

VOL. 197, NO. 3



MARCH 2000

NATIONAL GEOGRAPHIC

Madidi

Bolivia's Spectacular New National Park

BUGGING OUT 24 ARCTIC SUBMARINE 30 ANCIENT GREECE III 42
HARD ROCK LEGACY 76 STONE COLD ASCENT 96 BEIJING 116

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Lear's Macaw (*Anodorhynchus leari*) **Size:** Length, 71 cm **Weight:** 940 g **Habitat:** Dry scrubland, with sandstone cliffs for nesting and roosting, in northeast Brazil **Surviving number:** Estimated at fewer than 200
Photographed by Luiz Claudio Marigo

WILDLIFE AS CANON SEES IT

The cries of Lear's macaws echo across canyon walls before dawn as a flock prepares to leave its nightly roost in the cliffs. After flying long-distance to a stand of licuri palms, the indigo macaws disperse among the trees and on the ground to forage on ripe palm nuts, their favorite food. A bird sentinel keeps watch as the flock spends the day feeding; by the time they return to the cliffs at dusk, each bird will have

consumed more than 300 palm nuts. Scientists first discovered the home range of the Lear's macaw in 1978. Today, the most serious threats these birds face are destruction and disturbance of feeding habitat, and hunting for trade. As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

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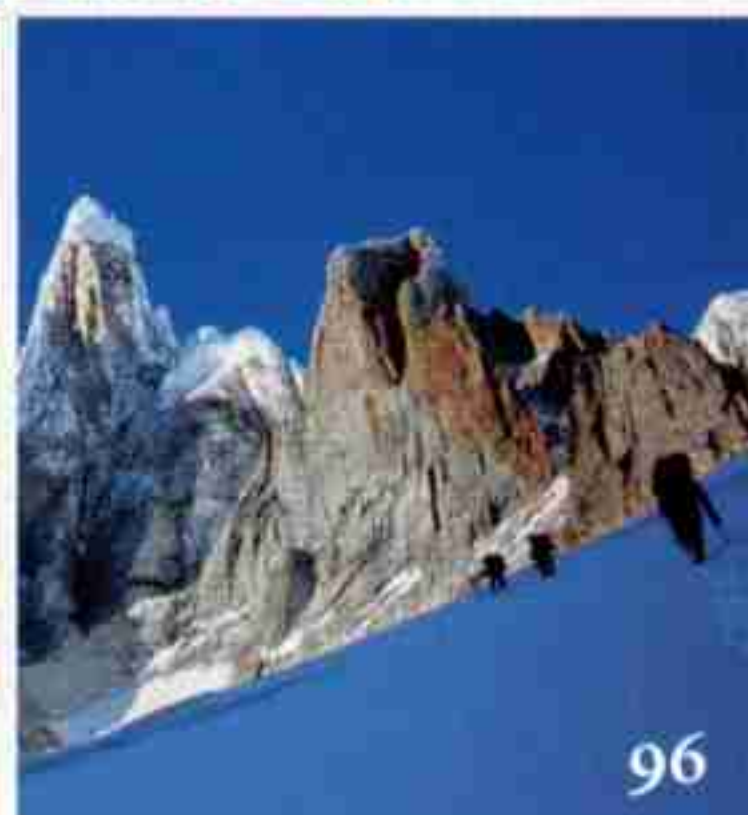
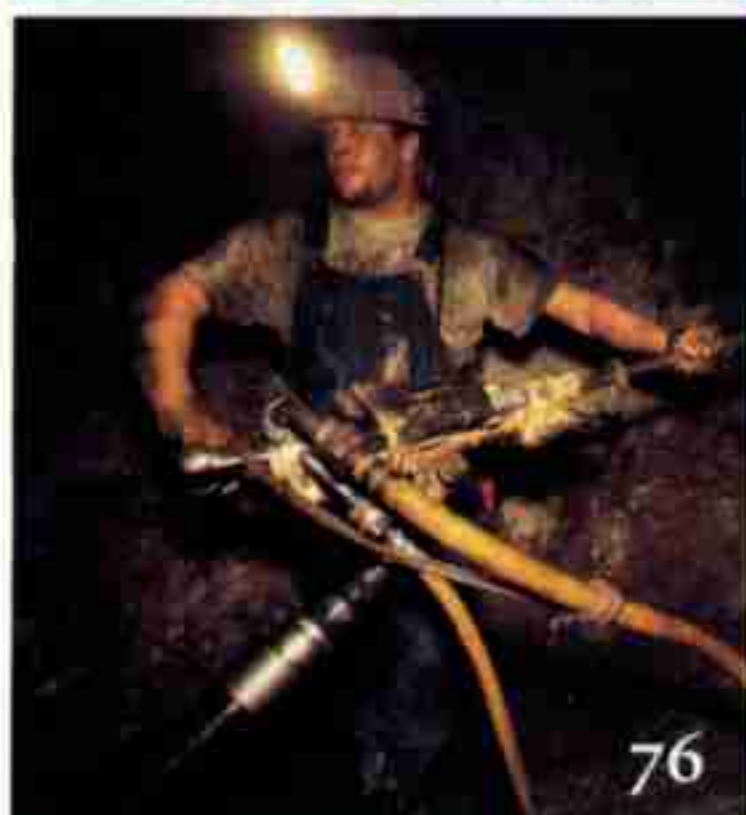
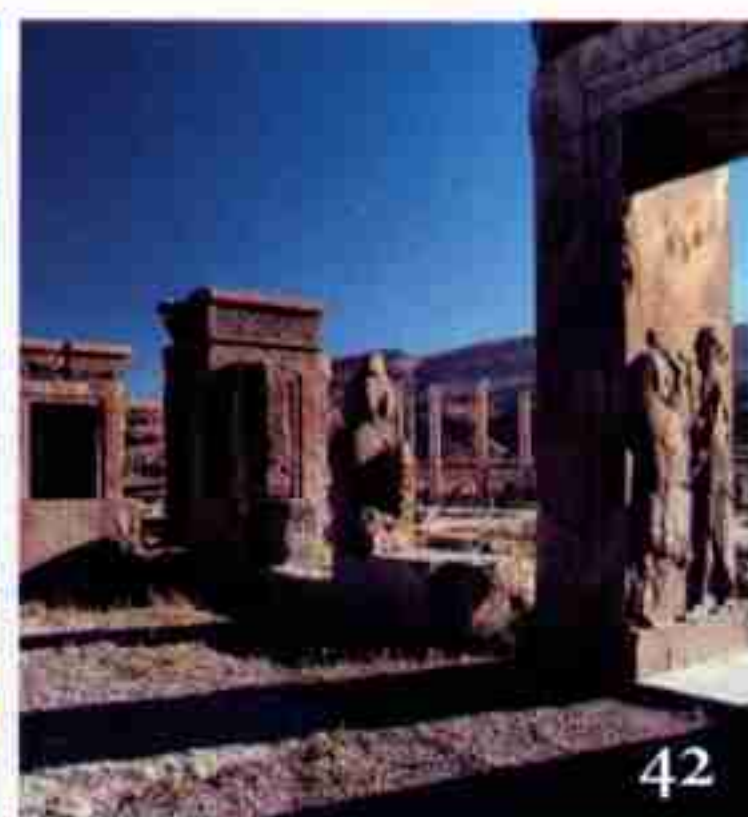
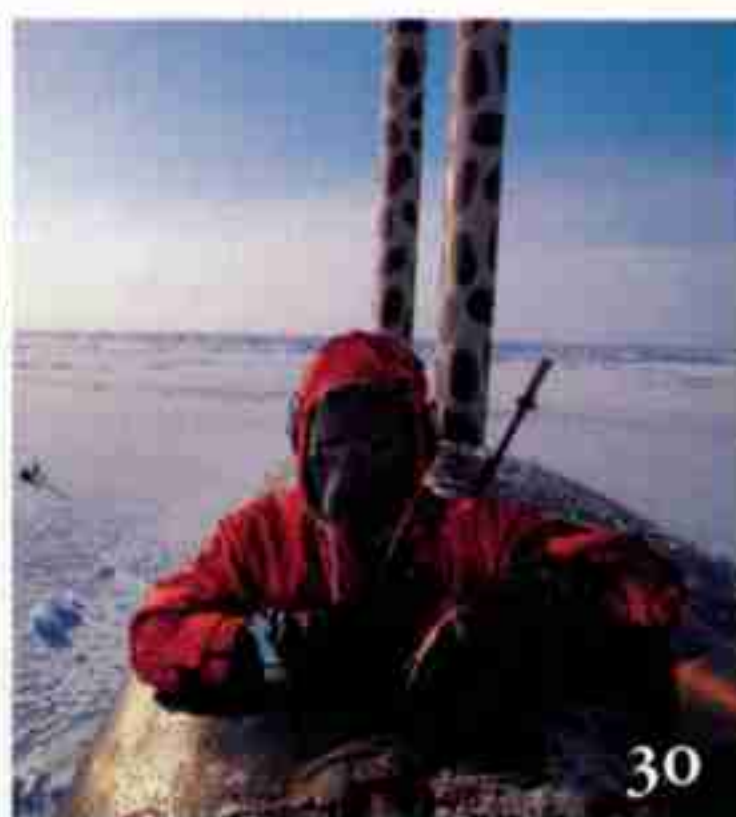
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NATIONAL GEOGRAPHIC

