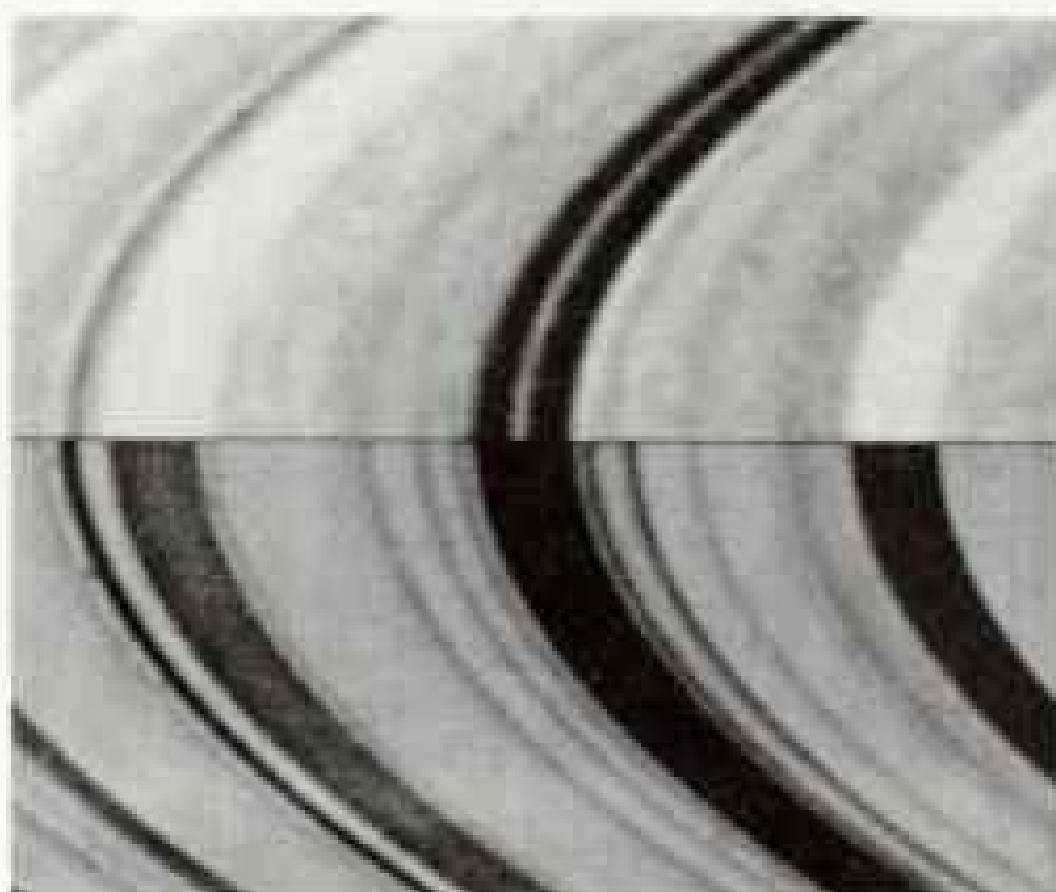
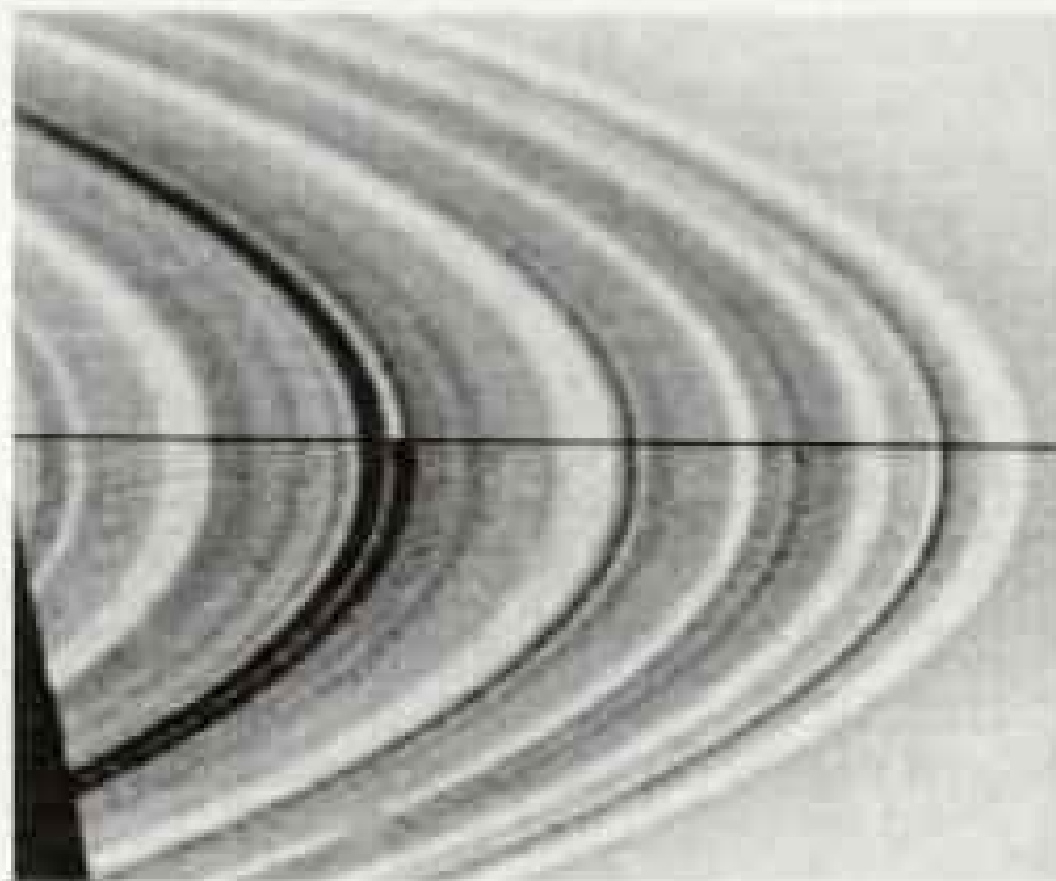
CAROUSEL OF TRILLIONS of particles from smaller than dust to larger than cathedrals courses around Saturn as its ring system. Voyager 1 found it to be full of structure and puzzles—such as spokes, one seen as a light streak (left) across the bright B ring. Spokes may be very fine particles lifted out of the ring plane by electrostatic forces.

Seen farther out in the grayish part of the A ring are two bright, narrow ringlets close together. Between them is a faint ringlet that begins as white in the upper right-hand corner. When followed counterclockwise, the ringlet turns dark, perhaps because it is somewhat tilted out of the ring plane.

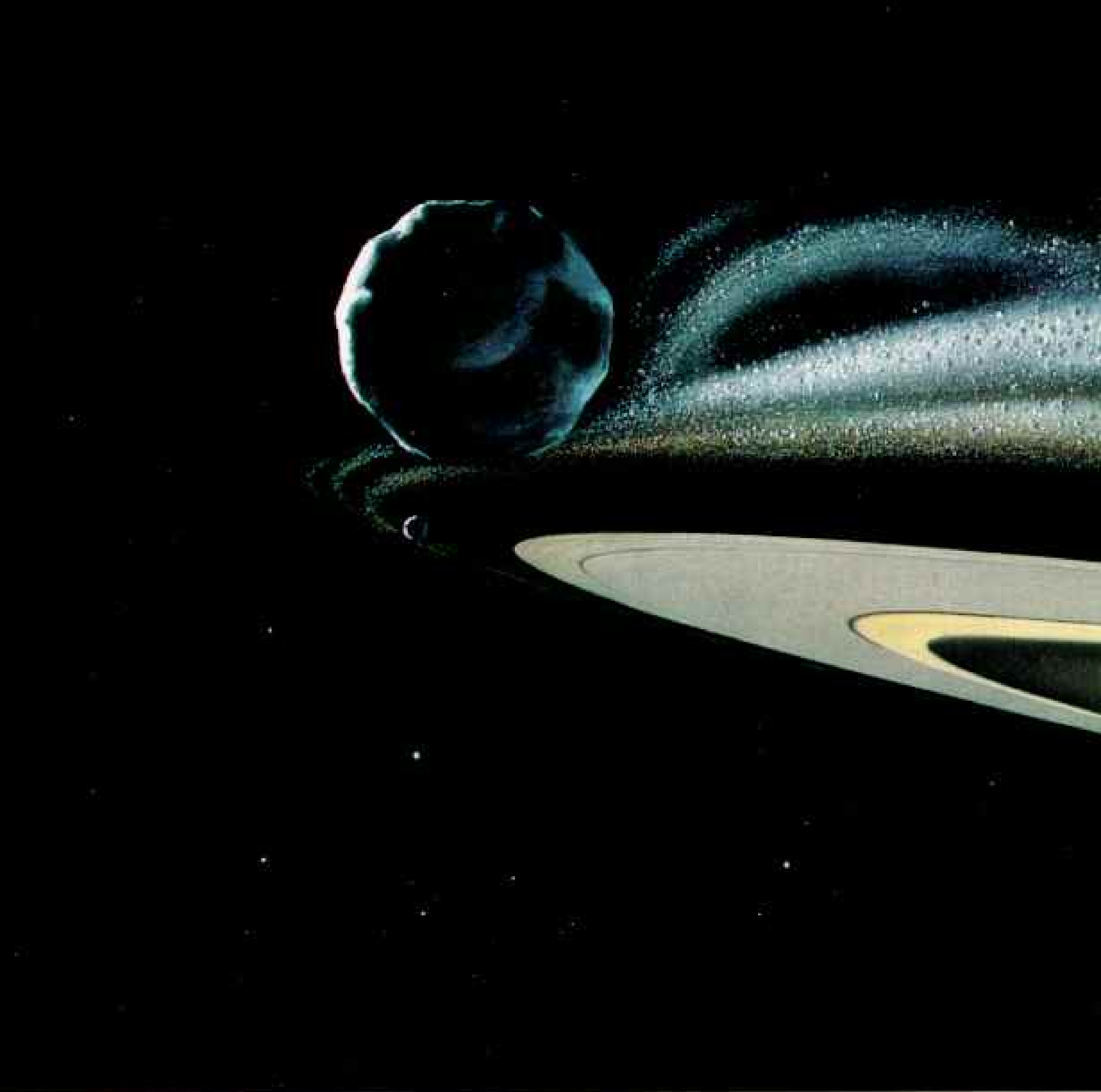
The density of rings can be roughly determined by the play of light upon them. In this composite view (right, middle) the upper, or sunlit, half was taken as Voyager 1 approached. Regions thick with material reflect light and thus appear bright. Regions void of material appear dark. The lower, or shaded, half of the image was taken from beneath the rings. Regions that are bright both above and below indicate particles that reflect light, but also, because of low density, allow some light to pass through. Regions bright from above but dark below indicate density so great that no light can pass through. Regions dark both above and below are void of particles.

A composite image of two separate sections of the C ring (right, top) shows one ringlet whose track doesn't match up, thus establishing it as an eccentric (out-of-round) ringlet that varies in width. It may be subject to perturbation by small, embedded moonlets.

The complex structure and features of the rings have turned out to be anything but obvious. As mission scientist Jeffrey Cuzzi (right) points out: "Understanding the structure is going to take a lot more work. It's not something that just clicks into place."



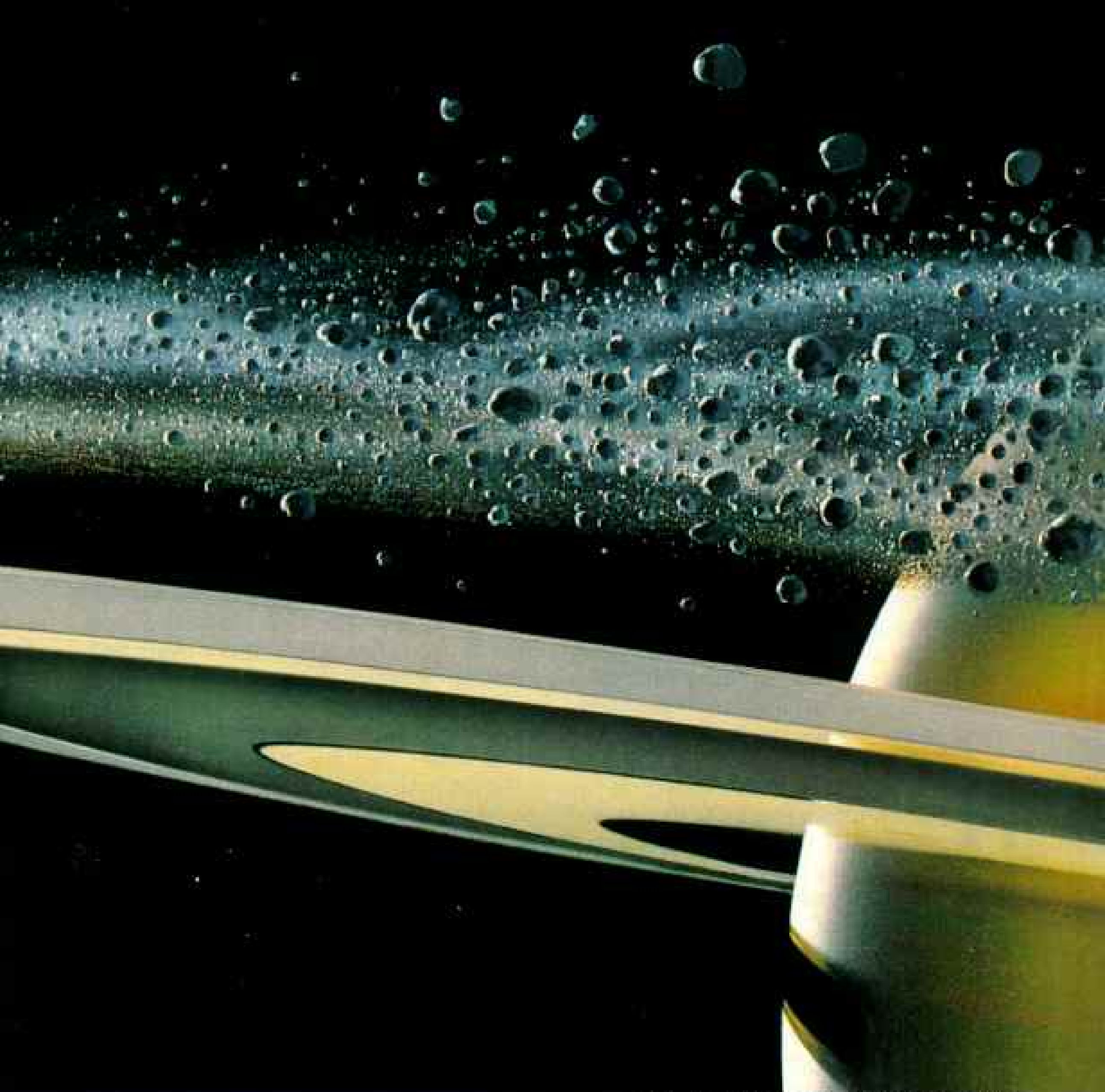
JAMES A. HIGDON



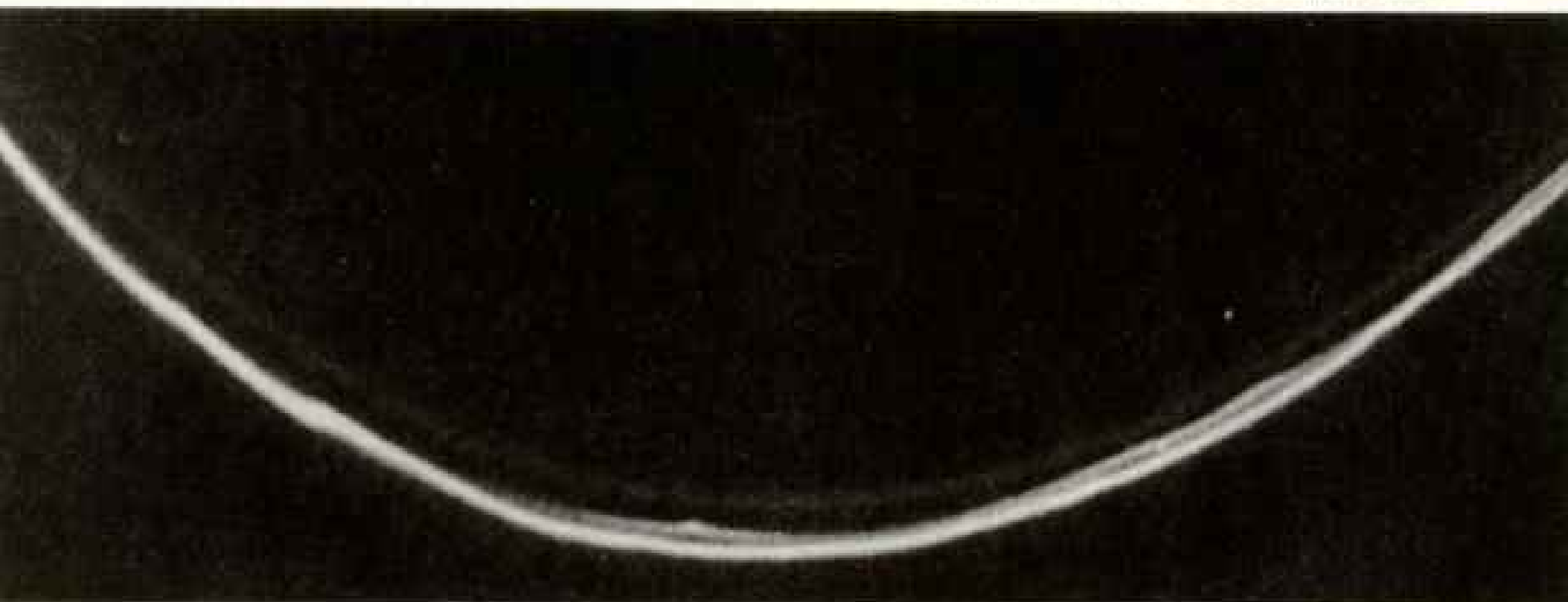
Shepherd moons

IF PACKED snowball fashion, about a fourth of Antarctica's ice could make up the two newly discovered shepherd moons (above) that confine the diffuse and twisted F ring, many of whose particles are microscopic. As seen by Voyager 1 (right), two of its three strands appear intertwined and kinked, and its material gathered in clumps. Why is the ring so disorderly? The moons' gravity plays a major role,

yet their gravity is so weak that astronauts could high jump a hundred meters on them. Both moons have eccentric orbits, as do the ring particles. The inner shepherd, rear, travels faster and repeatedly laps the outer, so the angles and intensities of gravitational pull keep changing. Electromagnetic forces may also play a role. In August 1981, Voyager 2 will take a more detailed look to try to unravel the mystery.



PRINTING BY WILLIAM H. DOWD, NATIONAL GEOGRAPHIC ART DIVISION



imaging team, Saturn is also the most bewildering thing in the sky. Today he is most baffled by those odd spokes, or fingerlike projections, that are slightly darker than the rings themselves and that stretch across the B ring.

"We've never been confused for so long about anything so obvious," he says, swatting rolled-up paper against his palm. "It's just so damned frustrating professionally. We first saw them three weeks ago, and we still don't have any good ideas."

These spokes emerge from the shaded side of Saturn, sometimes in bursts of five or so, and revolve with the rings. Gradually they fade away. Theoretically each particle that makes up the spokes should behave like a mini-satellite. Those closer to Saturn should be moving much faster than those farther out. The spokes should tear apart. Yet they seem to stay perfectly aligned.

"How do they form in the first place?" asks the frustrated Smith. "How do all those particles know to turn dark and line themselves up over 25,000 kilometers?"

NOVEMBER 11, 1980. Voyager is two million kilometers from Saturn and tonight flies within 4,000 kilometers of Titan. More ring close-ups have come in. Life grows no simpler for Brad Smith.

"The mystery of the rings keeps getting deeper and deeper, until we think it's a bottomless pit," he says at a press briefing. "The thing I least expected to see was an eccentric ring—and we have found two."

He flashes on a picture of one ringlet dramatically fatter on one side of Saturn than on the other (page 7).

Odd things too are happening out at the thin F ring, the one being shepherded by two little moons. Voyager images now show clumps in the F ring. Could these clumps be satellites trying to form? Are they moonlets being eroded? Do gravitational forces from the shepherding satellites focus ring material into odd-shaped regions? The mission scientists are clearly thinking on their feet.

The F ring is close to what astrophysicists call the Roche limit. Inside this limit the gravitational pull from huge Saturn should keep large satellites from forming.

The Roche limit helps explain why Saturn has rings. Most scientists believe that more

than 4.6 billion years ago, when Saturn was forming out of the solar nebula, it was much larger. It collapsed suddenly, then began spinning so rapidly that some of its gases and dust were left in a flat disk around its equator. Hot, young Saturn kept this disk much warmer than the minus 185°C (–300°F) temperatures in the rings today. Heavier materials such as metals and silicates either coalesced into Saturn's forming moons or swirled inward to form its deeply buried Earth-size core, which may be molten.

As the planet shrank further, it cooled, as did the ring region. The water vapor that was left there froze, says a leading theorist, Jim Pollack, and the resulting ice crystals gradually accreted into ring particles thought to be no more than a meter in diameter. At some point a phenomenal blast of solar wind blew away any gas that had not yet condensed. The ring particles would thus be the pieces of a large ice moon that could never pull itself together.

There has long been a competing view, however. Perhaps all those particles did not form where they are today. Perhaps they resulted from some catastrophe. The rings could actually be the end product of a moon, suggests mission geologist Gene Shoemaker. They could be a satellite smashed to pieces by another icy body. Or perhaps such a body, a traveling, homeless moon, was torn apart by Saturn's gravity.

However the rings formed, most astronomers believe they have been choreographed ever since by the laws of orbital mechanics, especially the process called resonance.

Through resonance the gravitational effects of Saturn's moons on parts of the rings are greatly magnified. For instance the moon Mimas and the inner edge of the Cassini Division are in resonance. Mimas takes exactly twice as long to orbit Saturn as do certain Cassini particles. This regularity means that these particles meet a slight gravitational tug from Mimas at precisely the same place every other orbit. Over time that extra tug stretches their circular orbits into ellipses. Eons ago Cassini particles thus started to crash into particles in adjacent orbits. Colliding particles were thrown into other parts of the rings. Gradually a large gap was swept out.

Before Voyager such resonances were

thought to be responsible for what little structure the rings had shown. But now the monitors at JPL are showing more structure, not only in the rings but also in the Cassini Division, than any symphony of resonances could explain.

THE NAME Peter Goldreich keeps popping up. Goldreich is not on the Voyager team. He teaches at the nearby California Institute of Technology. But of the minds that probe the dynamics of the solar system, his is among the very best.

Nearly two years ago in his Caltech office he noted: "The rings of Saturn are not going to be that easy." The subject then was Uranus. At least nine very narrow, very peculiar rings had recently been discovered around that planet, the next one out from Saturn. One of these rings is only three kilometers wide. The outermost is eccentric; its width varies from 20 to 100 kilometers.

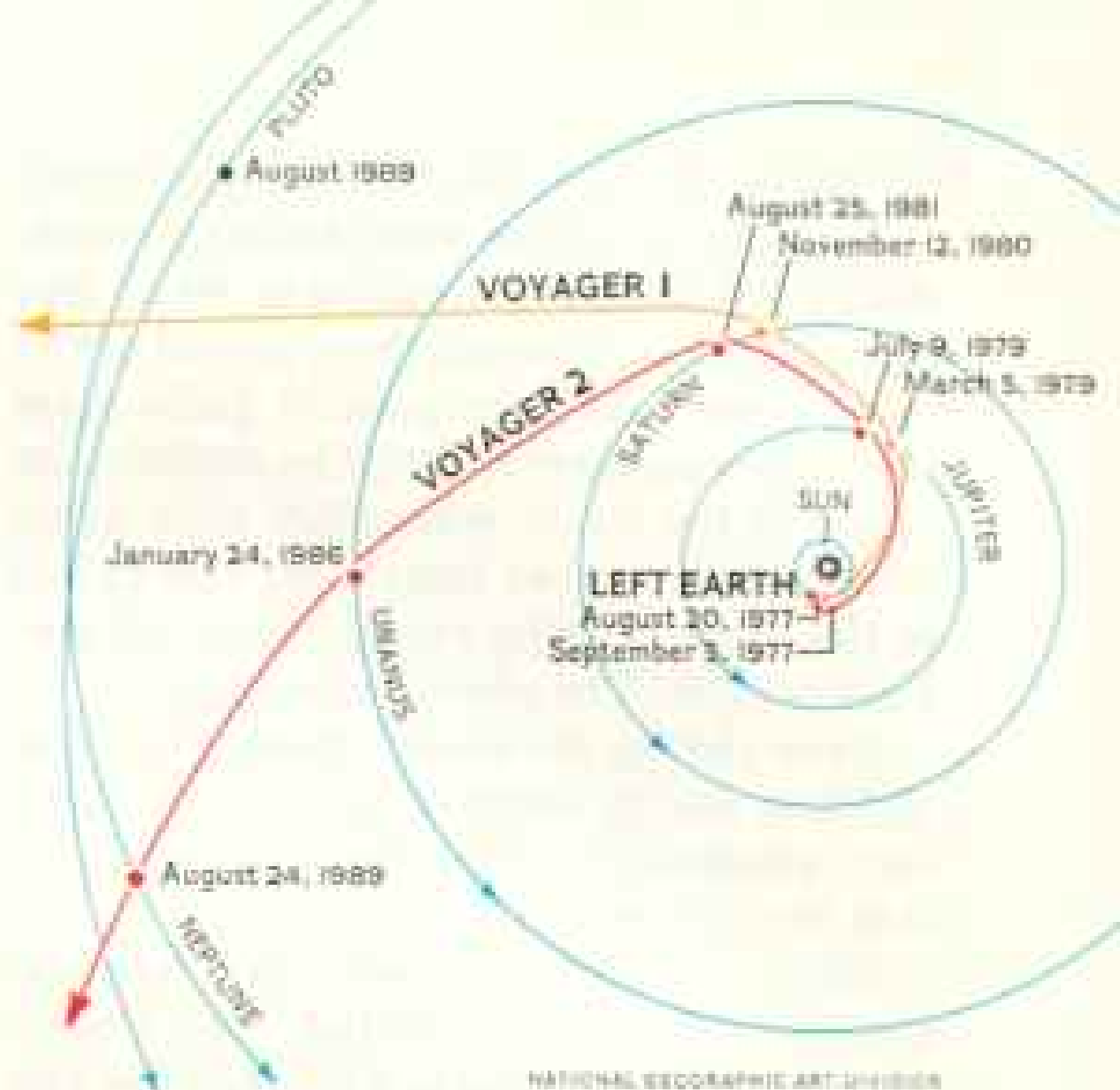
Goldreich and Scott Tremaine had proposed that it was not resonances but rather many little moons, too small to be viewed from Earth, that created Uranus's rings.

"Two satellites orbiting close together can confine small particles in between them into a thin ring," he had explained. "Gravity causes each satellite to repel the particles in its vicinity."

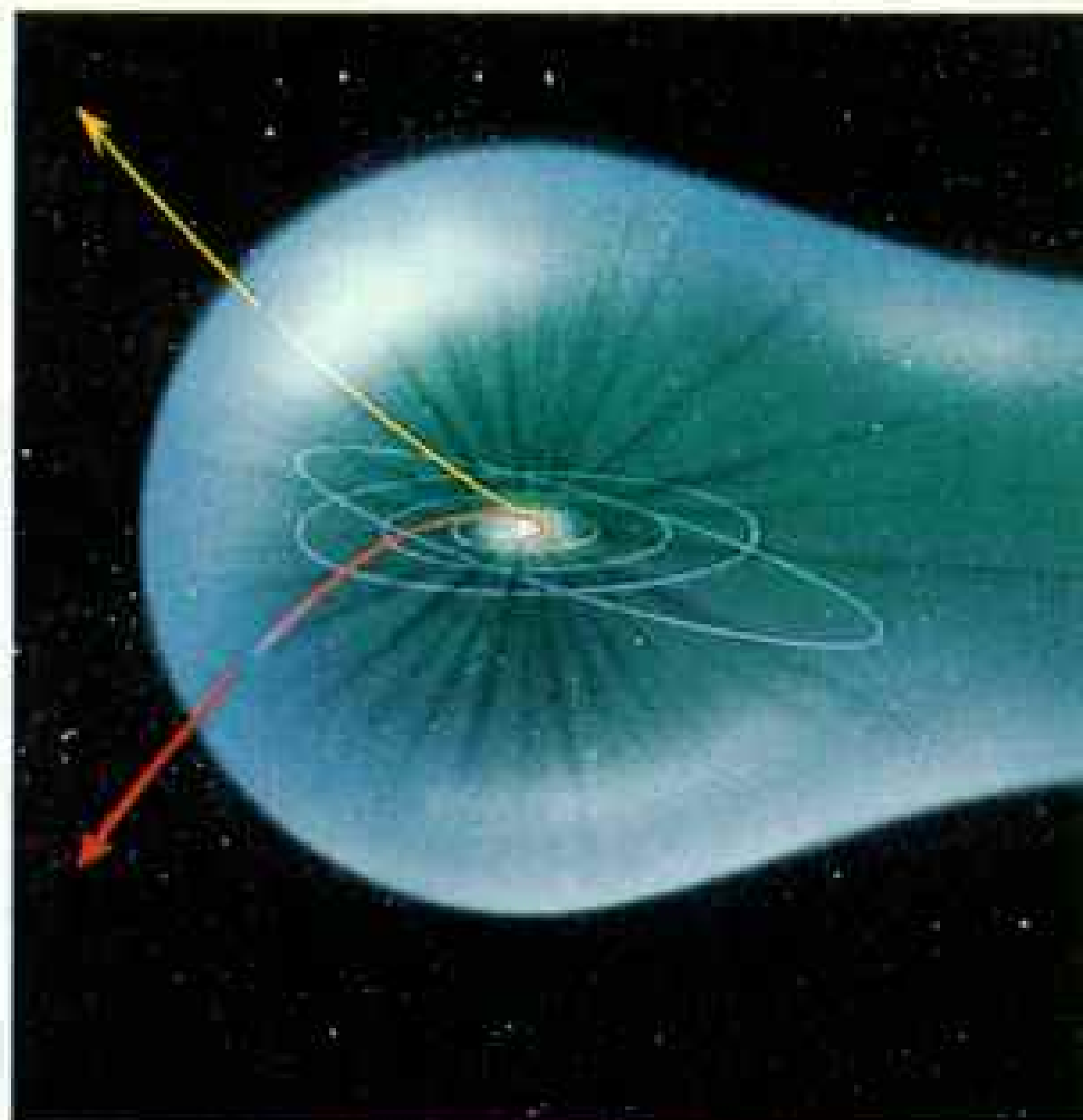
Gravity repel? The explanation is a riddle lover's delight.

The laws of orbital mechanics dictate that satellites in higher orbits go more slowly than those below because they need less velocity to overcome the pull of gravity from the planet. So if you have two moons with lots of ring particles between them, the inner moon will move faster than the particles, and the outer moon will move more slowly.

Consider the inner moon first. As it nears the slower ring particles, its gravity does indeed tug at them, pulling the particles closer to it and slowing them down. But as the moon passes, its gravity then starts to pull the particles along after it, speeding them up. Because the particles have been pulled closer to the moon, the satellite's gravity has a stronger effect on them after the moon passes than before. So they are accelerated more than they were slowed down. The ring particles get a net energy gain from the inner moon. That energy boosts—



Gravity's crack-the-whip sends each Voyager on its appointed course. If all goes well, Voyager 2 will use the boost of Saturn's gravity to put it on a trajectory for encounters with Uranus and, finally, Neptune, arriving at its last planetary rendezvous 12 years and 4 days after launch.



At the outer limits of the solar system—the heliopause, where the solar wind can no longer expand against the pressure of interstellar gases—Voyagers 1 (yellow) and 2 (red) will make some of their last reports—at least to Earth.

or repels—the particles into a higher orbit.

The reverse is true with the outer moon. Ring particles are overtaking it. So as they near the moon, it speeds them up and draws them closer. As they pass, it pulls them back, slowing them down. The particles are closer to the moon when they start being decelerated. So they have a net energy loss to the moon. Losing energy, they fall into a lower orbit. The moon pushes them in.

Even though the moons themselves gain and lose energy interacting with the particles, resonances with other moons could lock them in their orbits.

Many considered such gravitational gamesmanship unconvincing. “It’s a terrible thing to have to make a model when you need nine or so little satellites that can’t be seen,” Goldreich had conceded, “but I have no doubt that it’s correct.”

Suddenly Goldreich seems like a prophet. Saturn’s shepherding moons act just like the moonlets of Uranus in his model. Could Saturn’s rings have countless perturbing, distorting, invisible moons shepherding its ringlets as well?

NOVEMBER 12, 1980. The rings continue to confound. “We thought we had seen all there was to see,” Brad Smith tells the press. “But in this strange world of Saturn’s rings, the bizarre has

become commonplace. When we looked at the F ring today, this is what we saw.”

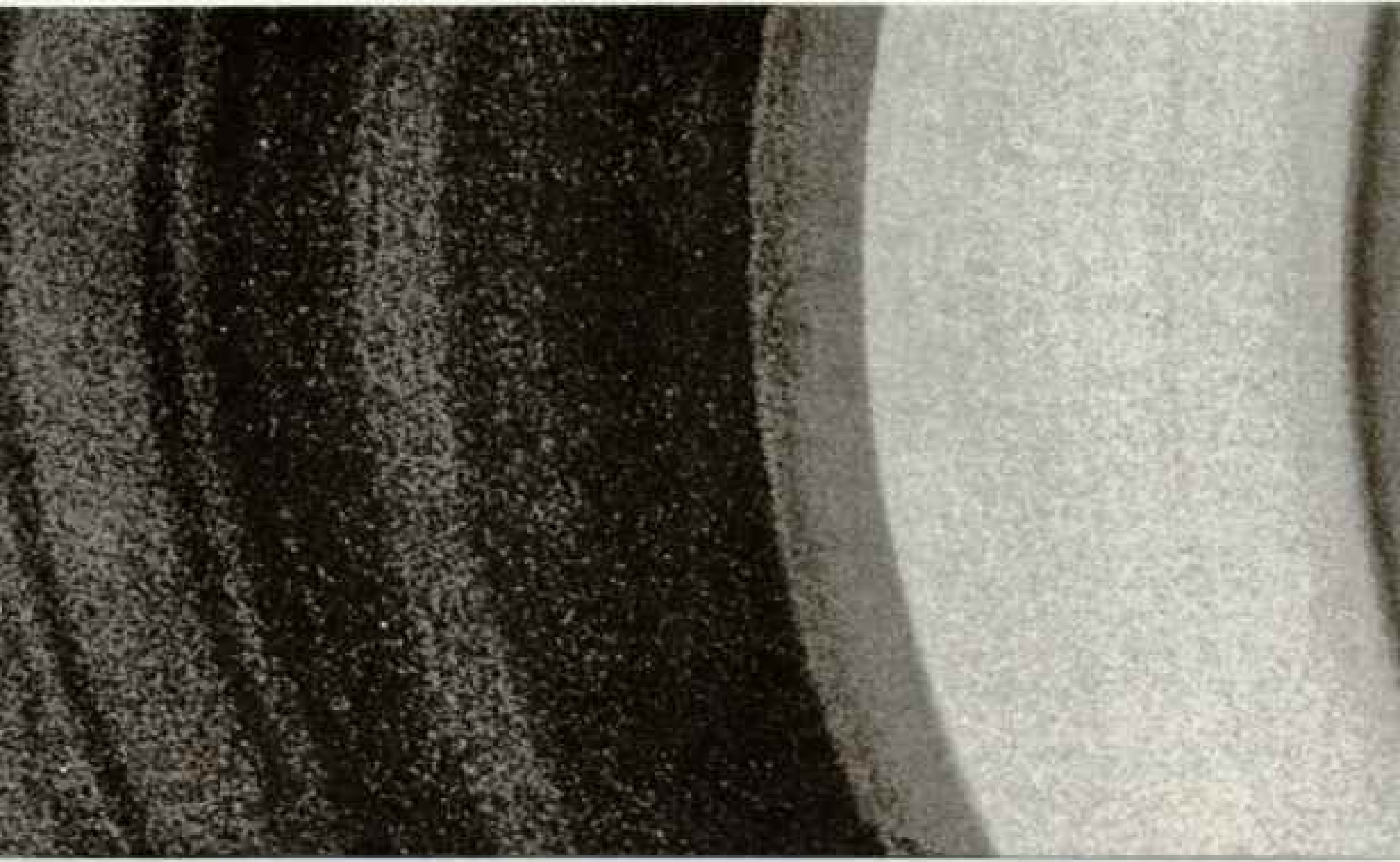
What Smith shows is a picture of the F ring split into three strands—two of them appear intertwined. They resemble a DNA double helix. Someone jokes that Voyager has discovered life at Saturn. Smith notes that there are also kinks in the strands.

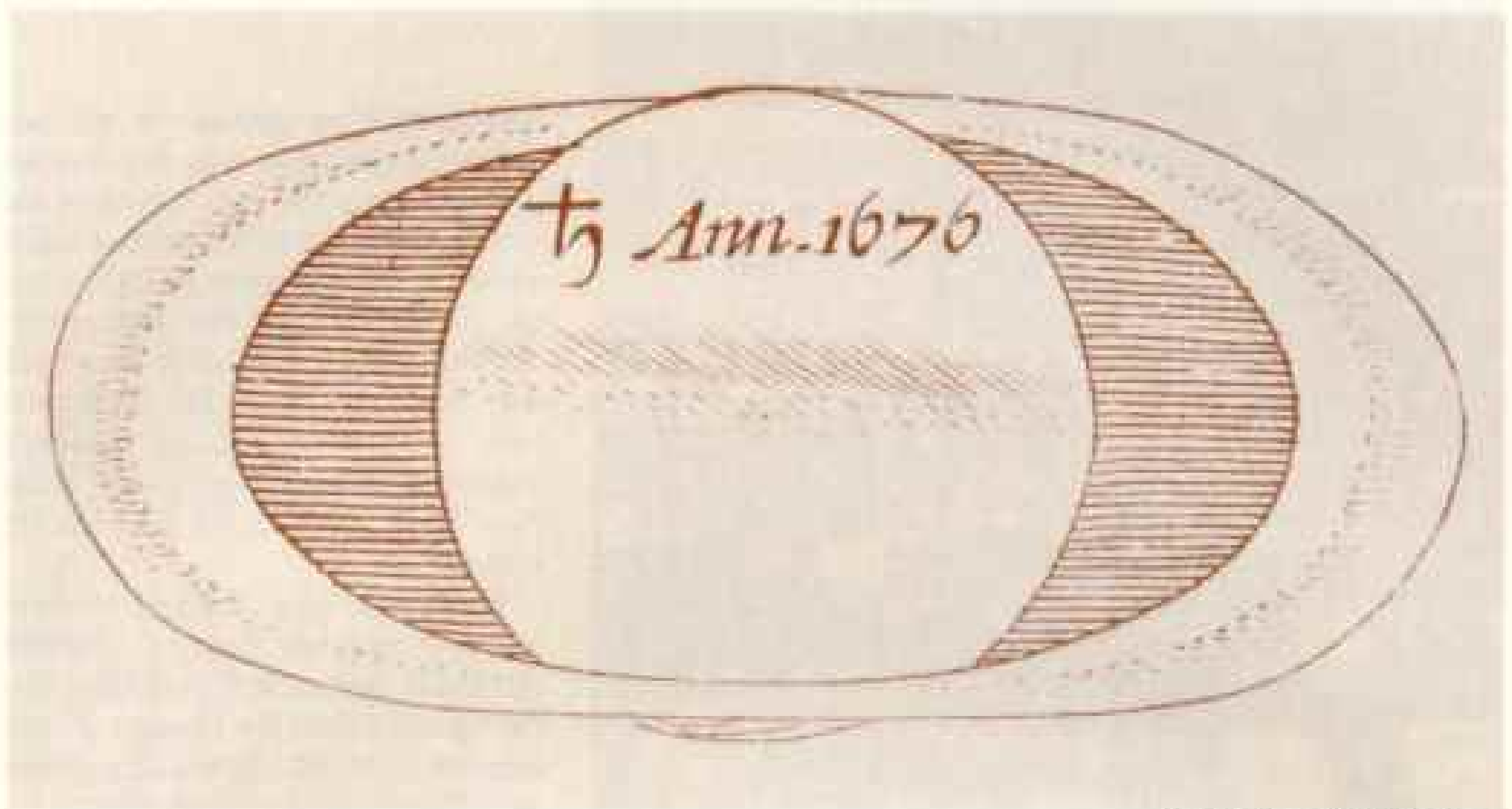
“Braiding defies the laws of orbital mechanics for several reasons,” he says. “But obviously these rings are doing the right thing. I guess we just don’t understand the laws very well.”

Attention is about to be drawn away from the rings. Overnight the closest images of Titan have come in. Faces are long. Clouds totally veil the surface. The Titan story will not be told in pictures. But today begins a dizzying series of closest encounters with Saturn’s other named moons.

Mimas, Enceladus, Tethys, Dione, Rhea. Not to mention Hyperion, Iapetus, and Phoebe. “Too many moons,” grumbles moon specialist Larry Soderblom. Until this week most of Saturn’s named moons were merely points of light through a telescope. Project scientists cannot even agree on pronunciation. Some say Mee-mas, some say My-mas. Some make Enceladus (EN-SELL-a-dus) sound like a Mexican dish.

These bodies are much smaller than Earth’s and Jupiter’s large moons, or their





COURTESY U. S. NAVAL OBSERVATORY

A dangerous reef in the rings

THE 15-GENERATION GAP: For centuries after Franco-Italian astronomer Jean Dominique Cassini discovered what seemed to be a gap in Saturn's rings and sketched it (above), the Cassini Division was thought to be a clear zone. A detail of a

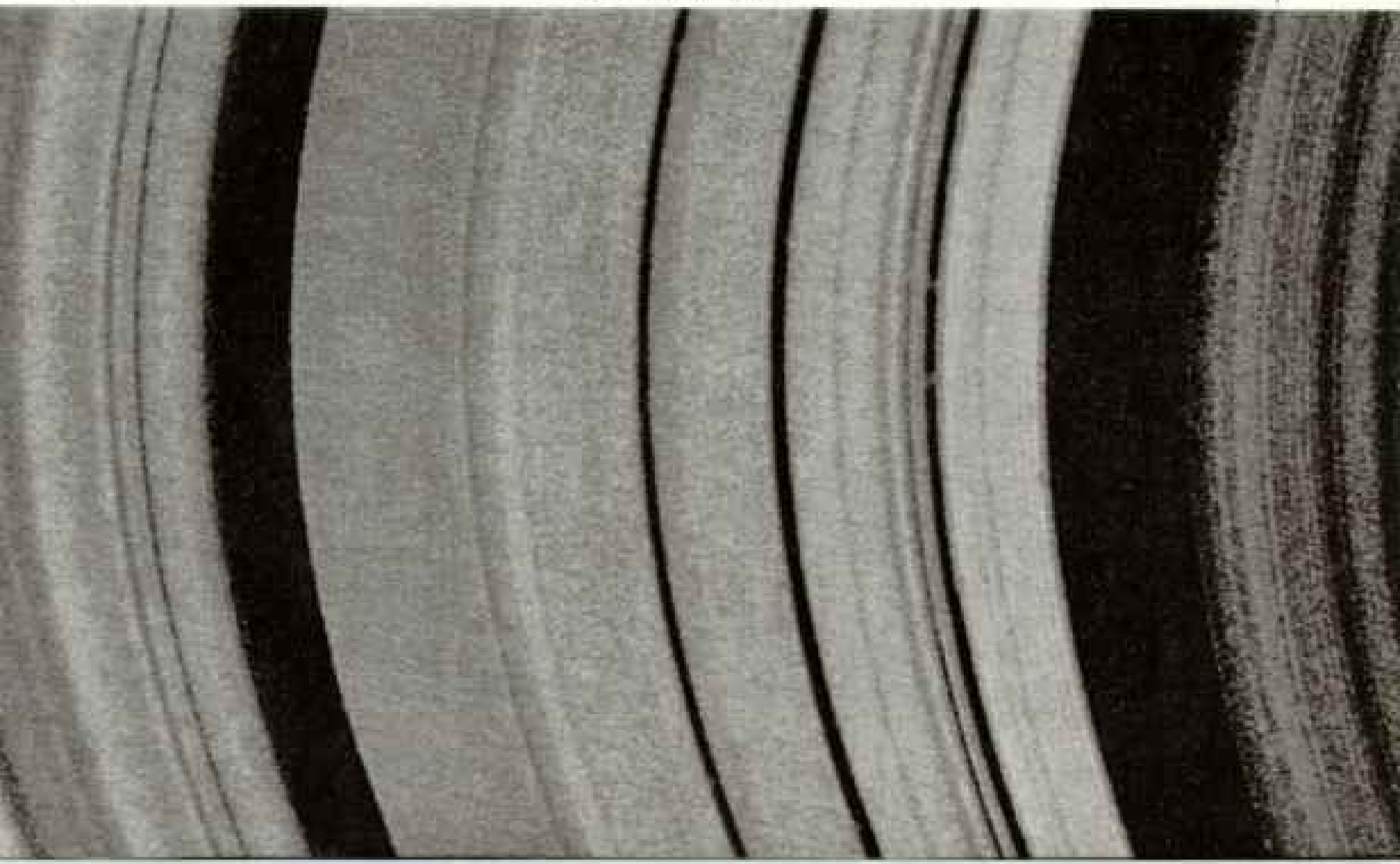
Voyager image taken from beneath the rings (below) proved quite otherwise.

One trajectory considered—and rejected—for an earlier spacecraft to Saturn, the less complex Pioneer 11, would have taken it through the Cassini Division.

Pioneer would have likely discovered that the division is no gap—and discovered it in the most unplanned, unpleasant, and final way.

13

CASSINI DIVISION





Navigation so precise it all but defies imagination was required to put and keep the two Voyagers on course. Years of concentrated work went into boiling down 10,000 possible trajectories for the spacecraft. Mission objectives had to be sorted and given priority: For example, how close to approach Saturn's enormous moon, Titan (closer than New York City is to London, it turned out).

Three days after Voyager 1's closest approach to Saturn, Charles Kohlhasse (left, at left) and Ray Heacock go over data for Voyager 2's encounter—still 283 days away, yet an immediate and pressing concern.

As a navigation aid, computer-generated images chart the region where Voyager 2 will pass between tilted Uranus (right) and its moon Miranda. Eventually, the craft will reach Neptune and dive over its north pole just 7,500 kilometers off the surface.

brother satellite Titan, yet larger than most asteroids and the tiny moons around Mars, Jupiter, or Saturn.

They should be made from roughly the same material—dust and ices—as comets. They should be too small to have much of the radioactive rocky material that in larger bodies heats up the interior and generates geologic processes such as volcanism. These watery moons should have frozen fast soon after forming. They should be heavily pocked with craters, the scars of countless random collisions with celestial debris. There is no reason to suspect they are anything but big dirty snowballs.

Voyager will not come close enough to Hyperion and Iapetus to reveal much. It will not even photograph Phoebe, the farthest out. Phoebe has long been known to travel in the opposite direction from Saturn's other moons. It is most likely debris captured by Saturn's gravity as it passed by.

Iapetus is perplexing. Even from Earth, it shows two faces. One side is five times brighter than the other. No one really knows

why, and Voyager 1 will not see it well.

But Voyager 1 has begun seeing some startling features on the inner moons.

Mimas, the innermost, looks the most like the bland snowballs everyone expected, except for an enormous impact crater (pages 16-17). Its walls are five kilometers deep, its diameter a third that of the moon. It is among the largest craters, relative to the size of the body hit, ever seen. Mimas came very close to being blown apart.

Like the other moons, Mimas is so cold that ice on its surface is as rigid as rock. "It's got about all the craters you can make," says Gene Shoemaker. "If you make any new craters on Mimas, you'll erase old ones."

This cratering has "fluffed up" or "gardened" the surface to a depth of at least several kilometers. So walking on Mimas would be a little like walking on a large snow cone, with many ice chunks, some larger than a house, sticking up from the rubble.

Farther out and much larger is Tethys. A great branching trench 65 kilometers wide stretches nearly from one end of this well



JAMES A. SWEENEY (LEFT); COURTESY CHARLES KOHLHAASE AND JAMES BLINN, NASA

cratered, 1,050-kilometer-diameter moon to the other (page 26). The valley looks too grand to be an impact fracture. It appears to have been created from within. Perhaps the stress of Tethys's freezing and expanding interior cracked the surface of the moon. Perhaps internal geologic churning caused the trench. Yet Tethys has a density close to pure water ice. How could a body with so little rock have been geologically active?

Tethys is extremely bright, yet not as bright as its astounding neighbor Enceladus. Enceladus reflects nearly 100 percent of the light striking it. Our moon, by contrast, reflects 11 percent.

Enceladus also seems to be strikingly smooth. Voyager observes no craters. Could some geologic process on Enceladus (pages 30-31) still be actively erasing or swallowing its craters? Enceladus could well be geologically alive.

Strange white wispy markings streak the next two moons out, Dione and Rhea, suggesting that something once blew out of their interiors.

Impact craters, formed very early in the solar system's history, blanket much of Rhea's surface, as they do that of Mimas. Yet some areas show less cratering. They apparently have been resurfaced.

Dione is in places as heavily cratered as Rhea, but it has a lot of younger terrain. As Larry Soderblom puts it, "Sometime, probably in its first half billion years, Dione's insides gushed out across its surface."

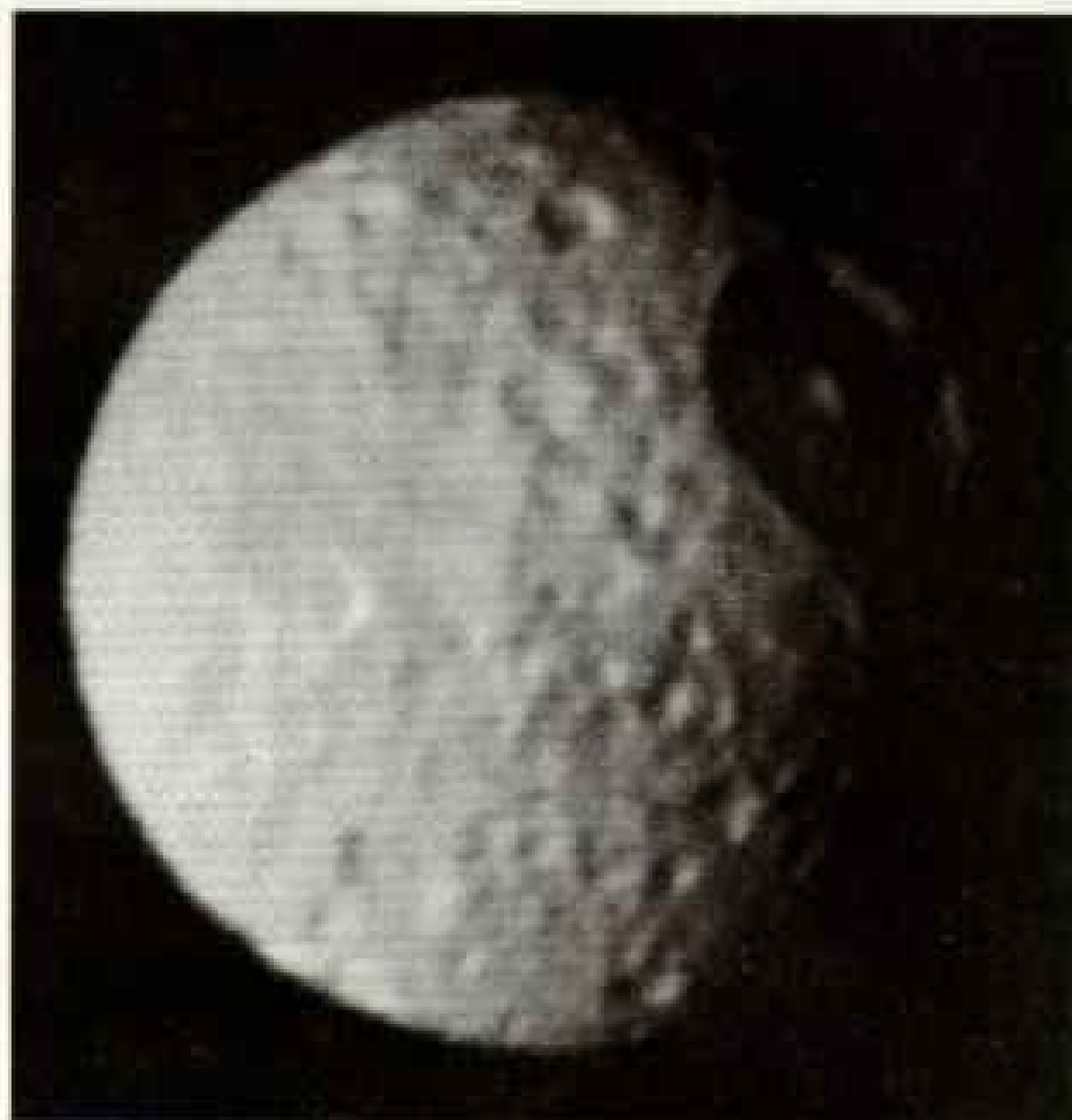
Mystery still shrouds the cloud-covered Titan. Titan will soon demonstrate, however, that Voyager can do more than take stunning pictures.

NOVEMBER 13, 1980. Scientist Rudy Hanel, leader of the NASA infrared spectroscopy and radiometry team, is ebullient.

"The rings may belong to the picture people, but Titan belongs to us!" he says.

Hanel's heat-analyzing instrument and data from the radio-science team have revealed that Titan's atmosphere is largely nitrogen, like Earth's. Not the widely





Mimas: a satellite nearly shattered

"IS IT THE ENGINE?" someone asked when this view (above) of Mimas was first shown. The "engine," a crater 130 kilometers across, remains from a collision, probably with another moon, that nearly blew Mimas apart perhaps four billion years ago. Grooves on the satellite's opposite side may have been caused by the tremendous stresses of impact on a body whose gravity is only five thousandths that of Earth.

The impact created steep crater walls, but a natural process called isostatic rebound formed a central peak (painting, left) that rises six kilometers from the crater floor. The effect would not be greater if Delaware were rolled into a ball and Mount Everest dropped on it.

PAINTING (LEFT) BY WILLIAM H. BOND



BOB BEHREND AND GARY E. HUNT



Titan showed a blank face as Voyager 1 neared. The only features visible (above) were a haze, a darkening of the northern hemisphere, and an even darker polar hood. The radio team and the infrared team, the latter led by Rudolf Hanel (top), probed Titan to its surface and found: temperature, 93° Kelvin (minus 292°F); atmospheric pressure, 1.6 times Earth's; main gas constituent, nitrogen; diameter, 5,140 kilometers—demoting it to second place behind Jupiter's Ganymede as the solar system's largest moon.

suspected methane. Methane is only a minor constituent, as water vapor is on Earth.

It is announced today that Titan's atmosphere is at least as dense as Earth's. It includes hydrogen cyanide. That news would not stop presses. But to biologists it is significant: Hydrogen cyanide is a critical building block for the more complex molecules of life.

The temperature at cloud tops is far too cold for life. But some scientists speculate that Titan's thick clouds could trap enough heat down below to make life imaginable.

There are not that many atmospheres in the solar system. Titan has one because it is massive enough to hold onto its gases gravitationally. Also, its temperatures are so cold that gas molecules do not have the energy to escape its grasp, as happened on the large moons of Jupiter when they formed.

"At Titan we may have a snapshot—a frozen record of the composition of Earth's early atmosphere," says Hanel.

Earth and Titan are different today primarily because Titan's low temperature keeps water frozen. On much warmer Earth there were oceans where life evolved. The oxygen released by living things utterly changed our planet's character.

Titan might have known warmer days as well. Gaseous ammonia in its early atmosphere may have trapped enough heat to permit liquid ammonia or even water to run across the moon's surface. Life could have begun and then frozen out.

"Presumably the fossils of chemical evolution are sitting out there waiting to be found," says mission astronomer Toby Owen. "You just need a long enough drill to get through the ice."

WHILE TITAN has stolen this day's show, the ring people are also excited. Voyager has flown past Saturn and is now taking pictures looking back. The mysterious dark spokes have suddenly turned bright. That means the spoke particles must be scattering sunlight forward toward Voyager's outbound eyes much more strongly than they had reflected it back toward the spacecraft as it approached. "That property is characteristic of very small particles," explains chief project scientist Ed Stone.

Looking back at the F ring, it too appears

Titan: a gas-wrapped moon

EXPLODED VIEW shows Titan's layered atmosphere (right). Outermost layer shown is a bluish translucent haze of organic (carbon-based) compounds. Within the haze and directly above the north pole of the planet-size moon is a hood of concentrated compounds, present perhaps only during the 7½-year winter.

Below a relatively clear zone lies a thick layer of smog, again organic compounds, but of larger particles and characteristically red. Under that is a layer of methane clouds and yet larger organic particles.

The topography of Titan's surface can only be guessed at. But since methane likely plays the same role as does water on Earth—it can be solid, liquid, or gaseous—this scene (below) is a reasonable conjecture. Fine methane sleet falls out of a perpetually cloudy sky. Jagged methane escarpments rise from a methane lake under a weak, obscured sun where full daylight may be comparable to full moonlight on Earth.

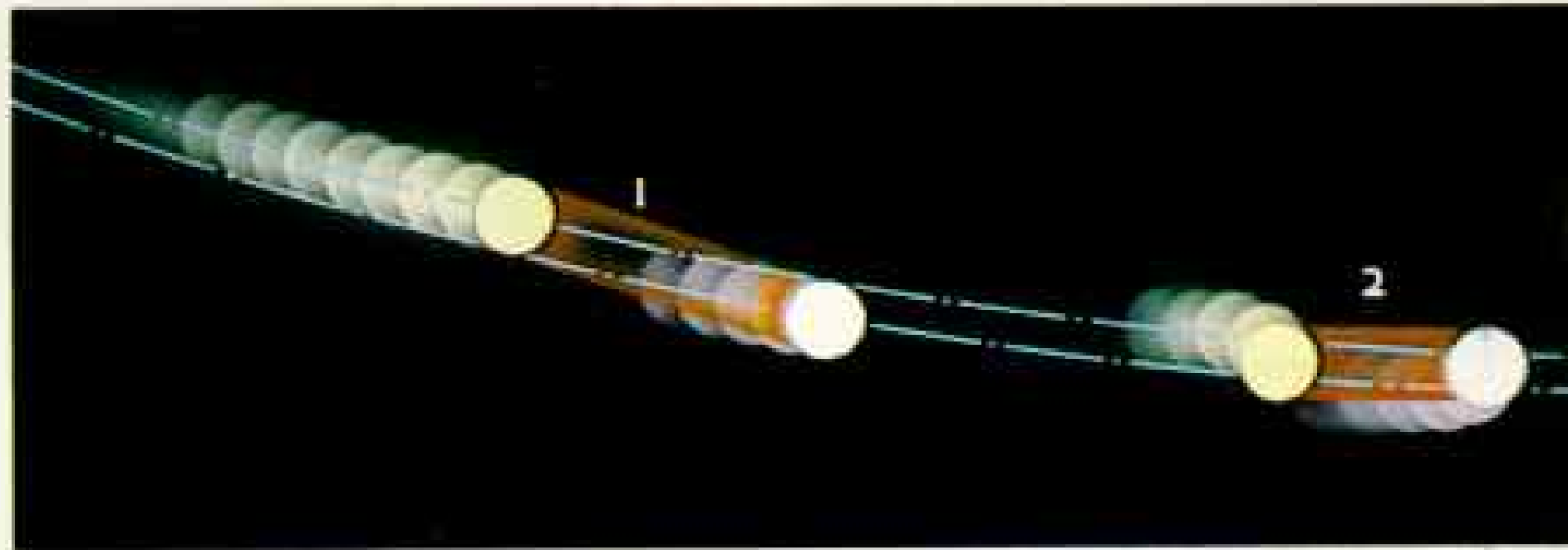


PAINTING BY LLOYD K. TOWNSEND



Hound and hare on Saturn's track

TO CATCH UP but never pass is a role each of the co-orbital moons plays in turn. When Voyager 1 flew by, the somewhat smaller and more ragged-looking moon (below, far left) trailed its more regular companion (far right). Colored stripes on the trailing moon are successive filter images of the F ring's



brighter. Both must have many particles about the size of wavelengths of light.

Such small particles can easily become electrically charged by influences other than gravity. Electrostatic forces, for instance, could lift them out of the B ring. Then the force lines of Saturn's huge, rotating magnetic field could keep the spoke particles aligned for a while before they shear apart.

A faint ring has emerged within the C ring, and is extending nearly to Saturn's atmosphere.

This is the long-suspected D ring. It may consist of particles leaking from other rings and spiraling toward Saturn. It could be scattered chunks too large to be pulled in. It could be both. Or neither.

Close-ups of one of the co-orbiting moons have come in. It looks like a tooth. This odd shape leads scientists to speculate that these two moons were once one. An impact blasted it in two. That could explain why their orbits are so close together.

But how do they avoid colliding? They behave somewhat like the shepherd moons.

"Think of the moons as runners on a track," suggests mission astronomer Rich Terrile. "The runner, or moon, in the inner lane is slowly overtaking the one in the outer lane because celestial mechanics say that the closer in you are, the faster you go.

"Now as the inner runner catches up, he starts to feel a gravitational tug from the outer runner—he gets energy from him. As he

absorbs this energy, he gets boosted into a higher orbit and slows down.

"The outer runner meanwhile has lost energy, and he falls into a lower orbit. He now goes faster and eventually laps the other runner, and the orbit exchange starts all over again."

THE RINGS AND MOONS have attracted so much attention that Saturn itself seems almost forgotten.

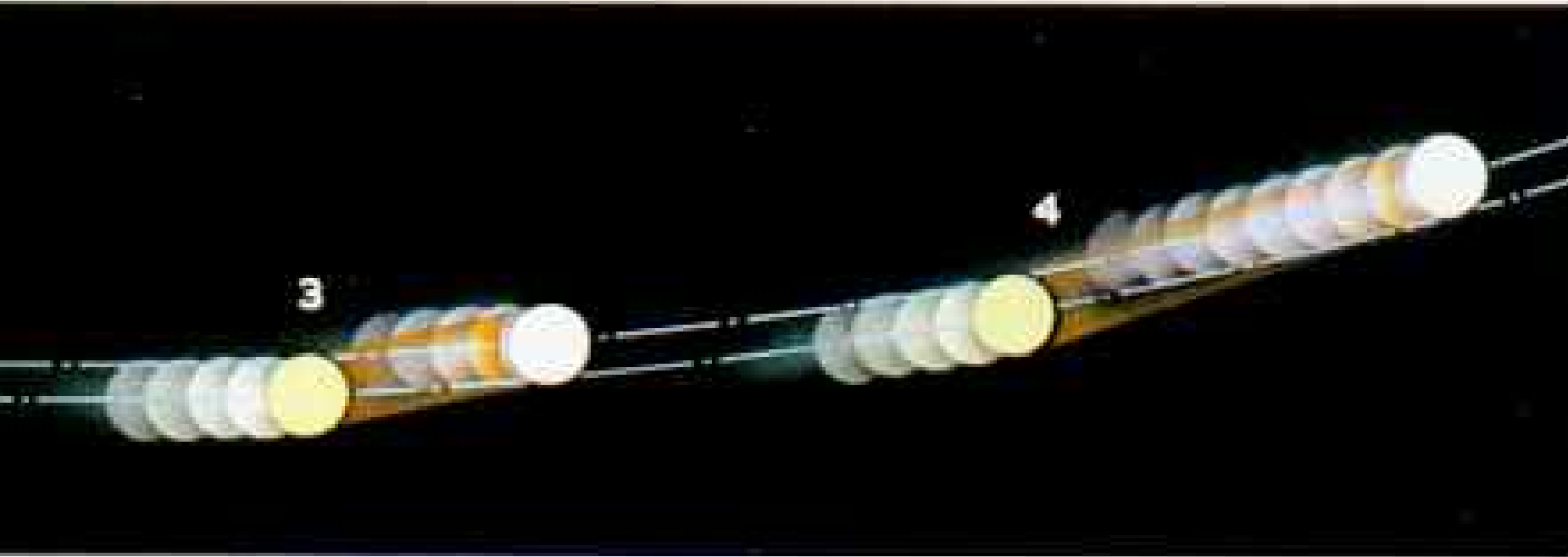
Compared to Jupiter, Saturn looks unexciting. The two planets are supposed to be very similar—giant gas balls of hydrogen and helium with hot interiors that provide much of the heat that drives their winds and weather. (See the special supplement distributed with this issue for a Voyager 1 view of Saturn and for a chart of our solar system.)

Why then does Saturn appear so bland? A thick haze may enwrap the ringed planet. And that haze could be obscuring cloud tops that are indeed as vividly colored as the cloud tops on Jupiter. Or else the convective currents from Saturn's seething interior may mix the colorful trace constituents in its clouds better.

Voyager close-ups are confirming that Saturn does have a smaller version of Jupiter's Great Red Spot. It also has white ovals and bands of lighter and darker clouds like Jupiter's. Both planets have strong jet streams racing around their equators. On Jupiter, upward from about ten degrees of

shadow. The moons' gravitational minuet is shown in the diagram below. 1 The trailing (yellow) moon travels faster because of its slightly nearer (to Saturn) orbit and approaches the leading moon. 2 As the moons close, gravitational force energizes the trailing moon, throwing it into farther orbit while

dragging the leading moon into nearer orbit. 3 Now in the nearer orbit, the leading moon travels faster. 4 The leading moon pulls away, and the gap between them widens. After about four years, the leading moon (having become the trailing moon) catches up and the pattern repeats.



PRINTING BY WILLIAM H. BIRD

latitude, other jets appear, each going alternately in opposite directions. Saturn's equatorial jet stream, however, is three times broader. Its winds are blowing more than three times stronger—a thousand miles an hour. Reverse jet streams appear only at far higher latitudes.

Why the difference? Is it because Saturn is tilted and so, like Earth, has seasons? Could the shading of the rings play a role?

Being farther out, Saturn gets only a fourth the solar energy that Jupiter receives. At Jupiter the solar heat striking the atmosphere is equal to the internal heat coming up. At more distant Saturn internal heating dominates. The upwelling of this heat may generate the much stronger surface winds. In any event, both planets are a theorist's delight.

"We have this paradox of bodies that are somewhat like stars inside, but have Earth-like weather on the outside," says mission meteorologist Garry Hunt.

NOVEMBER 17, 1980. Voyager 1 is on its way to a rendezvous a decade from now with the outer edges of the solar system, where the solar wind's influence ends. "We've had a great ride," says chief scientist Ed Stone. "It's been so smooth, it's hard to appreciate how much work went into it. Building the spacecraft was the work of thousands; flying it was the work of hundreds." Planning where Voyager would

fly took years of studying just where each moon and planet would be when. Ten thousand different trajectories were considered during the research period.

"We are in the rush of discovery," concludes Stone. "Next comes the understanding, which may take years."

DECEMBER 12, 1980. A month has passed. Titan becomes easier to understand. Mission radio scientist Von Eshleman announces in San Francisco that his team's experiment now shows Titan's atmosphere to be 4.6 times denser than Earth's, and its surface to be 93° Kelvin, or minus 292°F. Too cold for life. But cold enough for methane to liquefy. Titan is right on the edge of having large amounts—oceans, perhaps—of liquid methane.

"Titan may be the only other place in the solar system that has liquid on its surface," says Toby Owen. He believes there are at least lakes of methane.

Methane in Titan's nitrogen atmosphere might well rain or snow out. So will fine particles of other hydrocarbons—what we call smog. "If the surface is solid, there could be four and a half billion years' worth of smog snow, maybe a kilometer deep, covering the moon," says Jim Pollack.

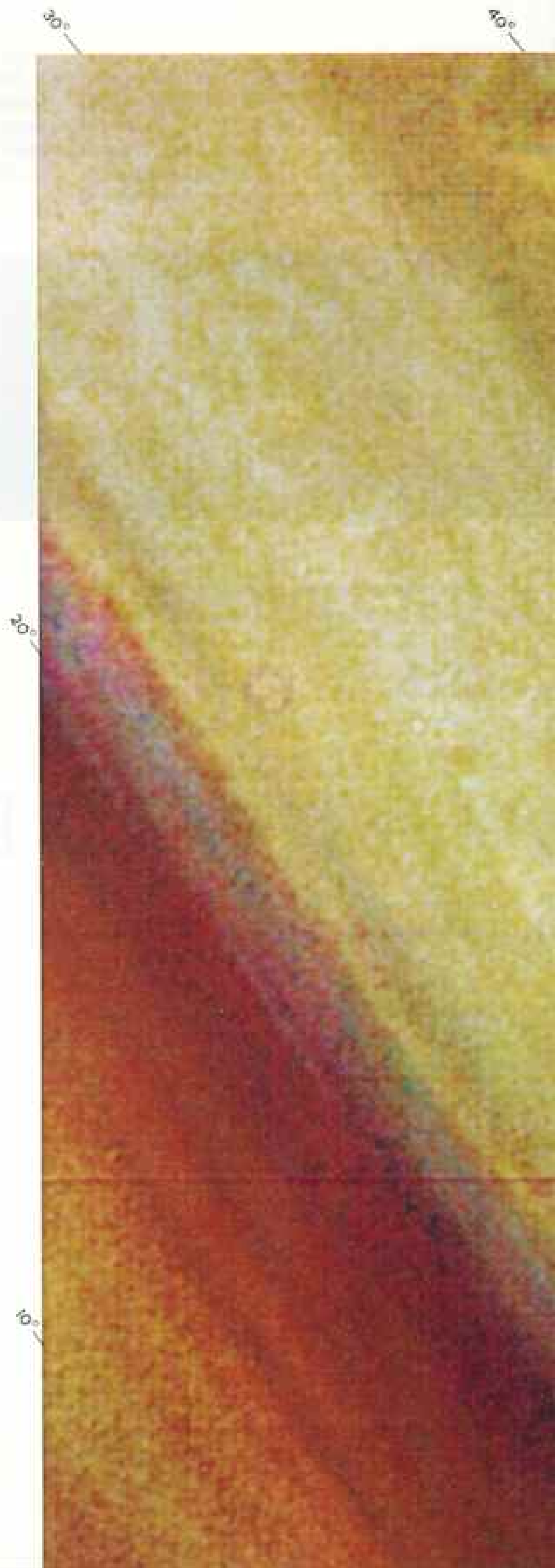
"A few degrees could make a very big difference on Titan," suggests Eshleman. The surface might differ from pole to equator. One region could melt in summer and then



The atmosphere: storm beneath the calm

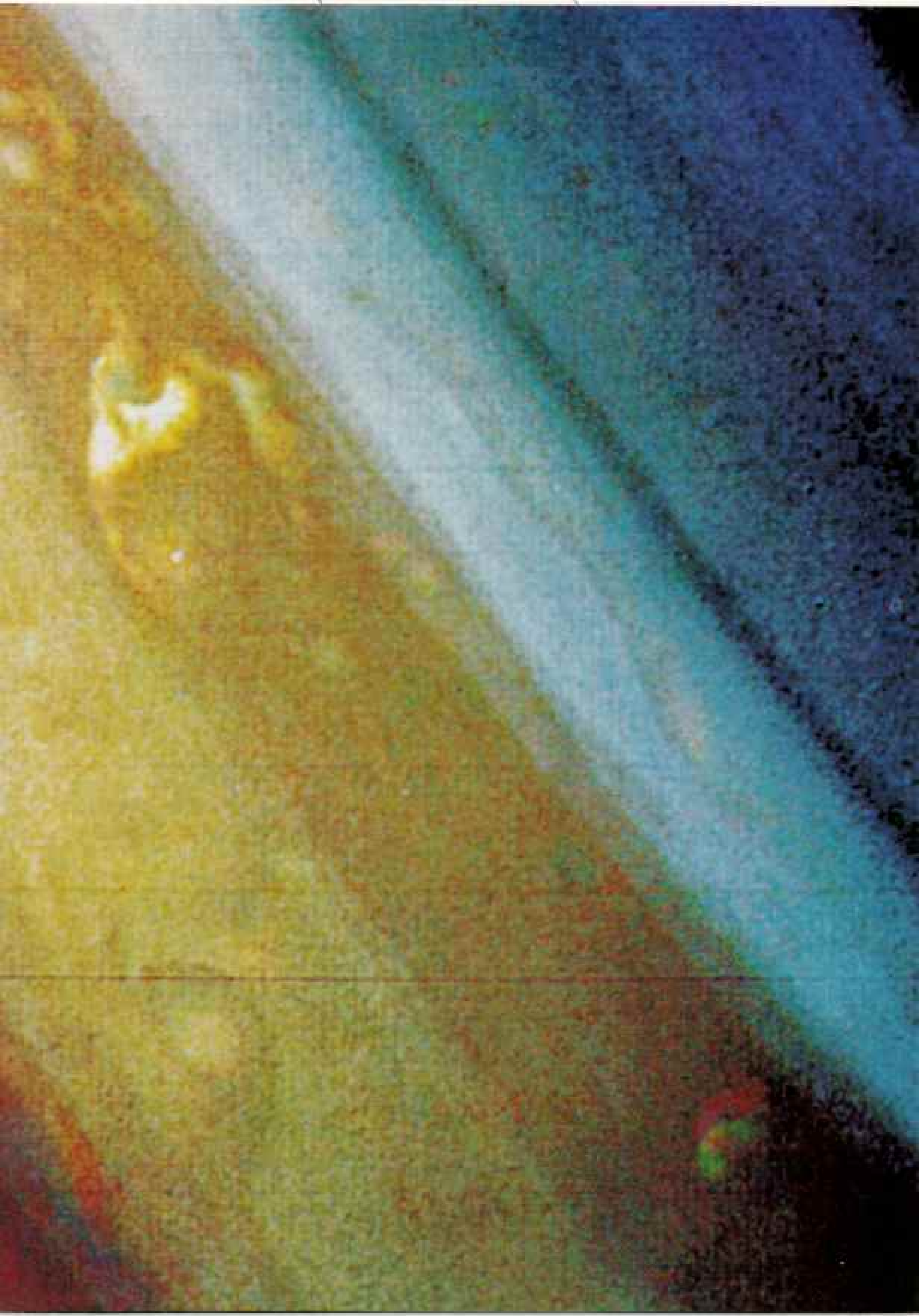
BLAND AS BUTTERSCOTCH, or so Saturn's atmosphere, composed mainly of hydrogen and helium, appeared from a distance in true color (above). When resolved into detail by imaging enhancement (right), it resembles turbulent Jupiter's.

Unlike Jupiter's atmosphere, reversals in wind directions do not coincide with the junctures of dark belts and light zones. Saturn's equatorial wind speeds are three times those on Jupiter, or ten times hurricane-force winds on Earth. Whether the sombrero effect of ring shadow or seasonal variations play significant roles in atmospheric circulation is not yet clear to mission scientists.



50°

60°



freeze 15 Earth years later, when the Titan winter arrives.

If there are lakes or oceans, the falling smog snow would make them sludgy. "There should be some very interesting chemistry going on," says Owen.

JANUARY 6, 1981. Over catfish and crab fingers in a Baton Rouge restaurant, Voyager's geologists are trying to decide what to say in their preliminary science report. This impromptu dinner is a break from a NASA planetary-geology meeting. The subject is moons.

Rich Terrile, one of the younger team members, is being grilled across the table about his ideas on Enceladus. There has been speculation that Enceladus could be caught in a tidal tug-of-war between Saturn and Dione. This tugging could be heating Enceladus's interior. The moon could be

like a big drop of water coated with an ice crust, explaining why Enceladus is smooth. Like a glacier, the moon's thin crust would be mobile enough to fill in craters.

Terrile and another Voyager scientist, Al Cook, had noted earlier that Enceladus is at the brightest point in the outermost E ring. Terrile now is arguing that Earth-based infrared measurements indicate that the broad and dim E ring has mostly small particles. Terrile and Cook think that those particles could be coming off Enceladus.

"One meteorite puncturing the surface every thousand, or even ten thousand, years could spray out enough ice crystals to supply the E ring," proposes Terrile. Ice volcanoes are also possible. The ring particles that either would produce could be coating Enceladus and neighboring Tethys. That coating might explain why both moons are exceptionally bright.

"Nonsense!"—and worse—argue some of Terrile's colleagues. Intuitively suspicious, they question his calculations. He defends his ideas adroitly. Even if they do not like the warm interior model, most team members would admit it is still the best explanation going for Enceladus's perplexing surface.

"Ideas are often wrong, so we really hit hard at them," says Larry Soderblom after dinner. "If they stand up under attack six or more times, some of us start to accept them."

On the other hand, Soderblom is starting to question some well-accepted ideas about how these moons formed. Supposedly they accreted slowly and relatively uniformly from the disk of dust and gas surrounding a young Saturn. But the moons have such unexpected densities. Being closer to Saturn, Mimas should have lost more of its rockier grains to the mother planet than Tethys, yet it is rockier than Tethys. Dione is likewise rockier than farther-out Rhea and may have been active longer. Evidently these moons are not all made from the same stuff.

"Say all the pieces that make up a moon are the size of a marble. Then even if there are lots of different colors of marbles, the moon would average out gray," says Soderblom. "But if instead the pieces are each 100 kilometers across, their colors wouldn't mix so anonymously. If just 30 pieces made up Tethys, it could have its own personality."

Thus it could have been chance that most



JAMES A. VAUGHN

Trading insights while the first data on Saturnian wind speeds and directions are plotted, Andrew Ingersoll and Reta Beebe begin the long, detailed process of putting numbers to observed phenomena. As mission chief scientist Edward C. Stone has put it, "Until you have numbers, you don't have a science."

Spaceworn Dione, mother of Aphrodite in mythology, reveals (facing page) fissures, craters, and, on the sunlit limb, evidence of coating from internal upheaval and escaping gases.



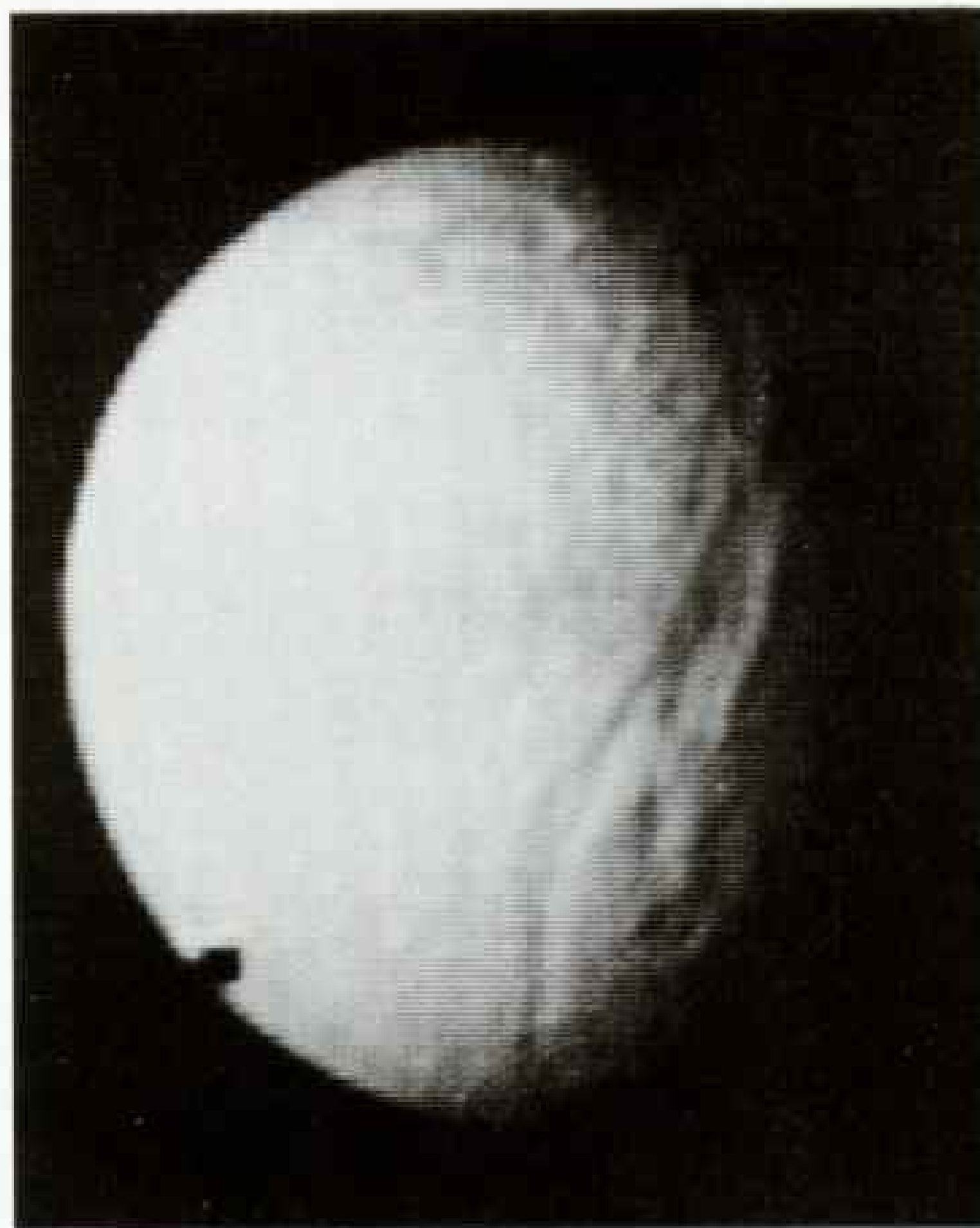
Pondering a lunacy of moons

A NEW CLASS OF MOONS, larger than all but the largest asteroids but smaller than Jupiter's Galilean satellites, presents a set of puzzles to scientists (above, from left) Laurence A. Soderblom, Richard J. Terrile, Torrence V. Johnson, and, standing, Eugene Shoemaker. If the moons had fit neatly with predictions, they should have been uniformly dead ice and dust balls, peas in a pod, except that their densities likely would have increased with distance from the planet.

Instead, they proved to be significantly different from each other, some with evidence of internal activity, now or in the past, with densities changing randomly without regard to distance from the planet.



JAMES A. BOGAN

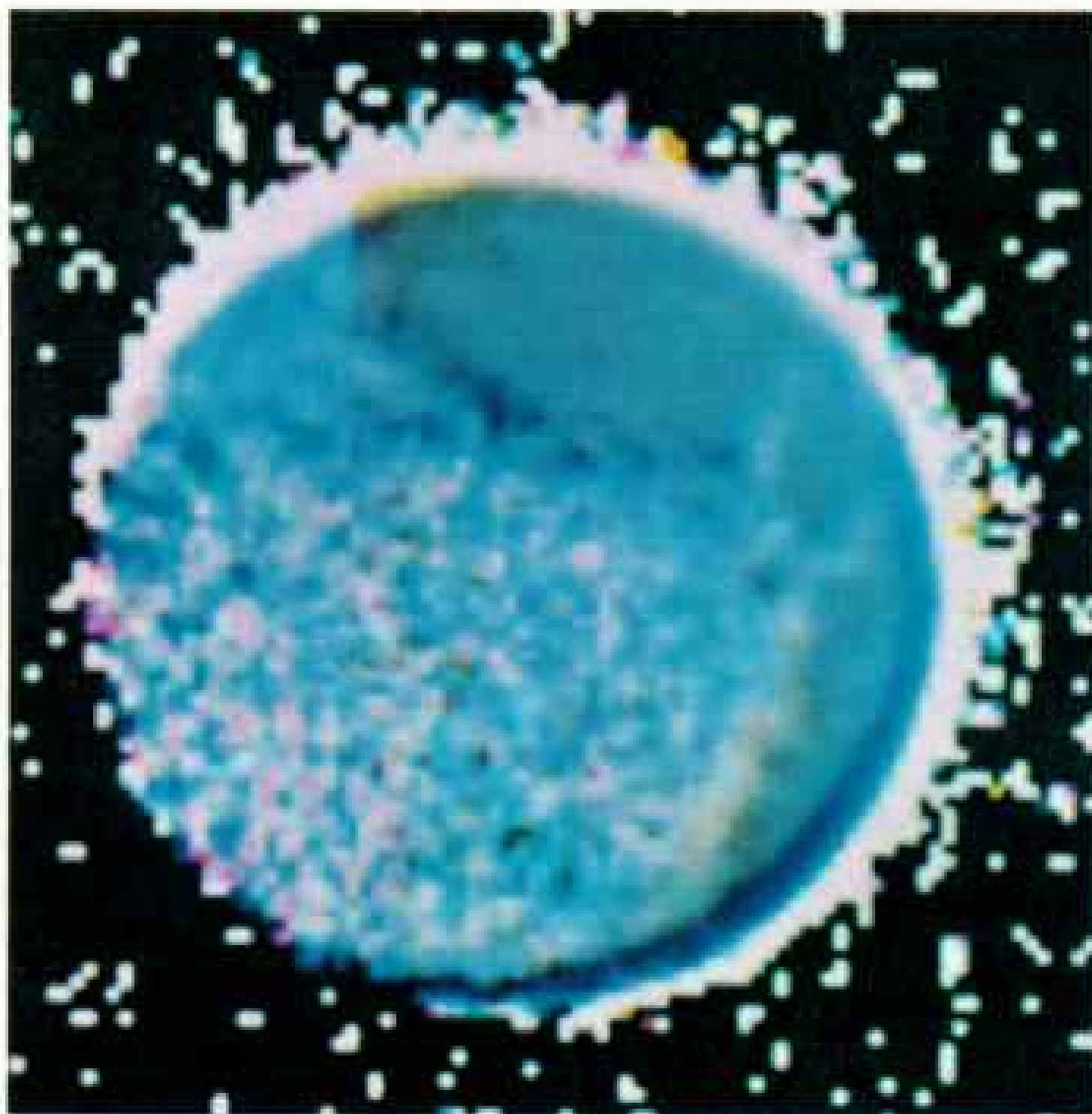


Tethys

Like an old tennis ball chewed by the family dog, Tethys (left) shows a long, sinuous trench about three kilometers deep and the tooth marks of large craters. Perhaps the least dense of Saturn's icy moons, Tethys is 80 percent or more water ice.

Besides the moons' relative distances from the planet, their densities may differ because of the various amounts and kinds of particles haphazardly accreted during their formation. The least dense may have rocky material scattered randomly throughout, while in the most dense the rock may have segregated and sunk toward their centers.

Those indicating geologic activity may have been heated during accretion or later by radioactive decay of rocky material.