MARCH 2000



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The Cover

A mated pair of red-and-green macaws are a vivid sample of the thousand or so bird species found in Madidi National Park, Bolivia. Photograph by Joel Sartore

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On Assignment



JOEL SARTORE WITH LUIS GONZÁLEZ (ABOVE); JOEL SARTORE

■ MADIDI NATIONAL PARK

Welcome to the Jungle

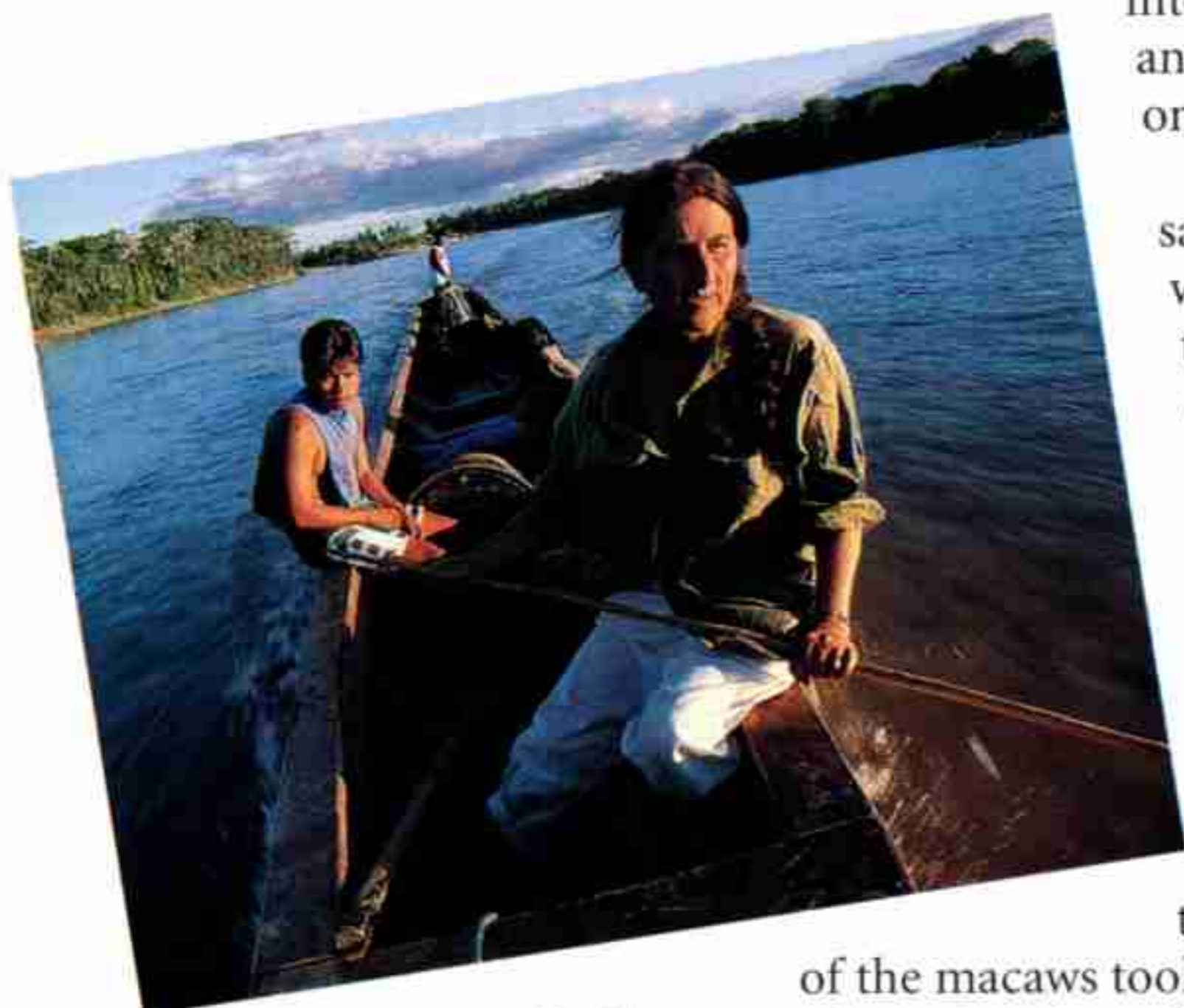
“Getting close is the name of the game,” according to veteran photographer Joel Sartore, who slithered right up to this baby caiman to photograph its gaping jaws. “The jungle is so thick, you can’t see 20 feet, so I worked the Río Tuichi a lot. There’s no sun anywhere else.”