Iapetus

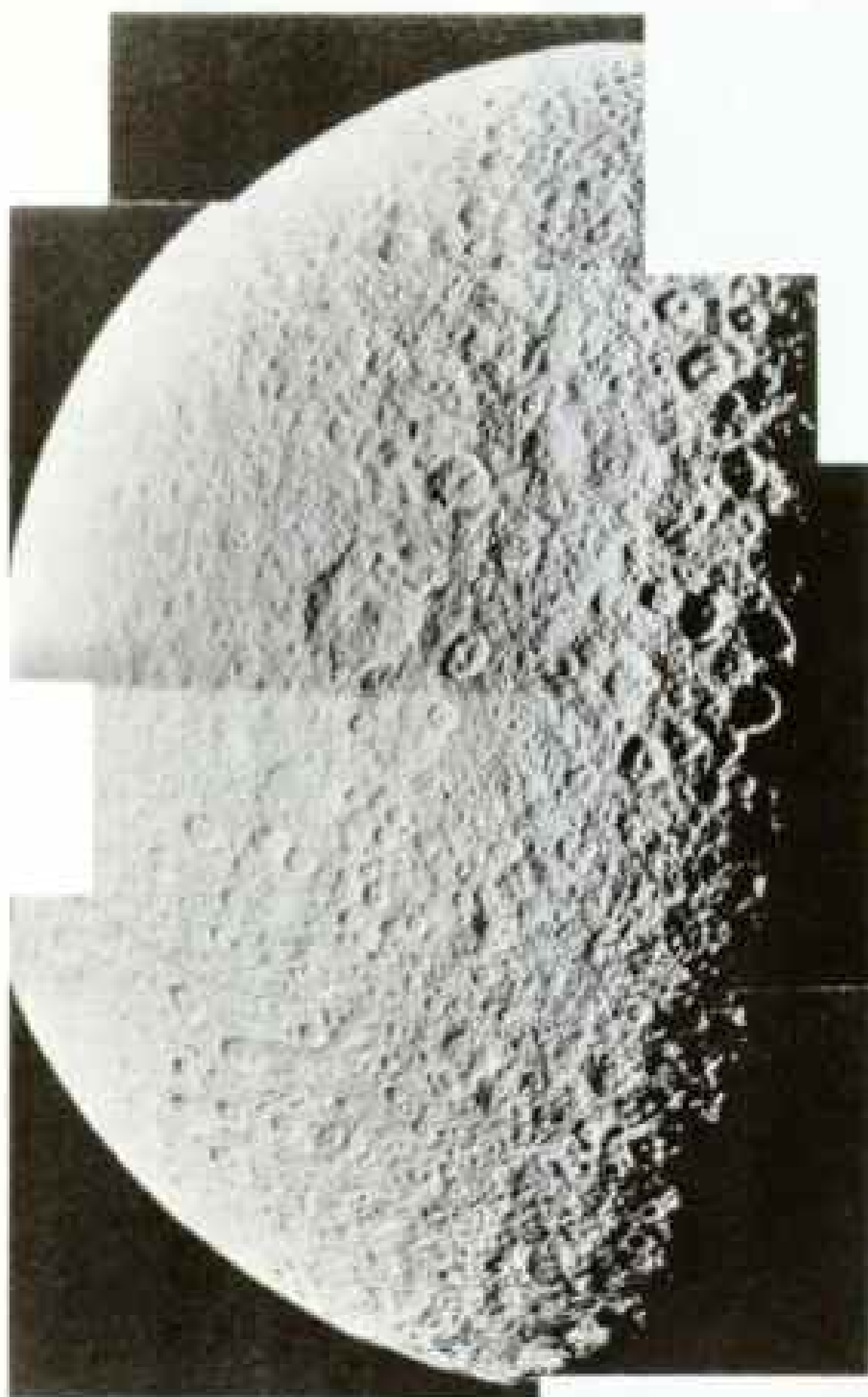
A yin and yang of a moon, Iapetus has one hemisphere five times brighter than the other, as seen in both enhanced false color (left) and in direct imaging (below). The cause is not known, but Voyager 2 will come in for a much closer look.



Rhea

Rhea's insides were stirred, probably very early in its history, for as seen in color at low resolution (below), white wisps indicate that water spewed out from the interior. A closer view of another region (right) shows intense cratering.

Some craters on Saturnian moons may be the products of other craters. When a high-speed body strikes a small moon, some debris goes into orbit and eventually impacts at low speed on the same moon.



EARTH

EARTH'S
MOON

SATURN

A RING SHEPHERD MOON

1980 S 27

F RING SHEPHERD MOONS

1980 S 26

CO-ORBITAL MOONS

MIMAS

ENCELADUS

TETHYS

1980 S 13

DIONE B

DIONE

RHEA

TITAN

HYPERION

IAPETUS

PHOEBE

Saturn's moons

Earth and its moon are superimposed to scale on Saturn. Saturn's larger moons are also shown to scale.

DIA diameter in kilometers
DIS distance from Saturn's center in kilometers
DEN density; water = 1.0
* moons not to scale

A ring shepherd (1980 S 28).
DIA 30 km; DIS 137,700 km.
Smallest of the satellites.

F ring shepherds (1980 S 27,
S 26). * DIA 220 km,
200 km; DIS 139,400 km,
141,700 km. These hold
the F ring in place.

Co-orbital moons (1980 S 1,
S 3). * DIA 180 km, 120 km;
DIS 151,450 km. May
be halves of a single
fractured satellite.

Mimas. * DIA 390 km;
DIS 185,500 km; DEN 1.2
A nearly fractured
moon scored by cracks.

Enceladus. * DIA 500 km;
DIS 238,000 km; DEN 1.1 (7)
The most reflective body
in the solar system.

Tethys. DIA 1,050 km;
DIS 294,700 km; DEN 1.0
Almost totally water ice
with great cracks perhaps
due to freezing expansion.

16th moon (1980 S 13). *
Not yet confirmed.

Dione. DIA 1,120 km;
DIS 377,400 km; DEN 1.4. Has
wispy streaks, probably frost.

Dione B (1980 S 6). *
DIA 50 km; DIS 377,400 km.
Shares the orbit of Dione,
probably similar to other
icy moons.

Rhea. DIA 1,530 km; DIS
527,000 km; DEN 1.3
Surface variable,
may have had several
bombardment eras.

Titan. DIA 5,140 km;
DIS 1,221,800 km; DEN 1.9
Has an atmosphere
much denser than Earth's.

Hyperion. * DIA 290 km;
DIS 1,479,300 km.
Poorly seen by Voyager 1.

Iapetus. DIA 1,440 km;
DIS 3,558,400 km; DEN 1.2
Extreme variation in
reflectivity between
hemispheres.

Phoebe. * DIA 50 km; DIS
12,945,000 km. A captured
moon with a retrograde orbit.

of the chunks that made up Tethys were icy. And those going into Dione might have had more radioactive rocks than Rhea's, keeping Dione's interior hot longer.

Radioactive rocks help heat the interiors of terrestrial moons and planets. "We never thought these moons were big enough to generate the heat needed to provoke the eruptions apparent on Voyager's moonscapes," says Soderblom.

This is the outer solar system, however. Earth's geology may not apply to moons with compositions like comet nuclei. Toby Owen suggests the moons could be active chemically rather than geologically. One comet, known as Schwassmann-Wachmann 1, whose orbit keeps it between Jupiter and Saturn, periodically explodes for no known reason. Perhaps something sparks a pocket of unstable gas within. Similar blowouts of gas and dust—chemical volcanism—could be resurfacing the cometlike moons of Saturn, as well as supplying the E ring with particles, says Owen.

JANUARY 14, 1981. The Voyager imaging team is reconvening at JPL to write its first mission report. The scientists are still struggling to make sense of the rings. Many now concur that there may indeed be lots of little moons lurking in the rings, dominating their dynamics. After seeing that the two co-orbital moons may once have been one, and that Mimas has nearly been smacked to pieces, some team members are conceding that the rings could have had a catastrophic origin. Others are rethinking their ideas on accretion. How could moonlets grow as big as 1 to 15 kilometers within the Roche limit? Some suggest ring particles could still be accreting.

Some scientists feel they can now at least better describe, if not explain, what Voyager saw in Saturn's rings.

The rings not only are dynamic but also have remarkably different characters. For instance, the C ring and Cassini Division particles appear significantly darker than A and B ring particles. And data from the radio-science team show that particles in the A ring and Cassini Division are five times larger than those in the C ring.

To ring expert Jeff Cuzzi this implies that each ring may have a different history. The

structure of the A ring is orderly. Many gaps in the A ring, he says, are clearly caused by satellite resonances. But there are also other highly regular patterns that look like the grooves in a record. These could actually be waves induced by resonance.

The B ring turns chaotic. Some ringlets are close together, some far apart. This is where most of the suspected moonlets lurk. The B ring is dense and opaque. Its many large pieces churn and grind against each other, generating clouds of fine ring dust.

This dust is what gets lifted up out of the ring to become the spokes. Jim Warwick, leader of Voyager's planetary radio astronomy team, believes that sunlight charges these minute particles. He also thinks that they then coat the larger ring particles. Warwick suspects that a thickly coated and thus highly charged moonlet travels through one region of the B ring. As it does, electricity leaps between the moonlet and countless smaller particles.

The result is a continuous static chorus of what sounds like lightning and might look like it too if the rings had an atmosphere to flash through.

The border between the B and C rings, says Cuzzi, is perplexing. There is no gap. But the C ring clearly contains much less material than the B ring. Its particles are probably much smaller. It is more transparent, has a different color, and shows orderly structure.

"Maybe the C ring is populated by fresher material," says Cuzzi. "Maybe A and B were the original rings and C was created more recently. Maybe micrometeorites sputter molecules off chunks in the B ring, and they land in the C ring and accrete into new particles."

As for the F ring, Rich Terrile says, "It's still braided. We couldn't make those pictures go away. Most team members think the gravitational forces from the shepherding satellites send 'traveling pulses' along those strands as they speed by. Both those satellites' orbits are eccentric, so a pulse from one of them could be 16 times stronger on one side of the ring than on the other. No wonder it is kinked, clumped, split, and tied up in knots.

"We're going to be working on this ring for a long time," says Terrile.

FEBRUARY 11, 1981. The first science report is complete, and Brad Smith is looking at Saturn through a 61-inch telescope in the Santa Catalina Mountains outside Tucson. He hopes to confirm a sighting he made last year of a 16th Saturnian satellite.

Through the lens appears the frosty haloed sphere that has sparked rapture in every observer since Galileo. It is hard not to gasp, hard to believe there is really something up there that looks like that.

"This is the way I've always seen Saturn," says Smith. "I've spent quite a bit of my life



BRADFORD SMITH

Riding herd on Saturn with a 61-inch telescope, Voyager imaging-team leader Bradford A. Smith tries to confirm a 16th satellite. When it comes to the Saturn system, he says, "We're still a long way from a detailed understanding."



Shining Enceladus

MIRROR OF THE SOLAR SYSTEM, Enceladus (right) reflects nearly all the light that reaches it. It may be that the satellite is continually being recoated from its interior (illustrated above). One hypothesis is that tidal forces—resulting from Saturn's and Dione's gravity—heat its interior. This keeps the moon a giant drop of water with a thin ice crust that can fracture to emit ice crystals, which can escape to feed the very faint E ring.

Other ideas are that meteorites puncture the crust with the same effect, or that chemical volcanism involving methane might be responsible. Voyager 2 will perhaps have some answers—and perhaps even more questions.





PAINTING BY LLOYD K. TOWNSEND

squinting through eyepieces, wondering what it is really like. Now the romanticist in me is sad.

"I'm probably the only one who feels this way, but Voyager has taken the mystique away. The wondering is over. I now know what it looks like. Now it's become clinical."

The scientist in Smith, however, is just going to work. "At Jupiter we saw puzzling things, but by this time we felt we were in the mop-up stage of understanding them. I don't believe we've made any real progress on the structure of the rings."

Smith is wary of the idea that invisible moonlets create most of the ringlets in the B ring. "Why wouldn't they be in the A and C rings as well?" He thinks Voyager 2 will reveal far more structure still when it flies

much closer to the rings late this August. With luck, Voyager 2 will take close-ups of the braiding in the F ring. Its cameras have been reprogrammed to try to observe the spokes as they form and dissipate. The surface of Enceladus will be seen in much greater detail. Yet Smith is concerned.

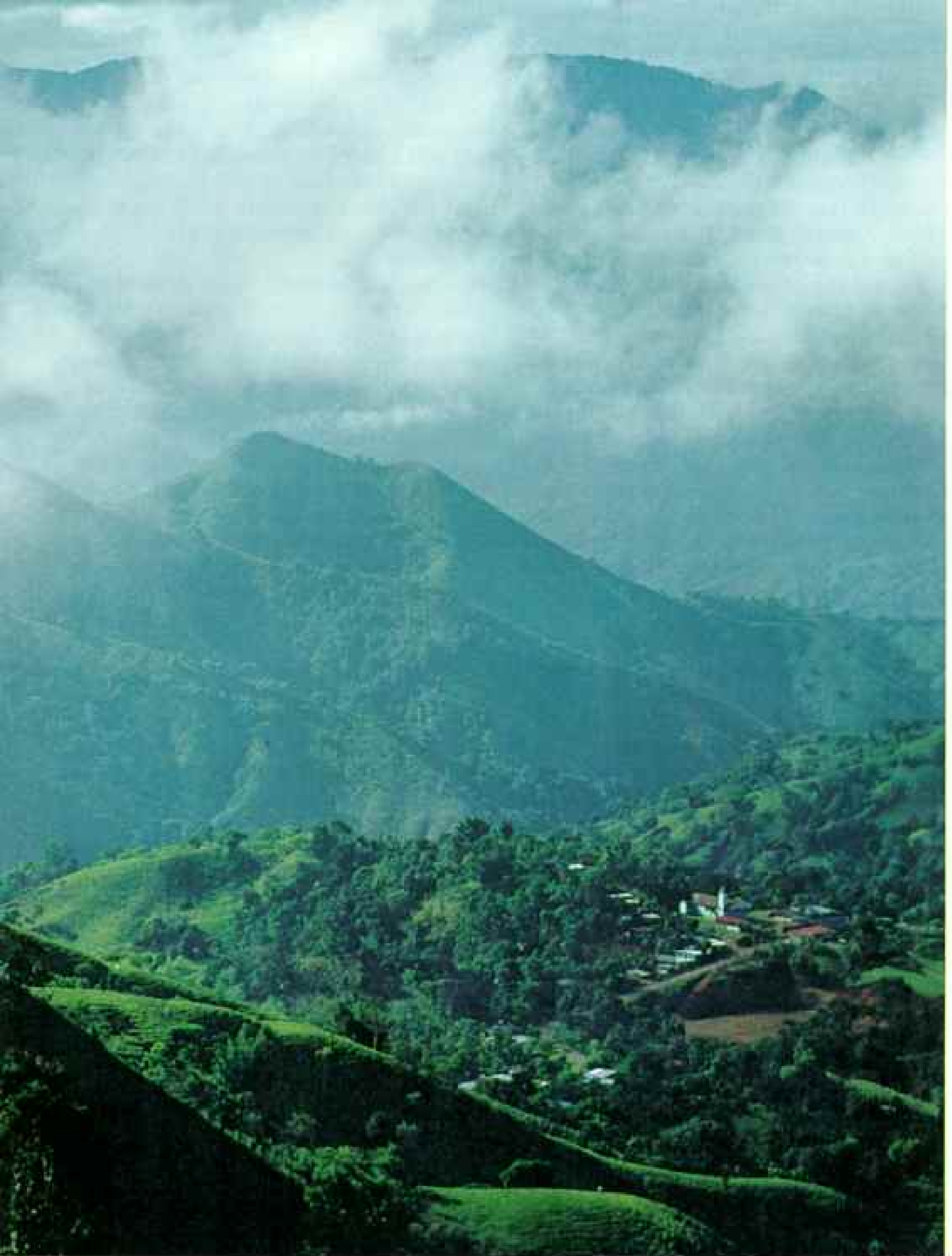
"I worry," he says, "that in August we'll find out that the sequence of images we've designed for Voyager 2 may not be the best, that we should have done it differently, and that we'll have lost a chance that may not come again in our lifetimes." He goes on, almost until dawn.

"We're dealing with such complex phenomena—with things that are just *very* different. It takes time," he says. "Saturn is becoming an obsession." □



By KENT BRITT NATIONAL GEOGRAPHIC SENIOR STAFF

Costa Rica Steers the



WILLIAM ALBERT BLAIR

Middle Course

Mountain backbone of the Cordillera Central divides Caribbean lowlands from Pacific beaches. In Central America's most peaceful nation, geography is the only extreme.

THE HORSE—old, tired, trail wise—topped the hill and stopped. With a distinct sense of relief I stood in the stirrups, raising myself off the hard wooden Spanish saddle, and gazed down at one of the rare stands of virgin forest on the Meseta Central, Costa Rica's most popular and most populous plateau.

I heard the labored whuffing of another horse, and Emilio drew alongside.

"It is there," he said, pointing, "there between the hilltop and the forest, where my uncle's dream, and mine, will come true."

The dream of Emilio Ramírez Rojas and his late uncle, Cruz Rojas Bennett, began with their desire to protect forever this untouched part of their vast cattle estate, Rancho Rodeo. The two men—both of them conservationists, philosophers, idealists—in the late 1970s donated to their country the 350-hectare (875-acre) forest for preservation as a national park.

More important, as their contribution to the world at large, they donated an adjoining 100 hectares to be offered to the United Nations, a gift from Costa Rica. There, students from many lands would pursue disciplines designed to alleviate the economic, social, and technological inequities that pit nation against nation.

Architects have drawn the plans. Curricula have been devised. As soon as the funds for construction are available, ground can be broken for the ambitious, anomalous dream of Emilio and his uncle: Here will stand the University of Peace.

No Peace at Hand Nearby

This is, I reminded myself, Central America, an isthmus haunted by discord and racked by turmoil.

El Salvador is engaged in bloody civil war; Guatemalan leftists are battling government troops and right-wing "death squads"; Nicaragua reels in the wake of a revolution that ousted the Somoza regime; Belize faces independence from Britain by year's end, but there is fear of a military takeover by Guatemala; Panama's strong man, Gen. Omar Torrijos, uneasily ponders an economy slumping to new lows (Central American map, pages 58-61).

And yet Costa Rica, surrounded and threatened by such havoc, offers itself as the

site for a university dedicated to peace.

It was only after several months in this fanatically democratic, West Virginia-size land that I found the anomaly beginning to fade. For Costa Rica most definitely is not what the North American mind too often misconceives as a banana republic.

Consider:

- In a part of the world where government by coup is the rule rather than the exception, Costa Rica holds the record for democratic transfers of power. Of some 50 presidents since independence from Spain was declared in 1821, only three were military men and only six could be termed dictators.
- Costa Rica maintains no formal military establishment; the 1949 constitution forbids it. The country has never suffered a major invasion, or occupation by a foreign power.
- A nation of educators and educated, Costa Rica has the highest literacy rate (90 percent) in Central America, and boasts, correctly, of more teachers than policemen.
- As close to a classless society as can be found in Latin America, it has few desperately poor and fewer fabulously wealthy citizens. Social and economic mobility in this most prosperous Central American land is possible and commonplace, thus minimizing class bitterness and resentment.

In the words of World Bank official Juan Bazo, a Peruvian, "Costa Rica is the land of the happy medium."

But how did it come to be that? And why? And can it retain that distinction?

Surely Christopher Columbus, who made landfall here in 1502, had more than medium expectations for this verdant region. After putting into a protected bay at what is now the Caribbean port of Limón (map, page 36), the discoverer encountered Indians ornamented with gold.

That, together with lush forests stretching endlessly inland, gave birth to the name Costa Rica—"rich coast"—and led generations of Spanish colonists to lives of despair. They found little or no gold. And what Columbus perceived as a land of maximum promise remained, for 300 years after its discovery, a land of the dismal minimum.

Incredibly diverse topographically, the country seems almost idyllic to modern eyes. The near-tideless Caribbean laps the tropical beaches along humid alluvial lowlands,

while the Pacific pounds the irregular west coast. A chain of lofty volcanic cordilleras—two-thirds of the land area—marches the length of the isthmian republic, from near its northwest border with Nicaragua to Panama. The highest peak, cold and windswept Chirripó, pushes skyward 12,533 feet, yet lies no more than 50 miles from either coast.

To the first Spaniards this dazzling diversity spelled only adversity.

Floods, hurricanes, and tropical diseases stalked them in the sweltering lowlands. And fierce, elusive Indians harassed them maddeningly. Here was no Aztec or Inca Empire to be enslaved intact, but hundreds of independent bands eager to slay the strangers and willing to burn their own crops to deny them food. Starvation was so constant a companion to the Spaniards that some resorted to cannibalism.

Without native slave labor, the early colonists were forced to work the land themselves. And without gold, trade with other New World colonies was infrequent at best.

"As a result of their isolation, they became very individualistic. Also barefoot," I was told by 74-year-old José María Figueres Ferrer—"Don Pepe" Figueres.

"At one point," Don Pepe continued, "with trade disrupted by English and French pirates the people made garments of goat hair and tree bark. Cacao beans became the medium of exchange."

History From a Revolutionary

I listened carefully to this man, this diminutive giant. He is more than a student of Costa Rica's past. Leader of the country's last revolution, Don Pepe is a major architect of the modern state.

Not for naught the colonists' travails, he told me, because "the struggle, where even the governor had to tend his own crops, brought about an unusual egalitarianism that survives today; the struggle paved the way for our free education and free elections that began in the 1880s."

To talk to this national hero, I had followed precipitous Highway 2 south from Cartago, in the central highlands, through awesome mountain passes where enveloping clouds drift dark and ominous as whispered rumors, and barricades loom from the mist to signal road shoulders sheared away.

After 30 kilometers I reached his *finca*, or farm. Its name, appropriately, is La Lucha Sin Fin—"the struggle without end."

At my urging, Don Pepe related what happened when his country's electoral process was tampered with in 1948.

The party then in power, backed by local Communist activists, refused to honor an election that would have ousted it. Don Pepe—farmer, (Continued on page 40)



WILLIAM THOMPSON

Top crop in Costa Rica and number one export, coffee brought 317 million dollars in 1980 for 125,000 tons. Grown on the mountain slopes of the Meseta Central, or "central plateau," coffee employs 45,000 people year round; an additional 12,500 pick the ripe red cherries when school lets out for harvest.



Costa Rica

“**RICH COAST,**” the name translates, but early Spanish explorers found little gold and few Indians to exploit. Thus the country evolved as basically middle class. Columbus discovered the country on his fourth and final voyage in 1502. The

nation gained independence from Spain in 1821.

GOVERNMENT: Republic.
AREA: 50,700 sq km (19,575 sq mi).
POP.: 2,240,000. **CAPITAL:** San José, pop. 250,000. **RELIGION:** Roman Catholic. **LANGUAGE:** Spanish. **ECONOMY:** coffee, bananas, sugar, beef, manufacturing.



WILLIAM THOMPSON



Protest from afar: Salvadorans living in Costa Rica march in San José to denounce repression in their war-torn homeland. Costa Rica has long opened its arms to refugees from totalitarian Latin American states, whether of the left or right.

The personification of Costa Rica's ideals, José "Don Pepe" Figueres Ferrer (right), here at his lumber mill, was a 42-year-old farmer-philosopher in 1948, when he led the country's last revolution. With an army of 600 university students and intellectuals, he toppled a government that had refused to step aside for its democratically elected successor. As leader of the revolutionary junta, Don Pepe had the constitution revised to outlaw any standing army—including his own—and then returned the reins of power to the actual winner of the '48 election. Costa Ricans rewarded him later with two terms as president.

Today's President Rodrigo Carazo Odio (below left) displays the easy informality that characterizes most politicians in this model republic.



WILLIAM THOMPSON (ABOVE) AND STEPHANIE MAZE (BELOW)





Star of the Meseta Central, San José basks in the morning sun. A quiet city of unstartling architecture, the capital still casts a spell woven of the warmth of its people, a profusion of flowers, and an ideal climate. At an altitude of 3,900



WILLIAM ALBERT ALLORD

feet, San José and neighboring Alajuela, Heredia, and Cartago (capital until 1823) enjoy year-round temperatures averaging 70°F—a major reason why two-thirds of the nation's population of 2,240,000 live in the central highlands.

economist, engineer, and self-proclaimed social democrat—raised a ragtag army of students and intellectuals. Within two months, supported by the presidents of Guatemala and Cuba, they had crushed the might of the central government, which was aided and armed by the Somoza regime in Nicaragua and by Honduras.

"I loved fighting!" Don Pepe said. "War is something you can be enthusiastic about!"

And something he was very good at, despite a total lack of military training. His 600-man army, outnumbered ten to one, captured the major cities of Cartago and Limón and was poised to pounce on San José, since 1823 the national capital, when the government capitulated.

"I am ashamed to say that we killed 2,000 people, many of them well-meaning, if confused, young Communists and many of them poor, illiterate Nicaraguans, banana workers here, who were each given an old rifle and a bottle of rum. Very tragic. We lost only 60 men."

Nurturing the Fruits of Victory

As the victor, Don Pepe became President of the Founding Junta of the Second Republic of Costa Rica. He immediately disbanded the army and implemented social-welfare programs and woman suffrage. Then, after 18 months—to the surprise of all Latin America—he handed over the reins of power to the man who had actually won the 1948 election, a man not even of his own party. In 1953 and 1970 Don Pepe was elected president in his own right.

Since abolishing its army, Costa Rica has relied on the reciprocal-assistance Rio Treaty. "This means," said Don Pepe, "that an attack on us is an attack on all the countries of the Western Hemisphere. That is our great strength—and we don't spend a cent on arms!"

It was early evening when I left the pastoral calm of La Lucha for the raucous bustle of the capital, some 50 kilometers distant. Snaking down the mountain, I thought how

fitting it is that this five-foot-four-inch warrior's favorite book, always at his bedside, is Cervantes' *Don Quixote*.

San José is Costa Rica's New York, Chicago, Washington, D. C., and San Francisco all rolled into one small package. It is the queen city of the upland valley called the Meseta Central. Because the 1,500-to-5,000-foot elevation keeps temperatures between 58° and 80°F year round, wet season or dry, about 65 percent of the country's 2.4 million people live in this great basin.

The capital city has its tree-shaded plazas and its block-square central market, Mercado Central, a redolent storm of a thousand Latin aromas. But if you're looking for colonial "quaint," skip relatively young San José. Spanishness emanates instead from the features of its people. In this land of unconquerable Indians, native and European blood mixed far less than in other New World countries. There *are* mestizos—social and economic equals—and, notably in Limón province, Jamaican-descended blacks and rapidly assimilating Indians. But the lighter complexions of early Old World immigrants are everywhere evident.

San José mirrors North America in clothing styles, in commercialism (Pizza Huts, McDonald's, Kentucky Fried Chicken), and most of all in its passion for motor vehicles—despite staggering import duties that can run the price of a Honda to \$20,000.

Specially made for such narrow streets, Japanese compacts play daylong Dodg'em with bullyboy buses bearing such improbable names as "Queen Mary," "Tico Tex," and "Nautilus."

Rush hour is a bullfight on the streets, with every car a blaring beast and every pedestrian a torero. Not even the sidewalks are safe, as a friend learned when a bus swooped curbside, hooked her with its mirror, and spun her into a less-than-elegant veronica.

The bus driver was exceptional; most Costa Ricans take justifiable pride in their reputation as a friendly and courteous people. Even their language is gentle, softened

Awash in guilt, a young bassoonist warms up for a performance by the Costa Rica Youth Symphony in San José's lavish National Theater. Financed by 19th-century coffee barons, the scaled-down model of the Paris opera house also headquarters the internationally acclaimed National Symphony Orchestra.

STEPHANIE MAZUR



Muted elegance of yesteryear finds willing models at a Costa Rican Garden Club fashion show in San José. Today's Costa Rican woman is more likely to embrace unpretentious trendiness than extravagant haute couture.

by the widespread use of the diminutive form. Thus *un momento*—one moment—becomes, in Costa Rica, *momentico*. The practice has led to the nickname “ticos.” A female tico, of course, is a tica. And the ticas, even ticos agree, rank among Costa Rica's most beautiful natural resources.

San José's stylish young ticas, garbed in unbelievably tight jeans and two-inch heels, deal capably with the attention-arresting “Ssssst!” of the Latin male. They trade glance for glance and stare for stare—and consider themselves the equals, at least, of Costa Rican men in intelligence, wit, ardor.

And ardor is not invisible in Costa Rica. To watch the viselike clutching of ticos and ticas dancing, whether at a San José discotheque or a crossroads cantina, is to marvel that the birthrate in this predominantly Roman Catholic nation is only 3.1 percent—among Central America's lowest.

Soccer Has Some Competition

“Making love is the number one pastime in Costa Rica,” insisted David Blanco, my friend and interpreter, “followed by drinking and eating. *Fútbol* [soccer], the so-called national sport, isn't even in the running.”

Even the poorest tico can afford the native red-eye called *guaro*, a harsh, clear spirit distilled from fermented sugarcane; a large shot costs only four colones (about 25 cents). Were it not for the delightful Costa Rican custom of offering *bocas*—tidbits ranging from *ceviche* to *tortillas con queso* (tortillas with cheese)—with each refill, many might get no real nourishment at all.

But the rest of the population makes up for the imbibers' bad eating habits.

“I just don't understand how ticas can have such sensational figures; they're eating all the time!” exclaimed my friend Jerry Cunningham. “Just watch. No Costa Rican can walk two blocks without buying something to eat from a sidewalk vendor.”

This is a slight exaggeration perhaps, but



nowhere else have I seen a family of five enter a restaurant for dinner with each of them licking at a double-dip ice-cream cone.

Jerry, who came from Spokane, Washington, to start a charter-boat business, is one of about 10,000 North Americans living in Costa Rica. And these gringos are vastly outnumbered by Latins from other Central and South American countries.

As an oasis of democracy this republic has



WILLIAM ALBERT ALLARD

long offered sanctuary to people driven from totalitarian countries. Many use Costa Rica only as a temporary refuge as they wait for political fortunes to change at home.

North Americans come for other reasons. For the never winter climate and endless white- or black-sand beaches, for business opportunities, for genteel retirement, or simply to escape the shoals of wrecked marriages. Costa Rica welcomes them all.

Costa Rica Steers the Middle Course

Capital investment is enticed by generous tax and duty breaks. Pensioned retirees are wooed with special customs allowances and the fact that foreign income is nontaxable.

Friends Form a New Society

Costa Rica holds a different kind of appeal for one of the most enduring, and insular, groups of North Americans in the country: the Quakers of Monteverde.

Situated at the end of a jeep-torturing road in the Cordillera de Tilarán 140 kilometers northwest of San José, Monteverde—"green mountain"—has just celebrated its 30th birthday. I drove past forest-embraced pastures clotted with unspeakably contented cows, turned at the Monteverde cheese factory, and soon reached the home of one of the community's founders, lean and smiling Wilford "Wolf" Guindon.

Tents, Mud, and an Oxcart Trail

At the dining-room table in his spacious house, with the young howler monkey Whoopy tugging at my beard, I learned how Monteverde came to be.

How, as a matter of conscience, Wolf and three other young men in the Society of Friends in Fairhope, Alabama, refused to register for the peacetime draft of 1948, and ended up in prison. How, once released, they heard of the wonders of Costa Rica from a Quaker couple who had just returned; heard of the farmer-turned-soldier Don Pepe Figueres, who (could it be true?) had abolished the Costa Rican army.

"We started moving our people here in '51," Wolf recalled. "That road you came up? Just an oxcart trail then; we used winches to pull our trucks up the mountain through knee-deep mud. Most families lived in tents while they were building homes. Pretty rugged—but it was worth it."

The main business of the community of perhaps a hundred people centers around the cheese factory. Producing its average 2,000 pounds of cheese daily requires some 2,300 gallons of milk—a demand that has also greatly benefited the Costa Ricans in the dairy zone.

The national hunger for the delicious Monteverde Cheddars, Gouda, Monterico, and cheese spreads seems limitless, but the company is reluctant to expand.

Red-bearded Thomas Dixon, the 27-year-old plant manager, explained: "There

Horns of a dilemma confront this vaquero and other cattlemen in the province of Guanacaste: Their work stimulates the economy, but also often entails widespread deforestation to create rangeland for expanding herds.

WILLIAM ALBERT ALLARD







It's a hardscrabble life, but getting better, for Costa Rican campesinos such as this young woman in Guanacaste province. Unlike many of her rural counterparts in other Latin American countries, she is assured of no-cost medical treatment, a retirement pension, and—in a republic where teachers outnumber policemen—a free education, compulsory through the elementary grades. These benefits, along



WILLIAM ALBERT BILARDI

with an ongoing agrarian-reform program aimed at giving land to every campesino family, effectively limit the appeal of Marxism, which has brought increasing turmoil to neighboring lands.

Costa Rica Steers the Middle Course

is a worldwide phenomenon of 'bigger is better' that does not go down well here. We're pleased with the community as it is. It's no paradise, but it does have some sense of community ideals where people—gringos and ticos both—are pulling together toward something good.

"But everything changes," Thomas muses, "and I'm beginning to detect some undercurrents of concern that Monteverde is changing. With the road graveled, we've become more accessible, more exposed to the influences of outsiders. And we're going to be getting more visitors all the time with the increasing popularity of the reserve."

Tribute to a Toad

The Monteverde Cloud Forest Reserve, 2,500 hectares (6,250 acres) of mostly virgin forest, owes its existence, in part, to a toad.

When the Quakers settled on the mountain, they set aside a heavily timbered region near the headwaters of the Guacimal River to be held undisturbed and in common to safeguard their small hydroelectric plant. The area attracted tropical scientists, especially after a small, brilliantly colored amphibian was found to be a new species, *Bufo periglenes*, the golden toad (following page).

When developers began buying up nearby land, the local scientific community persuaded international conservation groups to press for government protection of the area. That doubtless saved the golden toad, for its known range lies entirely within the reserve.

The parkland, owned and administered by the private Tropical Science Center in San José, straddles the continental divide and incorporates six major ecological communities. Together they offer more than 2,000 species of flowering plants, 100 mammals, and 320 birds, the foremost being the startlingly beautiful and elusive quetzal.

Costa Rica, with 13 new national parks and six biological reserves, leads Central America in moving away from the soil-leaching deforestation that has long plagued the isthmus. But it still has a long way to go. I was told by Gary Hartshorn of the Tropical Science Center.

"There are 2,000 native tree species in Costa Rica—twice as many as in the Continental U. S.," he said. "But lumbermen are probably adding a new species a month



ANN DUNCAN/STREPTAFIX



WILLIAM THOMPSON LARRELY AND NICHOLAS DE VORE III/CRISTY

*Savior of a primeval forest, the golden toad, *Bufo periglenes* (top), helped bring about the creation of the Monteverde Cloud Forest Reserve (above). The toad exists only in rainpools of this misty central Costa Rican sanctuary, at altitudes between 1,500 and 1,700 meters. The 2,500-hectare reserve counts far more than 2,500 species of flora and fauna.*

This ecological diversity, partly a product of volcanic activity by such still breathing giants as Volcán Arenal (right), attracts the attention of naturalists throughout the world.





to the market as they move farther upland."

The government has banned the export of 60 diminishing species, and national law proscribes the cutting of timber without the proper permits. But, Hartshorn added, "It happens anyway, more than a third of it illegally, with the logs being trucked into San José or Cartago at night. Deforestation is now occurring at the rate of 60,000 hectares a year, of a remaining one and a half million hectares."

Deforestation seemed as remote as snow as I boated along the east coast's jungle-hugged inland waterway, a 112-kilometer system of rivers and canals paralleling the sea from Limón to the northern border.

This waterway was established to bring the riverbank-dwelling backlanders into the mainstream of national life, to boost their subsistence economy by giving them a "road" to market in Limón. Water buffalo have been imported to see how they fare, and small-farm coconut production is being encouraged. And now a monthly medical boat treats anyone along the way—fulfilling the constitutional guarantee of free medical care for all Costa Ricans.

In steamy Limón I sensed the witching lure of lassitude that makes this leading Costa Rican port so different from energetic San José. In the noon heat the sloths creeping imperceptibly through the central park's trees seem supremely adapted.

For all that, the city ships a million tons of cargo a year—mostly bananas—and unloads 350,000 tons.

The ocean brings sailors of all nations to the city's streets. The nearby rivers and uncharted jungle trails bring the occasional Indian. Probably fewer than 5,000 Indians survive in Costa Rica today, and most have

been assimilated into the national culture.

But at Amubri, locked in the Valle de Talamanca, two Roman Catholic missionaries have joined with the Costa Rican government—and a 27-year-old Liechtenstein aid-program volunteer—to give Bribri Indians a chance to preserve their ancient tongue.

No road leads to Amubri, 25 minutes south of Limón by air. I flew there with Florin Hoch, the volunteer from Liechtenstein, in a small plane piloted by the younger

priest, Father Bernar-dito. We were met at the airstrip by his partner, Father Bernardo, and a flurry of nuns who unloaded supplies with practiced efficiency.

At lunch in the comfortable mission, Father Bernardo (whose full beard and girth remind one of a summertime Santa Claus) explained that his flock lives on isolated ranchos scattered miles and days apart throughout the dense jungle. Communication, for them, has always been difficult.

The "Voice of Talamanca," in combination with today's inexpensive transistor radios, is now changing all that. Broadcasting two hours a day, the new radio station plays music, announces a medical team's visit,

and transmits "personals"—many in Bribri, so the young will not forget their roots.

Messages bring word of a birth or wedding, an invitation to a family reunion, and not-so-subtle pleas for María to meet José at the big rock by the river's curve. . . .

I strolled jungle trails around the mission, admiring countless orchids—some of Costa Rica's 1,200 varieties. In clearings, small thatch-roofed houses perched on stilts—a wet-season necessity for an Indian rancho.

*Starting in late 1981 an exhibit of Costa Rica's pre-Columbian art will tour Washington, D. C., San Antonio, Los Angeles, Pittsburgh, St. Louis, and Detroit.



COURTESY BANCO CENTRAL DE COSTA RICA (ARDFEC)
BOTH BY WILLIAM THOMPSON

Fanciful musician playing flute and drum is part of the nation's gold collection. Such trinkets drew the Spanish, who brought their religion. At the basilica in Cartago (facing page) worshipers seek miraculous cures from the Virgin.*



Fertility from the earth's heart, volcanic ash enriches a potato field freshly plowed for planting. Potatoes are an important crop as Costa Rica attempts to diversify its agriculture and grow more of its own foodstuffs.

Beneath the homes chickens scratched and a hog or two rooted in the soil. Cacao fruit was stacked nearby, and the beans spread and drying in the sun. The trees themselves, fruit hanging pendulously from their trunks, were everywhere.

Not surprisingly, for some 75 types of cacao grow wild in Costa Rica.

I learned this from Arnold L. Erickson of CATIE (Centro Agronómico Tropical de Investigación y Enseñanza), a 880-hectare agricultural research station at Turrialba, a facility serving all Central America.

Designed primarily to help small farmers, CATIE maintains a living inventory of plants. Its collection of wild and clonal types of cacao numbers 400; the coffee collection has 1,200 varieties.

"Our main job here," Erickson said, as we walked through a legion of test plots, "is to determine what crops can best coexist. We experiment with everything from pineapple to yamlike *tiquisque* to pigeon peas to trees. The campesino traditionally has had annual crops mixed with perennials like coffee or cacao or sugarcane. We're trying to help him get the very most out of limited land."

For Campesinos, the Ultimate Gift

I heard that same theme, concern for the campesino, voiced by Costa Rica's President Rodrigo Carazo Odio a few days later at an open-air ceremony near Cañas, in the northwest province of Guanacaste.

The occasion was the government's gifting of land titles to 93 campesino families—the kind of small farmers who still take their crops to market in brightly decorated wood-wheeled oxcarts. The \$700,000 worth of land represented only a small part of the country's continuing agrarian reform.

As is usual in Costa Rica (and passing strange elsewhere in Latin America), the president arrived with no military honor guard—not even a policeman or body-guard—and he immediately mingled with



the crowd pressing in to shake his hand.

"It is important," the president told them, "that the people of Costa Rica remain in the countryside: Only in this way can the people of the cities eat. It is the republic's duty to defend the interests of those in the country who cannot get organized, who do not have unions because they are too busy in the fields growing food for us all. It is social justice!"

It sounded almost like a campaign speech, except that a president can serve only



NICHOLAS DE VIRE III

one term under current Costa Rican law.

President Carazo had told me earlier in an interview that Costa Rica must diversify, particularly in agriculture and agribusiness, to recharge an economy that is beginning to reel under the impact of expensive social programs and soaring fuel prices. With no petroleum of its own, Costa Rica now spends as much as its total coffee income for foreign oil each year. In 1980 the nation's money suffered a 50 percent devaluation.

Diversification proceeds apace. A range of recent projects in Guanacaste province, the Texas of Costa Rica, illustrates the imaginative search for new solutions:

- Just outside Cañas new irrigated fields of cantaloupes and honeydew melons have been harvested for shipment to the U. S.
- A shrimp farm sends thousands of pounds of the product to market each month.
- A new hydroelectric project at the base of Volcán Arenal, one of the country's four



JOHN MASON, COMM PHOTO INTERNATIONAL (ABOVE) AND
STEPHANIE MAZE (FACING PAGE)

Bananas bring smiles not only to this plantation worker in the coastal lowlands but also to national planners. The fruit vies with coffee as Costa Rica's leading export. At Limón (facing page)—the nation's busiest port and a city of many Jamaican-descended, English-speaking blacks—dockworkers load as many as 15,000 40-pound cartons of bananas an hour.

active volcanoes, has created a 75-square-kilometer lake and increased the nation's electricity output by 50 percent. An even larger project gets under way soon.

- Low-interest government loans and guaranteed prices have resulted in thousands of hectares of pastureland being put into rice, cotton, and sugarcane production.
- A huge new sugar mill near Liberia, the provincial capital, is using molasses (a sugar by-product) to distill as much as 64,000 gallons of alcohol a day for gasohol.
- The government is aiding development of a fishing industry on the west coast.

Facing the Winds of Change

Despite its evolving complexion, Guanacaste remains essentially what it has been for 150 years—cattle country. Here big ranchers are the social and economic elite, but they sense that they may be dinosaurs in the changing social order of Latin America. They worry that the leftist tide in neighboring countries could lap into Costa Rica.

"There is a very large middle class in Costa Rica," Alvaro Clachar told me at his El Real ranch at Liberia, where he produces more prize-winning Brahman breeding cattle than any similar enterprise in Central America.

"Because of that, the people don't want Communism. But they really like some sort of socialism, and sometimes you don't know where the border line is between the two. Is it pink? Red? Light pink, light red? Am I foolish in these times to devote so much money and effort to developing my ranch? I just don't know."

Seventy-one-year-old Alfonso Salazar, the weathered patriarch of a family that runs 10,000 head of cattle on 10,000 hectares, thinks the threat of Communism is real, but probably controllable.

"Somoza, a man I knew well but whose policies I disliked, was to blame for the leftist government now in power in Nicaragua. He let conditions ripen to the point where Communism looked good to the poor people. Ripen is the word—and then he had to drop like a mature papaya!

"Here," the rancher continued, "we think ahead; we are trying to take care of our poorer people, our campesinos. Still, I know that my kind is a target of Communist



Westering sun gilds a beach near Manzanillo on the Pacific coast. Blessed with sweeping strands on both coasts, Costa Rica has determined to keep many of them from development, establishing surfside parks for the people. These riders enjoy the quiet of their peaceful isle in Central America's sea of troubles.

56

propaganda. And I recognize that my landholdings are too pretentious for the tendencies of today. I already have everything I need. So I plan to sell off almost all my land. Maybe that will help my country avoid the excesses of the left. I hate Communism!"

In fact, Communism has only a small following in Costa Rica, perhaps 35,000, many of them in the banana workers' unions. And only 3 of the 57 members of the unicameral



Legislative Assembly were elected on the Communist Party ticket—a representation almost unchanged from three decades ago.

“Your country is our guide,” rancher Salazar explained. “We are within the orbit of the U. S.; we love it, and we emulate it. That is why we have what we have here—a living democracy, something out of this world!”

Yes, Costa Rica is special—not because of superlatives, but because of remarkable

normalcy; not because it stands at the heights of achievement, but because it resolutely pursues them. Neither rich nor poor, large nor tiny, warlike nor pacifist, perfect nor fatally flawed, Costa Rica is, indeed, the land of the happy medium.

I would offer this exemplary republic a benediction from its own national anthem:

*May your people, contented and peaceful,
Unmolested continue their toil.* □

WILLIAM ALBERT ALLARD



Troubled Times for Central America

THE SCENES ARE TRAGIC and familiar. Crops burn in the fields. Patrols meet ambush on mountain roads. Automatic rifles chatter in city streets at night. Priests are attacked in their churches.

Despite the indolent beauty and the economic promise of this tropical isthmus, political violence has long been the dynamic of Central American history. But today local conflicts attracting big-power involvement threaten to inflame the entire isthmus.

Since 1978 some 50,000 people have died in political violence in Nicaragua, El Salvador, and Guatemala as leftist guerrillas challenged authoritarian regimes. Earlier this year the U. S. Department of State accused the Soviet bloc of helping to smuggle arms, including U. S.-made weapons captured in Vietnam, to Salvadoran guerrillas. Soon thereafter the U. S. tripled military aid to the Salvadoran government to 35.4 million dollars.

History ordained Central America's troubled course. Dependence on a very few export crops—cacao in the 17th century, indigo in the 18th century, and coffee and bananas in the late 19th and 20th centuries—made the Spanish colonies vulnerable to political and economic turmoil after they gained independence together in 1821. In the past century alone, scores of regimes, often dominated by U. S. interests, have marched through the area, giving rise to the cynical sobriquet, “banana republics.”

These young nations have lived uncomfortably in Uncle Sam's shadow. James Monroe put Europe's powerful monarchies on notice in 1823 that the Western Hemisphere was closed to further colonization. But Theodore Roosevelt gave the Monroe Doctrine a

twist in 1903, when—vowing to “speak softly and carry a big stick”—he shepherded in the era of U. S. intervention. Since then, United States armed forces have landed in the Dominican Republic, Cuba, Honduras, Nicaragua, Mexico, and Haiti. In Guatemala, Washington helped depose President Jacobo Arbenz Guzmán in 1954, fearing he would deliver the country to Communists.

Colonization left another imprint on Central America's 22 million people—ethnic diversity. About half of all Guatemalans are pure Indian, descendants of the Maya, while nearly all Costa Ricans are descendants of Spanish colonists. The rest are mostly various mixtures of Indian, European, and African peoples. As in colonial days, stark contrasts of wealth and status divide these peoples. Almost two-thirds are rural peasants, many laboring on large estates owned by a relatively few wealthy families or large corporations, often foreign controlled. Illiteracy on the isthmus is high—close to 80 percent among Indians—disease is common, and underemployment chronic. One in 12 Guatemalan infants dies in the first year. Five in ten young Salvadoran children are undernourished.

“Ours is a history of people starving to death, living in misery,” said Salvadoran President José Napoleón Duarte. “For 50 years, the same people had all the power, all the money, all the opportunities.”

The memory of Vietnam now haunts Washington policymakers as the violence drags on in Central America. Offering economic aid as well as weapons and military training, the United States is trying to turn authoritarian regimes toward the democracy of Costa Rica and away from both the dictatorships of the past and the threat of Cuban-fostered new leftist dictatorships.

The weary people of Central America long for peace. But many share the concerns of the Reverend Arturo Rivera y Damas, acting archbishop of San Salvador: “Our peace ought not to be a peace of the cemeteries.”

Wilbur E. Garrett
EDITOR



Bay of Campeche

Yucatán Peninsula

Mexico

Guatemala

El Salvador

Belize

Honduras

An isthmus in turmoil

The Indians of Guatemala, who historically have kept apart in isolated villages, are being drawn into civil strife, some taking sides with Marxist guerrillas against the government. Death squads, mostly from the right, have murdered thousands of people, moderates as well as extremists. Unequal distribution of wealth is at the root of the unrest: Two percent of the people control two-thirds of the farmland. But a growing industrial sector and recent oil finds in northern rain forests may create new wealth and employment.

AREA: 108,889 sq km (42,042 sq mi). POP.: 7,058,000. RELIGION: Roman Catholic, traditional. LANGUAGE: Spanish, Indian languages. ECONOMY: Export crops: coffee, cotton, sugar, bananas, meat. Industries: food processing, textiles, mining. Domestic consumption: corn, beans. PER CAPITA INCOME: \$1,020.

Government forces in Central America's smallest, most crowded nation fight a coalition of leftist guerrillas in a simmering war of terrorism. A military-civilian junta in 1980 nationalized banks and export houses and began to redistribute large estates among rural workers. But both rebels and conservative forces have tried to sabotage the land reforms with violence. In the northern highlands frequented by guerrillas, villagers have accused right-wing gangs and security forces of atrocities against

women and children. Elsewhere gunmen have killed suspected enemies of the government—among them three U. S. nuns and a lay worker last December. In an attempt to wreck the economy, guerrillas have kidnapped and murdered businessmen, bombed stores, and burned crops. To help offset this, the U. S. plans to offer 123 million dollars this year in nonmilitary aid.

AREA: 21,041 sq km (8,124 sq mi). POP.: 4,805,000. RELIGION: Roman Catholic. LANGUAGE: Spanish, Indian languages. ECONOMY: Export crops: coffee, cotton, sugar, corn. Industries: food processing, textiles. Domestic consumption: rice, beans. PCI: \$670.

Britain plans to grant full independence this year to Belize, formerly British Honduras, a jungle-covered, self-governing colony of 145,000 people of mostly African or Indian descent. Guatemala has agreed to give up its long-standing claim to Belize in return for coastal access.

AREA: 22,965 sq km (8,867 sq mi). POP.: 145,000. RELIGION: Roman Catholic, Protestant. LANGUAGE: English, Spanish. ECONOMY: Export crops: sugar, citrus fruits, timber. Domestic consumption: seafood. PCI: \$1,030.

In the region's poorest country, a military regime has backed land reform and trade unions. A presidential election is planned for 1981. Long flayed as exploitive, two U. S. banana companies—the country's largest landholders—now help raise living standards. The nation harbors thousands of Nicaraguan and Salvadoran refugees.

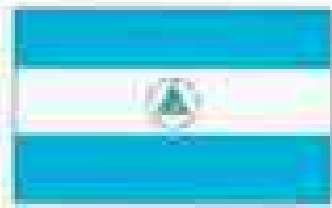
AREA: 112,088 sq km (43,277 sq mi). POP.: 3,773,000. RELIGION: Roman Catholic. LANGUAGE: Spanish, English. ECONOMY: Export crops: coffee, bananas, timber, meat. Industries: food processing, textiles, mining. Domestic consumption: beans, rice. PCI: \$530.



- Archaeological site
- ▲ Volcano that has erupted since 1800
- Pan American Highway System roads shown in darker red.
- Major product of each country shown in larger type.

Nicaragua

A junta dominated by the Sandinista National Liberation Front struggles to revive the war-torn economy of Central America's largest



country. After 18 months of strife that claimed at least 30,000 lives and left homeless a fifth of the nation's people, the Sandinistas ousted Gen.

Anastasio Somoza Debayle. The new revolutionary government seized the dictator's 500-million-dollar empire, which held a fourth of Nicaragua's farmland. But only heavy foreign aid, including 50 million dollars from the U. S. last year, has postponed financial collapse. Many businessmen, who control 60 percent of the economy, fear the Cuban-influenced regime may still enact radical changes.

AREA: 130,000 sq km (50,193 sq mi). **POP.:** 2,500,000. **RELIGION:** Roman Catholic. **LANGUAGE:** Spanish, English. **ECONOMY:** Export crops: coffee, cotton, meat. Industries: food processing, chemicals. Domestic consumption: corn, rice, beans. **PCI:** \$660.

Costa Rica

After nearly a century of democratic rule, with a relatively even distribution of wealth, Costa Rica spends 30 percent of its budget on education and next to nothing on weapons. The country sheltered Sandinistas in 1979, but now takes a conservative neutrality. High oil bills and



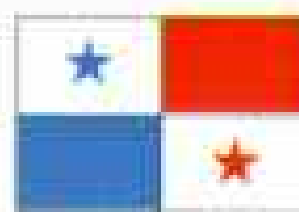
expensive social programs have slowed the economy, spurring labor troubles.

AREA: 50,700 sq km (19,575 sq mi). **POP.:** 2,240,000. **RELIGION:** Roman Catholic. **LANGUAGE:** Spanish. **ECONOMY:** Export crops: coffee, bananas, beef, sugar. Industries: food processing, textiles, construction materials. Domestic consumption: corn, rice, poultry, livestock. **PCI:** \$1,810.



Panama

The 1977 canal treaties—giving Panama full control of the canal by the year 2000—defused an explosive issue, since many



Central Americans have long resented the Canal Zone as a symbol of U. S. domination.

The canal is the mainstay of the economy, attracting international trade, tourism, and finance.

AREA: 77,082 sq km (29,762 sq mi). **POP.:** 1,830,000. **RELIGION:** Roman Catholic. **LANGUAGE:** Spanish, English, Indian languages. **ECONOMY:** Export crops: bananas, sugar, shrimp, coffee. Industries: shipping, food processing, oil transshipment. Domestic consumption: rice, corn, beans. **PCI:** \$1,350.



DRAWN BY JOHN D. WEBER AND ISABELEN BAKER
COMPILED BY HAROLD A. HANSON
NATIONAL GEOGRAPHIC ART DIVISION
TEXT BY PETER WILLY



Living With GUANACOS

Wild Camels of South America

ARTICLE AND PHOTOGRAPHS BY

WILLIAM L. FRANKLIN

WILDLIFE ECOLOGIST, IOWA STATE UNIVERSITY

“**W**HAT IS THIS?” I ask myself as I peer from my frigid observation hut on a windswept island of Tierra del Fuego. In a meadow before me, two male guanacos have been disputing the boundary between their territories. Now these wild versions of the familiar South American llama are squaring off in a very unusual way.

With measured paces they approach each other and stop. Then, as if on cue, they charge. At the last split second they draw up their front legs. THUNK! Their chests slam together with staggering impact.

Biting with large sharp canines, the animals tear cruel gashes in each other's necks. One breaks away. There is a short chase, and the vanquished intruder retreats.

Rarely in the literature on *Lama guanicoe* have I come across *this*. But I'm not surprised. Until my family and I bade good-bye to Iowa State University and drove our pickup and camper 14,000 miles down the Pan American Highway to this boot-shaped island at the uttermost end of South America, no biologist had focused on the social behavior of the handsome, adaptable guanaco (locally pronounced wuh-NAHK-oh).

This scientific void is surprising in light of the guanaco's importance among South American mammals, which include three

other members of the camel family (page 67). Compared to Africa, with its rich diversity of grazing animals, South America is impoverished. From the western Peruvian Andes to the Patagonian plateau to the beech forests of Tierra del Fuego, the guanaco is the dominant—and virtually lone—large wild South American herbivore.

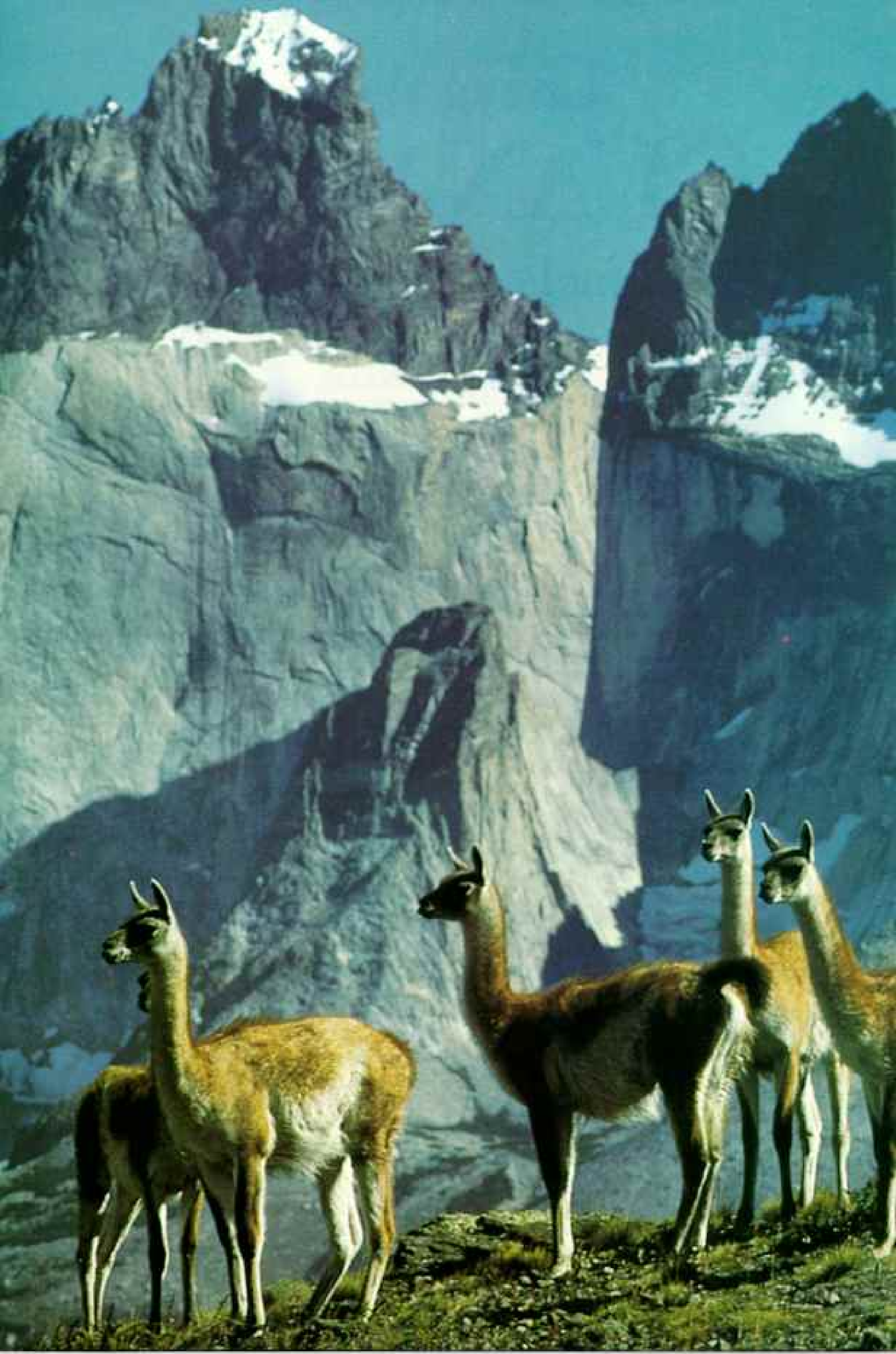
For thousands of years, the guanaco was crucial to the Patagonian Indians. Standing five feet tall and weighing 250 pounds, it supplied them with meat for food, wool and hide for clothes and shelter, sinew for sewing, and images for their mythology.

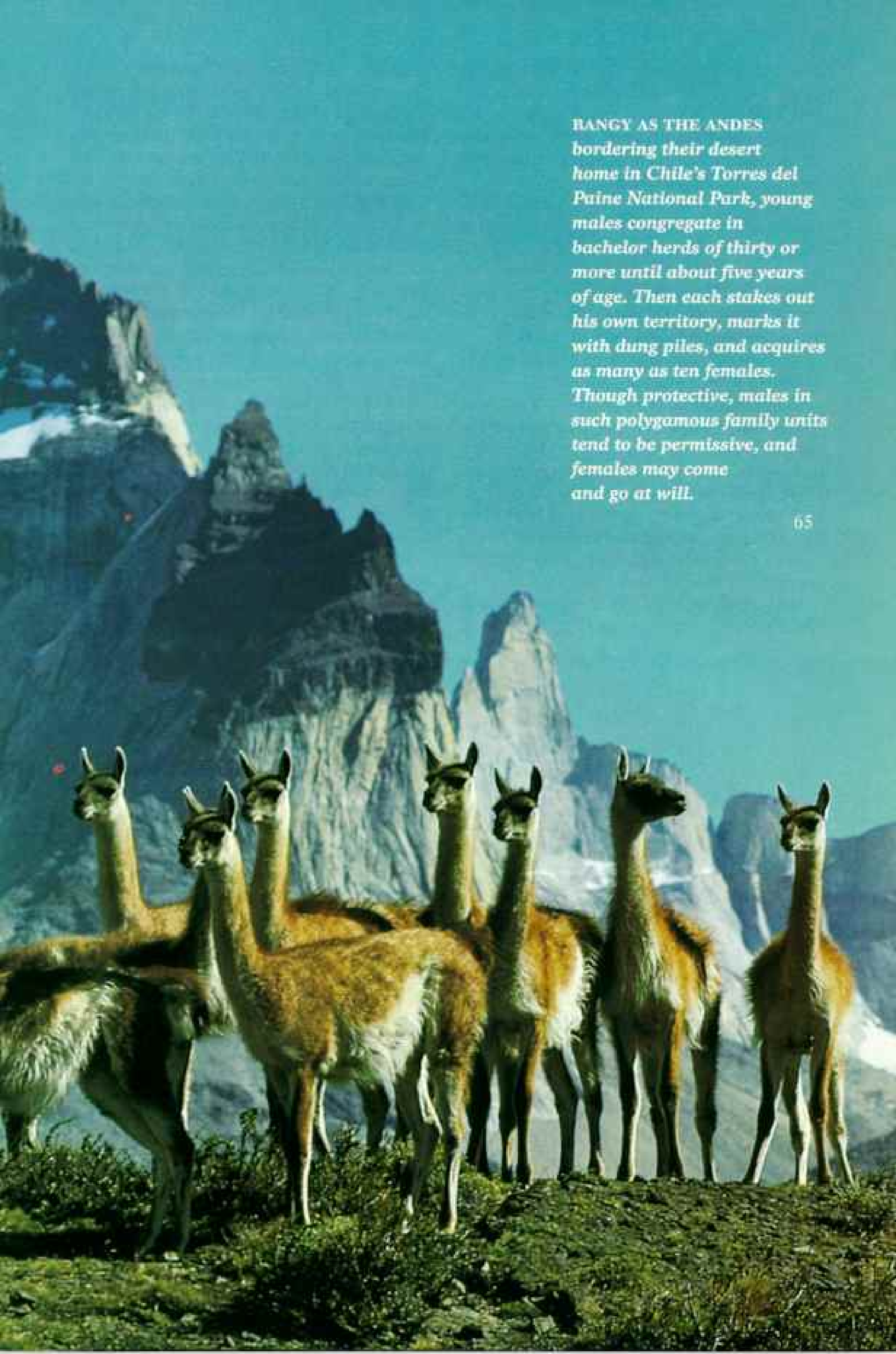
No one knows how many of these arid-land aristocrats roamed South America when Europeans arrived, but the number must have been immense. Tens of millions grazed Patagonia and Tierra del Fuego, with millions more on the arid Andean slopes. In 1871 naturalist George C. Musters reported guanaco herds 3,000 strong.

Food hunters took a toll of the meaty camelids. Hide hunters took even more, favoring the soft cinnamon-colored pelts of young guanacos, called *chulengos*. Ranching dealt a far more damaging blow. Fences interrupted guanaco movements, and competing sheep displaced them on the ranges.

Perhaps a mere 50,000 to 150,000 guanacos survive today on the entire continent.

Bundled in loving arms, Ona, a young 45-pound female guanaco, is hoisted on scales by the author's daughter Shelly. Dr. Franklin's behavioral study of the species in Tierra del Fuego—first of its kind and supported in part by the National Geographic Society—sheds new light on this threatened resident of earth's end.





*BANGY AS THE ANDES
bordering their desert
home in Chile's Torres del
Paine National Park, young
males congregate in
bachelor herds of thirty or
more until about five years
of age. Then each stakes out
his own territory, marks it
with dung piles, and acquires
as many as ten females.
Though protective, males in
such polygamous family units
tend to be permissive, and
females may come
and go at will.*

When my road-weary family—wife Merry, daughters Shelly and Katia, newborn son Jeremy Sundance, and dog Popsy—and I reached Patagonia's sea of shrub and grass, we saw only a handful of animals in this one-time guanaco stronghold.

That's why we had come all the way to Isla Grande, the big island of the Tierra del Fuego archipelago. About a tenth of the total guanaco population is on this Denmark-size island. Most live on the western, Chilean side, where huge ranches, or estancias, offer sanctuary from hunters.

With its 180,000 sheep and 1,000 horses, Estancia Cameron on Tierra del Fuego embraced half a million acres. Part was Patagonian grassland that overlapped the northern half of the big island. The rest lay in a patchwork of damp beech forests, peat bogs, meadows, lakes, and mountains.

When we arrived, we were taken in hand by Eduardo Barria, a weathered, soft-spoken sheep rider who headed the workers' cooperative that operated the estancia.

We quickly learned that Tierra del Fuego, "land of fire," was misnamed by Ferdinand

Magellan. It should be Tierra del Viento, "land of wind." Cold gales blow ceaselessly and force one to bundle in layers of clothing. Yet this grim climate, plus the island's isolation, has deterred human occupation and protected the hard-pressed guanaco.

At Eduardo's direction we stationed our camper beside an unoccupied tin house next to his home. We used the camper as kitchen and lavatory, and spread out our sleeping and research gear in the house. For heat we had two potbellied stoves imported long ago from England. Daughters Shelly, nine, and Katia, seven, hauled the wood needed to satisfy the stoves' prodigious appetites.

Hardly had we settled in when we added a new member to our family: a day-old baby guanaco. It was late December, the start of the austral summer and the guanaco's brief birth season. One of Eduardo's sheep riders had come upon the chulengo when it was only hours old and had brought it in.

We weren't ready for guests, but there was no refusing this bundle of soft fur with spindly legs, supple neck, and soulful black eyes and eyelashes. We named her Ona, for



Rivals for attention, Ona and the family dog, Popsy, play with Merry, the author's wife. Bottle-fed as an orphaned infant, Ona graduated in several months to a typical guanaco diet of grasses and shrubs and, atypically, an occasional page of field notes.

"At night we'd keep her on the porch, as much as our hearts would allow," says Dr. Franklin, a wildlife ecologist who has studied guanacos five years. More often, her bleats would gain her entrée to the house and a spot by the stove. One day a pack of ranch dogs cornered Ona and tore into her. Though bleeding badly, she limped home. But nothing could be done, and she died.

Once a crucial resource for the Indians of South America's Patagonia region, the guanaco provided hides for tents, wool for robes, sinew for sewing, meat for food, and bones for tools.

one of the island's now extinct Indian tribes that depended on the guanaco.

Merry offered the chulengo cow's milk from a bottle, but the little animal refused. "We'll have to teach her to drink," Merry advised Shelly and Katia.

The first day's effort failed, and Merry and I shared the girls' apprehension. Next morning Shelly nestled the bottle under her arm, and Ona responded by downing every drop. "This way, she thinks I'm her mother," Shelly declared. Within a week Ona was guzzling eight bottles a day.

Man: Both Friend and Foe

To help the chulengo adjust and avoid feeling lonely at night, I slept outside with her. As I lay in my bag, Ona cuddled against me, warm in her luxuriant, downy wool. Because of this close early association, she soon became my unshakable companion.

We weren't the first to adopt a chulengo. Patagonian Indians had long acquired guanacos for pets and to use as food.

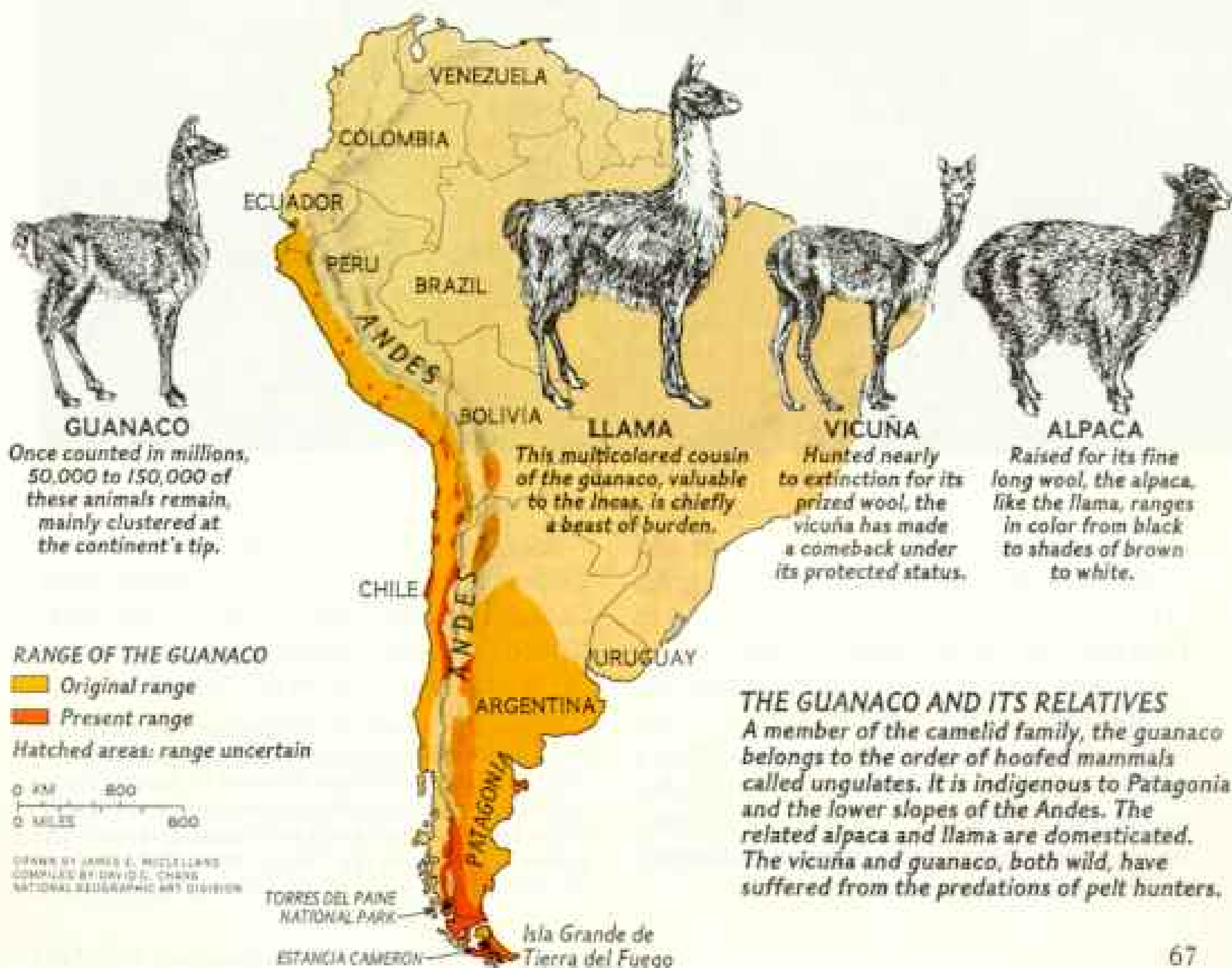
Here on Isla Grande, where galloping after a chulengo through boggy meadows and

dense forest can be dangerous, hunting has had little effect on the guanaco population. But on the mainland, hundreds of thousands of chulengos have been hunted down despite protective laws, and their pelts marketed throughout the world.

These depredations, combined with the overwhelming competition of livestock, have caused the species to be endangered in many parts of Peru and Chile. High profits from the fur trade, remoteness of animal populations, and scarcity of funds and data have hampered conservation efforts.

Within the past few years, however, concern for the guanaco has increased because of a growing wave of wildlife awareness in South America. Understandably, among nations with developing economies, many wildlife-conservation efforts are being asked to pay their own way.

"To gain support for such programs," explained Claudio Cunazza, a regional wildlife manager for the National Forest Service (CONAF) in southern Chile, "there often must be a return benefit to the people and the economy." This return can come





through tourism and the sale of meat and wool products—programs already being developed in Chile with the guanaco, and in Peru with the closely related vicuña.

“Success depends upon a biological understanding of the wildlife species,” Cunazza added. That’s where my research as a wildlife ecologist would come in. In collaboration with CONAF I would study guanaco social organization as background information for sound management.*

Soon two young men joined us: Danny Tishman, a senior from Evergreen State College in Washington State, and Isaac “Morty” Ortega, a graduate student in ecology from Chile’s University of Austral.

*The author’s research was financed by grants from the National Geographic Society, Organization of American States, Carnegie Museum of Natural History, Institute of International Education, Earthwatch, World Food Institute, and Iowa State University. The author reported on the “High, Wide World of the Vicuña” in the January 1973 NATIONAL GEOGRAPHIC.

A playful bump between two young males (left) portends serious territorial fighting in later life. Protruding chests act as shields and battering rams. Patience and a telescope allow Dr. Franklin (right) to observe animal behavior such as taking a dust bath (below). Wallows in pawed-out hollows fluff the wool and improve its insulation capacity. Found in desert, plain, and forest, the adaptable guanaco lives at altitudes ranging from sea level to 13,000 feet. Padded feet allow navigation through snow and sand. Able to draw moisture from forage, guanacos can go for long periods without drinking water.



With the aid of Eduardo, we located an ideal study area, a long meadow bordering a small peat-stained river and bounded by beech forest. Five family groups, each made up of a male and six to ten females, had staked out daytime territories along the meadow. A sixth group lived in the dense forest but sometimes ventured to the fringe of the meadow. From a blind at forest edge I was able to view the entire panorama.

We set to work building an elevated hut

we soon dubbed the Freezer. At almost any time we would see several family groups grazing undisturbed on the meadow.

"River dance coming up with Male 204," whispered Danny on my left.

I swung my binoculars and picked up Group 204. Several month-old chulengos were playfully chasing back and forth among the six females. Occasionally they paused to jump at each other, wrestle with their long necks, or nip at legs and flanks.

In the center of the group a mother stood nursing two of her young—a yearling born the previous birth season and her newly born chulengo. Though foraging begins within weeks of birth, guanacos are one of the few ungulate species that temporarily nurse two generations of offspring simultaneously. Perhaps their harsh climate requires a longer parental investment before offspring can go forth on their own.

Male 204 had left his group and was trotting purposefully toward the river. Looking ahead, I saw the cause of his agitation. The forest group had come down toward the river to graze. Its male had wandered to the

riverbank, which Male 204 regarded as a potential threat to his feeding territory.

At times Male 204 lowered his long neck so his chin glided just above ground level; at other times he tossed his head, kicked his front and back legs, and twisted his body about. He reached the narrow river that separated him and his antagonist. Suddenly both animals stiffened, their tails arched, their long necks in a rigid S shape, only their ears flicking nervously.

Now 204 performed the river dance foreseen by Danny. Rearing adroitly, the male stood kicking his front feet high in the air. Was this an invitation to chest ram? We



never learned. Apparently the natural river boundary eliminated the need for a fight.

Seldom did an hour pass without some form of territorial conflict between the edgy males of the meadow. Usually a simple chase sufficed to resolve their disputes.

Male Orphan Joins Family

On these summer days we had nearly 20 hours of light. But the guanacos kept a reasonable schedule that began about nine and permitted us to head for our tin house by seven in the evening. While the truck was still a mile away, Ona would see our dust; Popsy would pick up the cue, and soon both

animals would be dancing around the truck. When we got out, Ona would nuzzle against me and bleat softly. By then the girls would have appeared, glad to break away from the schoolbooks we had brought.

"We've got a little surprise for you," Merry announced one day when we pulled in. "Yahgan!" she called in a motherly tone.

Out from the camper came the girls, guiding a newborn male chulengo. "The sheep riders found him all alone and brought him in. Can we keep him?" Merry asked. She already knew the answer. Perhaps because we doted on him less, Yahgan proved to be much more independent than Ona.



Caught in the middle of a rite that will expel it from the family group, a yearling (left, at center) crouches in submission as an adult male, right, and female square off in the head-up, ears-back, arched-tail stance of aggression. Trying to protect her young, the female charges the male, who counters by spitting (below, left), another form of aggression. The two then slam chests (below, right). With the female routed, the male will charge the youngster, ultimately driving it off to make room for his new generation of offspring. Expelled male yearlings join a bachelor herd. Females seek admission to another family group and begin breeding at about two years of age. Gestation lasts 11 to 11½ months. Within a day of its birth an infant, or chulengo, is already a swift runner. Females mate again almost immediately after giving birth; thus two successive generations may end up nursing together until the elder is expelled.





From our vantage point in the Freezer we compiled a lengthening dossier on the guanacos—their territorial behavior, group sizes and composition, preferred habitats, feeding habits. We observed that these family groups occupy a specific area the year round. Others that we knew of—on the island and the mainland—migrate between winter and summer ranges to avoid deep snow or drought.

Winter can be a cruel time for them, as we discovered one day when we came upon the body of a dead guanaco hanging by its head from a fork in a beech tree. While snow lay deep the previous winter, the animal had reached high for browse, slipped, and wedged its neck in the fork. Dangling in

the cold wind, the body had “freeze-dried.”

When Darwin visited the region in the 1830s, he observed guanaco bones concentrated in a low ravine. He thought the animals shared communal cemeteries—a theory since discounted. When fierce snows sweep the land, groups of starving guanacos find forage in increasingly smaller areas. Herdsmen believe that heat from the animals’ bodies can melt surrounding snowdrifts, which then refreeze into ice corrals from which there is no escape.

The polygamous nature of the family group leaves a large reservoir of surplus young males. Expelled as yearlings from the group, they band into herds of thirty to fifty and larger. Once while camping on the



Wire noose of civilization, a fence snared and stranded this guanaco, which starved to death (below). Fences also spell a long-term threat by denying migratory herds access to their traditional feeding grounds. Pastures fenced for sheep—the guanaco's chief competitors for food—suffer overgrazing (left, at right), another deprivation. Man poses the biggest threat to the guanaco's survival.



ISAAC M. ORTIZ

mainland at Torres del Paine National Park, I awoke to find myself surrounded by more than a hundred males. In such high-density areas, some animals can be harvested without disturbing family reproduction.

Father Rules the Roost

If a male survives to reach four to six years of age, he splits from the herd and carves out a territory. Now he is ready to start his own family group, though it may be months before he attracts his first mate.

Soon after the female gives birth, guanacos breed again, a necessity for a species whose gestation period is 11 to 11½ months. When the females drop their chulengos, they become exceedingly nervous. For the first

several weeks they retreat to the forest at the least provocation.

For the chulengos, life seems a lark of exuberant romping. Sometimes they select the unlikeliest of playmates—the stern male. Approaching, they first dip into a submissive crouch, then trail behind him like little shadows, even during mating.

Why does he permit such familiarity? In winter many of the mothers and their chulengos vanish into the forest. In spring they return and must seek readmission to the group. Perhaps the early intimacy between male and chulengo helps with recognition for this later reunion.

For several weeks we had been watching Male 202, who headed one of the meadow

groups. He showed increasing interaction with a yearling female in the group. Now we were to see a brutal but necessary social rite: the driving away of last year's young to make room for this year's.

Male 202 was agitated, his body rigid, tail erect. Fifty feet away stood the yearling and her mother. As the mother shifted nervously, the yearling pressed against her side, as if to nurse. Each time the male moved, the yearling dropped into a submissive crouch, her tail curled forward.

Suddenly the male lunged toward the yearling. The mother bumped the male, biting and gurgling, forcing him back. Several times he charged the yearling; each time the mother shielded it. All the while the adults exchanged a spittle of green mist—a trait that surprised zoogoers often discover in captive llamas and alpacas.

They reared on their hind legs, then rushed together. THUNK! Their chests crashed. As they fell, biting each other's neck and shoulders, the male gained the upper hand. He briefly drove off the mother, then turned on the cowering yearling.

The yearling fled, and the male pursued, biting great reddish rents in its hindquarters. Three times the young animal dropped to the ground to escape the male's teeth. The chase carried them into the forest. Soon the male returned, tired, muddy, bloodstained, and alone. The young female would soon join a new family group.

Life and Death in the Wild

As winter approached and we rounded out our picture of guanaco social life, a question remained: Would it be possible to reintroduce Ona and Yahgan into the wild?

After one of their daily trips with us to the study area, we quietly drove off without them. In the following days, Yahgan seemed to accept his new home. But not Ona. She realized that the departing truck meant her friends were leaving without her.

Late one evening Merry was sewing and I was writing up the day's field notes. Danny

and Morty had returned to their universities, soon to be replaced by my graduate research assistant, Bob Jefferson. The murmuring stoves warded off the chill of an early snow. Merry heard a faint but familiar voice above the rattling of the windows. She checked the door. "Bill, someone is here to see us." Ona had come home.

The other half of the experiment, however, was going well. Yahgan was beginning to associate with the forest group.

Then came a terrible day. Ona was grazing near the ranch buildings when she was chased by a group of ranch dogs, cornered, and severely bitten. She limped back bleeding heavily, calling for us when she got to the door. We doctored her as best we could, but the next morning she died.

To brighten our melancholy, the girls asked if we might try to see Yahgan. When we arrived at the meadow, now brown amid autumn's flaming foliage, we saw Yahgan grazing with his adopted group a quarter of a mile away. We identified him by a bright red ribbon we had tied around his neck.

I cupped my hands and called into the wind with a high-pitched bleating cry we used to attract the chulengos. Yahgan lifted his head, looked around questioningly, and stared at our family group—Merry, Shelly, Katia, Jeremy, Popsy, and me. Together we cried out "Yahgan! Yahgan!" He took a few steps in our direction. Other guanacos followed until they saw where he was headed.

Yahgan walked, then ran, to the receiving arms and hugs that awaited him. He and the girls jumped and danced as they had so many times in the past.

"Can't he stay with us?" the girls pleaded. "No, now he belongs here," Merry explained with blinking eyes. The girls led him to an opening in the forest where his group had entered, and said their good-byes.

Reluctantly we left this land of guanacos at the end of the earth. Among our many lessons was a last one taught to us by Yahgan—that we had become as much a part of his world as he had of ours. □

Head held high, Ona nestles in a field of wild flowers. The animal described by naturalist Charles Darwin as "elegant with a long slender neck and fine legs" faces a promising future. Concern has prompted reserves in Argentina, Chile, and Peru and raised hope for the establishment of an increased guanaco population.



Buffalo Bill and the Enduring West

By ALICE J. HALL

Photographs by JAMES L. AMOS

BOTH NATIONAL GEOGRAPHIC STAFF

LESS THAN A CENTURY AGO a door of history slammed shut on the great western frontier. Settlements broke the empty plains. Indians were pacified and relegated by force to reservations. A third of all Americans lived in towns, with passenger trains, not prairie schooners, to transport them. The near extinction of North America's largest mammal, the bison, made way for a growing cattle empire.

Frederick Jackson Turner, the noted Wisconsin historian, in 1893 brilliantly marked the passing of the era. He speculated that the frontier experience had actually shaped the American character, "that coarseness and strength combined with acuteness and inquisitiveness . . . that masterful grasp of material things . . . powerful to effect great ends . . . that buoyancy and exuberance which comes from freedom."

He might have been describing William F. Cody. For the man popularly known as Buffalo Bill summed up the era. He had been part of some of the more dramatic episodes in the settling of the West. And even as eulogies were spoken over the dying frontier, Cody was, in effect, reviving it.

Galloping into the arenas—and hearts—of America and Europe, he was perpetuating his own romantic vision of the Old West, instilling images that shape our own.

From 1883 until 1913 this superb horseman, clad in fringed and beaded buckskin and broad-brimmed Stetson, a Winchester in hand, rode at the head of a rip-roaring, shooting, tooting troupe called the Wild West. Audiences cheered as diminutive Annie Oakley shot a hundred flying targets without a miss. Cowboys inspired small boys by reenacting the Pony Express and riding bucking broncos. Cody hunted a buffalo herd with blanks. Indians in war paint attacked an emigrant train. Princes and presidents lined up to ride in the Deadwood Coach, undergo capture by Indians, and applaud rescue by Buffalo Bill. Celebrities—from Britain's King Edward VII to Thomas A. Edison—came to call him friend.

Cody has been debunked as a fake, a drunk, and a womanizer, little more than a cardboard figure on his own giant show posters. But tracking the man and his times through Kansas, Nebraska, South Dakota, Wyoming, and Colorado brings to life a

His life a legend, William F. Cody turned youthful adventures as Pony Express rider, Army scout, and buffalo hunter into his extraordinary traveling show called the Wild West, which toured for 30 years. Off season he was a cattle rancher and civic leader. In buckskins or cutaway, Cody seemed the quintessential Westerner.

THE HUNTINGTON LIBRARY, SAN MARINO, CALIFORNIA



multifaceted American, who earned the acclaim he knew in his own day. He was renowned as a sportsman, Army scout, civic leader, and showman. His friend Episcopal Bishop George A. Beecher dismissed any faults as "surface irregularities which developed upon the fringe of his better self as the result of a long continued relationship of . . . false friends and jealous critics."

Cody was a gentleman. His word was his bond, and he insisted that his show portray the real thing. His cowboys had to be men who had eaten dust behind a trail herd and

mastered a wild horse on its home ground. Men like Harry Webb (page 85).

Six-foot-one, 92-year-old Harry sits as tall in his recliner in a Tujunga, California, bungalow as he once sat a saddle in Wyoming. Exuberant as a spring calf, he recalls how the boys of the M Bar ranch had trailed cattle to railhead in Cody one dusty day in 1909.

"The fellows said, 'Last one into town has to buy the drinks,' so we were a-goin' up the main street at a high run. This roan of mine kicked up a piece of baling wire—thought it was a rattler—and took off bucking. We



plowed right through the window of Campbell's Drug Store.

"When they dragged me out of the perfume bottles, I was decorating the landscape with spouting blood. This giant of a man with a white goatee boomed, 'That was a pretty good ride you made, young fella . . . as long as it lasted.'

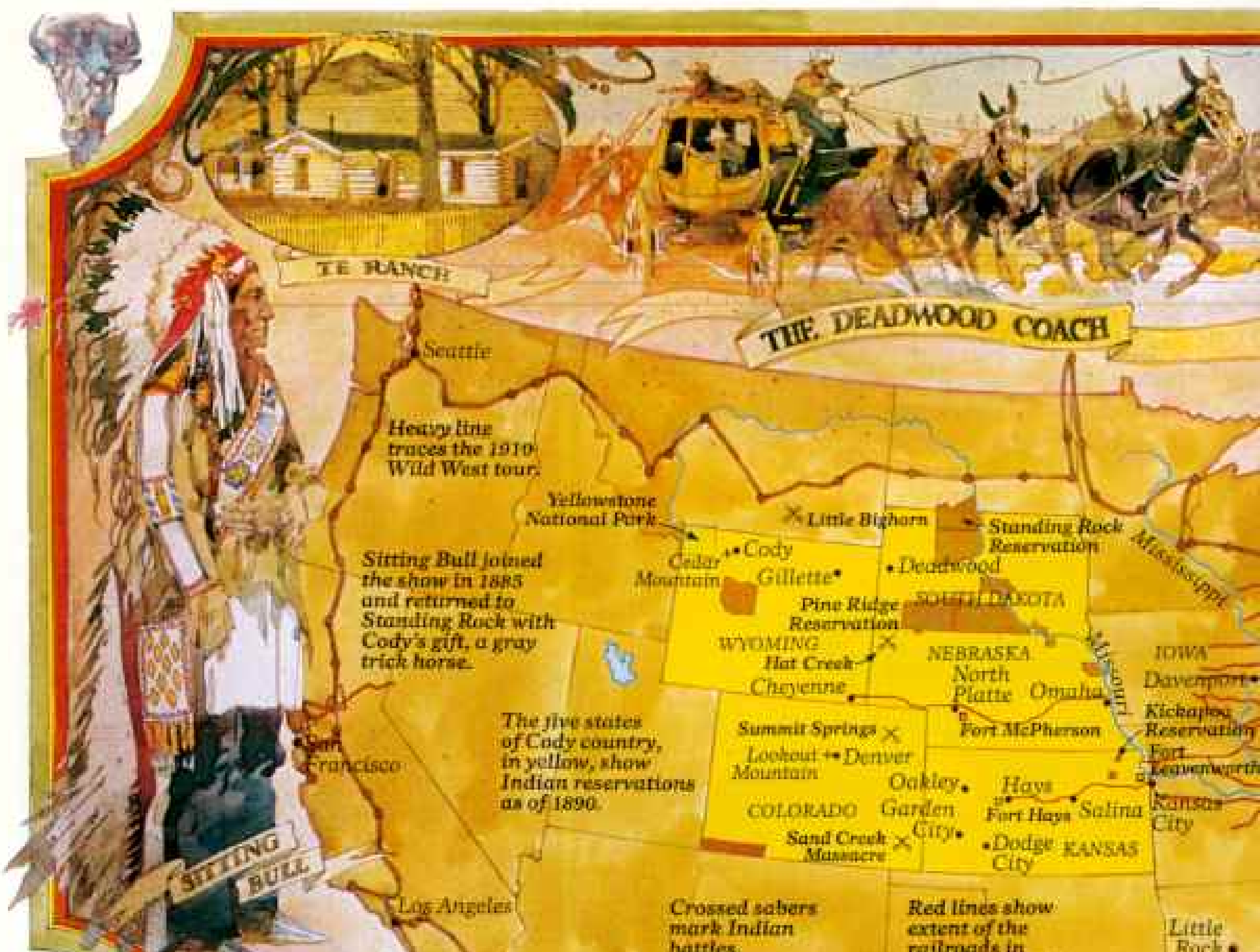
"He gave me this card and told me to send to Johnny Baker for a contract and he'd see me next spring in the show.