While shooting in Bolivia’s Madidi National Park, Joel spent a lot of time on the river’s banks. But to travel through the park, he had to get off the banks and into a dugout canoe, accompanied by native trackers and Rosa María Ruiz (left), director of Eco Bolivia and one of Madidi’s staunchest defenders.

“She was my guide, interpreter, friend, and life-saver,” Joel says. “She made sure I stayed out of harm’s way.” When the Nebraska native and first-time visitor traipsed through the jungle with a column of trackers, Rosa María kept him in the middle in case wild pigs—peccaries—or some other dangerous animal decided to investigate the two-legged intruders. “The Bolivians could escape the pigs,” Joel says, “but they knew they’d need lots of time to get the fat gringo up a tree.”

Most of the abundant creatures in Madidi were less than keen to have Joel capture them on film, including the pigs. Nearly every photograph in the story required agonizing waits—the cover photo

of the macaws took a week. Throughout, Rosa María worked hard to put Joel in great photo situations. “We built platforms, hideaways, a tower, and combed the forest,” says Rosa María. Says Joel, “Many of the pictures are because of her.”

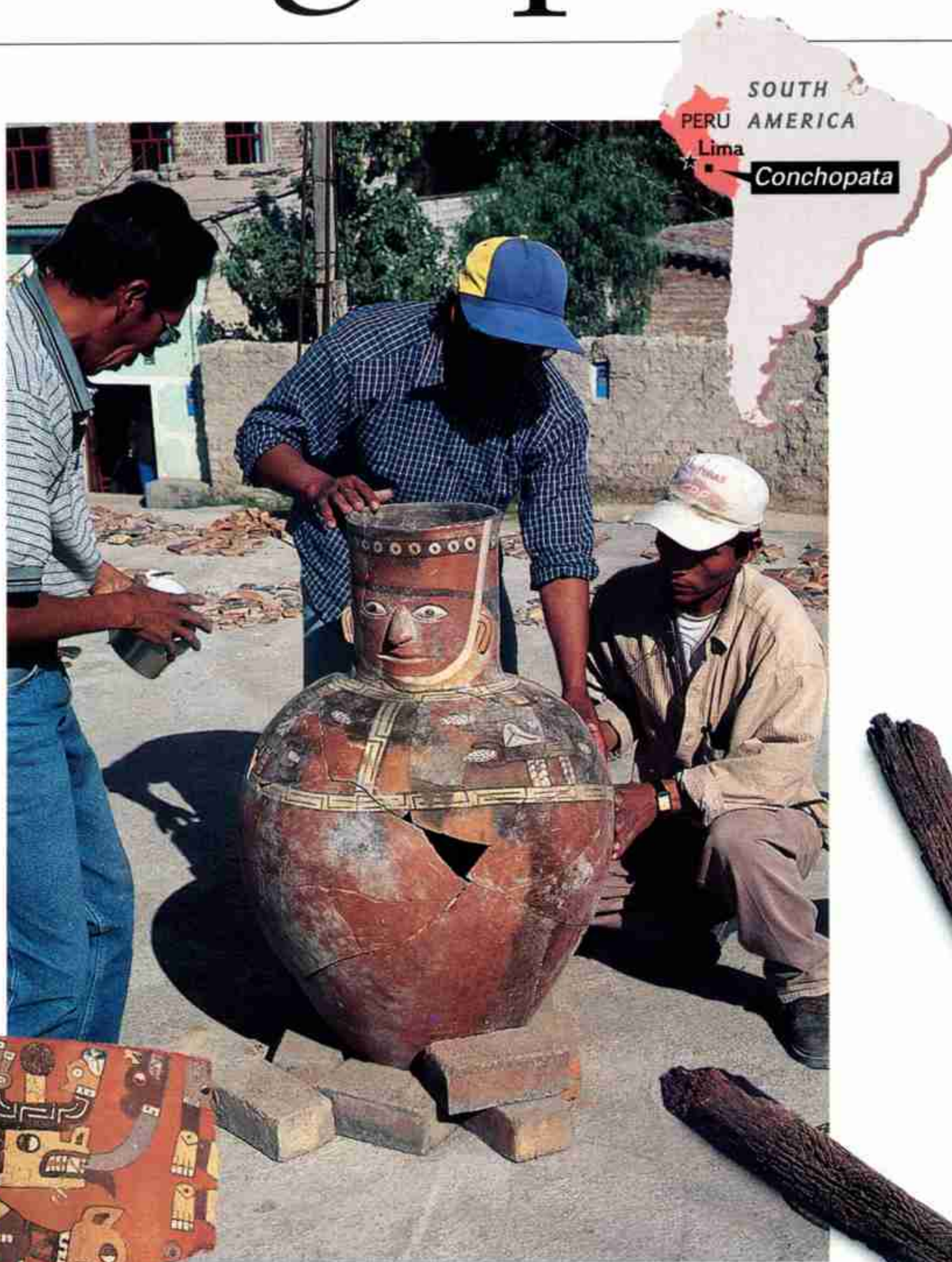


WHAT EVERYBODY ELSE IS DOING



NATIONAL GEOGRAPHIC

Geographica



ALL BY WILLIAM H. ISBELL

■ NGS RESEARCH GRANT


Unearthing an Early Peruvian City

When he talks about last summer's excavations at Conchopata—high in the Peruvian Andes—William H. Isbell hardly knows where to begin. The results? “Spectacular!” says the SUNY-Binghamton archaeologist, who has worked in Peru for 30 years.

Isbell's team found seven tons of pottery, much of it bearing cosmological scenes (above left). The ceramics included ceremonial pots, many with faces fashioned on their necks and ritually smashed, that stood nearly four feet tall when reassembled (top). Two fragments of archers' bows, perhaps the oldest ever found in South America (above right), lay in a tomb that held two mummies: a man clad in wool and a woman mostly in cotton. The many other discoveries included a structure lacking typical domestic features, which may have been a palace, and a small architectural model, possibly of a building in which leading figures were buried.

A major urban center from the seventh to the ninth centuries, Conchopata has been known by archaeologists since the 1920s. Isbell, co-director of the dig with Anita Cook and José Ocha-toma, hopes that the new finds will prompt an upgrading of its importance: Plans to build new housing on the site threaten to bury its history once more.

IT'S NOT WHAT EVERYBODY ELSE IS DOING

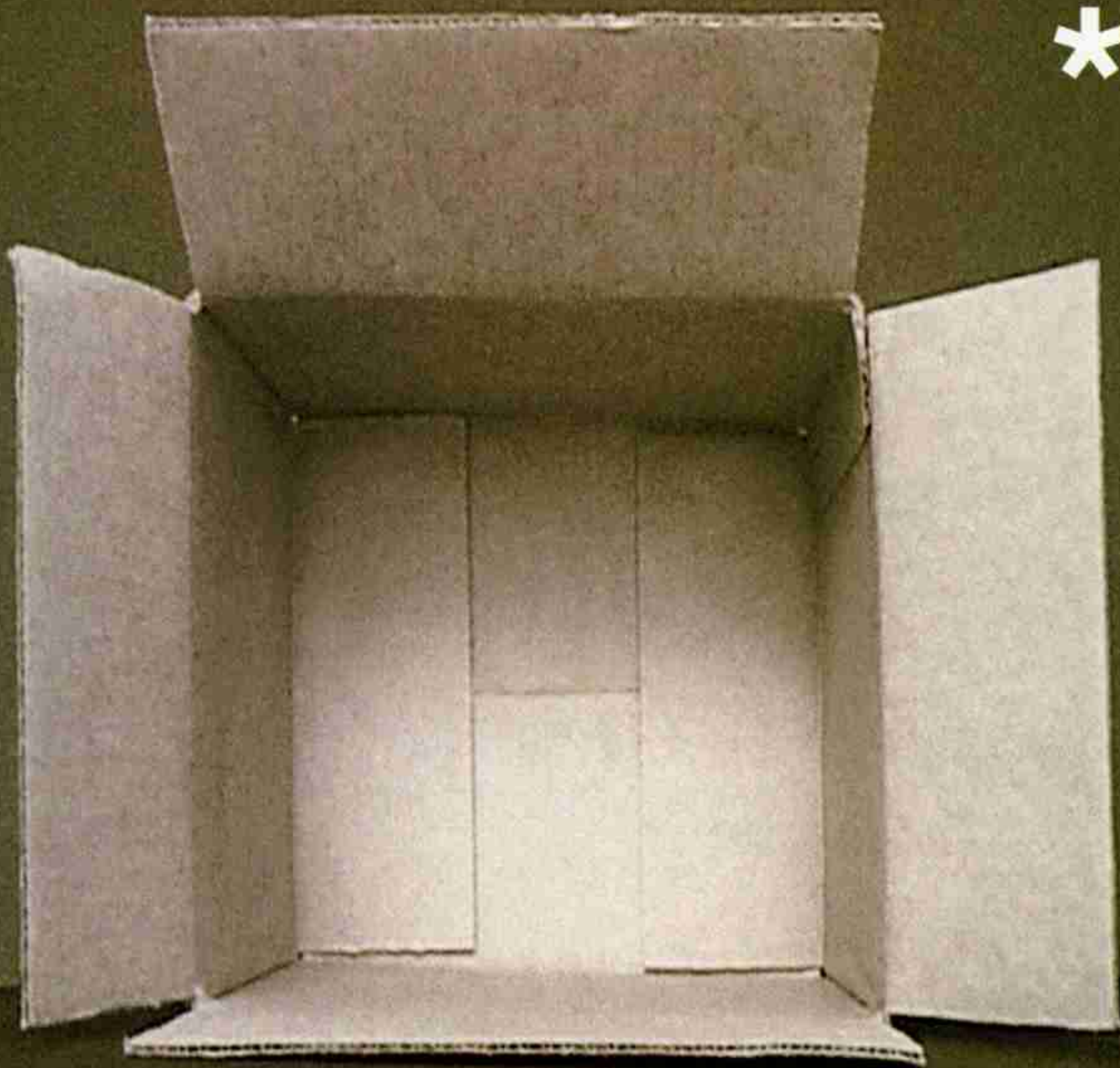
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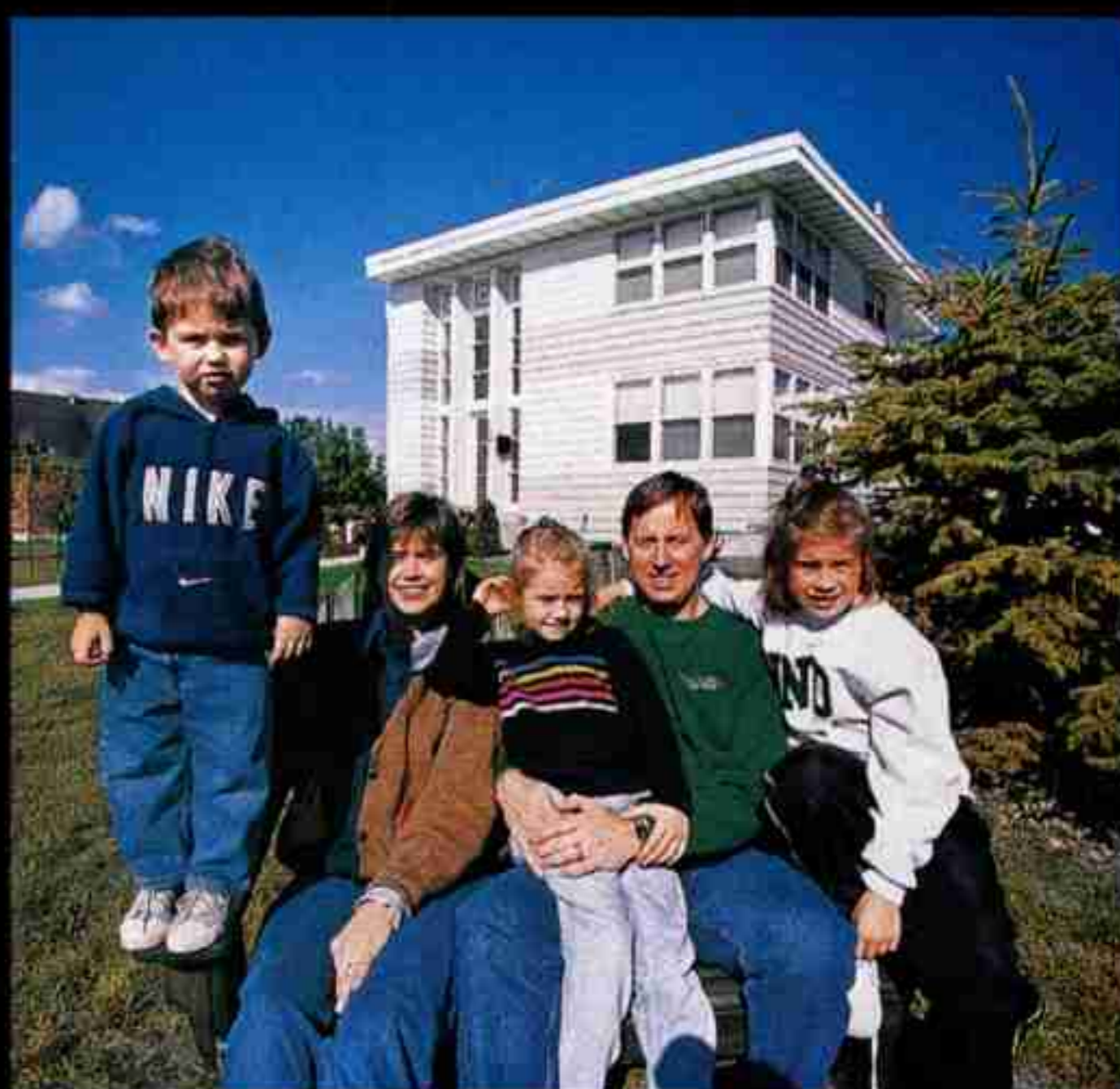
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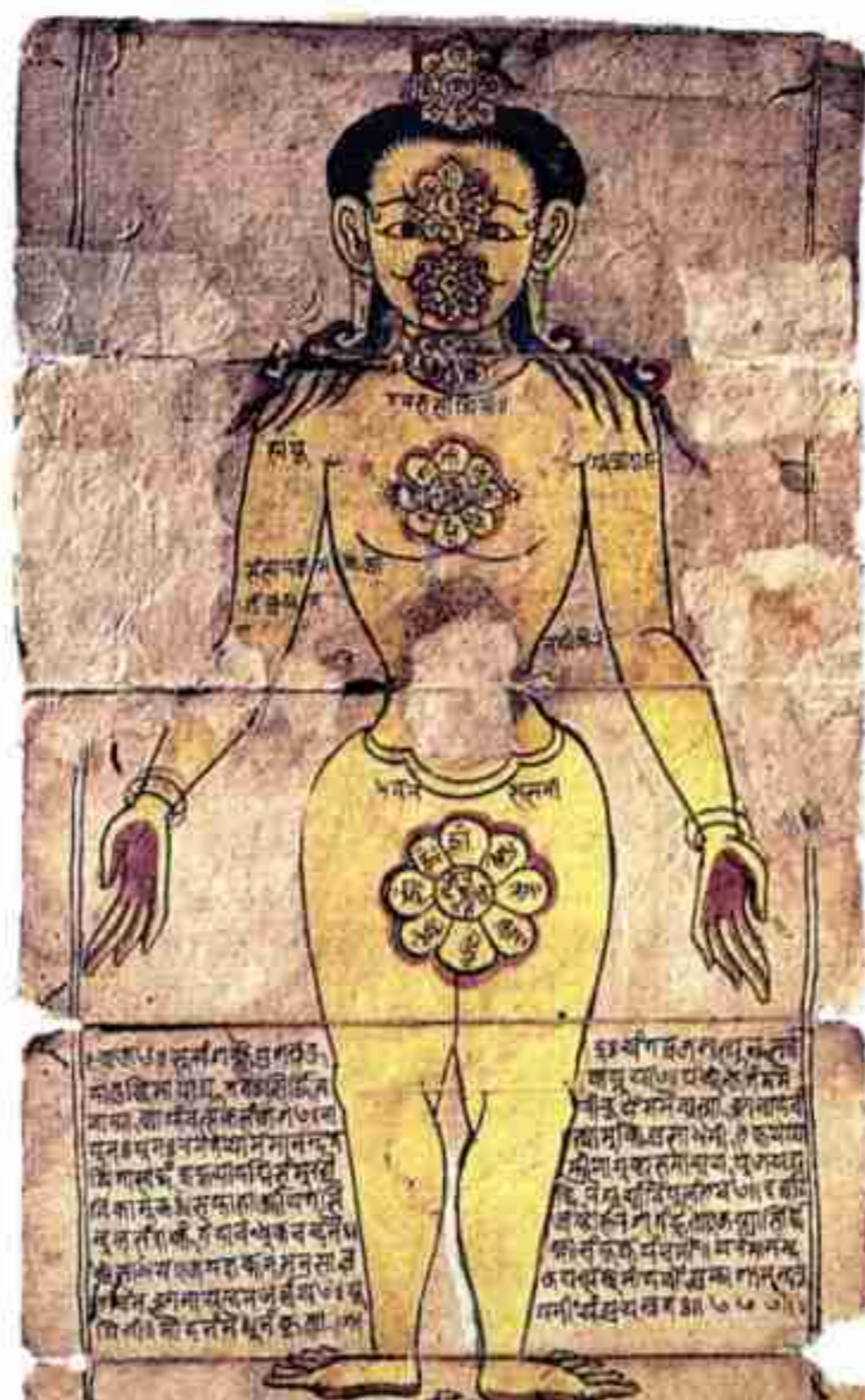
The 1997 spring flooding of the Red River of the North created havoc as it gutted residences, including the Larson home in Minnesota (above), seen in a snapshot held by eight-year-old Ellen. The Larson family and six neighbors moved their East Grand Forks houses (above right) two miles away to higher ground (GEOGRAPHIC, July 1998). "We may have basement flooding, but I never worry about losing our whole house," says Stephanie Larson (right), with husband, Gary, and their three children. "The kids probably adjusted better than their parents," she says. "We're better off as a community, but at a cost. We're not back all the way yet, but it seems like home."