" 'Show?' I asked him. 'What show?'

"He let out a war whoop, 'Whose show do

Chaos of Indian wars of the 1860s was brought by the Wild West to towns across the U. S., Canada, and Europe from 1883 until 1913. Here in Omaha in 1908 riders in cavalry dress and Cody in buckskins rescue white captives in a reenactment of the Battle of Summit Springs. In another act, Arabs, gauchos, vaqueros, Cossacks, cowboys, and Indians demonstrated varied riding styles. Cody called them the Congress of Rough Riders of the World, a name adapted by his friend Theodore Roosevelt.





THE RANCH

THE DEADWOOD COACH

SITTING BULL

Seattle

Heavy line traces the 1910 Wild West tour.

Yellowstone National Park

Sitting Bull joined the show in 1885 and returned to Standing Rock with Cody's gift, a gray trick horse.

San Francisco

The five states of Cody country, in yellow, show Indian reservations as of 1890.

Log Angeles

Crossed sabers mark Indian battles.

Red lines show extent of the railroads in 1867, when Cody hunted buffalo for tracklayers.

Buffalo Bill's Wild West



COL. W.F. CODY, BUFFALO BILL





The Sioux chief Iron Tail, Cody's close friend, led many attacks on the Deadwood Cough.

you suppose? My show, of course. Buffalo Bill's Wild West.'"

Harry sent for the contract. "It had about 50 clauses. Every one concerned the party of the second part. You promised not to ogle girls, get drunk, swear, or miss a performance. Why, if I got killed, I'd have to pay for my own funeral."

The contract resembled the agreement Cody at age 15 had sworn to uphold when he became a rider for the Pony Express. * Harry and a friend got brave and signed up—and they never regretted it. They opened at Madison Square Garden in New York City and embarked on a show train for a killing cross-country circuit of one-night stands. Cody's bark proved worse than his bite, Harry learned.

"He was always fair and never asked more of us than of himself. He never missed a show. Once I broke an ankle vaulting onto a galloping horse. The colonel kept me on the payroll while it healed. The cowboys and cowgirls really loved him."

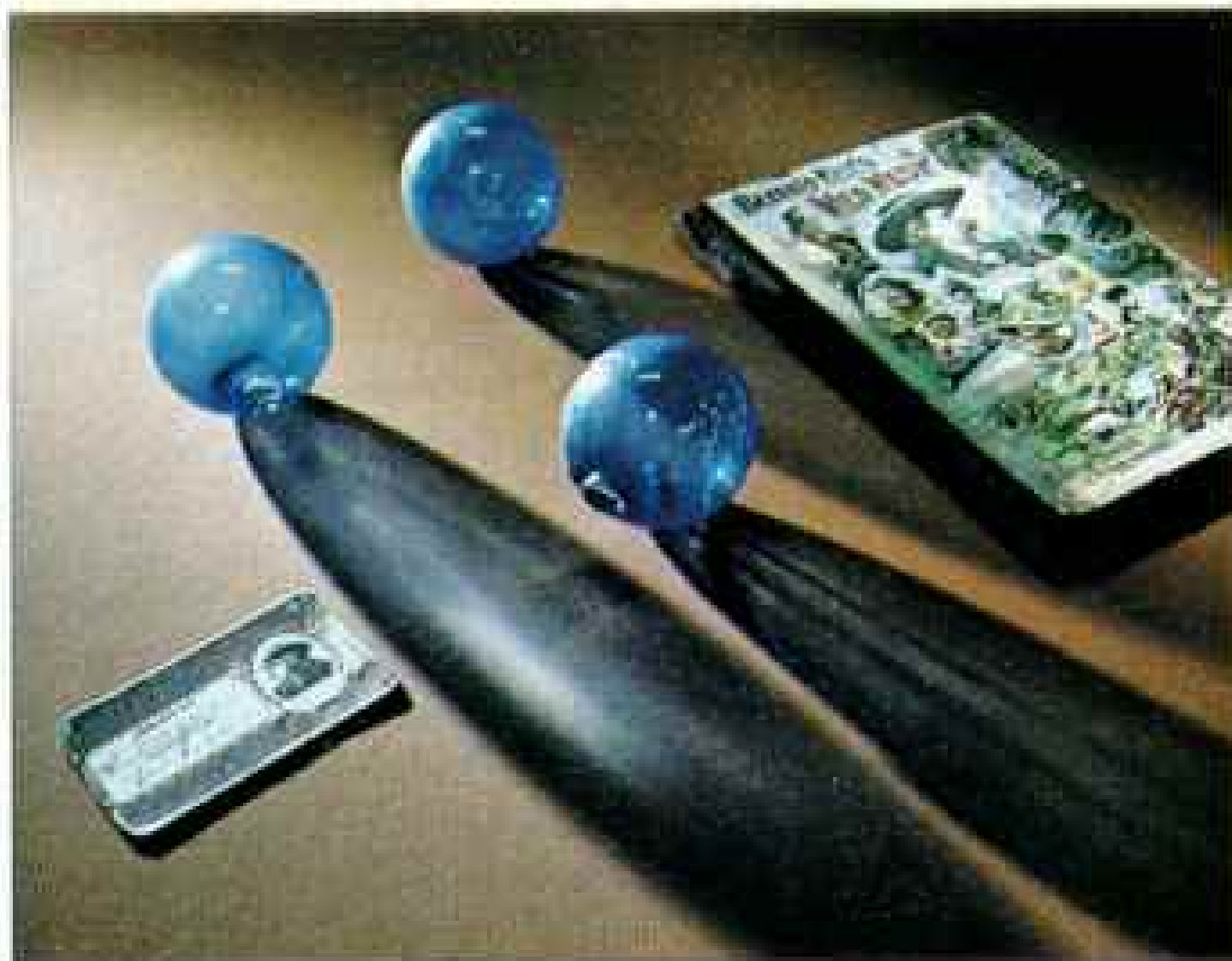
Cody earned millions of dollars with the show, only to lose it as expenses mounted and investments turned sour. In 1909 he joined with Pawnee Bill's Historic Far West and Great Far East, trying to recoup and retire. But four years later Harry Tammen, a publisher of the *Denver Post*, would trigger the impoundment and auction of the show to settle a \$60,000 debt.

WHILE COWBOYS were a great drawing card, the Indians made the show. One former trouper, an Oglala Sioux, still lives on Pine Ridge Indian Reservation in South Dakota where Cody agents usually recruited. Louis Whirlwind Horse was a small boy when he accompanied his father on a two-season circuit.

The frail, kindly 76-year-old recalled details that could serve as narration for films of the Wild West that Thomas Edison made. After the grand entrance, the Indians reentered the arena, riding bareback, pulling travois. With a graceful forefinger, Louis traced their route on the tabletop.

"The squaws set up tepees; the chiefs confer. The young braves dance. Then all the people go inside. All is still.

*Rowe Findley retraced the grit-and-glory days of the Pony Express in the July 1980 *GEOGRAPHIC*.



Superb horseman and marksman, Cody thrilled fans with skills learned during his Kansas boyhood. At full gallop he would shoot glass-ball targets (upper left)—a feat duplicated by a grandson, Fred Garlow, near Cody, Wyoming (right). But amiability, not marksmanship, made Cody his friends. In appreciation for an 1872 buffalo hunt, Grand Duke Alexis of Russia gave Cody a diamond-encrusted buffalo-head stickpin and a robe of Russian furs (lower left). The \$20 gold piece came from Gen. Philip Sheridan, and the French pistol from boyhood chum Wild Bill



Hickok. Edward, Prince of Wales, who often dined with Cody in London, gave him the pocket watch with a gold-mounted amethyst on the fob. Queen Victoria sent the diamond brooch after a command performance so exciting it was "almost impossible to sit." These belongings are among memorabilia at the Buffalo Bill Historical Center in Cody, Wyoming. A showcase for western Americana that grew out of Cody's personal collection, the complex includes the Whitney Gallery of Western Art, the Plains Indian Museum, and the Winchester Museum of historic firearms.

"The horses are on one side. An Indian and a dog guard them. You hear a bugle; the dog tries to wake the guard. Three times he nudges him. The third time the Indian runs the horses toward the tepees. The enemy is on the way.

"Then Buffalo Bill and the soldiers ride in shooting. Indian horses are trained to stand still to be caught; then some fall down as if shot. It all happens so fast. Some Indians

and some soldiers fall dead. Then everyone leaves the arena."

But what about the white captives?

"Oh yes," the elder chuckled, "the two white women. The squaws beat them until they scream. The clubs are well padded, of course. The women duck into the tepees and give us children candy and laugh until they have to go back out and scream."

The act portrayed with loose accuracy the Battle of Summit Springs, Colorado. On July 11, 1869, scout Bill Cody located the village of Cheyenne chief Tall Bull, who had been raiding Kansas settlements. Cody suggested to Maj. Gen. Eugene Carr a maneuver for the surprise attack. The cavalry rarely encountered and charged a mass of Indians on the frontier, though the scene is a staple of Western movies. And though scouts weren't hired to fight, Cody admitted shooting a warrior to obtain his fine white horse. When Tall Bull's widow wailed at the sight of the horse, Cody realized that he had killed the famed leader.

LOUIS WHIRLWIND HORSE remembers Cody not as an enemy but as a strict, honorable man. "My father liked to travel and went with Cody every chance he got. He knew he'd be all right. Before he died, he said he had visited every European country except Portugal."

Present-day critics—both Indian and white—told me Cody exploited Indians, as in a freak show, "making them stage phony little battles" and "glamorizing a very dark period in American history." Religious reformers in Cody's day criticized him on other grounds. They argued that Indians should be kept on reservations. They should go to school, hoe arid fields, put away all things Indian, and adopt white ways. But Cody encouraged Indianness.

"If there was exploitation, it worked both ways," explained another Pine Ridge resident, Calvin Jumping Bull, principal of the Red Cloud Elementary School.

"The exploited figure out a way to get what they want. Being in shows was always up to the individual. It became a family tradition. Some of my relatives were with the Wild West. My parents danced at celebrations in the Black Hills, so today I go to Cheyenne Frontier Days. We Sioux use a



THE DENVER PUBLIC LIBRARY, WESTERN HISTORY DEPARTMENT

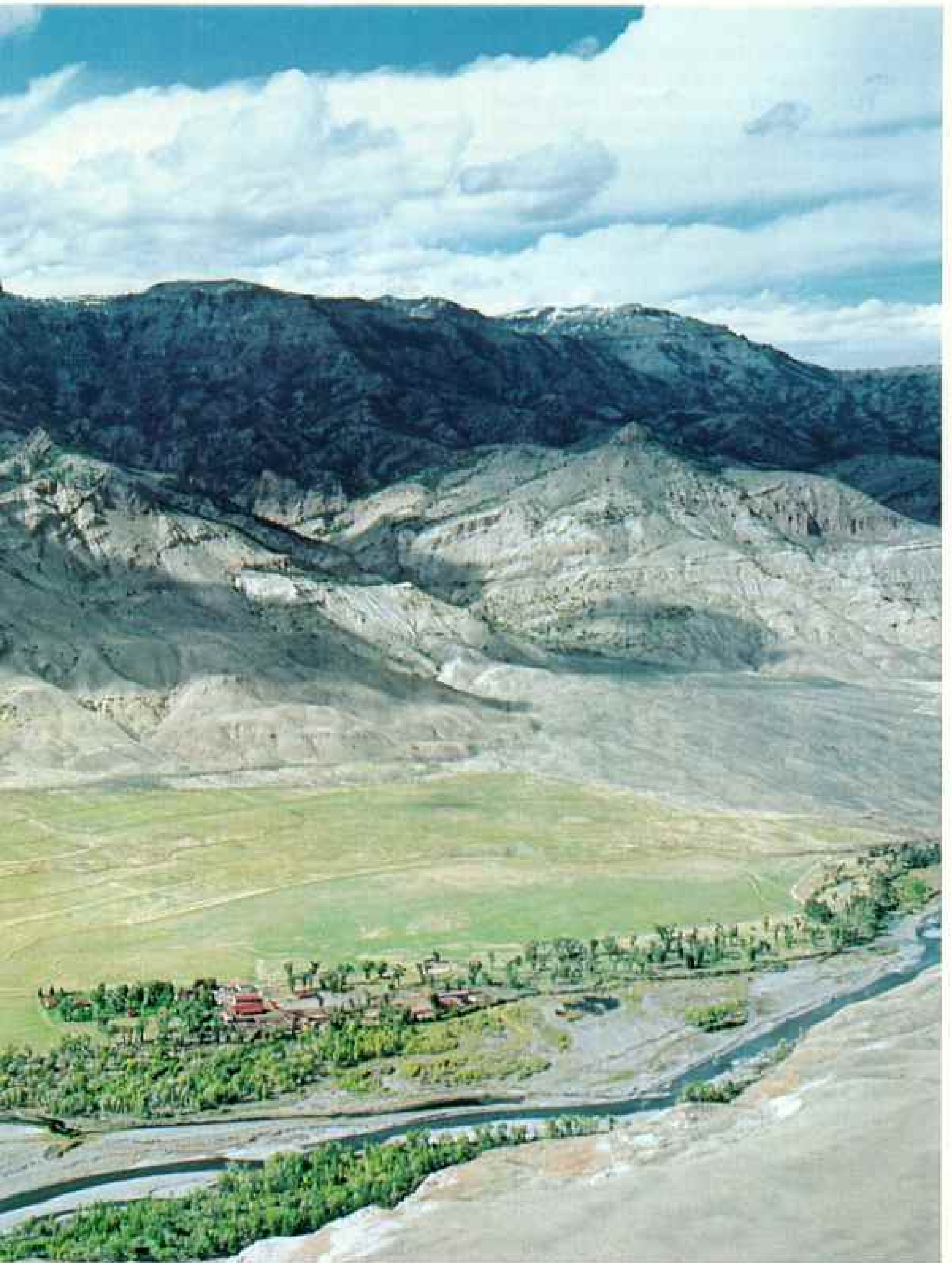
Crack woman shot Annie Oakley with her manager-husband, Frank Butler, joined the show in 1885. Her charm and unerring skill quickly earned her top billing. To Cody, the petite star was always Little Missie.

Cowboy Harry Webb (facing page) joined some 500 troupers for the 1910 show. "It can't be duplicated," he says, although one present-day show is trying, advertising with barn-broad posters.





"Thinking of dear old TE"—the Wyoming ranch of Cody's later years—kept him from depression when in his 60s he was still on the road. One summer



his daughter Irma and her husband ran TE as one of the first dude ranches. The spread on the South Fork of the Shoshone River is still a cattle operation.

term of honor that dates from Cody's day, *oskate wicasa*—one who performs."

Little in Cody's youth aimed him toward performing. His was the hardscrabble existence of any pioneer child—with little exposure to schooling but close acquaintance with work. The frontier, that border between settled and wild, had passed through Iowa when he was born near Davenport in 1846. His father, Isaac, cleared and managed a farm until he caught the California fever of the forty-niners. Only illness kept him from chasing off to the goldfields.

The West with its ever renewing opportunity still beckoned. In 1854 Isaac Cody moved his family—wife, five daughters, and son—to the territory called Kansas. When Congress permitted settlement of this Indian territory, Isaac claimed a homestead in Salt Creek Valley near Fort Leavenworth, a terminus for trails west.

Little Willie marveled at the "vast number of white-covered wagons" camped along the streams. Isaac traded with the Kickapoo, surveyed new towns, and traveled east to encourage abolitionist settlers. His sentiments made him a target of proslavery vigilantes, as bleeding Kansas acted out the prologue of the Civil War.

The pageantry of dress parades at the fort and of Indian friends made a lasting impression on Willie and his favorite sister, Julia. They loved the Fourth of July feast their father held for Indians and whites. The Indians "gave their war dances, Horse or Pony races, played at their different Games, and it was the most wonderful Picnic I ever seen," Julia later reminisced.

Even more wonderful to Willie was his first horse, traded from the Indians. Cousin Horace Billings, a circus rider, broke the stallion Prince and taught the boy to shoot from him. Willie's ambition to become as "skillful a horseman" as Horace was a dream he realized. For years after his father died in 1857, Willie helped support the family from horseback.

One of his first jobs was riding messages from the Leavenworth office of the Majors and Russell freight company to the fort three miles away. Then he stabbed a bully hectoring a girl friend. The wound was slight, but Mrs. Cody got her boy out of town on his first wagon train—ahead of the constable.

Four months later, Julia recalled, Willie returned "covered with the Bugs of the Plains," starved after a diet of hardtack, bacon, and coffee. Yet to Willie the trip was "most enjoyable." He would not think of staying home.

ONCE AT LEAST young Cody, now called Bill, *tried* to settle down. In 1866, after 18 months as a Union cavalryman in the Civil War, he married Louisa Frederici, a convent-educated beauty from St. Louis. At first, they managed the family home near Leavenworth as an inn, the Golden Rule House. Not a trace remains, but memories outlast buildings. "Will radiated hospitality," his sister Helen recalled. "Socially, he was an irreproachable landlord; financially, his shortcomings were deplorable."

To Bill, being a landlord "proved too tame . . . and again I sighed for the freedom of the plains. Believing that I could make more money out West on the frontier . . . I sold out . . . and started alone for Salina." Louisa and Helen moved into Leavenworth; for the rest of his life Bill rarely spent six months of each year at home.

Salina in early 1867 marked the frontier's crest, the end of track. The railroad was a-building west, opening the plains to whites and closing them to Indians. The cavalry policed the process, and jobs were there for the taking.

"I could make more money." Cody's refrain echoes today, among young railroad workers in Kansas, for example. A brakeman leaned on the counter at the Oakley, Kansas, depot, the only crew-change station between Denver and Salina, and explained, "There's good money in railroading [brakemen's wages start at \$25,000] for someone with no college, no ties."

The last passenger train whistled through Oakley in 1971. So I climbed up into the cab of an eastbound freight, at the invitation of Union Pacific, to see the route Cody came to know as hunter and scout.

Where buffalo grass once waved, endless fields of winter wheat ripened in the May sunshine. Like oases in the vastness, farmsteads stand within palisades of trees, planted by pioneers. Ducks flew up from a marshy ditch, and a deer bounded across the

tracks. The engineer pointed to an oil well pumping in the middle of a cornfield. "Now that's what I call farming."

The freight passed through Hays. From the fort here Cody learned to scout with the likes of Wild Bill Hickok. Nearby he once sold illegal whiskey from a tent city called Rome. He and a partner sold lots, dreaming that Rome would become the depot town. But Rome fell. Railroad men built Hays.

The train rattled on. Three miles to the east at Big Creek a granite obelisk on a knoll above a cottonwood grove reflected the setting sun. "That's a cemetery for six tracklayers killed by Cheyennes in 1867," the engineer said. He blew his whistle for a crossing. It seemed more like a salute.

The Cheyennes in 1867 were enraged. The track was cutting through their hunting ground like a spear through the jugular. Game was disappearing; trees were felled. Three years earlier the Colorado militia had massacred a Cheyenne village at Sand

Creek, ignoring both U. S. and white flags flown by peace leader Black Kettle. Now young braves were fighting back. Their sudden raids and fast retreats, their horse stealing and hostage taking had all the markings of guerrilla warfare. The Army called them hostiles.

After the Big Creek raid on August 1, a Capt. George A. Armes set out from Fort Hays with 34 men from the black Tenth Cavalry. Cody wrote in his 1879 autobiography that he was the scout and made an entertaining story of the pursuit, but he didn't make himself a hero—he rarely did. The Army, however, did not record his presence; possibly he only heard about the episode. But his telling does agree with the Army account that the regiment survived being surrounded by hundreds of Indians, only to be laid low by cholera. Bill wondered which was the greater danger, fighting Indians or cholera: "The former was decidedly more inviting." Western movies notwithstanding,

Banner farm of Nebraska, Scout's Rest was Cody's first ranch, purchased near North Platte with profits from his earliest show-business career—a decade as an actor in touring melodramas. In 1883 he organized the Wild West, and three years later spent \$3,500 to build this Victorian ranch house, now a historical site. His sister Julia, who chose the design, and her husband managed Scout's Rest, while Mrs. Cody lived in a town mansion. Just about everyone dropped in whenever the celebrity hit town. Before he moved to Wyoming in 1902, Cody supported numerous local improvements: a new Platte River bridge, an irrigation canal, band uniforms, and an opera house. He even convinced Milan's La Scala opera to perform in the little prairie town.







disease claimed far more white lives than Indians ever did.

That fall something yet more inviting turned up. Bill was offered the exorbitant sum of \$500 a month for 12 buffalo a day to feed the 1,200 railroad workers camped near Hays. He had learned to shoot animals out of a running herd, starting at the rear.

"It was at this time that the very appropriate name of 'Buffalo Bill' was conferred upon me by the road hands," Cody later wrote. "I have never been ashamed of it."

ALMOST DEPLETED BY 1900, buffalo today roam the nation in growing private and public herds, estimated at more than 40,000 head. One herd lives well in the custody of Larry Kerr, who carefully superintends a 3,600-acre sand-sage-prairie state game refuge south of Garden City, Kansas.

After a spine-jarring pickup ride, we found 40 females with a dozen calves blocking an abandoned rail grade, looking immense and defiant. Larry's weathered face creased deeper in amusement as he recalled uninformed buyers who came to purchase surplus animals: "That was before we had auctions. One lady showed up with a leash to claim hers. She took one look and went home empty-handed."

We watched a 1,000-pound cow sink to her knees and roll to scratch. Dust flew as a wallow formed. Larry frowned. "Wallows are a real problem on our limited range. Too many and grass won't grow."

Growing grass is a main concern here. Larry leaned over to point out: "Forbes—buffalo utilize that for protein. Sage—they eat for roughage in winter. Big bluestem—that's ice cream to a buffalo."

Suddenly the herd was in motion. One animal lumbered off, and two by two, cow and calf fell into line, as if obeying a hand signal from a cavalry officer.

"There you see why the buffalo were so

Defying nature, a buffalo named Cody overcomes fear of fire on the rodeo circuit. His trainer, Bunky Boger, says that most spectators today have never seen the wild animal that Buffalo Bill helped make a symbol of the American West.



KANSAS STATE HISTORICAL SOCIETY, TOPKANSAS

Hillocks of buffalo hides from 40,000 animals await a train east from Dodge City, Kansas, in 1874. Seven years earlier, Bill Cody shot several thousand head to feed Kansas railroad workers, but later hunters killed millions just for hides, bringing the species close to extinction. Cody became a preserver; by 1890 his show herd of 18 was the third largest in captivity. Now safe, buffalo are raised for their fine-textured meat. This herd of 2,400 roams free near Gillette, Wyoming.



vulnerable," Larry said. "They don't disperse. They follow the leader."

BILL CODY'S marksmanship, tracking ability, and bravery made him a highly valued, well-paid Army scout. Once he made his way through blinding snowstorms to find a command lost in the Texas Panhandle. Often he carried dispatches through hostile country in the dead of night. Bill admitted to occasional high jinks and "partaking too freely of 'tangle-foot,'" but that didn't affect his work. Gen. Philip Sheridan, admiring his "endurance and courage," named the 23-year-old the chief of scouts for the Fifth Cavalry in 1868.

With the job went a log house at Fort McPherson near North Platte, Nebraska, for his growing family. By 1872 the Codys had three children, Arta, Orra, and Kit Carson. Sadly they lost Orra and Kit to childhood diseases. Their last daughter, Irma, was born in North Platte in 1883.

For 30 years Cody's loyalty to the West would focus on North Platte, today a major agricultural warehouse and rail yard. Back

in 1871 the little fort—today the site is a farmer's cornfield—was a center of activity. When soldiers weren't out chasing raiders, they were entertaining tourists. In a masterful public relations gesture, General Sheridan invited prominent New Yorkers for a hunt: James Gordon Bennett, editor of the *New York Herald*; financier Leonard Jerome, grandfather of Winston Churchill; and others. Sheridan selected Cody as guide; the Army supplied china, ice, and French chefs. Recognizing that it was to be a "nobby and high-toned outfit," Bill recalled, "I determined to put on a little style myself."

Cody selected a high-stepping white horse, a broad sombrero, and a suit of light fringed buckskin with a crimson shirt, embroidered, no doubt, by Louisa, a skilled seamstress. Guests expecting a braggart found "a mild, agreeable, well-mannered man, quiet and retiring in disposition, though well informed and always ready to talk well and earnestly upon any subject."

The New Yorkers declared the ten-day hunt a success, counting among their kill the meat of 200 elk and 600 buffalo. Bennett





BUFFALO BILL HISTORICAL CENTER, CODY, WYOMING (TOP), AND BUFFALO BILL'S MEMORIAL MUSEUM, LOOKOUT MOUNTAIN, GOLDEN, COLORADO.



Traditional foes became friends as stars in the Wild West. Sioux warriors, right, had once fought Pawnees, left, who, like Cody, had scouted for the U. S. Cavalry. The Sioux with their feather warbonnets, tepees, and horsemanship became the stereotypical American Indian, as Cody was stereotyped as the Indian killer. He repeatedly dramatized, as here in a 1913 film (left), the 1876 cavalry encounter at Hat Creek with Cheyennes who were riding to join Sitting Bull after the Battle of the Little Bighorn. Killing a minor chief, Cody shouted in revenge, "First scalp for Custer."

In truth, Cody respected Indians, speaking out against government mistreatment on the reservations and for preservation of Indian cultures. Sioux Chief Rocky Bear (third from right) wrote him in 1892, "I know you are a friend of the Indians."

invited Cody to New York as his guest. There Cody realized, as so many of his troupers would, that "I had seen but a small portion of the world."

On his big-city hunt, Bill charmed high society with his frontier dance steps, buckskins, and gallantry. Then he broke harness to attend the Bowery Theatre with Ned Buntline. The eccentric temperance lecturer and dime novelist had met Bill at Fort McPherson and asked "a great many questions." Ned wrote a Civil War romance based on the exploits of Wild Bill Hickok, but titled *Buffalo Bill, The King of Border Men*. The manager of the Bowery offered Cody \$500 a week to play himself in the theatrical adaptation. Cody refused, but back home the old idea took hold. "I could make more money."

BILL RESIGNED HIS POST with the cavalry in November of 1872, sent the family to St. Louis, and with his friends Ned Buntline and Texas Jack Omohundro opened in Chicago in *The Scouts of the Prairie*. The men forgot their lines and "shot" extras portraying Indians. One critic called it "a combination of incongruous drama, execrable acting, renowned performers, mixed audience, intolerable stench, scalping, blood and thunder." Audiences clamored for more.

Only 26 years of age, W. F. Cody set off on one of the most curious dual careers ever recorded. Each winter he staged western melodramas to cheering throngs across the country; during summers on the plains he guided hunting parties and troopers, most notably in pursuit of Sitting Bull after the Battle of the Little Bighorn.

Money poured in. The play grossed \$16,200 in one week in Boston. In 1878 Will purchased property in North Platte, the nucleus of a spread he called Scout's Rest that reached 4,000 acres and became one of the state's finest ranches. Sister Julia and her husband, Al Goodman, managed it, in constant consultation with its owner. "Tell Al to always keep a little Busine [whiskey] in the house—and keep open house to any nice callers," Cody wrote.

On a nearby ranch, Charlie Evans—a spry 72-year-old who wears his white hair caught in a ponytail—received me with

similar hospitality. His grandfather had come out with the railroad in 1873 and homesteaded.

"No one had any experience with these sand hills then," he said. "Their tops were barren; there wasn't a tree around. Settlers tried different things. Some worked, others didn't. Through land management we get this prairie grass growing everywhere. Lately we've gone to Angus-Hereford crosses; they feed out better."

A CHANCE TO TRY new things—that was the opportunity the cattle frontier gave Cody and the Goodmans. He sent purebred cattle from England, and fine horses. He also introduced sugar-beet cultivation and with a local banker financed an irrigation canal still in use.

"They all succeeded," Charlie continued. "On the other hand Cody sank hundreds of thousands of dollars in an Arizona tungsten mine that never panned out. I think his manager was a crook. Cody was probably the most trusting man that ever lived."

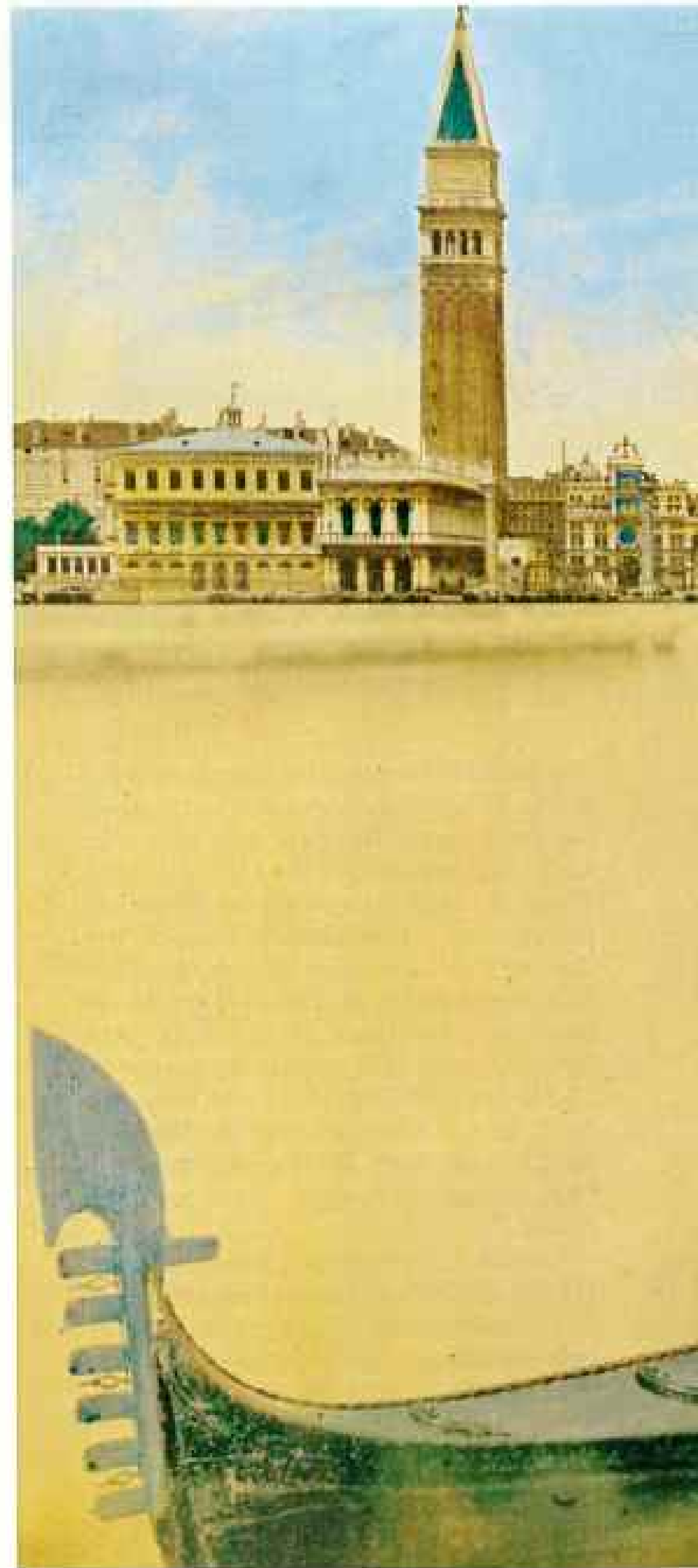
A longtime student of western history, Charlie turned his attention to Cody in 1963, when friends asked him to portray Buffalo Bill at a Fort McPherson centennial pageant. In costume and flowing wig, he was such a hit that similar invitations poured in.

Since his wig kept falling off, Charlie grew his hair long. Soon he so closely resembled the original that when he walked into a Denver restaurant, the Buckhorn Exchange, for a Cody look-alike contest, a roomful of Buffalo Bills conceded defeat.

Bill Cody's wife, Louisa, never much approved of her handsome husband playing Buffalo Bill. She was jealous of the acclaim of other women and of the love he showered on his sisters. She invested money that he sent home in real estate in her own name, preventing him from borrowing on it. "She has tried to ruin me financially," Bill complained to his sister Julia in 1883, and he

contemplated divorce. The suit he finally brought in 1905 ended in a deadlock, and the couple remained harnessed in alternating animosity and affection for life.

A Fourth of July in North Platte proved the seed for Cody's Wild West. In 1882 he organized a rip-roaring blowout with parade, horse races, and cash prizes for lassoing a Texas longhorn and riding a buffalo. Perhaps not the nation's first rodeo as North Platte claims, it succeeded so well that Cody



Canals of Venice witnessed this curious sight in April 1890 during one of the Wild West's nine tours in Europe. Cowboys and Indians took every opportunity to sight-see; they even attended an audience with the pope in Rome.

picked up an old idea—an open-air touring exhibition of frontier activities. His Wild West became just about the best and certainly the most famous show of its kind.

By the 1890s Cody, now a colonel thanks to a commission in the Nebraska militia, was hunting new challenges. "I am a broad gazer," he wrote Julia. "And I am willing to back my judgement."

In his opinion the empty Bighorn basin of northwest Wyoming, a well-watered grassy

bowl on the doorstep of Yellowstone National Park, was a natural for farming and tourism. So the prince of the plains shifted his loyalty to the mountains. He bought land. Then he built a town . . . from scratch.

As one of his grandsons recently recounted: "A bunch of fellows got together. Jakie Schwoob agreed to put in a trading post, George Beck to develop the irrigation and utilities. Jesse Frost would open the saloon, and Cassie the honky-tonk.

Only Indians were in Venice



Granddad said that he would publicize it."

Appropriately the investors called the spot, near the fork of the Shoshone River, Cody. And publicize it he did. Wild West brochures hawked the "Colossal Pleasure Garden of Entrancing Scenic Revelations." Cody had urged the railroad to build a spur to the town and the government to open a road to Yellowstone's east gate. Theodore Roosevelt reportedly concurred: "I would take chances on building a road into the middle of eternity on his statement."

For his own retreat the colonel picked land about as far up the South Fork of the Shoshone as you can go before the valley butts into mountains. He called it TE Ranch, after the brand carried by his herd trailed from South Dakota. A whitewashed log lodge became hospitality center for his friends—cowboys, celebrities, Sioux and Crows, ministers and artists. Frederic

Remington came to listen and later translated the frontier tales into the spine-tingling paintings now on display at the Buffalo Bill Historical Center in Cody, an eye-opening repository of western art.

In town, Cody built a sandstone hotel and named it the Irma, for his youngest daughter. The great mirror of the 36-foot-long cherrywood bar, imported from France, has always reflected the stars in the Cody drama. Today they are hard-hatted oil workers, Stetsoned truck drivers, dude-ranch wranglers, U. S. Senators, and eastern financiers. As the colonel predicted, Cody town has gone boom.

In front of the Irma in September 1913 Cody welcomed Prince Albert of Monaco on the first visit of a ruling prince to the United States. He took the visitor hunting to a favorite North Fork site, which he graciously named Camp Monaco. On a similar pack



BUFFALO BILL HISTORICAL CENTER, CODY, WYOMING

"I am going to build a beautiful little hotel in Cody," Bill wrote in 1902 of his plans for the Wyoming town he helped found. The two-story Irma (above), named for his daughter, was soon filled with fine furniture and paintings by western artists.

trip I came to know Cody's only living grandsons, Fred and Bill, born to Irma and Fred Garlow in 1911 and 1913. In them survive contrary sides of the Cody personality.

THE NARROW TRAIL, rock strewn and muddy from rain, dipped and wound along the river. The sky was clear, but, as Fred noted, "Anyone predicting the weather is either a stranger or a fool." Fred is neither. The bracing mountain air, like brandy, loosened his tongue, and he turned in his saddle to speak of his youth. "There I shot my first elk." He pointed to a grassy clearing. "Skinned and butchered it on the spot and packed it out on my horse."

Fred didn't go to school much after the ninth grade, but joined up with outfitters taking out fall hunters. "I got this dream of walking every creek and standing on every

mountaintop in this part of Wyoming. I think I've done it." After Fred married, he owned two dude ranches, and now he manages property for Easterners.

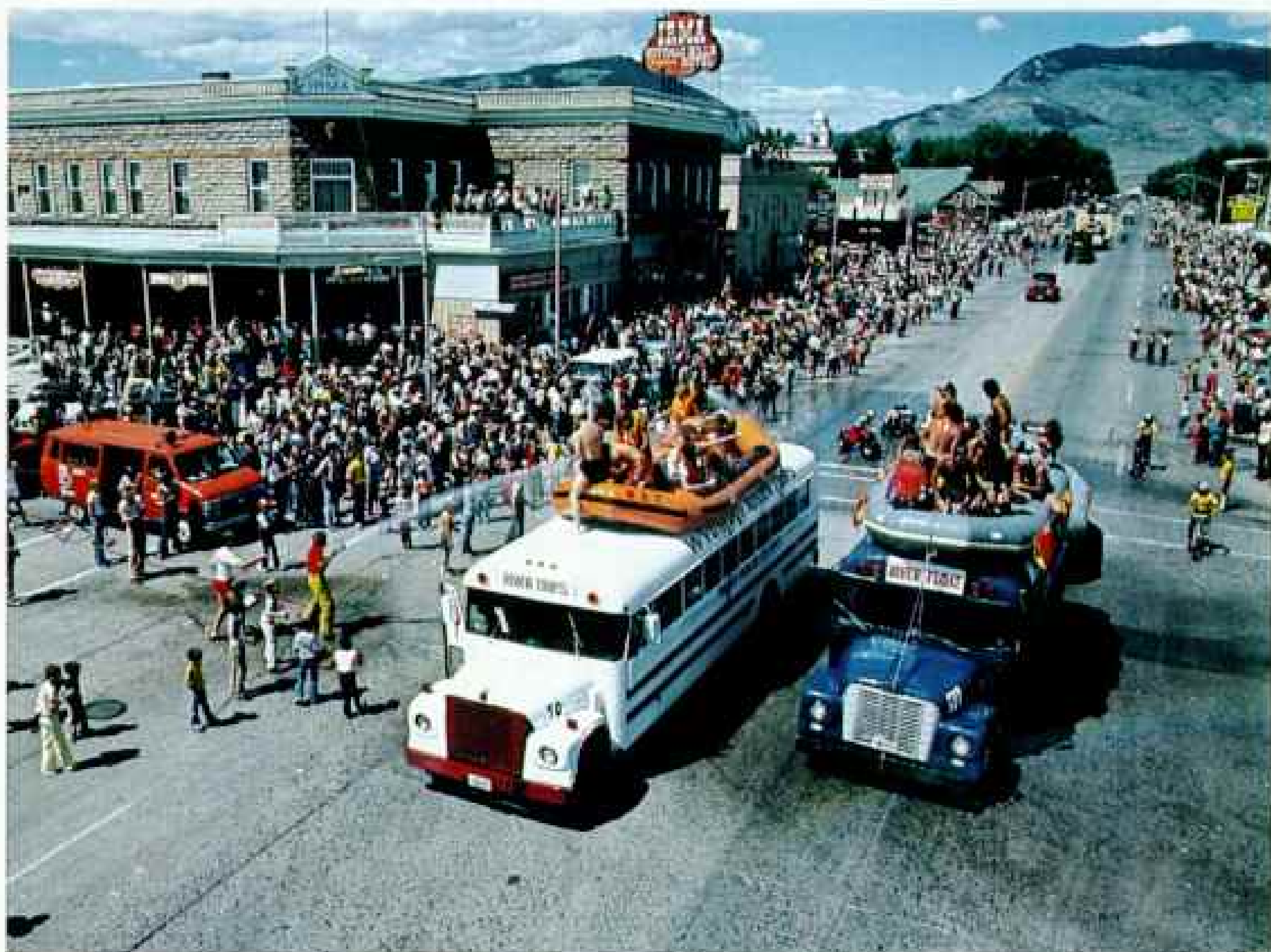
"Looka here," Fred chortled after several hours on the trail. "That's a squaw print!"

The footprint belonged to Barbara, his brother Bill's wife. They had come up earlier to set up camp. Our pack train finally spilled over a ridge and into a broad meadow. On the far side among the spruce, we saw a slender woman in jeans and red parka, moving amid a cluster of canvas tents.