NEPAL-GERMAN MANUSCRIPT PRESERVATION PROJECT (BELOW); JIM RICHARDSON (TOP RIGHT); MIKE ZERBY

Extending the Life of Nepalese Texts

Nepalese monasteries, archives, and private collections hold fragile treasures: ancient manuscripts like this Hindu ritual text illustrating the body's "energy centers" (right). Written primarily in Sanskrit or Tibetan, the manuscripts range from Hindu and Buddhist religious philosophy to tracts on dance, grammar, even veterinary medicine. But the worn documents—some written on palm leaves in the ninth century—face danger from rats and insects, fire, and natural deterioration.



For the past three decades the Nepal-German Manuscript Preservation Project has been micro-filming the manuscripts. Often sending teams on horseback and on foot to search the libraries of remote monasteries, the project has thus far recorded more than 170,000 documents. The work has taken on additional urgency because similar documents have been destroyed in nearby Tibet.

The originals and microfilm remain in Nepal; copies go to a Berlin library, where they are available to scholars. The project aims to complete a CD-ROM version of its catalog by the time work ends next year.

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I am stronger

Avandia, along with diet and exercise, may be used either alone or with Glucophage[®] (metformin HCl) for improved blood sugar control.

In studies, the most common side effects included cold-like symptoms and headache. A small percentage of people experienced anemia and/or mild to moderate swelling of their legs or ankles. If you experience these or other symptoms, talk to your doctor.

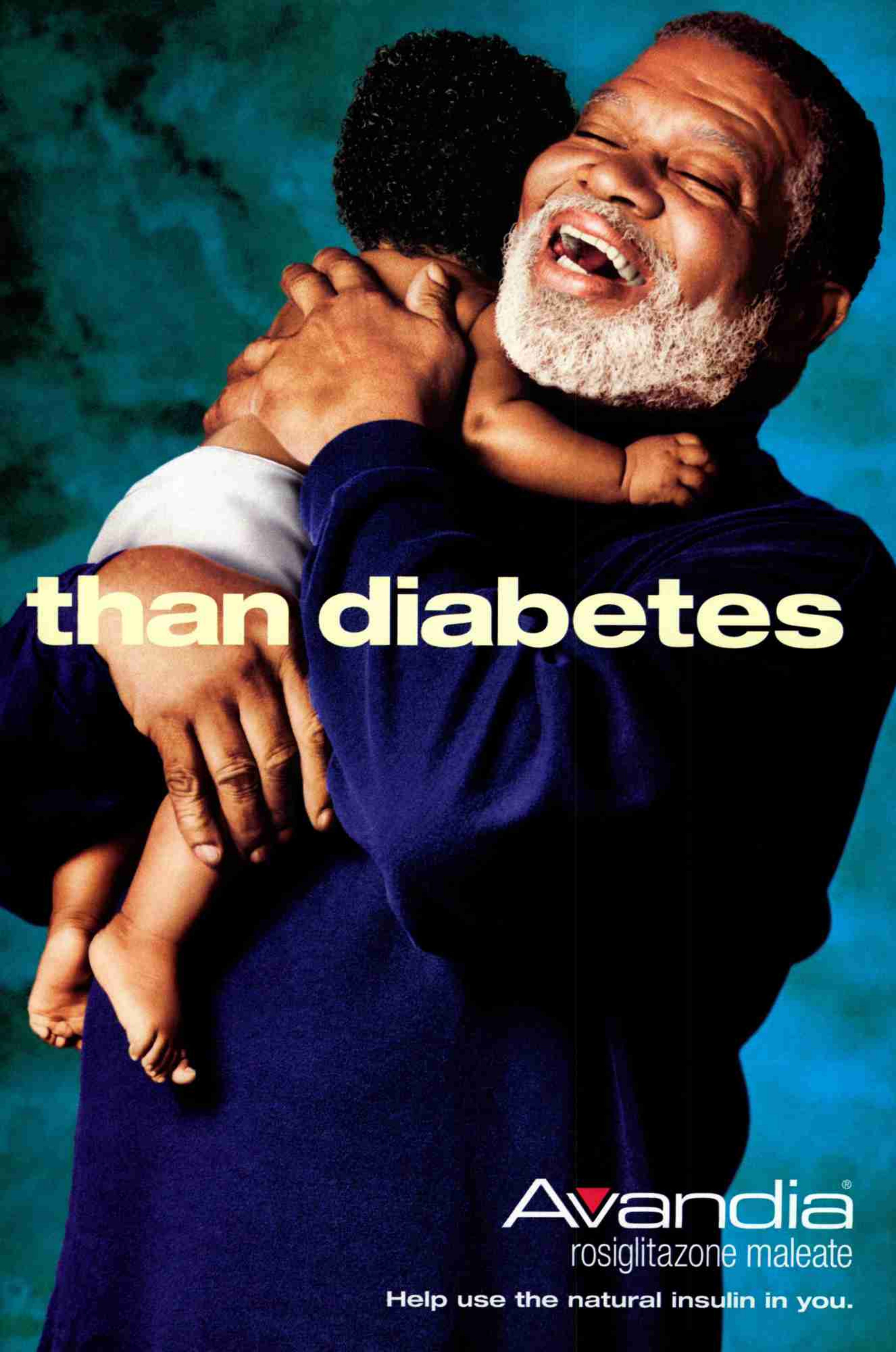
As with most diabetes medications, you may experience an increase in weight (3 to 8 pounds). This often occurs with improved blood sugar control.

If you are a premenopausal woman who is not ovulating, you should know that *Avandia* therapy may result in resumption of ovulation, which may increase your chances of becoming pregnant. Therefore, you may need to consider birth control options. Talk to your doctor before taking *Avandia* if you are nursing, pregnant or thinking about becoming pregnant.

While taking *Avandia*, follow your doctor's guidelines for periodic liver monitoring. If you experience nausea, vomiting, stomach pain, tiredness, anorexia, dark urine or yellowing of the skin, talk to your doctor immediately. Tell your doctor if you have a history of congestive heart failure or edema. Please see important patient information on the following page.

For improved blood sugar control, follow the diet, exercise, weight-loss and medication plan recommended by your doctor and test your blood sugar regularly.

If you have type 2 diabetes, talk to your doctor.
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What is Avandia?

Avandia is one product in a new class of prescription drugs called thiazolidinediones (thigh-a-zoe-lid-eeen-die-owns). It is used to treat type 2 diabetes by helping the body use the insulin that it is already making. *Avandia* comes as pills that can be taken either once a day or twice a day to help improve blood sugar levels.

How does Avandia treat type 2 diabetes?

If you have type 2 diabetes, your body still produces insulin but it is not able to fully use the insulin. Insulin is needed to allow sugar to be carried from the bloodstream into many cells of the body for energy. If insulin is not being used correctly, sugar does not enter the cells very well and builds up in the blood. If not controlled, the high blood sugar level can lead to serious medical problems, including kidney damage, blindness and amputation.

Avandia helps your body use insulin by making the cells more sensitive to insulin so that the sugar can enter the cell.

How quickly will Avandia begin to work?

Avandia begins to reduce blood sugar levels within 2 weeks. However, since *Avandia* works to address an important underlying cause of type 2 diabetes, insulin resistance, it may take up to 12 weeks to see the full effect. If you do not respond adequately to your starting dose of *Avandia*, your physician may increase your daily dose to improve your blood sugar control.

How should I take Avandia?

Your doctor may tell you to take *Avandia* once a day in the morning or twice a day in the morning and evening. It can be taken with or without meals. Food does not affect how *Avandia* works. To help you remember to take *Avandia*, you may want to take it at the same time every day.

What if I miss a dose?