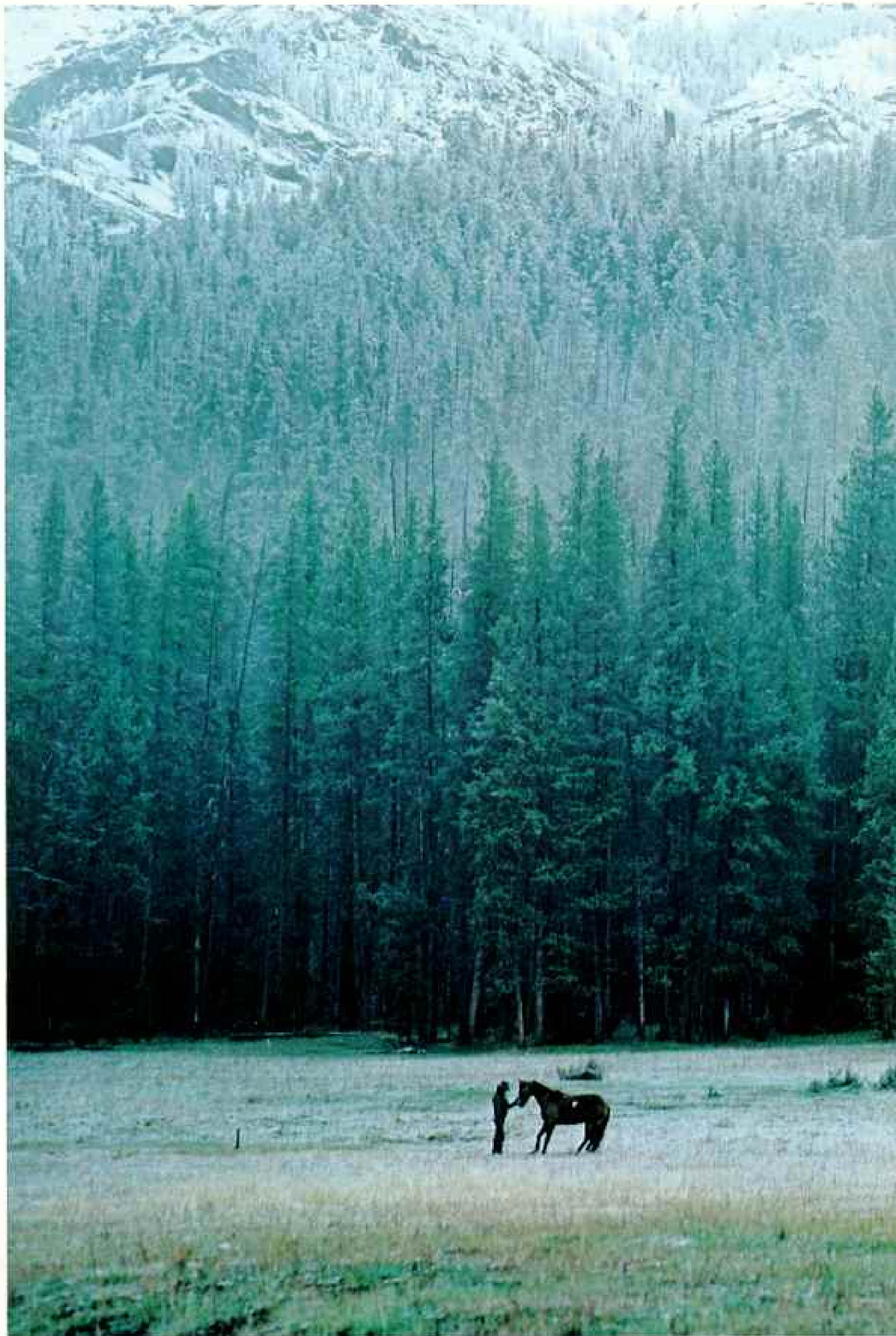
A towering man with white hair and goatee rose from a director's chair, a German shepherd at his heels—Bill Cody himself.

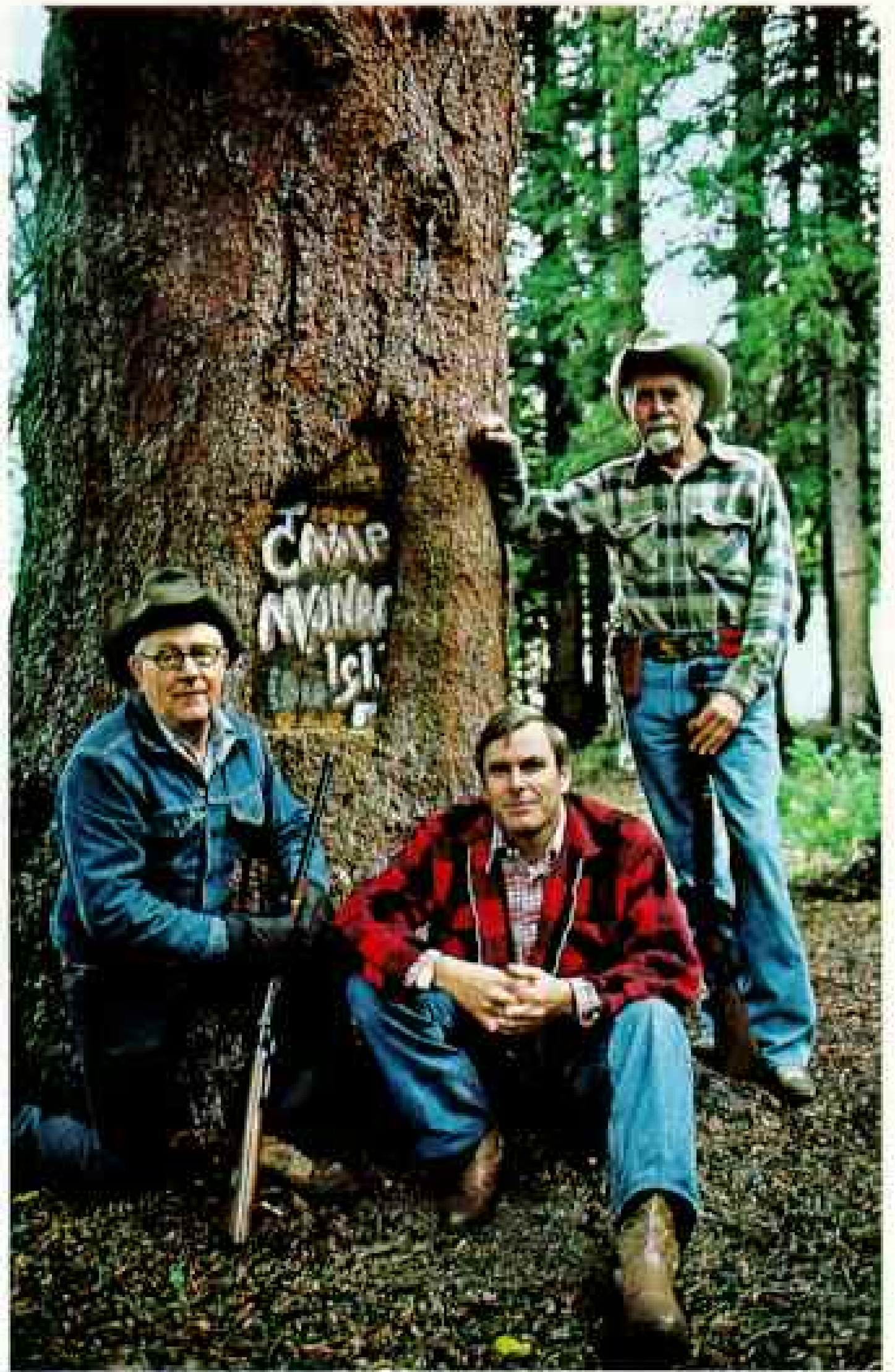
Bill, indeed, changed his name from Garlow to Cody 12 years ago, when he was promoting an air rifle called the Buffalo Bill.

If Fred is the mountain-man side of his famous grandfather, Bill is the obverse—a



Horse-drawn coaches carried tourists the 50 miles west to Yellowstone Park. Guests still flock to the Irma, here a grandstand for a Fourth of July parade (above). The bus, at right, advertises river float trips run by a great-grandson, Kit Carson Cody.





"The life I love," Cody called fall hunting trips into the Wyoming Rockies. He relished the bracing air, the search for elk and moose, the storytelling around the campfire with old-timers and illustrious guests on their first trip west. In 1913 Cody guided Prince Albert of Monaco to a favorite campsite half a day's ride up the North Fork of the Shoshone River. There Cody christened the camp Monaco, a name preserved on present-day maps and on the original sign on a spruce at the site (above).

Last fall Cody's grandsons, Fred Garlow, left, and Bill Garlow Cody, right, and great-grandson Bill Garlow organized a pack trip to the pristine spot. As in a former day, packhorses are turned loose to graze a meadow, here dusted by early snow. Like their famous ancestor, the men hold a democratic view of the wilderness. While they want to see it preserved, they also wish it could be made more accessible for all people to enjoy. As it is, in this Bill Cody's words, "The wilderness is only for the healthy and the wealthy."

traveler and entrepreneur. A Harvard Law School graduate, and a lieutenant colonel in World War II, he returned to Cody and helped start a radio station, motel, and the nightly rodeo. Then he got into Texas oil.

"Eventually I went broke," Bill told me, laughing. "I just played too hard and chased too many girls. After I married Barbara, we bought an old lodge on the Yellowstone road for \$500 down. Everybody said we couldn't make it. We remodeled, and last summer we had to turn down a thousand reservations."

THE CAMP Bill and Barbara set up at Monaco was worthy of royalty. Wood stoves kept the tents cozy through all-night downpours. White sheets added class to the bedrolls. When we rode to a higher ridge, blanketed by a September snowfall, the beauty moved Bill to reflect.

"My grandfather loved this country, and he loved to show it to friends. You know, if I had my life to live over, I'd do it just like Fred. I'd never leave these mountains."

Grandfather Cody never wanted to leave either. He even selected Cedar Mountain, west of town, as his burial site. But a funny thing happened on his way to the happy hunting ground. He died in Denver.

Cody passed away in his sister May's home after a brief illness. The *Denver Post* wanted him buried atop nearby Lookout Mountain and gave Mrs. Cody \$10,000 to help with expenses, according to the magazine editor who handled the transaction.

Now thousands of people come each year to that Colorado mountaintop with its museum and breathtaking views of Rockies and plains. On a bright July morning I joined the Buffalo Bill Saddle Club of Golden on a ride up a back trail. Riding alongside, blond Diane Bradford shared her enthusiasm. "I've been a rider and a club member for 20 years, since I was 12. I got my husband on a horse and then all four kids. They learn responsibility, keeping a horse."

Our little cavalry, uniformed in yellow club shirts and blue chaps, galloped in a final charge up the last 300 yards to the mountaintop. There, a horsewoman solemnly laid a great showy wreath of carnations on the grave of William F. Cody, Buffalo Bill. It was, to me, a heartfelt and appropriate tribute to the Old West from the New. □



With a flourish, Bill Cody doffs his hat and, before taking a drink,



To
Little Halcy
One of my oldest
and truest
friends
God Bless Him

W. F. Cody
"Buffalo Bill"

Mercury Club
Apr. 2nd 1909

BUFFALO BILL TRACT STATE HISTORICAL PARK, NEBRASKA GAME AND PARKS COMMISSION, NORTH PLATTE

waters his horse. The photograph of a vignette from his show, inscribed to an old friend, stands like a trademark of the life of the buoyant and openhearted Westerner.

BOMBAY, the



Other India

By JOHN SCOFIELD

Photographs by
RAGHUBIR SINGH



WHEN KING CHARLES II of England acquired Bombay from the Portuguese in 1661, Clarendon, his lord chancellor, jumped to a strange conclusion: The new bit of empire lay “within a very little distance of Brazil.”

Three centuries later this pulsing—and puzzling—place can still confuse even a seasoned Asian traveler, which Clarendon clearly was not. I am, and I know the difference between Bombay and Brazil. Yet a dozen visits to other parts of India had still not prepared me for the realities of India's commercial capital.

What am I to make of a place that reclaims land from the sea and puts gleaming skyscrapers on it before the earth has been squeezed dry, yet drags so far behind in housing that more than half its 8.2 million residents must live in nauseating slums? What of the unchecked *prosperity*—not poverty—that threatens the very survival of one of the great cities of the world?

Said press officer Raja Rajwade: “Almost anyone can find work. What they can't find is a decent place to live. Every day Bombay spins more and more out of control.”

It was this idea of wealth as a problem that I was least prepared for. I became aware of it one sweltering evening on fashionable Nepean Sea Road, where “crush hour” traffic flowed past rows of shining 15- and 20-story apartment blocks that turned coppery gold as the sun settled into the Arabian Sea. At the feet of these luxurious buildings huddled a scattering of tattered canvas and plastic-sheeting hovels. This is the paradox of Bombay. Even here in the poshest residential area, people with jobs but no homes have

Glamour queen of Indian cities, Bombay casts a spell on the nation with her wealth and glitter. From all over the country they come—the poor, the jobless, the hungry—jamming into the vast slums of India's commercial capital with their dreams of success.



invaded the sidewalks in their ceaseless quest for a place to live.

A sidewalk vendor was preparing hot snacks for a little congress of well-dressed customers gathered around his pushcart. A man beside me smiled, and we struck up a conversation.

"Try *bhel puri*," he suggested. This is Bombay's famous "trash," a flavorful mix of puffed rice, potatoes, and onions, garnished with a chutney sauce. The pushcart man handed it to me on a fresh green leaf.

As I ate, I saw a beggar approaching. My acquaintance must have sensed my feeling of shock at the contrasts around us. "You must reexamine your viewpoint," he said. "That man has not come to Bombay out of desperation. He has come because Bombay is the best place in India to be a beggar.

"This is the richest city in southern Asia," he added, with a trace of bitterness. "And it is strangling on its own prosperity." He crumpled his leaf plate, dropped it into the gutter, and hurried off toward one of the luxurious warrens across the street.

City Lures Hundreds Daily

I was to hear variations on this theme again and again. "Bombay is a magnet," said municipal commissioner B. K. Chougule. "Every day 300 to 500 new people pour into the city. They are Indian citizens. If Bombay is where they want to be, I have no power to keep them out."

"When one person gets a foot here," executive health officer Dr. Mohan N. Gurnani told me, "he brings in relatives. They all expect services—water, medical care, security. So the balance was long ago lost between population and the ability to provide amenities."

And yet Bombay is imbued with stubborn vitality. Things *work*, as they work nowhere else in India.

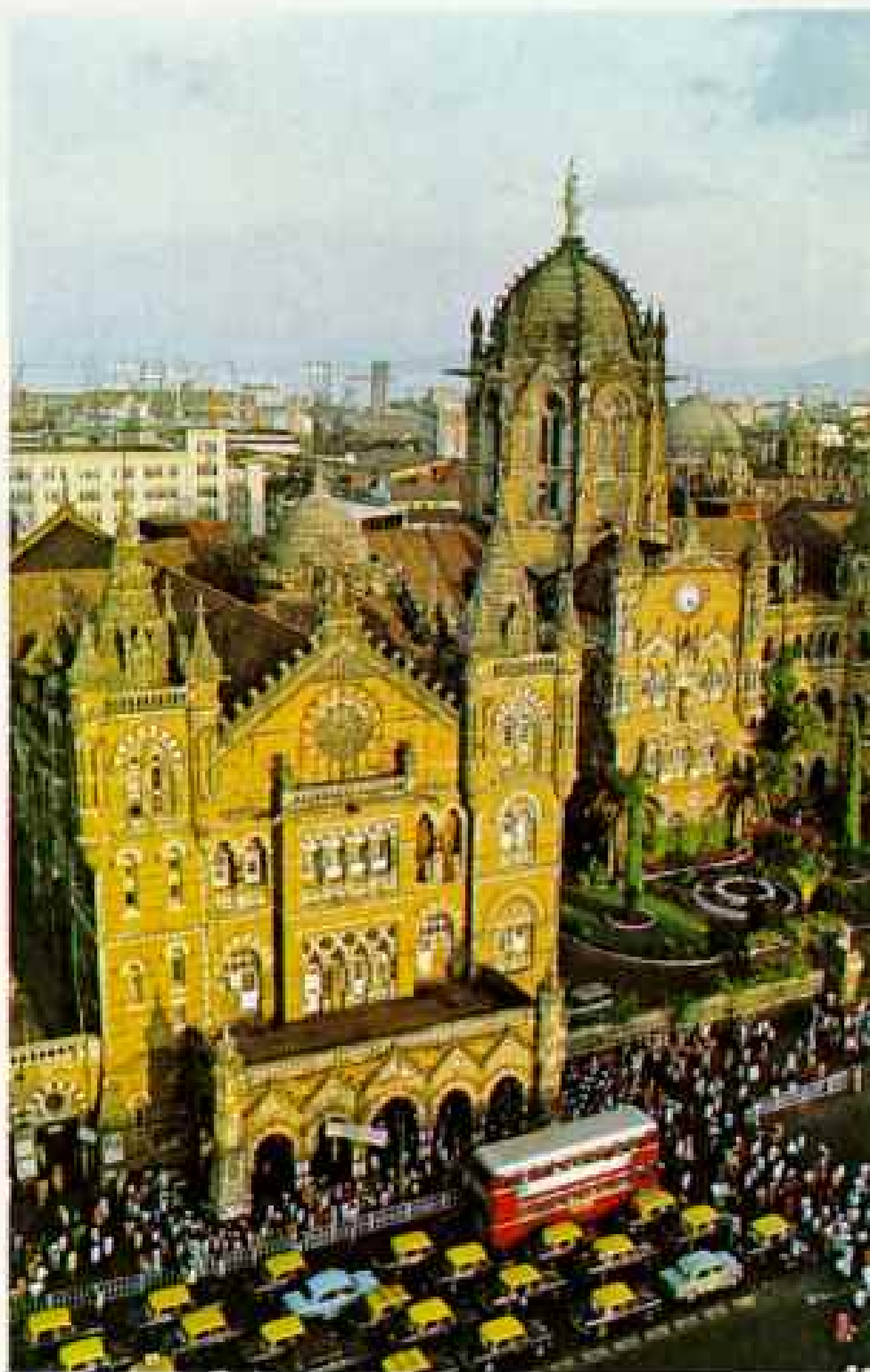
Transportation, for instance. "Each day," commissioner Chougule told me, "Bombayites going to and from their jobs make four and a half million trips by train and four million by bus." The trains run on time, averaging one every three minutes.

Red double-deck London-style buses, as crowded and plentiful as the trains, charge an average fare of only five cents a ride. Some of the buses acquire a permanent list

to the left from the off-balance weight of passengers clinging to the platform outside the door.

Or consider trade. . . . The bulk of the commodities consumed in India cross the wharves or pause in the wholesale warehouses of this one city. From Bombay's textile mills come nearly a third of all the fabrics produced in India.

Or wealth. . . . Bombayites, who are only



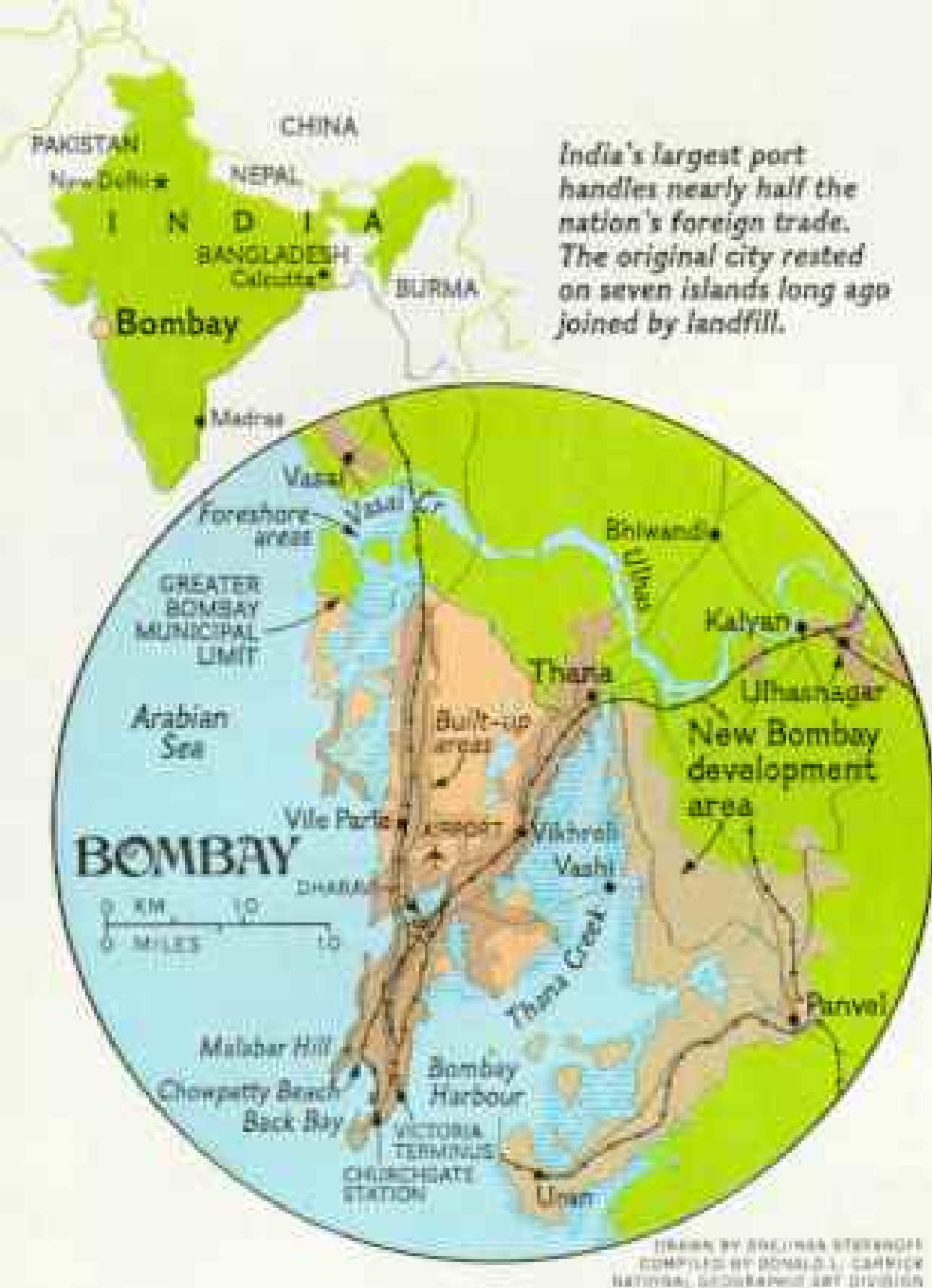
So many commuters stream into Bombay each morning that trains must carry twice their rated capacity—some 4.5 million riders a day (facing page). Most pass through Victoria Terminus (above), whose "Indo-Gothic" facade reflects three centuries of British rule. Acquiring Bombay in 1661, the British transformed it from a fishing village into a flourishing city of trade. They withdrew from India in 1947.



A rising tide of worshipers sweeps Chowpatty Beach, where they celebrate Ganesh Chaturthi by immersing images of Hindu gods in the Arabian Sea. With only an eighth as much open space as tightly packed Londoners, Bombayites regularly flock



to beaches for breathing room. Bumping elbows with fellow residents is almost inescapable in this city of 8.2 million people, one of the world's most densely populated. Neighborhoods burst at their seams with as many as 2,000 persons on each acre.



India's largest port handles nearly half the nation's foreign trade. The original city rested on seven islands long ago joined by landfill.

1.2 percent of India's 684 million people, pay a third of the nation's income taxes.

Or that very special product, motion pictures. . . . As the Hollywood of India, Bombay is chief purveyor to the world's largest cinema audience. "Not many of us can afford television," a taxi driver told me, "and there is not much to watch anyway. So we go to the films. I see one every night."

What he sees are frankly escapist melodramas that snatch him for three or four hours into a never-never land of wealth, song, ribald clowning, and improbable adventure. More than ten million tickets are sold throughout India every day at 15 to 60 cents each. Much of that money flows back to the Bombay-based producers, whose sumptuous homes—and those of their stars—dot the chic northern suburbs.

Business, it seems, has always ruled Bombay. From the moment the British acquired Bombay, through Charles II's marriage to a Portuguese princess, they set about making the little island settlement a gateway to the riches and the trade of all India. Artisans and merchants were encouraged to settle. Textile manufacture got under way with an order from London for 500 pairs of cotton

stockings. In the first decade of British dominion, Bombay's population more than tripled. Except for brief dips, the curve has been going up ever since.

Pressure for more land developed early. Bombay's seven islands quickly disappeared as more and more building space was reclaimed from the shallows around them. Roughly half of today's city rests on land that once lay beneath the sea.

One day I drove through a crowded area just north of the main business district with Mrs. Padma Vora. The wife of a Bombay physician, she had volunteered to show me some out-of-the-way corners of this complex city. She pointed to a walled enclave amid a clutter of busy streets, railway lines, small shops, and middle-class housing—the mixture that makes up much of modern Bombay. "A burning ghat," she said, "where we Hindus cremate our dead." Strange, I commented, that it should be in such a place. I had earlier seen burning ghats only on the banks of rivers or beside the sea.

"It was beside the sea," she said. "Now the nearest shore lies hundreds of yards away."

Colonial Figures Lose Their Heads

The British, of course, created old Bombay. Only 20 years ago it was still being hailed as one of the finest surviving Victorian cities in the world. But soaring land values—as much as \$6,000 per square meter—have led to the razing of hundreds of ornate, century-old homes. Public buildings have been spared—grand piles in "Indo-Gothic" and "Indo-Saracenic" style—but not the statues of the men and women who ordered them built: Britain's London-appointed viceroys and governors, and Empress Victoria, whose authority they exercised.

No one knows quite what to do with these embarrassing relics of empire since they were replaced with statues of independent India's own heroes. I found a dozen of them in a disused bit of garden beside the Bombay zoo. Queen Victoria lacks a nose, as does Lord Sandhurst. Four of the statues no longer have names. Two also lack heads.

"We call it the 'English cemetery,'" said Mrs. Vora. "Even before the British left, people took to throwing stones at them, so they were taken down and stored here."

Along with their Victorian buildings, the

British also created parks. Today the tropical green of Bombay's streets and parks belies another melancholy fact. As the island city's population has mushroomed, so has its breathing space shrunk. Bombay offers only an acre of open area—playing fields, parks, beaches, even traffic circles—for every 3,000 residents. "Congested" London enjoys eight times as much.

Bombay's prime outdoor gathering place, Chowpatty Beach, lies beside the Arabian Sea. In the afternoon, when the sun pulls waves of humidity from the shallows offshore and the thermometer hangs in the 90s, Chowpatty was always deserted. But on a Sunday evening, I would realize how really crowded Bombay is, how desperate its people for a place to sit and pass the time of day. Sit? By dusk on any weekend, Chowpatty offers standing room only. During my last week there the beach lay at the feet of a 65-foot-high paper-and-tinsel demon that would go up in flames as the climax of a ten-day autumn festival. Until then the effigy towered almost as a mockery of the tiny sweltering humans around it, who literally hid the sands at their feet.

What can one see amid this shouldering throng? Pony rides, hand-powered merry-go-rounds, Ferris wheels hardly higher than a man, sand sculptors, performing-monkey acts. Pink-turbaned ear cleaners, armed with tiny silver spoons and vials of oil, gently ply their curious trade.

Around an open area the size of a blanket, Sunday strollers gawk four deep at a pair of human arms projecting from the sand, making gracefully disembodied gestures while a bystander explains to me that a Hindu holy man lies buried beneath them. He is able to breathe through the loosely packed sand.

"My brother," says a young entrepreneur beside the arms, and indicates that a ten-paisa coin—1.2 cents—would be appreciated. I remember a comment of my friend at the Nepean Sea Road pushcart. "Anyone can find some kind of work to do here," he said. "Something that will earn him a couple of meals a day."

Unhappily, finding a way to eat in this disastrously crowded city carries no guarantee of a spot to bed down. Walking at night, I grew accustomed to stepping over and around sidewalk sleepers.hovels cluster at

the bases of gigantic motion-picture billboards, beneath bridges, at the edges of city parks. Shantytowns creep dangerously close to railway lines—ten people die each day by straying onto the paths of suburban trains—and inch across low-lying areas that will flood when the next monsoon arrives.

At the Tata School of Social Sciences, Dr. Ashok Yesudian showed me a 1977 report that gave the dimensions of Bombay's chief problem: 1,680 separate slum areas, sheltering roughly a third of the city's population. But that tells only part of the story. To Indian statisticians, only areas of makeshift shacks count as slums. If you add the multitudes who live in squalid, rotting tenements—slums by any other definition—at least half of Bombay's populace must be counted as slum dwellers.

Amid Squalor, Pride and Hope

Crime flourishes in many of these ghettos. Some slum dwellers live by begging, others by distilling illicit liquor. But not all, I discovered. Upward movement exists even in the darkest of these deprived communities. Bombay's biggest slum (but by no means its worst) shelters a third of a million people in an area the size of a few dozen city blocks. It goes by the name Dharavi Labour Camp.

Mrs. Vora took me there. "Indians are always eager to meet foreigners," she reassured me as we peered into the tiny home of a part-time welder named Aaftab Sheikh. The house was compounded in part of scraps from old movie billboards painted on plywood. The weather-stained face of an Indian actress grinned crazily at me, upside down, beside the doorway.

We were instantly invited into the seven-by-nine-foot house, where Aaftab Sheikh's wife was fixing breakfast on a one-burner kerosene stove. "Mind your head," Aaftab warned in English as I entered, then lapsed into Hindi when I began asking questions.

Aaftab's parents had brought him with them from northern India 23 years earlier. "When I married, I moved here," he told me with pride. "Now I have my own place." He and his family share it with a brother.

I made a quick eyeball inventory of the household. Five people. Tin and cardboard suitcases. Clothing. An oil drum for water storage. Pots and pans. The kerosene stove.

East meets West in fashions sold at this posh shop near the Back Bay (right). Clothing on display here may be made with Bombay textiles, the city's first major product in the 19th century. Local mills still spin or weave nearly a third of the country's fabrics, helping to make this city India's wealthiest. Bombayites pay a third of the nation's income taxes, even though they total only 1.2 percent of the population.

English remains a main language of trade in most parts of the metropolis. But Marathi, Gujarati, Hindi, and dozens of other tongues help define neighborhoods where diverse ethnic groups preserve their distinctive customs. In a neighborhood of South Indians, Hindu priests (below) gather near a temple.





Sleeping mats neatly rolled in a corner. Miscellaneous boxes, tins, and bundles. All this in 63 square feet!

"We don't need electricity," Aaftab volunteered. "Too expensive." Dharavi, unlike the worst slum pockets, has some city amenities, so he and his brother pay the municipality 20 rupees—\$2.40—each month for the land they occupy and the water they use. The single outside tap runs erratically—sometimes all day, sometimes for only an hour or two—so a supply of water has to be kept inside. That one tap supplies a couple of hundred families. People must always stand in line.

"Life here is better than in the village I came from," Aaftab says with a measure of contentment. "I would never go back."

A Stranger in Paradox

Despite Aaftab's sunny outlook, Dharavi seems utterly degrading, a denial of human dignity and aspirations. But wait a minute. Is that a TV antenna atop the hut next door? Is Aaftab's wife wearing a gold necklace? And that immaculate young man stepping so carefully around the piles of trash in this festering alley. A clutch of papers in his hand suggests that he works in an office. How can he be so clean amid such filth?

The paradox of Bombay dawns on me again. Far from being a defeat of the human spirit, Dharavi is, I begin to see, something of a triumph. In circumstances that could crush any but the strongest will, many of its people do a great deal more than merely survive. They raise families, stay clean, work toward a better future. And when a stranger from another world crosses their threshold, they receive him with dignity and warmth.

Aaftab Sheikh follows the creed of Muhammad, but many among his neighbors migrated to Bombay from southern India. The little shrines in their cramped quarters shelter colored pictures of Hindu deities before which bits of incense burn.

Aaftab's fellow Muslims labor in the textile mills or, like him, somewhere along P. D'Mello Road, where docks and warehouses lie. Other Muslims stitch clothing or find work in a slaughterhouse, a task no vegetarian Hindu would accept.

Some of the most fascinating sights in all Bombay lie in the old Crawford Market and



Mapping the future, architect Charles Correa—at home with his wife, Monika—has helped create plans for a twin city across the harbor. Designed to disperse congested

National Geographic, July 1981



industry and population, the New Bombay project envisions satellite communities to house and employ workers and port facilities to handle cargo not consigned to Bombay.



भुवन हटल

दुवा भुवन हिंदु होटल

the Muslim neighborhood around it. Shoppers entering the market still glance up at an allegorical sculpture of village life above the main entrance designed by Rudyard Kipling's father. Lockwood Kipling would find the market little changed, with fruit and vegetable sellers still crying their wares from strange three-story stands that climb close to the ceiling, where bookkeepers look down from desks just under the roof.

On Mutton Street lies the incredible clutter of Chor Bazaar. The name means Thieves' Market. "If you lose one shoe," joked Mrs. Vora, "you can come here and find a replacement to match it exactly." Not to mention old Victrolas with gleaming brass horns, fancy parrot cages, and second-hand parts for every kind of machine ever used in British India.

In a neighboring street one can buy handbags with coveted symbols of Gucci and Dior, but they will be fakes made by skilled Muslim leatherworkers. The originals to be copied are brought by aircrew members flying in from Paris and Rome.

Rainy Bombay Is Sheikh Resort

The visitor to Bombay constantly discovers enclaves of shared language and religion. Industrious Sikhs, bearded and turbaned, have filtered in from the Punjab and erected their temples, called gurdwaras. Gentle Jains follow an offshoot of the Hindu faith; their monks wear gauze masks over nose and mouth, lest they inadvertently kill some tiny insect by breathing it in.

Arabs from the gulf oil states, denied their traditional spending sprees in war-ravaged Beirut and, because of Egypt's separate peace with Israel, in Cairo, now look to Bombay's well-stocked shops and comfortable hotels. The lobby of the plush \$90-a-day Taj Mahal buzzes with the Arabic of vacationing Saudi Arabians. July, when monsoon rains inundate the city, marks the height of the Arab tourist season. Many of them have never seen rain before.

Neatly whitewashed houses mark the

neighborhoods of Roman Catholics, descendants of Indians converted centuries ago by the Portuguese, who settled on India's west coast after Vasco da Gama's landing in 1498. Find a synagogue and you have come upon one of the pockets of Bombay Jews, whose forebears, they will tell you, were cast ashore near here 22 centuries ago.

No bit of Bombay's rich past, it seems, ever altogether disappears. I was struck by the sight of beflagged sailboats and a village of low huts crowding a little beach in the middle of downtown Bombay. It belongs to some Koli fisherfolk, whose ancestors were here even before the Jews.

The Koli men slip out with each day's tide, past the city's skyscrapers, to fish the Arabian Sea. Their womenfolk, saris drawn skintight between their legs and tucked up behind, stride imperiously to market with the catch balanced on their heads in flat, dripping baskets. Kolis are the principal suppliers of that odorous delicacy, Bombay duck—slivers of dried *bombil* fish that are fried and served with fiery curries.

They are stubborn traditionalists, these Kolis, and they seem to have stopped Bombay's cherished Back Bay reclamation project in its tracks.

"We have always fished from here," a slight, bearded fisherman told me when I visited the little village of Machimar Nagar. "When there were no tall buildings, and no one had come to turn the sea into more land, our boats were here.

"Then the city decided to build. We went to court." The village was awarded 90,000 square feet of land between traffic-laden Cuffe Parade and the Arabian Sea.

"What we have now, they say we may keep," the fisherman concluded. "But the government has told us not to let anyone else settle in the village." And there on their bit of shore, sandwiched incongruously between towering office blocks and apartment buildings, I hope they stay.

The Parsis have not been in India as long as the Kolis

(Continued on page 122)

They sleep on the street because the slums that shelter more than half of Bombay are hot and overcrowded. At least 100,000 people live permanently on the pavement. Most can find some form of work, however menial. But the city can no longer meet even their basic needs. And 300 to 500 more, most of them men, arrive daily.



Though tattered and worn by climate and time, this home would be considered enviable by many Bombayites. Millions throughout the city dwell in far less

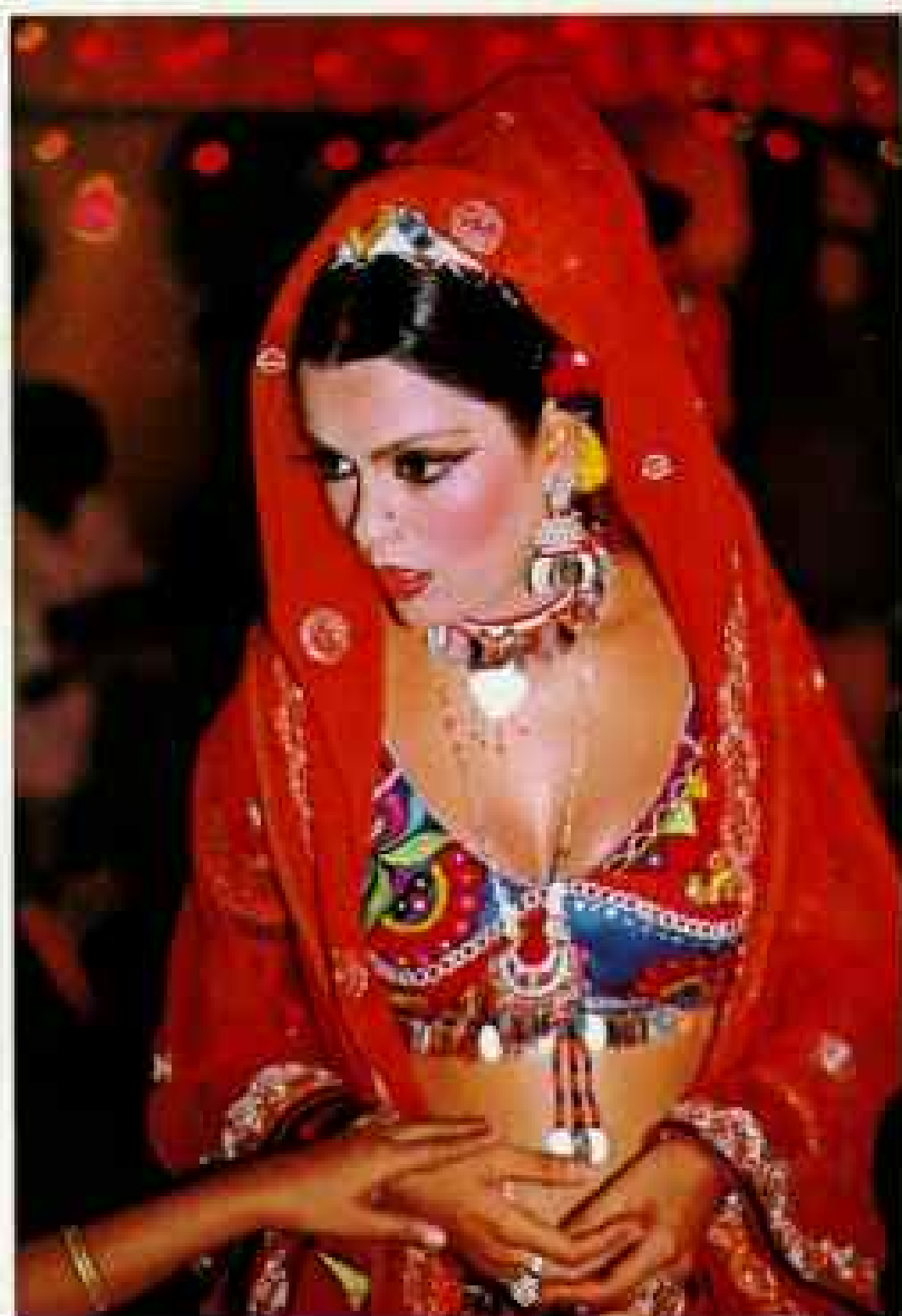
National Geographic, July 1981



permanent structures, including one-room shacks. A Maratha family has dressed up the doorway for a New Year's festival by stringing leaves and marigolds.

Movie madness grips India's 684 million people—the world's largest cinema audience—and Bombay filmmakers turn out hundreds of lavish, action-packed features a year. For as little as 15 cents, villagers and slum dwellers alike escape into make-believe worlds of romance, song, and happy endings. Actress Zeenat Aman (right) made a splash in 1978 when she gave her screen hero a kiss, the first in many years permitted by sober-minded censors. Bombay movies are usually filmed in Hindi, India's most widely spoken language.

To preserve traditional dance and music, Bombay inaugurated the National Centre for the Performing Arts in 1980. At a school in a South Indian neighborhood, young women (far right) take a break in their study of Bharata Natyam, a classical dance form. Through his masterful playing, musician Ram Narayan, at home with his daughter Aruna (below), has elevated the sarangi, a popular stringed instrument, to new heights in classical music.

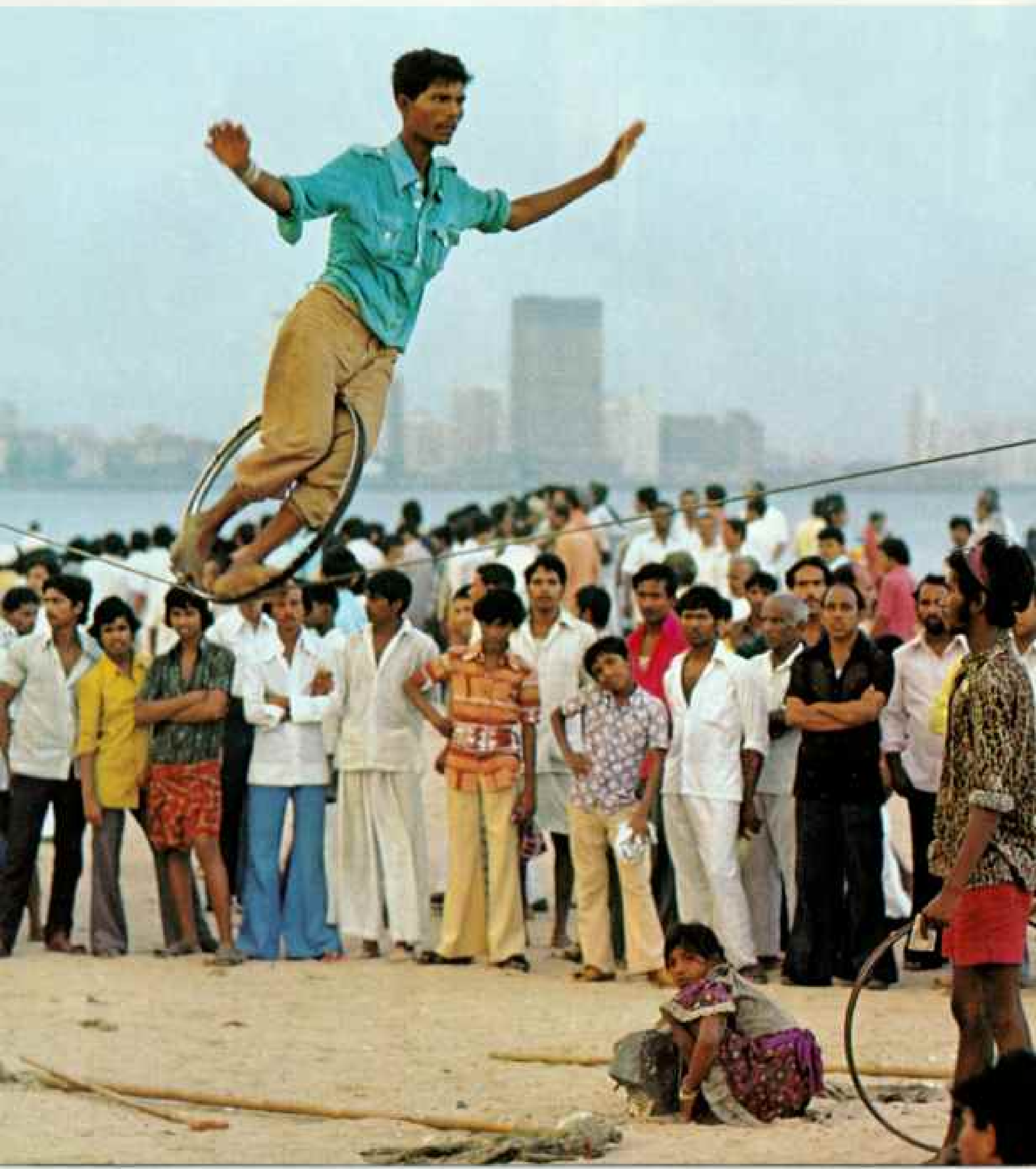




or the Jews—only since the eighth century, when the first of them migrated from Persia. This community of about 80,000—the largest concentration of Parsis in the world—has wielded an influence in Bombay far out of proportion to its numbers. Though aggressive businessmen from other groups have now broken the Parsis' near monopoly on wealth in this wealthiest of Indian cities, three Parsi names still stand out: Tata (hotels, steel mills, trucks, chemicals),

Wadia (textile mills), and Godrej (typewriters and electric refrigerators among a host of other products).

Philanthropy and civic responsibility have been Parsi touchstones for generations. I saw those three names repeatedly as donors to hospitals, schools, Bombay's sparkling new National Centre for the Performing Arts, and the Tata Institute of Fundamental Research. S. P. Godrej, the enthusiastic, unassuming head of the



Godrej organization, sketched a typically Parsi philosophy as he showed me around his company's spacious garden township at Vikhroli, on the edge of Bombay.

"Our workers come to us with only their hands," Mr. Godrej said, as his arm swept a horizon of factories, housing blocks, schools, and—above all, that commodity so rare elsewhere in Bombay—space. "Our job is to give them skills. Today three-quarters of the Godrej working force of 12,000 live

here. Their children go to school here. Our idea is to transform the so-called working classes into middle classes."

The Parsis brought with them from Persia the religion of Zoroaster, which sees earth, water, and fire as too sacred to be defiled. Hence Bombay's famed Towers of Silence, seven squat structures of circular walls with platforms inside on which Parsi dead are placed to be devoured by vultures.

I saw a few wheeling birds but never glimpsed the towers. They lie hidden behind foliage atop Malabar Hill. Unhappily for orthodox Parsis, though, Bombay's penchant for high rises has penetrated the leafy screen so that chance viewers sometimes see what Parsis may never view. Occupants of nearby apartment buildings can look directly down into the towers whenever one of the hereditary burial squads—four non-Parsi men—brings a body.

Critics, some of them Parsis, argue that the vulture population has dwindled and the surviving birds are not doing their jobs. When they do, airborne bits of flesh sometimes land on city streets. Rudyard Kipling never forgot his mother's distress when she found a child's hand in the garden. In the face of such incidents, some Parsis cremate their dead.

Diverse Languages Pose Problem

Because of the many schools endowed by the sect's philanthropists, few Parsi children depend on the municipality for their ABC's. With other groups, however, Bombay's linguistic wealth sometimes proves a trial.

"We feel an obligation to teach children in the language they speak at home," said municipal education officer Mrs. Kusum Kamat. Three-quarters of Bombay's primary-school students speak Marathi, the language of Maharashtra state, of which Bombay is capital. The rest are taught in one of nine other languages widely spoken in Bombay. One group, however, consists of

Low-budget thrills divert a crowd at Chowpatty Beach as a daredevil tightropes on a bicycle rim. Some evenings the carnival-like scene changes hourly as pony rides and monkey acts give way to wrestlers and hawkers of spicy snacks.





just 122 South Indian children speaking Malayalam.

If teaching youngsters in ten different languages sounds complicated, ponder the problem of getting home-cooked lunches from 100,000 different kitchens in the suburbs to that many office workers in perhaps 10,000 buildings in Bombay's business district. Not only getting the right lunch to each man, but doing it on time.

Once again, religious and ethnic backgrounds play their parts. Most Hindus are vegetarians or at least refuse to eat beef. Muslims shun pork. High-caste Hindus insist on food prepared by high-caste cooks.

When the city was small, husbands trundled home for meals that satisfied all these proscriptions. But as suburbs inched out, distance made that impossible. Today many workers in Bombay's incredibly crowded office district travel 30 miles or more to their offices. Hence that unique Bombay institution, the *dabbawallah*.

Delivering Lunch Dabbawallah Style

One morning in the suburb of Vile Parle, I fell in behind young Gyaneshwar Medge as he dogtrotted from house to house. At each he picked up from wife or mother a tiffin carrier—an aluminum contraption with four round food compartments and a handle. All bore cryptic symbols. The tiffin carrier I would follow to Bombay bore marks in green paint: VP for Vile Parle, D10 to identify the man who picked it up, and 6X5 to identify building and floor.

By his last stop Gyaneshwar had collected 40 tiffin carriers plus his bicycle. Now he walked it toward the railway station, with the carriers hanging in awkward clusters from handlebars and rear fender.

At the station other dabbawallahs waited, and the first of many furious reshufflings began. Lunch pails were exchanged, sorted by district, put in order on narrow six-foot-long trays. Each man hoisted one of the trays atop his head and made his way into an already crowded second-class carriage.

As the train pulled out, the shuffling continued. New men boarded with more trays, exchanged some of their cargo, and rearranged the rest. At Churchgate Station, frantic now in the morning crush hour, the dabbawallahs assembled on a sidewalk. In an even more frenetic ballet, 50 or more of them passed pails back and forth and arranged them on bicycles, carts, or head trays for the final leg of the journey. Through it all, I kept my eye on VP D10 6X5.

With many stops, Gyaneshwar's route led into the banking district and up to the New India Assurance Company's severe granite building. This was the "six" of those mysterious symbols. On the fifth floor Gyaneshwar left the tiffin carrier in a company cafeteria behind about 20 others.

A few minutes later, a surprised office worker named K. A. Desai courteously let me join him as he opened each of his lunch pail's compartments: tortilla-like chapaties, green beans, rice, lentil soup, chutney, and yogurt. It was, in fact, identical to thousands of other lunches delivered in Bombay that day. But it had come straight from the kitchen of Mr. Desai's wife, Rashmi. That was the important thing.

Mr. Desai wiped his lips with one of the company's paper napkins, reassembled his empty tiffin carrier, and put it back where Gyaneshwar would pick it up. By 4:30 it would be back in Mrs. Desai's kitchen. By 5:00, so would Mr. Desai.

Somehow, in a marvel of organization, each of Bombay's 3,000 dabbawallahs receives fair pay for the number of lunches he handles, though he takes few of them the whole way from home to office. "I earn about 300 rupees a month," Gyaneshwar told me. That equals \$36. He sends some of it home to his family.

Gyaneshwar shares a room with half a dozen other newcomers to the city. Their status as single men points up a serious problem. Hundreds of thousands of men who have come to the city seeking jobs are either unmarried or have left wives and children

Student of a unique culture, a Parsi boy learns the history of his own people. Descended from Persians who fled Arab conquest in the eighth century, Bombay's 80,000 Parsis form the world's largest community of Zoroastrians. Skilled as traders, Parsi businessmen greatly influenced Bombay's history.



Bombay's favorite god, Ganesh, the elephant-headed Hindu lord of prosperity and wisdom, rides in glorious effigy through a working-class neighborhood during a



celebration of his birthday. About half of the city's population is Hindu, the rest Muslim, Christian, Buddhist, Jain, Sikh, Zoroastrian, or Jewish.



30 तीस बीस
विजय नवकी प्रो

श्री कृष्ण भुवन

इयु आरु कंपनी

चसंत रलोभरी



behind. The result is a lopsided population: roughly four males to every three females. And no city in Asia has a larger or more flagrant red-light district.

Problems, problems! Where does Bombay go from here? Municipal commissioner B. K. Chougule, the working head of this complex city, said, "People say Bombay is dying, but that is not true. Solutions can be found. There are various ways to slow the city's growth. The key word is dispersal. Existing industry we must disperse. New industry must go somewhere else. Already we have stopped the skyscraper boom with a law that restricts the ratio of floor space to ground space.

"Now we must move out of Bombay the commercial activities that belong to the nation rather than to the city: the wholesale markets, the transshipping facilities. Did you know that when someone in Madras, across India on the east coast, orders a car-load of steel, it will probably come from a Bombay wholesaler? The irony is that the wholesaler bought it from a mill near Calcutta, also all the way across India.

"Every day," he continued, "6,000 trucks move into Bombay, to load or unload. They clog our streets and create pollution. But few of those trucks carry goods that will stay in Bombay.

"Talk to the people at CIDCO," Mr. Chougule suggested as I left. "What they are planning will lie across the harbor, outside my jurisdiction, but it holds the key to Bombay's future."

CIDCO—the City and Industrial Development Corporation of Maharashtra—plans a New Bombay on the mainland, directly across the oil-slicked and polluted harbor from today's crowded island city.

In his high-rise office, CIDCO's Raja Rajwade's fingertips hopped from one spot to another as he sketched on a wall map the outlines of the New Bombay plan. "Here will be a new port, to handle goods consigned to New Delhi, Madras, anywhere except Bombay."

He showed me where 20 satellite townships are planned. Each of them will be self-sufficient, with schools, housing, shops, community centers. "One township, Vashi," Mr. Rajwade said, "already has 10,000 families of workers in petroleum, chemicals, and cement." All told, 125,000 now live in the 12.5-square-mile area that will become New Bombay.

"So you see, the movement has begun. By the year 2000 we shall have our new port and our 20 townships. When we started Vashi," Mr. Rajwade explained, "5,000 people had already made down payments of a thousand rupees, so we could confidently put up housing for 5,000 families."

Each house costs the equivalent of \$2,400. I wondered how much of a house that would buy. "Concrete walls," Mr. Rajwade said. "One room, 150 square feet. Two hundred square feet of open space around each house. An inside water tap and an outside toilet."

One room again! This is better than a slum? Then I remembered the 63 square feet, with no toilet, no water tap, no outside space, that Aaftab Sheikh and his family occupy in the depths of Dharavi Labour Camp. If moving there had been a step upward, what a leap it would be to move across the harbor to New Bombay.

Harbinger for the World

If Aaftab and his family can take that next step, and then his neighbors, and their neighbors, it would bode well for city dwellers everywhere. For the troubles and hopes of Bombay are not just those of some faraway place beside the Arabian Sea. London and Mexico City, Hong Kong and Los Angeles, Jakarta and New York hold seeds of the same urban illnesses. Watching Bombay over the next two or three decades, as its health improves or sinks, might help other cities as they seek to avoid those same crises some decades from now.

What happens in Bombay, good or bad, will be worth keeping an eye on. □

Drenched by monsoons but not drowned by problems, people of Bombay weather polluted air and drinking water, housing shortages, traffic snarls, oppressive heat, and torrential rains—some 24 inches in July alone. And yet they retain the determined optimism that first attracted many to India's city of opportunity.





SLIME MOLD

The Fungus That Walks

ANY SCIENCE-FICTION BUFF would recognize the creature: Neither plant nor animal, the protoplasm grows in the cool damp darkness of a rotting log. Then, cued by its mysterious inner clock, the blob oozes upward, toward the surface and sunlight, toward the world of open air—there to undergo an astounding transformation.

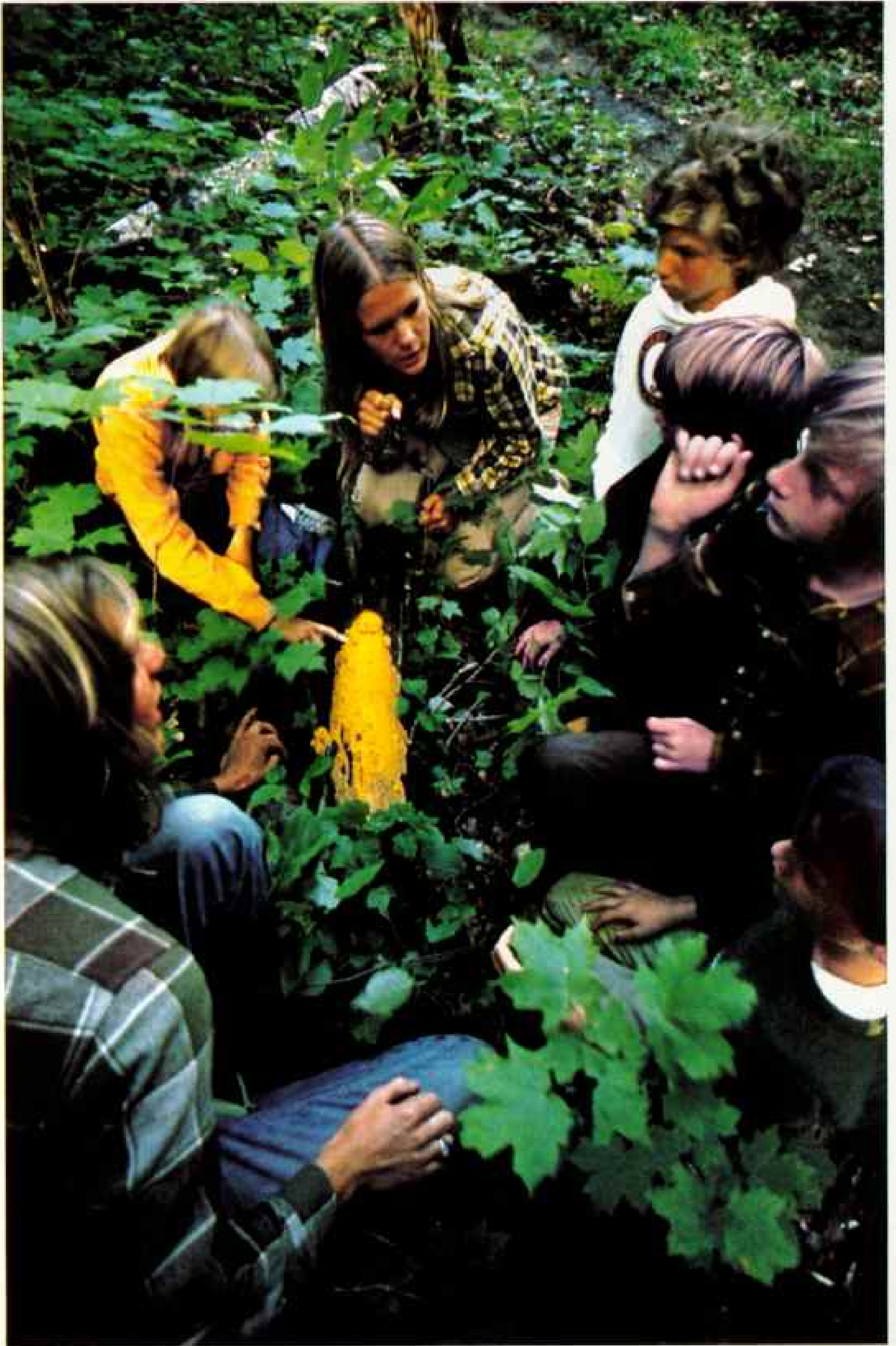
That blob actually exists, not in fevered imaginations but in our own woods and gardens. It's the thoroughly terrestrial slime mold, an often lovely organism with an unlovely name. Some five hundred species of this cousin to mushrooms confound zoologists and botanists alike with a life cycle that takes them from beast to beauty to beast again. They first resemble primitive animals that grow into shapeless, slime-coated masses called plasmodia, then change into funguslike spore-bearing "fruiting bodies," or sporangia. Thereafter, they begin the cycle all over. Many species' sporangia take forms from an artist's dreams: Those of *Arcyria denudata* (left) could be cotton candy drawn by Dr. Seuss, and they stand about the right height for an ant to snack on.

Photographs by PAUL A. ZAHL

Text by DOUGLAS LEE

NATIONAL GEOGRAPHIC EDITORIAL STAFF

MAGNIFIED 30 TIMES



NATIONAL GEOGRAPHIC PHOTOGRAPHER STEVE RAYMER

CHANCE encounter in Wisconsin woods introduces hikers to *Physarum polycephalum* (left), which emerges from within a tree stump still in its bloblike guise. At this stage many slime molds are noticeable to the casual observer. Much of their life cycle is spent in total darkness in rotting wood or vegetation, where they feed on bacteria, spores, and other organic material. The gelatinous, near-fluid protoplasm spreads through crevices and porous areas, growing as it engulfs and digests food like a single giant amoeba. When temperature, moisture, light, acid balance, and food supply trigger it, the creature migrates to the surface of the log, bark, grass, or leaves that have housed and nourished it. Many species take the form of an advancing fan followed by veiny threads, as shown by *Physarum roseum* (top right). Even at this stage the entire slime mold is but a single cell, a mass containing many nuclei and other intracellular parts within a tougher envelope coated with slime. This unusual cell structure intrigues researchers probing the secrets of molecular genetics.



EX. RAY SIMONS



EX.



EX. RAY SIMONS



EX.

Then, miraculously, the unsightly mass gathers, rises in strange humps, and transforms itself into fruiting bodies of rare beauty. Sporangia of *Stemonitis axifera* (second from top), seen up close, resemble little sparklers. A *Stemonitis* displayed at the Chicago World's Fair in 1933 was billed as "Hair Growing on Wood—Believe It or Not." *Craterium leucocephalum* (second from bottom) can be found on leaves, both living and dead. *Lycogala epidendrum* (bottom) takes a larger, puffball form.

“WASP’S NEST,” as some call the *Metatrachia vesparium* (right), forms clusters with shiny caps that hold the lid on countless spores. When these dustlike spores are mature, the touch of an insect, the fall of a raindrop, or a breath of wind pops the brittle caps (below left). Bright orange fibrous matter called capillitium, which had held spores, spills out with them. The spores may float for miles on the wind or fall a few inches from their birthplace. When water touches them and temperatures are right, usually in spring and summer, the spores germinate (center), their cases splitting to release a living cell.

During their spore-bearing phase, slime molds behave much like fungi, and their most commonly used scientific classification, Myxomycetes, combines the Greek for “slime” and “mushrooms.” Zoologists and botanists, however, tug them back and forth. Some scientists use the term Mycetozoa, literally “mushroom animals,” because the cell that emerges from the spore and the plasmodium it becomes behave like denizens of the animal world.

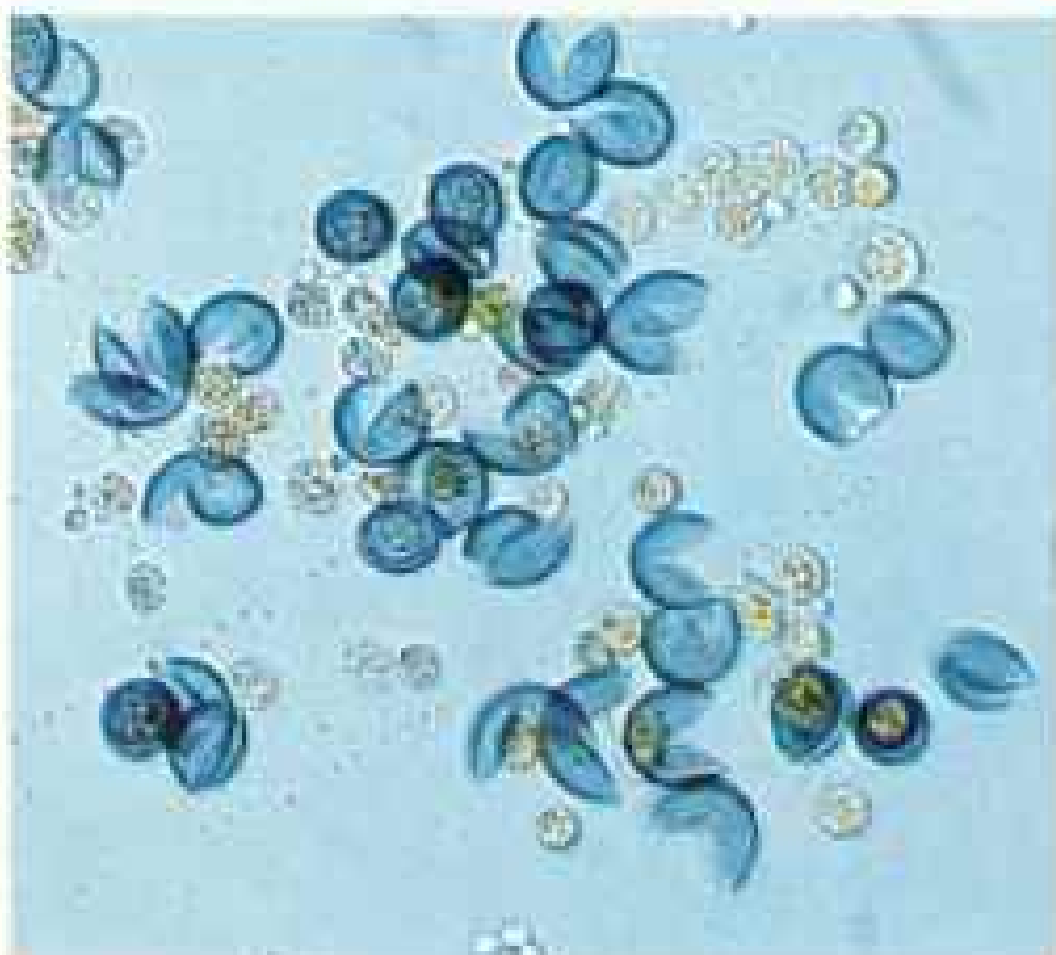
Each cell contains half the chromosomes necessary to reproduce. Each can assume an amorphous, creeping myxamoebic form or become a “swarmer,” equipped with flagella (far right) that propel it in search of food, darkness, and a cell of its own species and form containing a compatible package of chromosomes. When the two unite, plasmodium production begins as the slime mold starts to grow once again toward maturity and the fruiting stage.



2.33



71



858

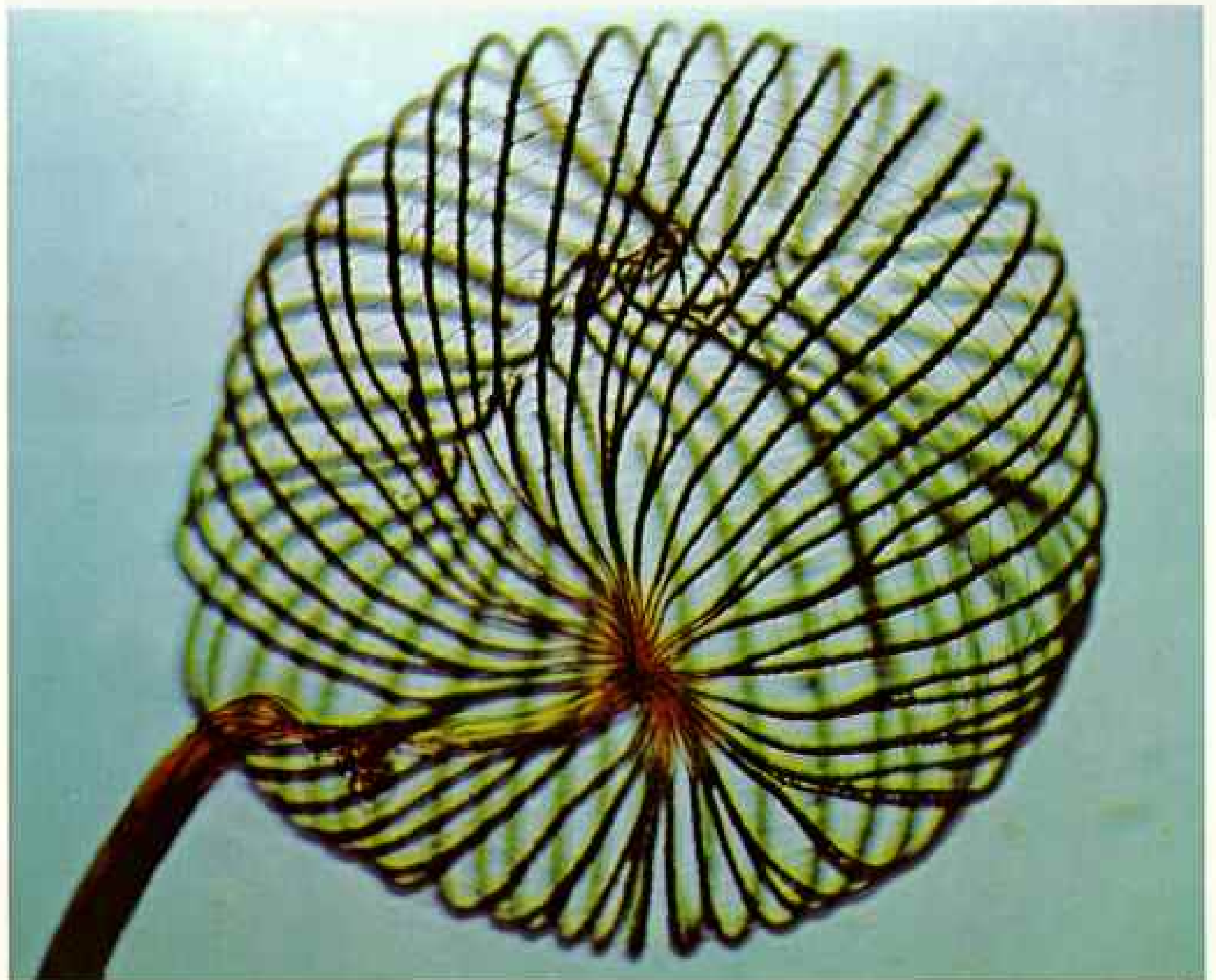


1798, WILLIAM R. WEST, CAROLINA BIOLOGICAL SUPPLY COMPANY



RIGHT UNDER our noses but rarely before our eyes, these diminutive changelings create fantasy shapes and landscapes in miniature. Fruiting bodies of *Didymium iridis* decorate a leaf (**left**), while the microscopic fretwork of a *Dictydium* sporangium (**below**) stands like an empty birdcage, its spores flown. Not all slime molds are as unobtrusive as these. In the rainy spring of 1973, specimens of *Fuligo septica*, among the largest of slime molds, made headlines in Dallas when one grew to a foot and a half in diameter in a suburban yard while another climbed a telephone pole.

But for the most part, Myxomycetes go about their business with little fanfare, despite their distribution over all the tropical and temperate world. Perhaps it is this very elusiveness, the evanescence of the transformation from slime-coated blob to fragile, flowerlike form, that accounts in part for the beauty of the beast. □



NATIONAL GEOGRAPHIC SOCIETY

WASHINGTON, D. C.

Organized "for the increase and diffusion of geographic knowledge"

GILBERT HOVEY GROSVENOR

Editor, 1899-1954; President, 1920-1954

Chairman of the Board, 1954-1966



THE NATIONAL GEOGRAPHIC SOCIETY is chartered in Washington, D. C., in accordance with the laws of the United States, as a nonprofit scientific and educational organization. Since 1890 the Society has supported more than 1,950 explorations and research projects, adding immeasurably to man's knowledge of earth, sea, and sky. It diffuses this knowledge through its monthly journal, NATIONAL GEOGRAPHIC; its books, globes, atlases, filmstrips, and educational films; National Geographic WORLD, a magazine for children age 8 and older; information services; technical reports; exhibits in Explorers Hall; and television.

GILBERT M. GROSVENOR, President

OWEN R. ANDERSON, Executive Vice President

HILLEARY F. HOSKINSON, Vice President and Treasurer

WILLIAM T. BELL, FREDERICK C. GALE, LEONARD J. GRANT,

JOSEPH B. HOGAN, ADRIAN L. LOFTIN, JR., LEWIS P. LOWE,

RAYMOND T. McELLIOTT, JR., Vice Presidents

EDWIN W. SNIDER, Secretary and Corporate Counsel

BOARD OF TRUSTEES

MELVIN M. PAYNE, Chairman of the Board

ROBERT E. DOYLE, Vice Chairman

LLOYD H. ELLIOTT, Vice Chairman

President, George Washington University

MELVILLE BELL GROSVENOR, Chairman Emeritus

THOMAS W. MCKNEW, Advisory Chairman

OWEN R. ANDERSON
Executive Vice President,
National Geographic Society

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

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

J. CARTER BROWN, Director,
National Gallery of Art

WARREN E. BURGER
Chief Justice of the United States

GEORGE M. ELSEY, President,
American Red Cross

GILBERT M. GROSVENOR
President, National
Geographic Society

ARTHUR B. HANSON, Attorney

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

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

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

MRS. LYNDON B. JOHNSON

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

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

LAURANCE S. ROCKEFELLER,
Chairman, Memorial Sloan-Kettering
Cancer Center

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

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

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

CONRAD L. WIRTH, Former
Director, National Park Service

Trustees Emeritus

CRAWFORD H. GREENEWALT

FREDERICK G. VOSBURGH

LOUIS B. WRIGHT

COMMITTEE FOR RESEARCH AND EXPLORATION

MELVIN M. PAYNE, Chairman

T. DALE STEWART, Vice Chairman

EDWIN W. SNIDER, Secretary

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

ASSISTANT VICE PRESIDENTS: James P. Kelly, Ward S. Phelps, Cletis Pride. **ASSISTANT TREASURER:** Alfred J. Hayre. **ASSISTANT SECRETARY:** Earl Corlies, Jr. **ASSISTANTS TO THE PRESIDENT:** Joyce W. Graves, Thomas E. Kulikosky, Richard E. Pearson.

ADMINISTRATIVE STAFF: Accounting: Dorothy L. Dameron, Jay H. Givans, Laura L. Leight, William G. McGhee, George E. Newstedt, David H. Peters. Administration: D. Evelyn Carnahan, Ruth E. Clark, Robert V. Koenig, Zbigniew Jan Lutyk, Marta M. Marschaiko, Myra A. McLellan, Ross L. Mulford, Shirley Neff, Jimmie D. Pridemore, Joyce S. Sanford, Karen F. Shrewsberry, Nell G. Snow, Janet C. Soper, Frank M. Twigger. Computer: James G. Schmelzer, William L. Chwening, Ronald C. Kline, Richard A. Mechler, Harold E. Smith. Educational Services: Wendy G. Bugers, Dean R. Gage, Carl W. Harmon, Jr. Employee Benefits: Howard R. Hudson, Explorers Hall: Peter Purpura. Membership Services: Margaret L. Bassford, Robert C. Dove, Erna T. Goetzinger, William T. McDowell, Paul B. Taylor, Dorothy M. Wagner, Margarita M. Wise, Peter F. Woods. Personnel: Thomas L. Hartman, M.D., Robert E. Howell, Glenn O. Pepperman, Shirley N. Wilson. Printing: Joe M. Barlett, Frank S. Oliverio, Margaret A. Sifer, Hans H. Wegner. Promotion: Charles T. Kneeland, Robert J. Warfel, Eileen W. Bowering, James R. Dimond, Jr., Robert L. Feige, Joseph S. Fowler, Thomas M. Kent, Mary A. Mattingly, Marian B. Platt, F. William Ruth, Towne Windsor. Purchasing: Robert G. Carey, Thomas L. Fletcher, Sheila H. Inman.

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

COPYRIGHT © 1981 National Geographic Society, 17th and M Sts., N.W., Washington, D. C. 20036. Second-class postage paid at Washington, D. C., and elsewhere. Cover design and title protected by U. S. and foreign trademark registrations. \$13.50 a year, \$1.70 a copy. **POSTMASTER:** Send address changes to National Geographic (ISSN 0027-9588), P. O. Box 2174, Washington, D. C. 20013.

MELVIN M. PAYNE, Chairman of the Board
MELVILLE BELL GROSVENOR, Editor Emeritus

NATIONAL GEOGRAPHIC MAGAZINE

GILBERT M. GROSVENOR, President

WILBUR E. GARRETT, Editor

JOSEPH JUDGE, Associate Editor

SENIOR ASSISTANT EDITORS

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

TEXT

ASSISTANT EDITORS: Rowe Findley, Bart McDowell, Elizabeth A. Moize, Meric Severy

SENIOR WRITERS: Thomas J. Abercrombie, David S. Boyer, Thomas Y. Carby, Mike Edwards, William S. Ellis, Rick Gore, Noel Grove, John J. Harman, Peter T. White

SENIOR EDITORIAL STAFF: Harvey Arden, Robert Booth, Kent Britz, John L. Elliot, Boyd Gibbons, Alice J. Hall, Bryan Hodgson, David Jeffery, Michael E. Long, Ethel A. Starbird, Paul J. Vealind, Gordon Young

EDITORIAL STAFF: Allen A. Borstein, Larry Kohl, Douglas Lee, John L. McIntosh, Cathy Newman, Cliff Tarpy

RESEARCH: Frances H. Myers (Associate Chief); *Research-Editors:* Susan L. Anderson, Judith Brown, Lesley B. Rogers, Michaeline A. Sweeney, *Researchers:* Carolyn H. Anderson, Julia A. Gamble, Ann B. Henry, Jan Holderness, Patricia B. Kellogg, Kathy B. Maher, Barbara W. McConnell, Jean B. McConville, Jeanne E. Peters, Frances W. Shaffer, *Geographic Information:* Betty Joan Goss, *Legends:* Abigail A. Tipton

ILLUSTRATIONS

PHOTOGRAPHERS: Dean Canger, Joseph J. Scherschel (Assistant Directors); James L. Ames, Joseph H. Bailey, James P. Blair, Victor R. Borwell, Jr., Jodi Cobb, Bruce Dale, Gordon W. Gahan, David Alan Harvey, Otis Imboden, Emory Kristof, Joseph D. Laramburg, Bianca Laves, Bates Littlehales, Robert W. Madden, George F. Mobley, Robert S. Oakes, Steve Raymer, Robert F. Steiner (Natural Science); James L. Stanfield, Willem Wentzel (Archives); Administration: Claude E. Petrone, Susan A. Smith

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

LAYOUT: Constance H. Philips

ART: William N. Palmstrom, J. Robert Terjago (Associate Directors); Walter Q. Crowe, John D. Garst, Jr. (Assistant Directors); Elle Sribhan (Production); Artists: Lisa Biganzoli, William H. Bond, John W. Lohers, Ned M. Seidler, *Map Editors:* John T. Blozis, Gary Platt, *Research:* Virginia L. Bova, Harold A. Hanson (Supervisors); Ross M. Emerson, Margaret Deane Gray, Dorothy A. Nicholson, *Map Artists:* Isaac Ortiz, Leo B. Zebarth (Supervisors); Iskandar Baday, Peter J. Balch, Snajinka Stefanoff, Alfred L. Zebarth

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

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

CARTOGRAPHY

John F. Stupe (Associate Chief); Ted Daughters, Richard K. Rogers (Assistant Chiefs); John F. Dorr (Art Director); Margery K. Baridull, Charles F. Case, Henri A. Delanghe, Rosal G. Fritz, Martin J. Golden, Charles W. Gotthardt, Jr., Thomas L. Gray, Catherine M. Hart, Karen P. Jacoby, Harry D. Kaufman, Mary C. Latham, Mary Anne McAleer, Charles L. Miller, Roland R. Nichols, Robert W. Northrop, Charles L. Stern, Douglas A. Strobel, Tibor G. Toth, Thomas A. Wall, Thomas A. Walsh, Elizabeth Wolf, Susan Young

EDITORIAL SERVICES

ADMINISTRATION: M. Jean Vile (Asst. to the Editor); Elaine Rice Ames, Marie L. Barnes, G. Merrill Child, Neva M. Collins, Lillian Davidson, Virginia H. Fittingan, Eleanor W. Habne, Mary F. Klemann, Lucille L. McInerney, Patricia M. Gukes, Barbara A. Shattuck, *Correspondence:* Carolyn F. Clewell, Owen Dolyn C. Blackman, *Indexing:* Juliette M. Blozis, *Travel:* Virginia A. Bachant

LIBRARIES: *Publications:* Virginia Carter Hills (Librarian); Patricia Murphy Smith, Susan M. Pifer, Carolyn Locke, Louise A. Robinson, Maria Strada, *Illustrations:* L. Fern Dame, Carolyn J. Harrison, M. Scott Bolden, *Records:* Lore Northrop, Mary Anne McMillen, Marguerite S. Northwood, Marlene M. Smith, *Film:* Betty G. Kocher

NEWS SERVICE: Paul Sampson (Chief); Donald J. Frederick, Ellen E. Kohlberg, Barbara S. Moffer, William J. O'Neill, Robert C. Radcliffe

PHOTOGRAPHIC LABORATORIES AND TYPESETTING: Carl M. Strader (Chief); Milton A. Ford (Associate Chief); Lawrence F. Ludwig (Assistant Chief); Herbert Ahemus, Jr., Billy E. Barnett, Richard A. Bredbeck, David H. Christman, Ellwood M. Kohler, Jr., Geoffrey T. McConnell, Arietta M. Malinart, William S. Petrini, Bernard G. Quattrick, Joan S. Simms, James H. Trott, Alfred M. Yee

RELATED EDUCATIONAL SERVICES OF THE SOCIETY

ROBERT L. BREEDEN, Vice President

SENIOR ASSISTANT EDITORS: Donald J. Crump, *Special Publications and School Services:* Charles O. Hyman, *Book Service*

BOOK SERVICE: Kenneth C. Danforth (Assistant Director); Thomas B. Allen, Ross Bennett, Mary H. Dickinson, Karen F. Edwards, Robert C. Firestone, Anne Dirkes Kober, J. Edward Lanouette, Carol Bittig Lutyk, Linda B. Meyer-rieks, David F. Robinson, Shirley Scott, David M. Seager, Margaret Soborn, Verla Lee Smith, George E. Stuart, Anne E. Withers

SPECIAL PUBLICATIONS AND SCHOOL SERVICES: Philip B. Slocott (Associate Chief); William L. Allen, Jody Bolt, Tom Eugene, Seymour L. Plathlein, Ron Fisher, Patricia F. Frakes, William R. Gmy, Barbara Grazzini, Sallie M. Greenwood, Mary Ann Harell, Suzanne J. Jacobson, Bonnie S. Lawrence, Christine E. Lee, Geraldine Linder, Tee Loftin, Louisa V. Magnum, Tom Mellam, Robert Messer, H. Robert Morrison, Rita D. Murshed, Thomas J. O'Neill, Thomas B. Powell III, Cynthia Ramsay, Kathleen F. Teter, Jennifer C. Urquhart, George V. White, Merrill Windsor, *National Geographic WORLD:* Ralph Gray (Editor); Pat Holland, Ellen Ann Hurst, Margaret McKelway, Pat Robbins, Eleanor Shannahan, Veronica Smith, Ursula Perrin Vosseler, *Educational Media:* George Peterson (Editor); Jamie Abercrombie, James B. Caffrey, Margery G. Dunn, Jacqueline Geschickter, Jane R. McCauley, Judith E. Binard

TELEVISION AND FILMS: Dennis B. Kane (Chief); Sidney Platt (Manager, Educational Films); Donald M. Cooper, Anne B. K. Krumbhaar, Georgos N. Lamplithakis, Louise C. Millikan, Marjorie M. Mooney, Patricia F. Northrop, Nola L. Shrewsberry, Carl E. Zerbe

AUDIOVISUAL: Joanne M. Hess (Chief); Jon H. Larimore (Technical Director); Ronald S. Ahemus, Robert G. Fleegal, Mary W. McKinney, Gerald L. Wiley

The American Goldfinch

by Peter Barrett

For the first time—
the internationally renowned
wildlife artist creates
an original sculptured bell.

Intricate sculpture in fine,
hand-painted porcelain...
at the very attractive price of \$60.

Hand-decorated with pure 24 karat gold.
Sculptured life size / Hand-painted
Limited edition

'The American Goldfinch' reflects all the beauty of two great traditions. Combining the intricacy of a hand-painted porcelain sculpture... and the liting magic of an exquisite bell... to capture that miracle of nature known as a songbird.

Artist *Peter Barrett* has won international acclaim for his work—from the time of his first exhibition in London's famed Royal Academy to his recent commissions from the Royal Society for the Protection of Birds. Now, in his first sculptured bell, he has re-created nature's own richness of detail.

Here, a splendid little Goldfinch cocks his head to investigate a cluster of wild thistles. The individual barbs of his gold and black feathers—even the tiny joints of each leg and foot—are portrayed with exacting precision. Each thistle is a wonder in itself, with every one of its needle-sharp quills superbly captured. And the graceful bell of snow-white bisque porcelain is embellished with *pure 24 karat gold*.

Both Goldfinch and setting are sculptured *life size*. Each sculptured bell will be individually handcrafted and hand-painted by Franklin Porcelain in Japan—home of many of the world's most gifted porcelain craftsmen. Importantly for collectors, this is Franklin Porcelain's *first* sculptured bell—and the first in a series portraying songbirds of the world.

'The American Goldfinch' will be issued in a single, firmly limited edition. A restriction of just *one* 'Goldfinch' bell per person will be enforced, and the total edition will be limited forever to the exact number of individuals who order the songbird bells by the close of the issuing year—1981. Then, to ensure the edition remains permanently closed, the porcelain molds will be *broken*.

To endow your home with a work of singular beauty... and acquire a future heirloom for your family... you need only return the application on this page. Please note the expiration date it bears—*July 31, 1981*. To be valid, it must be received with a postmark no later than July 31, 1981.



Bell shown smaller than actual 5" size.

© 1981 P.P.

RESERVATION APPLICATION

THE AMERICAN GOLDFINCH

Valid only if postmarked by July 31, 1981.

Limit: One per collector.

Franklin Porcelain
Franklin Center, Pennsylvania 19091

Please accept my reservation for *'The American Goldfinch'* by Peter Barrett. This original sculptured bell will be handcrafted for me in the finest hand-painted porcelain.

I understand that I need send no money at this time. I will be billed in three equal monthly installments of \$20,* plus \$1. for shipping and handling, with the first payment due before the work is sent to me.

*Plus one state sales tax

Signature _____

ALL APPLICATIONS ARE SUBJECT TO ACCEPTANCE

Mr./Mrs./Ms. _____

PLEASE PRINT CLEARLY

Address _____

City, State, Zip _____

Canadian residents will be billed \$C30, plus \$C3, shipping and handling in four equal monthly installments of \$C20.75 each.



Welcomed
from the Grand Canyon
to the Grand Canal.



Wherever you're going, it's good to know your BankAmerica Travelers Cheques are welcome in over 150 countries around the world. That's why we call them World Money.[®] And if your



cheques are lost or stolen, it's also good to know you can get refund service at more than 40,000 locations both here and abroad.

BA CREDIT CORPORATION 
A BANCORP COMPANY

BankAmerica Travelers Cheques
They make you feel good all over.



An inside look at strategic Oman



LYNN ABERCROMBIE (TOP); THOMAS J. ABERCROMBIE

RUGGED and remote, Oman stands sentinel on the toe of the Arabian Peninsula at the strategic passage from the Persian Gulf. To learn how life is changing in this oil-rich sultanate—still chary of foreigners—NATIONAL GEOGRAPHIC author and photographer Thomas J. Abercrombie (above) visited mountains, deserts, and oases. His wife, Lynn (left, with camera), tries on a masklike veil in Sharbatat, by the Arabian Sea, where Bedouin women await the visit of a flying doctor.

Your friends can receive such firsthand reports too; nominate them for membership below.

18-MONTH NATIONAL GEOGRAPHIC SOCIETY MEMBERSHIP

JULY 1981 THROUGH DECEMBER 1982

EIGHTEEN-MONTH DUES in the United States and throughout the world are \$19.25 U. S. funds or equivalent. To compensate for additional postage and handling for mailing the magazine outside the U.S.A. and its outlying areas, please remit: for Canada \$27.50 Canadian or \$22.80 U. S. funds; for all other countries \$30.70 if paid in U. S. currency by U. S. bank draft or international money order. Upon expiration of the 18-month term, memberships are renewable annually on a calendar-year basis. Eighteen-month membership starts with the July 1981 issue. Eighty percent of dues is designated for subscription to the magazine.

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

**CHECK
BELOW**

I WISH TO JOIN the NATIONAL GEOGRAPHIC SOCIETY and enclose my dues of \$_____

(FILL IN YOUR NAME AND ADDRESS BELOW.)

ENTER A GIFT MEMBERSHIP for the person named at left. I enclose \$_____
membership dues.

Send gift card signed: _____

NOMINATION ONLY: Check here if you want us to send membership information only (not a gift) to the person named at left. Use separate sheet for additional nominees or gifts.

**NEW
MEMBER**

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

STREET

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

**MY
NAME**

PLEASE PRINT (MR., MRS., MISS, MS.)

STREET

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

00781

On behalf of the Westminster Collectors Society
readers of National Geographic are invited to acquire

The Royal Wedding

a magnificent Collection of truly valuable First Day Covers

First Day Covers shown smaller than
actual size of 4½ by 8½ inches.



More than fifty nations will issue magnificent stamps in tribute to The Royal Wedding. Their First Editions will be officially certified by the one-day-only postmark at the city of issue, your assurance the collection can never be duplicated.

Each First Day Cover will feature a bouquet of blossoms native to the issuing nation, created by two of Great Britain's gold-medalist floral artists.

The Cipher interweaves Charles' and Diana's initials in a regal design. It was created by British artist Jeffery Matthews.