If your doctor has prescribed Avandia for use once a day:

- As soon as you remember your missed dose, take one tablet anytime during the day.
- If you forget and go a whole day without taking a dose, don't try to make it up by adding another dose on the following day. Forget about the missed dose and simply follow your normal schedule.

If your doctor has prescribed Avandia for use twice a day:

- As soon as you remember the missed dose, take one tablet.
- Take the next dose at the normal time on the same day.
- Don't try to make up a missed dose from the day before.
- You should never take three doses on any single day in order to make up for a missed dose the day before.

Do I need to test my blood for sugar while using Avandia?

Yes, you should follow your doctor's instructions about your at-home testing schedule.

Does Avandia cure type 2 diabetes?

Currently there is no cure for diabetes. The only way to avoid the effects of the disease is to maintain good blood sugar control by following your doctor's advice for diet, exercise, weight control, and medication. *Avandia*, alone or in combination with other prescription drugs, may improve these other efforts by helping your body make better use of the insulin it already produces.

Can I take Avandia with other medications?

Avandia has been taken safely by people using other medications, including other antidiabetic medications, birth control pills, warfarin (a blood thinner), Zantac® (ranitidine, an antiulcer product manufactured by Glaxo Wellcome Inc.), certain heart medications, and some cholesterol-lowering products. You should discuss with your doctor the most appropriate plan for you. If you are taking prescription or over-the-counter products for your diabetes or for conditions other than diabetes, be sure to tell your doctor.

What should I discuss with my doctor before taking Avandia?

You should talk to your doctor if you have a history of edema, liver problems or congestive heart failure, or if you are nursing, pregnant or thinking of becoming pregnant. If you are a premenopausal woman who is not ovulating, you should know that *Avandia* therapy may result in the resumption of ovulation, which may increase your chances of becoming pregnant. Therefore, you may need to consider birth control options.

What are the possible side effects of Avandia?

Avandia was generally well tolerated in clinical trials. The most common side effects reported by people taking *Avandia* were upper respiratory infection and headache. As with most other diabetes medications, you may experience an increase in weight (3 to 8 pounds). This often occurs with improved blood sugar control. *Avandia* may also cause edema and/or anemia. If you experience any swelling of your extremities (e.g., legs, ankles) or tiredness, notify your doctor.

Who should not use Avandia?

The following people should not take *Avandia*: People with type 1 diabetes, people who experience yellowing of the skin with Rezulin® (troglitazone, Parke-Davis), people who are allergic to *Avandia* or any of its components and people with diabetic ketoacidosis.

Why are laboratory tests recommended?

Your doctor may conduct blood tests to measure your blood sugar control. In addition, your doctor may conduct liver enzyme tests. *Avandia* did not show signs of liver problems in studies. However, because a related drug (*Rezulin*) has been associated with such problems, and because *Avandia* has not been widely used, your doctor may recommend a blood test to monitor your liver before you start taking *Avandia*, every 2 months during the first year and periodically thereafter.

It is important that you call your doctor immediately if you experience nausea, vomiting, stomach pain, tiredness, anorexia, dark urine, or yellowing of the skin.

How should I store Avandia?

Avandia should be stored at room temperature in a childproof container out of the reach of children. Store *Avandia* in its original container.

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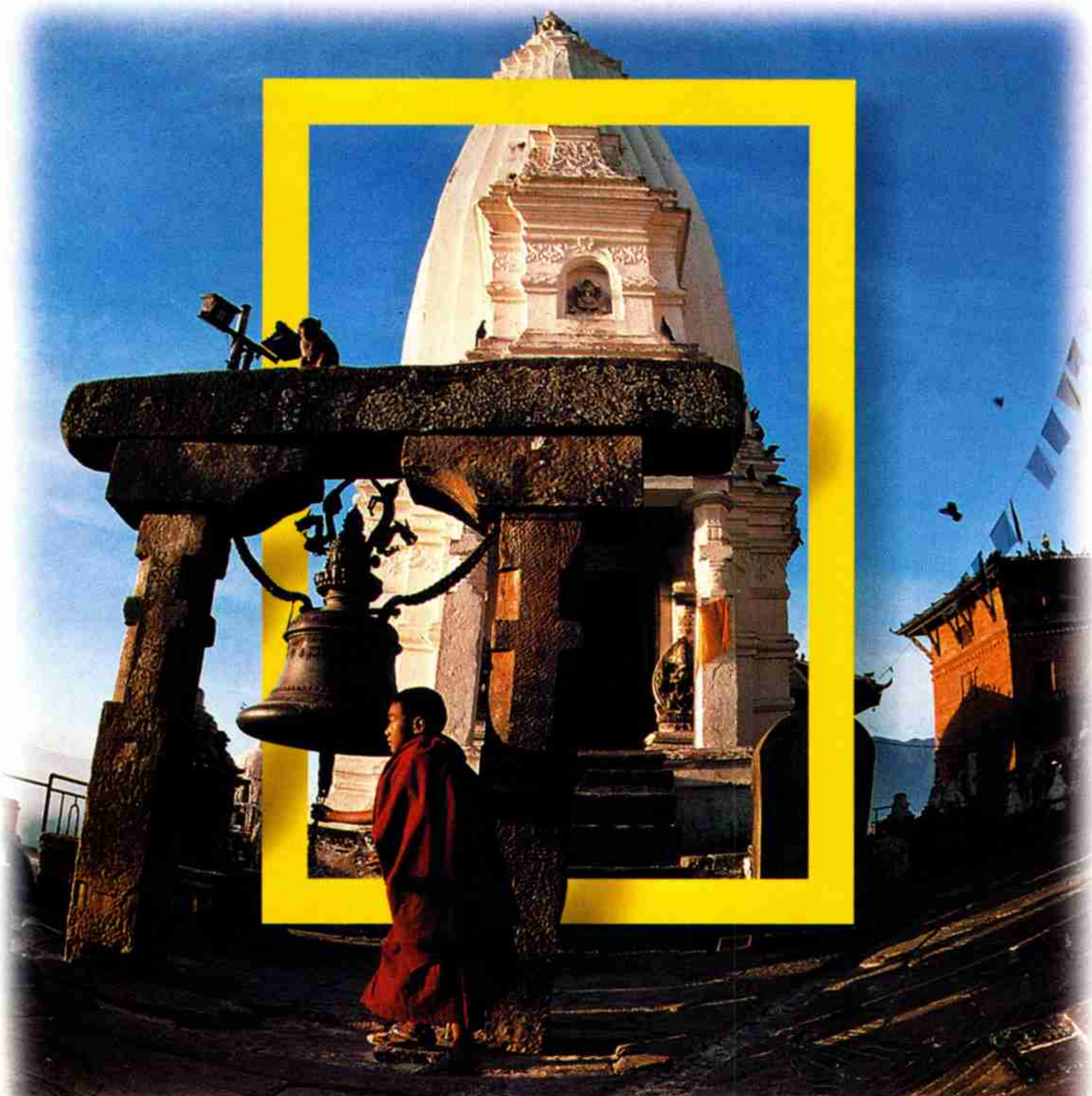
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A scene from Everest, a MacGillivray Freeman Film for IMAX®.