THE WESTMINSTER
COLLECTORS
SOCIETY

Available by Advance Subscription Only
Subscription rolls will close forever on July 29, 1981

Focus of faith, witness to the march of history, the great cathedral of St. Paul in London is a living symbol of the greatness of Britain. On July 29, 1981, the eyes of the entire world — including the Commonwealth of Nations on which the sun never sets — will be focused on this site for the historic wedding of Charles, Prince of Wales, and the Lady Diana Spencer, descendant of King Charles II.

Nearly fifteen centuries and fifty-four generations separate the Royal Couple from England's first monarchs. Yet, on their wedding day, Prince Charles and his bride, like every Royal Couple before them, will forge a new link in the continuity of the Throne.

There may not be another event of this grandeur for generations. Surely, *The Royal Wedding* is an occasion

which you, your children, even your grandchildren will want to remember always.

A PHILATELIC CELEBRATION OF THE ROYAL WEDDING

In honor of the wedding of Britain's future monarch and his future queen, more than fifty members of the Commonwealth will join together to preserve the pageantry and tradition of the grand celebration in an international series of stamps.

From elegant floral bouquets . . . to royal yachts and portraits of the entire Royal Family . . . the panorama of stamps will honor *The Royal Wedding* with topics as historic as the Commonwealth countries themselves.

Of special interest, many of these beautiful stamps are being issued in their country's highest stamp values, making the total collection a significant philatelic tribute to *The Royal Wedding* and one of genuine value.



AVAILABLE TO YOU, ELEGANT FIRST EDITIONS

The unprecedented nature of this tribute to *The Royal Wedding* makes your opportunity to acquire *first editions* of these stamps extremely significant. For the first editions — the First Day Covers — will be only a small fraction of the total number of stamps sold.

Moreover, First Day Covers of the individual stamps marking *The Royal Wedding* will be available *only* on the exact day the stamps are first issued and never again. In many countries, the First Day of Issue will be July 29, 1981, the precise day of *The Royal Wedding*.

The Royal Wedding stamps will be issued by the Westminster Collectors Society, in one complete collection of more than fifty First Day Covers. Established under the auspices of Fleetwood, America's oldest purveyor of First Day Covers, the Westminster Collectors Society encourages a greater appreciation of British and Commonwealth culture.

To prepare for a collection of this importance, three noted artists have been steadily at work since 1979. Each First Day Cover will bear a *Cipher* of Charles' and Diana's initials interwoven in an elegant design and the issuing country's name hand lettered in beautiful calligraphy by British artist Jeffery Matthews.

Matthews' artistry is especially favored by the Royal Family. He is, indeed, well known in Britain and throughout the world for distinctive stamp designs he created for *The Royal Wedding of Princess Anne*, *The Queen Mother's Birthday* — and stamps, Official Souvenir Booklet and First Day Covers he created for the historic *Queen's Silver Jubilee*.

In addition to Matthews' beautiful contributions to *The Royal Wedding* collection, the First Editions will bear original works of art created exclusively for the collection by stamp designers and gold-medalists Kristin Rosenberg and Leonora Box, two of Great Britain's best-loved artists.

Each of the works for *The Royal Wedding* collection will depict a lovely floral bouquet of blossoms native to the stamp-issuing nation, tied with flowing ribbons in the country's national colors.

AN EXCELLENT VALUE

The Royal Wedding collection will be issued solely for subscribers, and the total number of collections will be

forever limited to the exact number of original subscriptions postmarked not later than July 29, 1981 . . . the very day the world will witness Charles' and Diana's wedding vows.

Each subscriber will receive the First Day Covers of *The Royal Wedding* at the convenient rate of three per month, beginning in September, 1981. The modest issue price of only \$19.50 per month will be guaranteed for the entire collection. *In view of the high denomination of the stamps, the elegant designs by artist Jeffery Matthews, and the beautiful art by Kristin Rosenberg and Leonora Box, this is an excellent value.*

Past British First Day Cover collections honoring events of this magnitude have sold out rapidly. And, after July 29, 1981, *The Royal Wedding* collection will never be available again except from those fortunate collectors who acquired it at the time of issue.

Moreover, as a convenience, collectors need only pay for the first month's shipment now, or charge it to their credit card account.

Collectors who acquire *The Royal Wedding* collection will also receive, without additional cost, a lavishly bound Collector's Album.

WORLDWIDE DEADLINE: JULY 29, 1981

As a reader of *National Geographic* you have a special opportunity to acquire *The Royal Wedding* First Day Cover collection. To take advantage of this opportunity, you must postmark your Subscription Application no later than July 29, 1981, and mail it directly to Fleetwood, One Unicover Center, Cheyenne, Wyoming 82008-0001, under whose auspices the Westminster Collectors Society was established.

©1981 Fleetwood

ADVANCE SUBSCRIPTION APPLICATION

The Royal Wedding

First Day Cover Collection

All applications must be postmarked by July 29, 1981, the final worldwide deadline

Fleetwood
Cheyenne, Wyoming 82008-0001 C3

Please accept my subscription for *The Royal Wedding* First Day Cover collection which will consist of approximately 57 Covers to be sent to me at the rate of three per month beginning in September, 1981. The total price of \$19.50 per month is guaranteed for the entire Collection. A handsome Collector's Album will be sent at no additional cost.

I prefer to pay as follows:

- I enclose \$19.50 for the first month's shipment. I will be billed for future shipments as made.
- Please charge \$19.50 for the first shipment and each subsequent shipment as it is made to my:
- | | |
|-------------------------------------|---|
| <input type="checkbox"/> MasterCard | <input type="checkbox"/> American Express |
| <input type="checkbox"/> Visa | <input type="checkbox"/> Diners Club |

Card Number _____

Expires _____

Signature _____

All applications must be signed and are subject to acceptance by Fleetwood.

Mr. _____
Mrs. _____
Miss _____

Please print clearly

Address _____

City _____ State _____ Zip _____

The Westminster Collectors Society was established under the auspices of Fleetwood, America's foremost purveyor of First Day Covers since 1929. Fleetwood is a division of Unicover Corporation.

Your collection will include a custom-made Album to protect and display your Covers. It is yours at no additional cost.



INTRODUCING DODGE MINI RAM. MORE MILEAGE, RANGE AND SEATS THAN VW VANAGON FOR THOUSANDS LESS.



Who moves more people than VW for less money? It's Ram Tough Dodge's new Mini Ram Wagon.

Compare Dodge Mini Ram 250 to VW Vanagon — passenger seating, mileage, fuel capacity and range, horsepower and rear loading area. Mini Ram gives you more.

Then compare factory-installed options like power steering and your choice of 6 sound systems: all available in Mini Ram. Not in Vanagon.

Now compare price. Mini Ram costs \$2,553 less than Vanagon. For panel-side van buyers, there's a Dodge Van with the same performance, efficiency and interior

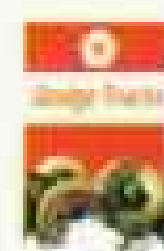
Here's how Mini Ram beats Vanagon

	Dodge Mini Ram Wagon 250	VW Vanagon
Sticker Price (MSRP) at base	\$8,137.00*	\$10,690.00*
EPA EST. MPG	18 MPG**	17 MPG**
Horsepower	96	67
Passenger Seating	8	7
Overall Length	178.9"	179.9"
Wheelbase	106.6"	91.8"
Fuel Capacity	16 gal.	15.9 gal.
EPA Est. Range	648 miles**	270 miles**
Side Door Width	49"	42"
Removable Rear Seat	Yes	No
Factory-Installed Air Conditioning	Option	Not Available
Power Steering	Option	Not Available
Color-Keyed Carpeting	Standard	\$410 with int. pkg.

dimensions as Mini Ram Wagon at a price VW hasn't seen in years: just \$6,418.*

Underneath it all, Mini Ram is a Ram Tough Dodge Wagon. With the best rust protection of all wagons. There's 100% electrocoating, plus 370 sq. ft. of galvanized steel in critical areas... compared to VW's 4 sq. ft.

New Dodge Mini Ram Wagon. It does more than VW Vanagon and it does it for less. As a pure people mover, it just might be the best buy on the road today.



DODGE
TRUCKS ARE
RAM TOUGH

*Sticker price comparison, excluding title, taxes and destination charge. Unadjusted for different levels of standard equipment. Two-tone paint and whitewall tires \$340 extra.

**Use these numbers for comparison. Your mileage and range may differ depending on speed, distance and weather. Calif. est. lower.

NOW WE KNOW WHAT IT'S LIKE TO BE ALONE.

It wasn't always this way. It used to be hard to decide among all the 35mm SLR's. Then we created the new Minolta XG-M. A camera so extraordinary it stands alone in its class. With an unrivaled combination of creative features.

First, it's automatic. So it's easy to get sharp, clear pictures. You just point, focus, and shoot. It even has electronic features that keep you from making mistakes.

As your skills advance, you'll appreciate advanced features like metered manual and exposure override for full creative control.

To further separate ourselves from the competition, we built in the option of professional motor-drive. Something normally found only on more expensive cameras.

It lets you shoot a blazing 3.5 frames per second. So you can catch a baseball as it comes off the bat. Or halt a horse leaping a hurdle.

But to fully grasp the XG-M's advanced design, you have to hold it.

The body feels rugged yet light. With a built-in textured grip that's sculpted to fit snugly in your hand. And oversized controls that make it easy to adjust to changing conditions.

As your creative potential develops, you'll have access to over 45 interchangeable, computer-designed Minolta lenses. As well as the Minolta system of SLR accessories.

All in all, the XG-M is a remarkable achievement. But then, we have over 50 years of remarkable achievements to draw on.

The new Minolta XG-M. Now we know how it feels to be alone.

But we're not complaining.

**WAIT 'TIL YOU SEE
HOW GOOD YOU CAN BE.**



MINOLTA

For more information, write Minolta Corporation,
101 Williams Drive, Ramsey, N.J. 07866.
Or see your Minolta dealer. In Canada: Minolta, Ontario, L4W 1A4.
Product appearance and/or specifications are subject to change without notice.
©1981 Minolta Corporation.

You can count on Sears to make sure it will do the job

"Will those paints stand up to the weather?" is one of thousands of questions about thousands of products that the Sears Laboratory answers every year. Founded in 1911, it is among America's biggest and oldest labs devoted to testing consumer products.

In our photograph you see a few of some 20,000 paint panels taking a beating from Florida weather at Sears laboratory in Fort Myers.

Which paint best resists mildew in the humid Florida climate? Which fades the least under the scorching Florida sun?

No new paint appears on the shelves at Sears until the lab has tested formula after formula—sometimes for as long as *five years*.

All this is on top of extensive testing conducted in the north, by the manufacturer, under Sears watchful eye.

Every day, Sears electrical, chemical, and mechanical engi-

neers turn dozens of products upside down and inside out. Sears laboratories in Chicago and Fort Myers test over *ten thousand* products a year.

There are tests for color fastness, shrinkage, durability, flame resistance. Tests for convenience. Tests for performance.

It's all part of Sears commitment to offering you consistently good values. For over 50 years Sears has made this promise:

*Satisfaction guaranteed
or your money back*

Thanks in large part to the work of Sears laboratories, many millions of people have been completely satisfied shopping at Sears.

Sears

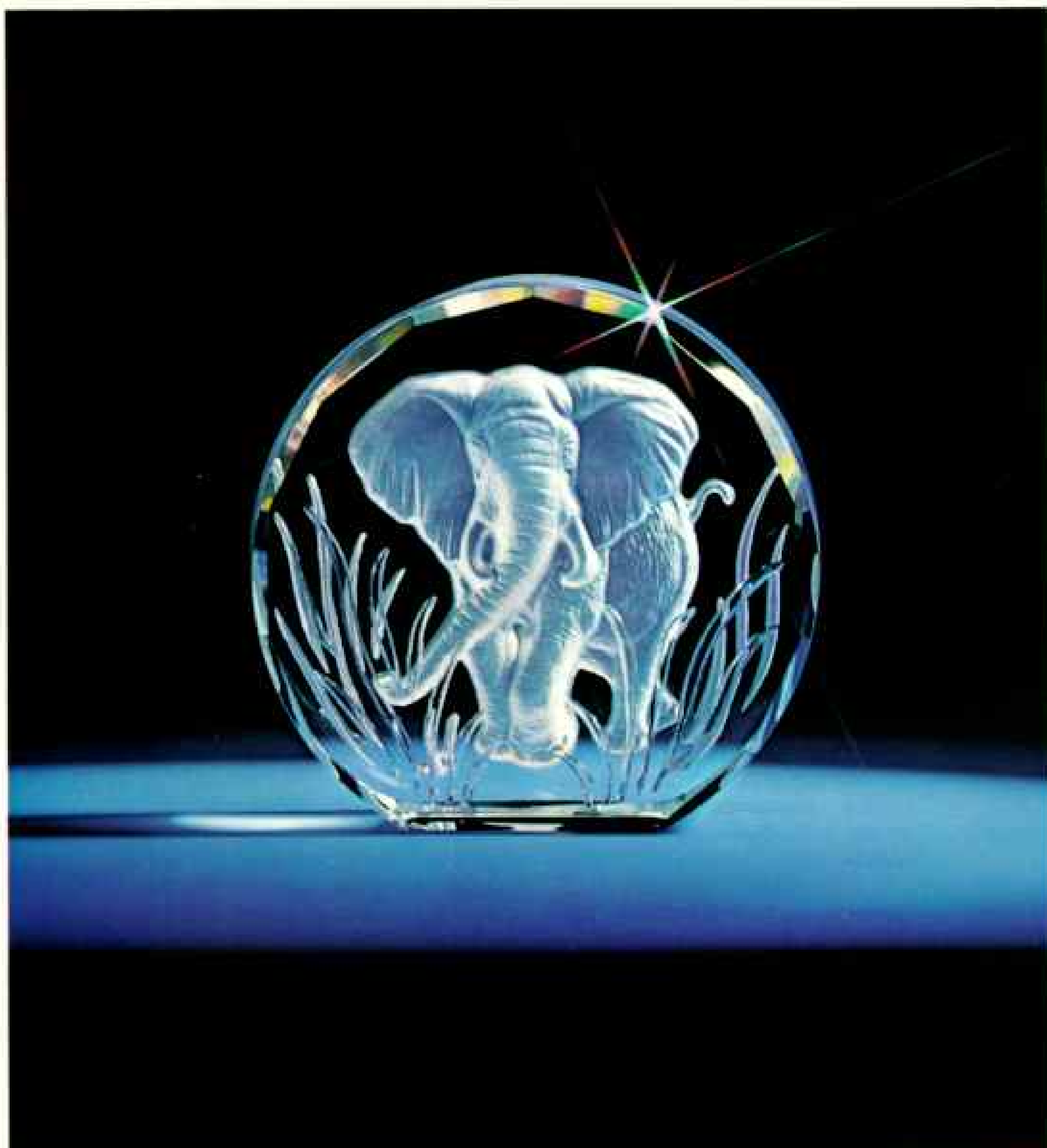
© Sears, Roebuck and Co. 1991

At the Sears laboratory in Fort Myers, a technician checks the effects of Florida sun and humidity on samples of potential Sears paints.

Announcing....

Wildlife Sculptures in Crystal

A limited edition collection
of 12 museum quality crystals
portraying wildlife from around the world.



Crystal above shown actual size.

No substance on earth can rival the beauty and elegance of sculptured, faceted crystal. This exquisite artistic medium combines the brilliance and flawless clarity of crystal... the delicate faceting of priceless jewelry... and the three-dimensional artistry of sculpture. It is rare to find handcrafted crystal sculptures of genuine museum quality. Rarer still is a privately commissioned collection of such sculptures, each sharing a unified theme and designed by the same master sculptor. You can now obtain such a collection, but only briefly. The Danbury Mint is proud to announce *Wildlife Sculptures in Crystal*.

Twelve Museum Quality Reproductions Depicting Wildlife from Around the World

The collection will consist of twelve crystal sculptures, comprising a magnificent "glass menagerie" of wildlife from around the world -- each depicted in a vivid, dramatic scene in its native habitat.

Because this is the first such collection ever offered by the Danbury Mint, it will forever enjoy a special status. No effort or expense has been spared to make each crystal work of art part of one of the most memorable crystal collections ever created.

Finest Imported Pure Lead Crystal

Each crystal will be individually handcrafted and shaped by the master crystal makers of West Germany. The outer rim will be gracefully faceted, much in the manner of a precious jewel. This faceting adds significantly to the crystal's elegance, beauty and value.

The intricate design of each creature will be painstakingly formed in three-dimensional relief into the center of the crystal. The crystals will also feature fine details on both the front and back surfaces to portray the animal as it lives in the wild. These details will enhance the three-dimensional effect and create a veritable "light show" of shimmering reflections when the crystal is held to the light.

Original Works of Art

These twelve wildlife sculptures are exclusively commissioned works of art by the noted sculptor, Alfredo Marino. Marino enjoys a worldwide reputation as one of America's foremost contemporary sculptors. He took his formal training at the Academy of Fine Arts in Florence, Italy, a center of Renaissance sculpture.

Strictly Limited Edition

The *Wildlife Sculptures in Crystal* will be available only from the Danbury Mint and only by advance reservation. The size of the U.S. edition will be forever limited to the exact number of collections reserved by the final deadline, September 30, 1981.



Convenient Acquisition—Satisfaction Guaranteed

To reserve your *Wildlife Sculptures in Crystal*, simply complete the attached reservation application. There is no need to send payment now. Your twelve crystals will be issued to you at the rate of one every two months. You will thus be billed for each of your crystals at convenient two-month intervals.

If you receive any crystal you are not completely delighted with for any reason, you may return it upon receipt for replacement or refund. And, of course, you may cancel your subscription at any time.

You Must Act Promptly

Considering that this is the first collection of its kind ever offered by the Danbury Mint, this is truly an exceptional collecting opportunity if ever there was one. Don't let it pass you by. Mail your reservation application today.

Wildlife Sculptures in Crystal G46

The Danbury Mint
47 Richards Avenue
Norwalk, Conn. 06856

Must be
postmarked by
September 30, 1981.

Please accept my reservation to the *Wildlife Sculptures in Crystal*. I understand this is a collection of 12 museum quality crystal works of art portraying wildlife from around the world. The collection will be issued at the rate of one crystal every two months at a cost of \$27.50 per crystal (plus \$1.50 postage and handling).

I understand I need send no money now. I will pay for each crystal as billed at two-month intervals. Any crystal I am not completely satisfied with may be returned upon receipt for replacement or refund, and this subscription agreement may be cancelled by either party at any time.

Name _____

Address _____

City _____

State, Zip _____

Check here if you want each crystal charged, as it is shipped to you:

Master Charge VISA

Credit Card No. _____ Expiration Date _____

Signature _____

Allow 8 to 12 weeks after payment for initial shipment.



Shown are four of the crystals as you might display them in your home.

"My Maytag Washer has been so great, I got a Maytag Dryer and Dishwasher, too," states Mrs. Whitehead.

Now going on 12, it still washes two loads a day, six days a week.

"I'm hoping we'll enjoy as many happy years with our Maytag Dishwasher as we have with our other Maytags," says Mrs. Nancy Whitehead, Oak Ridge, N.J.

"Our Maytag Washer was a housewarming gift from my parents in July of 1969," she continues. "This machine has been doing approximately two loads a day, six days a week, ever since. It has also washed diapers for two babies."



Mrs. Whitehead got her Maytag Dishwasher in 1979. "It's a pleasure to use, and it does a marvelous job of getting my dishes clean," she states.



Susan, 7; Jimmy, 10; James and Nancy Whitehead

As hard as that washer has been working all these years, the repairman is still practically a stranger, according to Mrs. Whitehead. That's because Maytag Washers are built to last longer and save you money with fewer repairs.

"Later we purchased a Maytag Dryer," she states, and it has also proved to be a faithful workhorse. "Since our other Maytags have given us such great service, we natu-

rally turned to Maytag for a dishwasher in 1979. I am delighted with my Maytag Dishwasher and hope to enjoy it a long time," concludes Mrs. Whitehead.

Naturally, we don't say all Maytags will equal that record. But long life with few repairs is what we try to build into every Maytag product. See our washers, dryers, dishwashers, and disposers.



MAYTAG

THE DEPENDABILITY PEOPLE

The Maytag Company, Newton, Iowa 50208



MORE MILES PER GALLON. MORE YEARS PER CAR.

Today most everyone wants a high-mileage car.

But sometimes the car that goes further on a gallon also goes faster to a trade-in. Not the Datsun 210. It offers you the mileage you're counting on and the longevity you're dreaming of.

It guards against rattles with a body that's fused into one solid piece by thousands of welds, not held together by nuts and bolts. You know how fast rattles can shake you of that new-car feeling.

It's protected against rust with panels of galvanized steel, coatings of zinc, yards of sealers and treatments of anti-chipping compound. You know how fast rust can dim your new-car glow.

36 **47** **MPG**
EPA EST. HWY EST.

* Extra life is built into the engine by a massive five-main-bearing crankshaft. It's an engine that has satisfied drivers for almost 400 billion miles. Inside there are rich, roomy seats. Big, readable instruments. Stalk controls. Electric rear-window defroster. And a level of workmanship you'd be proud to call your own. See for yourself at your Datsun dealer.

From the Nissan Motor Co., Ltd., world-wide leader in automotive excellence.



DATSUN 210 MPG

* Standard 5-speed with MPG 1.4-liter engine, not available in California, where the best EPA estimate is 31 MPG, 44 estimated highway for a 210 5-speed. EPA estimates are for comparison. Actual mileage may differ depending on speed, distance and weather. Highway mileage will probably be less.

DATSUN WE ARE DRIVEN





• Przewalski's horses photographed by Mike Price.



Wildlife as Canon sees it: A photographic heritage for all generations.

When a work of creation is gone, there is no way to bring it back.

We can never bring back the bluebuck or any of those birds and animals that have vanished forever from the face of the earth.

The Przewalski's horse, a wild horse discovered in the Gobi Desert in the previous century, is in danger of going the way the last bluebuck went. It lives under the spectre of total extinction.

Should it vanish forever, it would be very sad indeed. But sadder still would it be, were we to

be left with no records of it at all.

And that's where Canon comes in. With Canon, the Przewalski's horse and all of wildlife can be recorded for posterity.

It would be a photographic heritage worthy to be handed down from generation to generation.



F-1 with FD 300mm 1/2.8L

Przewalski's Horse.

Genus: Equus
Species: przewalskii
Adult size: 1.2–1.5m up to shoulder, 2.2–2.8m long (approx. 1m long tail)
Adult weight: 200–300kg
Habitat: Steppes around the Gobi Desert
Surviving number: 254 (1976 estimate)

Canon
 Images for all time



Presenting the 1981½ Toyota Corolla Sports Hardtop. A totally new kind of Corolla from the roof down.

Fresh, crisp, contemporary lines. Distinctively subtle, yet the very latest in sporty good looks. The hardtop design gives you a wide-open, airy feeling. The spacious trunk allows you to lock valuables out of sight. And the roomy interior is loaded with the kinds of standard equipment you'd expect

to pay extra for on most other cars.

But best of all, beneath that beautiful, sporty exterior, the Sports Hardtop is all Corolla. And it acts like one. It's incredibly dependable. Totally economical. And extremely thrifty.

With Corolla's 1.8 liter 4-cylinder engine and 5-speed overdrive transmission, the Sports Hardtop is rated at 39 EPA EST. HWY. MPG, (28) EPA EST. MPG. Remember: Compare this

estimate to the EPA "Estimated MPG" of other cars with manual transmission. You may get different mileage, depending on how fast you drive, weather conditions and trip length. Actual highway mileage will probably be less than the EPA "Highway Estimate."

The 1981½ Toyota Corolla Sports Hardtop. It's a whole new sport that's hard to top.

INTRODUCING THE COROLLA SPORTS HARDTOP. A WHOLE NEW SPORT.





ANNOUNCING  BY CADILLAC
Cimarron

Quick-handling. Road-hugging. And fun to drive. This . . . is Cimarron. An efficient new kind of Cadillac. With the traction of **42** **26***
Hwy Est. City Est. Mpg
 MacPherson strut front suspension . . . and power-assisted rack and pinion steering with responsive 14:1 steering gear ratio. Plus, it has Cadillac refinements such as genuine leather seating areas, body-

contoured bucket seats, air conditioning and more. All standard. Test-drive Cimarron by Cadillac. Due to limited initial production, Cimarron is not available at all Cadillac dealers at this time.

*Use estimated mpg for comparison. Your mileage may differ depending on speed, distance, weather. Actual highway mileage lower. Cadillacs are equipped with GM-built engines produced by various divisions. See your Cadillac dealer for details.

A NEW KIND OF CADILLAC FOR A NEW KIND OF CADILLAC OWNER.



**"I WOULDN'T
TREAT MY BIKE
THE WAY YOU
TREAT YOUR BODY."**

—Judy Lafferty



When Judy Lafferty prepares for a race like the annual cross-Iowa run, she makes sure her bike is in perfect shape.

She inspects and adjusts every part. She tunes and balances the whole machine, so it can go the distance.

Because she treats her body the same way, she discovered a lump in her breast a few years ago.

She discovered it early. And these days, 85% of early breast cancers can be treated successfully.

Judy has since had reconstructive

surgery, too. And she feels like herself again. Alive, vibrant, ready to get on her bike and take on the world.

Judy Lafferty is just one example of the kind of progress we're making against cancer in its many forms.

The American Cancer Society takes some credit for that progress. But credit won't finance our work.

We need your money to help us win this race.

**SHARE THE COST
OF LIVING.**

GIVE TO THE AMERICAN CANCER SOCIETY. 

Japanese Beetles.

Bait 'em.
Bag 'em.
Throw 'em away!

ONLY TRAP WITH A SEX LURE.

A unique scientific breakthrough makes the BAG-A-BUG™ Japanese Beetle Trap incredibly effective. It is the synthetic reproduction of the natural sex attractant of the Japanese Beetle. While other traps may look like the BAG-A-BUG trap—*no other trap performs like it.*

UP TO 5 TIMES MORE EFFECTIVE.

The BAG-A-BUG trap outperforms any other trap you can buy. While other traps use only a floral lure, the BAG-A-BUG trap's two-part bait system combines both a floral lure and the exclusive sex lure. Beetles are attracted in droves. They hit the collecting vanes, fall into the bag and die.

- NO POISON SPRAYS • DISPOSABLE BAGS
- SEASON-LONG BAIT SUPPLY

BAG-A-BUG™

The
unbeatable
beetle trap.



J.T. Baker Chemical
Company
Horticultural Products
Phillipsburg, New Jersey 08865

TWO-PART
BAIT SYSTEM
1. Floral lure.
2. Exclusive
sex lure.

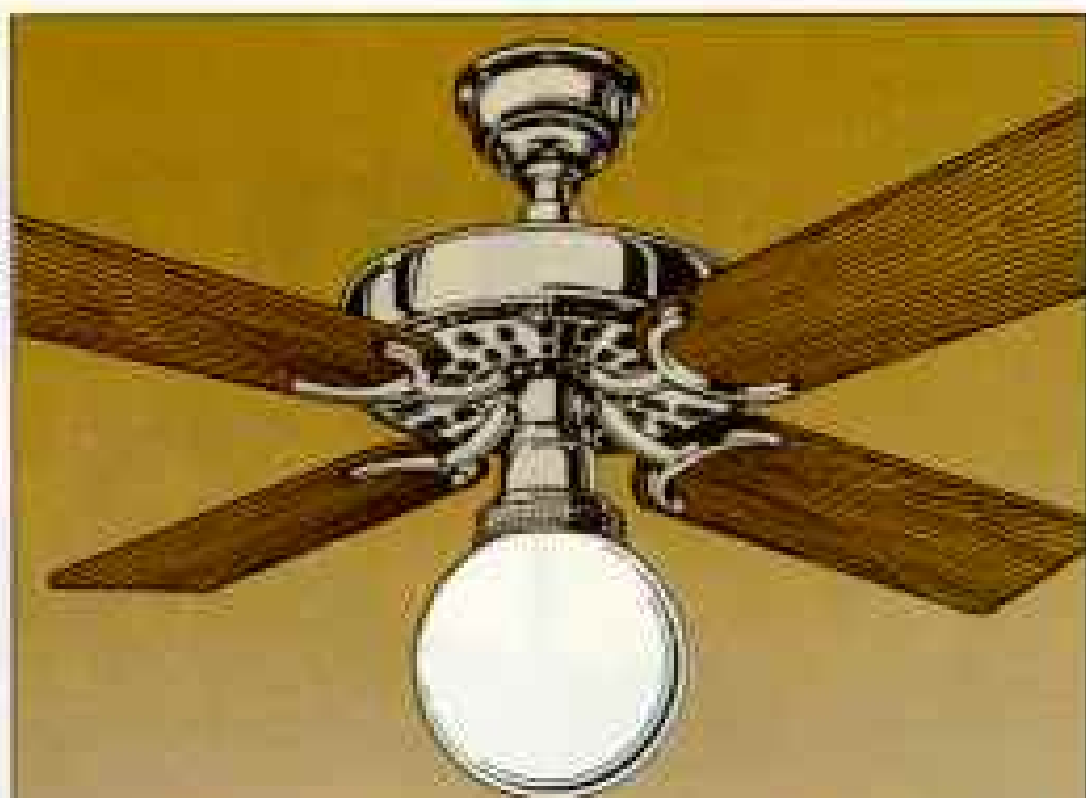


© 2005 J.T. Baker Chemical Company



TABASCO
Aged for Flavor

© 1997 TABASCO is a registered trademark of
McIlhenny Company, Avery Island, Louisiana 70513



Hunter. Ironclad Quality Since 1886.

All ceiling fans are not alike. Hunter is the original. Since 1886. Whisper quiet. Cast iron housing. Fine hardwood blades. Hunter can cut summer cooling costs up to 40%, and pull warm air down in winter to save on heating costs. Models and finishes for any decor. Send \$1 for 16-page color catalog, Dept. V-1, Box 14775, Memphis, TN 38114. Or telephone 1-800-238-5358 for your nearest dealer. Then put your Hunter Original Olde Tyme Ceiling Fan in your will. It's that good.



Ready for Mt. St. Helens, Hurricane Allen, Love Canal.

Red Cross: Ready for a new century.



A Public Service of This Magazine
& The Advertising Council



Collect Geographics in handsome files . . .

... that look like fine books on your library shelves. Only \$1.75 each (in quantity). Have red, leather-like fronts embossed in gold. One file holds six issues (12 are too heavy) or many maps. Offset gold numbers (not foil) supplied for neatly adding dates. Supplied only in cartons of six; specify your choice (A) carton of six magazine files, or (B) carton of five magazine and one map file. One carton \$10.55 (\$12.35 foreign), 4 or more cartons \$9.95 each. Postpaid. Send check, Mastercard or VISA holders send number with expiration date and signature or place order by calling toll free 1-800-621-5199 (in Illinois: 1-800-972-5855) anytime. File catalog free with order. HIGHSMITH CO., Box 25NG, Fort Atkinson, Wisconsin 53538.

Only Eastern gives you a little Walt Disney World before you even get there.

Our exclusive Fun Flight Bag[®] and Fun Flight Meal[†]

On an Eastern flight, we keep your kids amused all the way to the Walt Disney World Vacation Kingdom in Orlando. With our Fun Flight Bag, featuring puppets, games, puzzles and more. And our Fun Flight Meal. A hot dog, shake, fruit and cookie for lunch and dinner. The fun doesn't stop there.

Only Eastern offers you a Walt Disney World Character Breakfast[⊙]

Once you've arrived in the Magic Kingdom, Eastern can still give you things no other airline can.

We can offer you breakfast with Donald and the bunch when you book your vacation with us.

We give you the most nonstops to Walt Disney World.

Eastern serves Orlando with nonstops from cities all over the U.S. Many of them are wide-body movie flights (there's a \$2.00 charge for headsets in coach).

Only Eastern can give you a Super 7[™] super vacation.

We can give you a low-cost vacation too good to pass up. It includes discounted airfare, hotel, rental car and a 2-day passport that includes admission and unlimited attractions

inside the Magic Kingdom.

Call your Travel Agent for more information. Or call the official airline of Walt Disney World. Eastern, of course.

- * Available on nonstop and direct flights. Passengers on connecting flights receive gift bag at final connection.
 - † You must ask for the Fun Flight Meal when you make your reservations.
 - ⊙ Breakfast costs extra unless included in package. Cost may vary. Movie program and system provided by Trans Com—a unit of Sundstrand Corp.
- ©1981 Eastern Air Lines, Inc.



© Walt Disney Productions



EASTERN
WE HAVE TO EARN OUR WINGS EVERY DAY.™



Davey Tree's Total Program will make beautiful sense to you.

Healthy trees and shrubs are a reflection of your property value. That's why Davey Tree's total program of preventive maintenance makes so much sense. Beautiful sense.

Actually, the most expensive thing you could do is to let your trees and shrubs decline from lack of proper maintenance.

Davey Tree's total program is an easy, economical approach to the health and beauty of your landscape.

Start with insect control.

Scientific spraying is the most effective way to prevent damage from specific insects and disease. Only by scheduling an ecologically approved spray program can you protect the beauty and health of your valuable trees and shrubs.

You feed your lawn.

Why not trees and shrubs?

Nature's renewal cycle helps trees and shrubs survive in the forest naturally.

Then, along comes civilization! Man destroys this productive cycle by disrupting roots, raking leaves and compacting the soil.

You can help restore nature's cycle with Davey Tree's patented ARBOR-GREEN.[®] This slow-release fertilizer is an ideal

mixture of organic nitrogen, phosphorous and potassium. Once we hydraulically inject it into the ground, you'll receive beautiful benefits for two full years. That makes good sense and only Davey Tree has it.

A total program you can benefit from.

You can look to Davey Tree for a variety of complete services. Feeding, spraying and pruning. *Periodic service calls and customer property inspections with no obligation.* An industry leading Research & Development staff available to help you. The cost of our preventive maintenance program will be less expensive to you than costly remedial maintenance. We're fast, economical and reliable. We're also in the Yellow Pages under "Tree Service".

DAVEY TREE

KENT, OHIO 44240
Coast to Coast and Canada



An employee-owned company.

Keeping America Green Since 1909.

MIRACLES FOR SALE.



Would you give 2¢ to help save this child from going blind?

2¢ worth of vitamin A could save her from a blindness that millions of children in poor countries already face.

2¢ can save her sight. Nothing can buy it back.

So please give what you can to Helen Keller International.

Even if it's only 2¢

And you thought there was no such thing as miracles.

Helen Keller Centennial Fund
Box 777, New York, N.Y. 10011

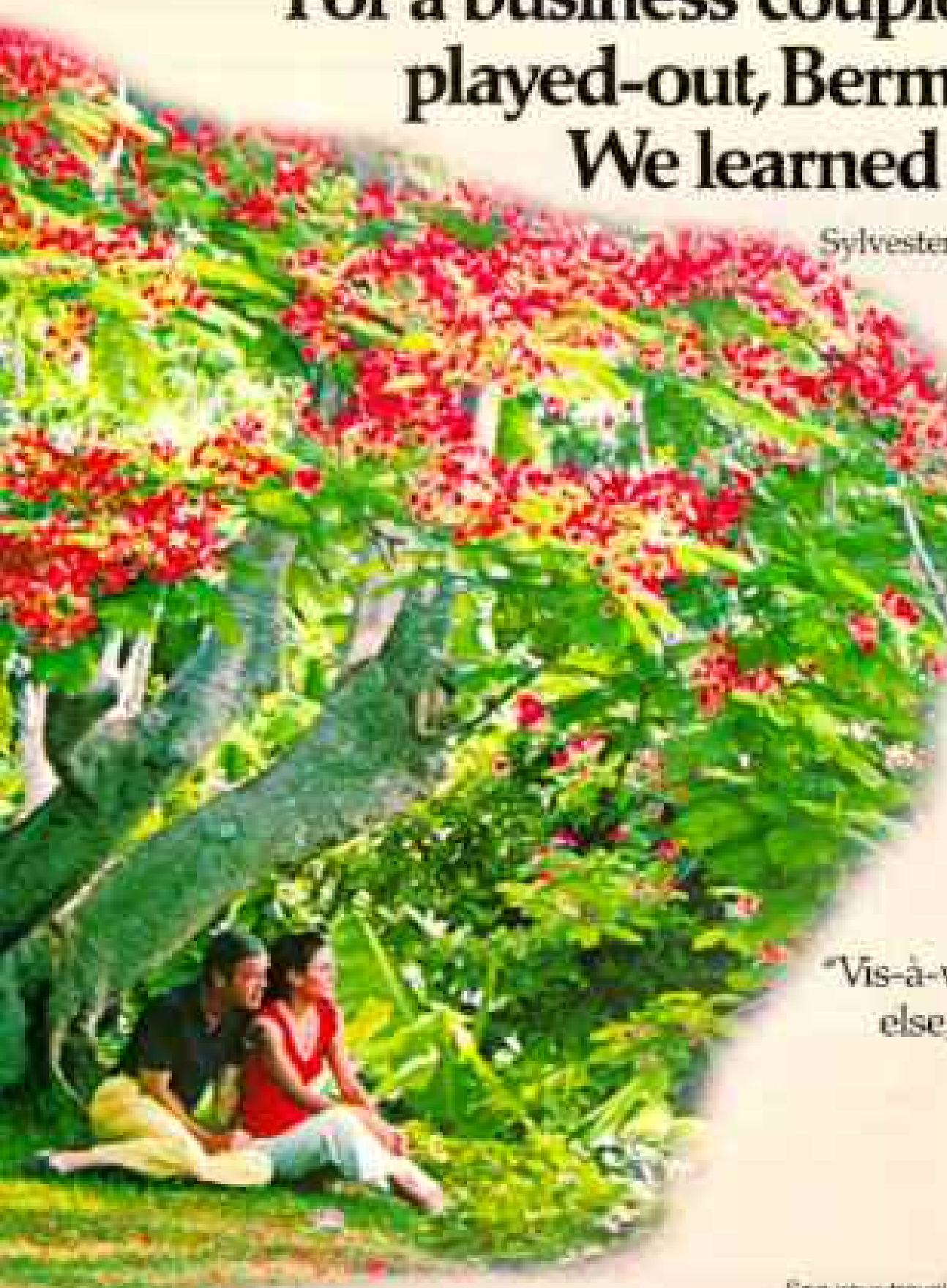
Prepared as a public service by D'Arcy-MacManus & Manius/deGarmo



Bermuda. Get away to it all!

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

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



“There’s incredible beauty here. We relax, we’re restored, we find time for one another.”

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

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



See your travel agent or write Bermuda, Dept. 1115, 630 Fifth Ave., New York, N.Y. 10020 or Suite 1010, 44 School St., Boston, Mass. 02108 or 300 North State St., Chicago, Ill. 60610

"In the past 15 years, we've had 3 cars, 6 transmissions and one refrigerator. A Frigidaire."



FRIGIDAIRE
HERE TODAY, HERE TOMORROW.

Frigidaire One of the White Consolidated Industries



TWA's Getaway Middle East.
Wonders from the past.
Memories for the future.

This year, take in the myriad wonders of the Middle East—the exotic Nile, the fabled Aegean, the mystical Holylands.

This year, take a Middle Eastern vacation with TWA Getaway.

As America's most comprehensive tour program to the Middle East, TWA Getaway offers 9 quality vacations combining the finest modern accommodations and services. Ranging in price from only \$668 to \$2258.*

For your free TWA 1981 Getaway Middle East brochure, call your travel agent or TWA. Or use the coupon below. After all, there's no time like the present to discover the wonders of the past.



Please send me TWA's 1981 Getaway[®] Middle East brochure.
Mail this coupon to: TRANS WORLD AIRLINES,
P.O. Box 530, Madison Square Station, New York, N.Y. 10010

Name _____

Address _____

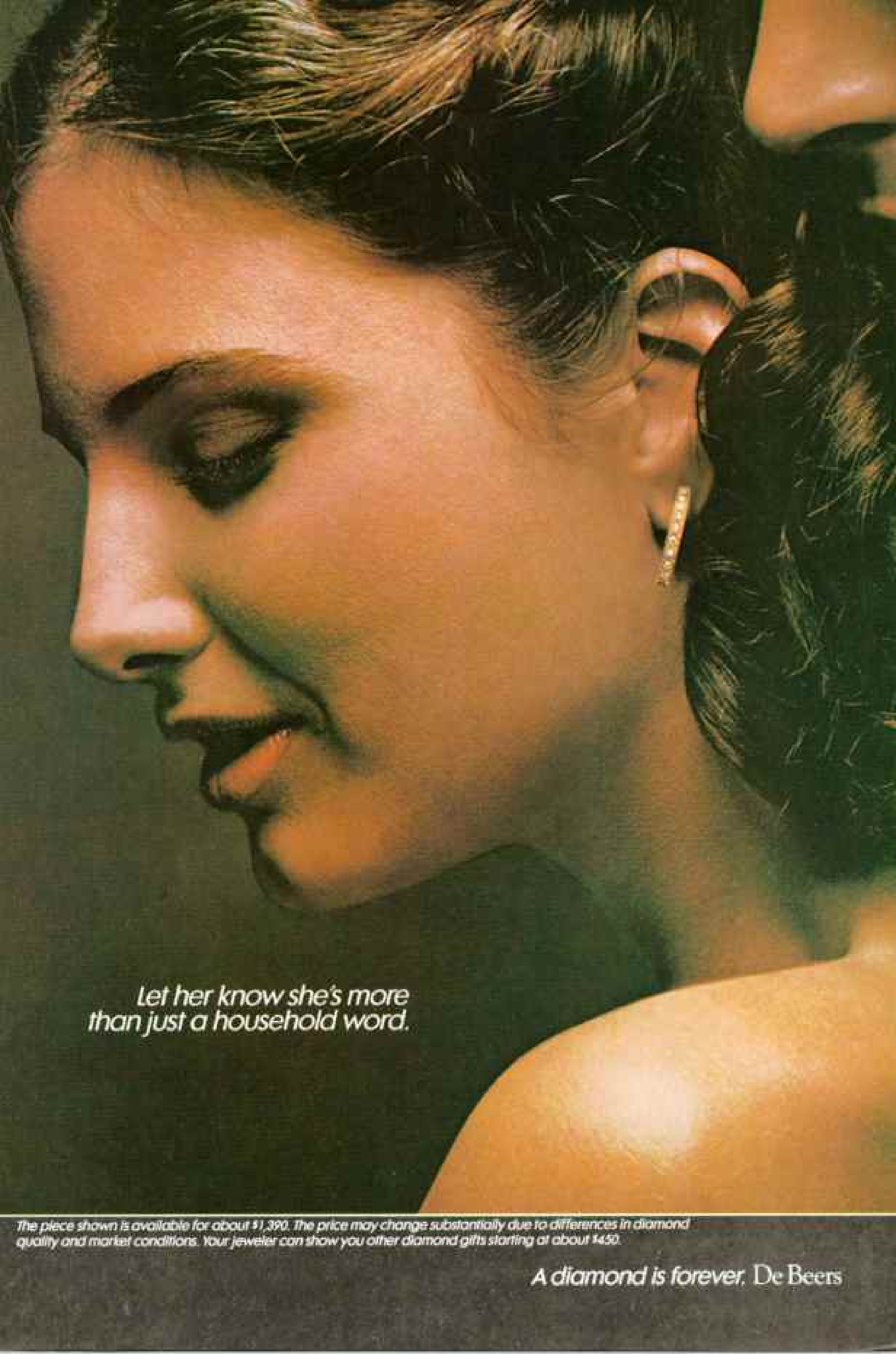
City _____ State _____ Zip _____

You're going to like us



NA007

*Per person, based on double occupancy, exclusive of air fare.



*Let her know she's more
than just a household word.*

The piece shown is available for about \$1,390. The price may change substantially due to differences in diamond quality and market conditions. Your jeweler can show you other diamond gifts starting at about \$450.

A diamond is forever. De Beers