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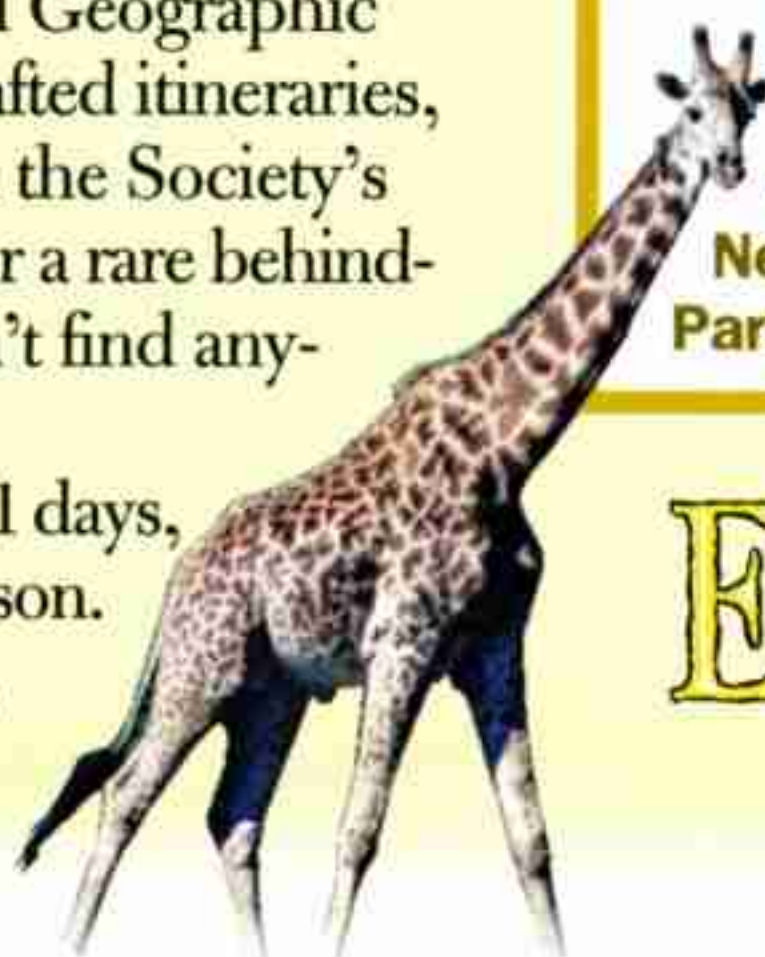
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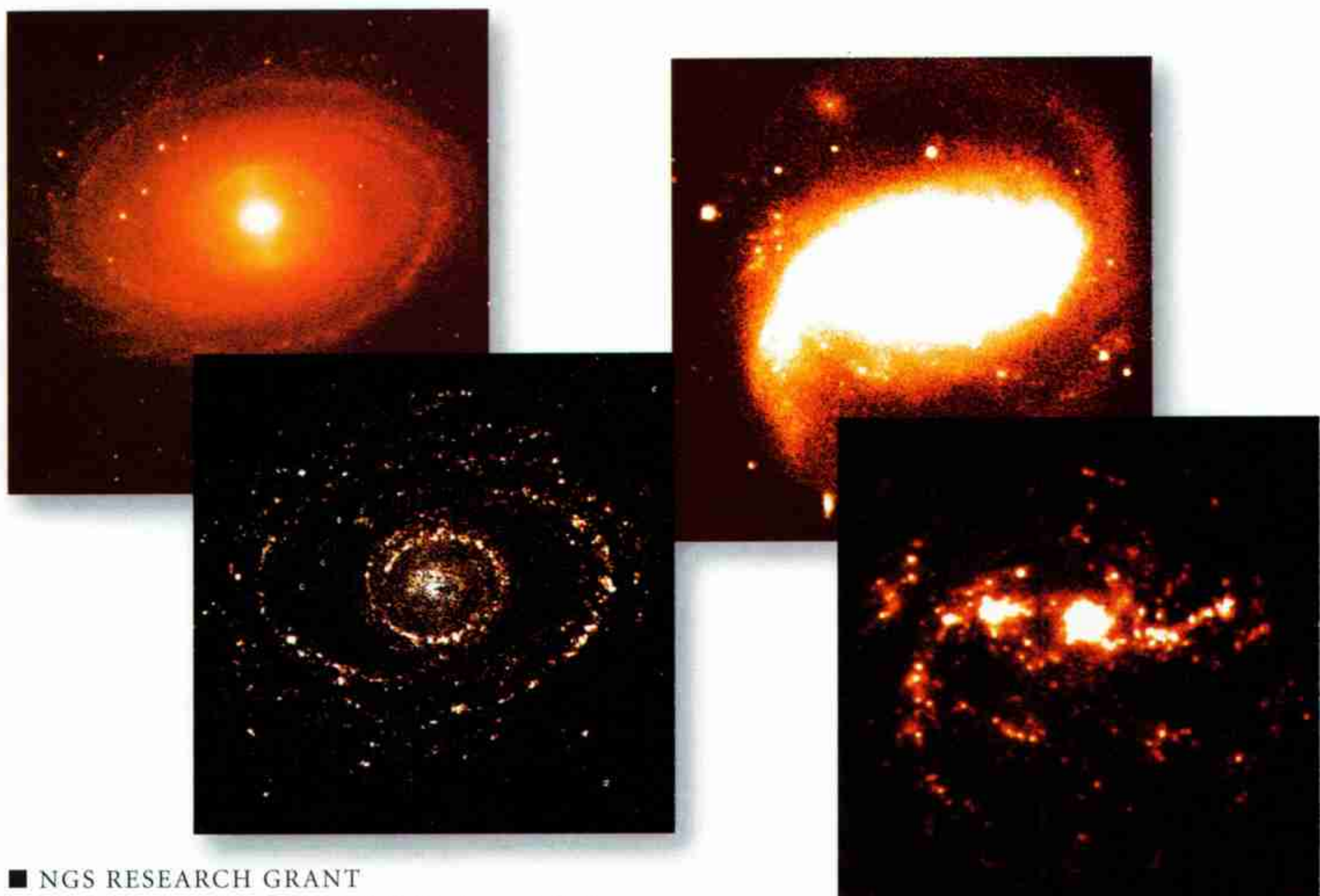
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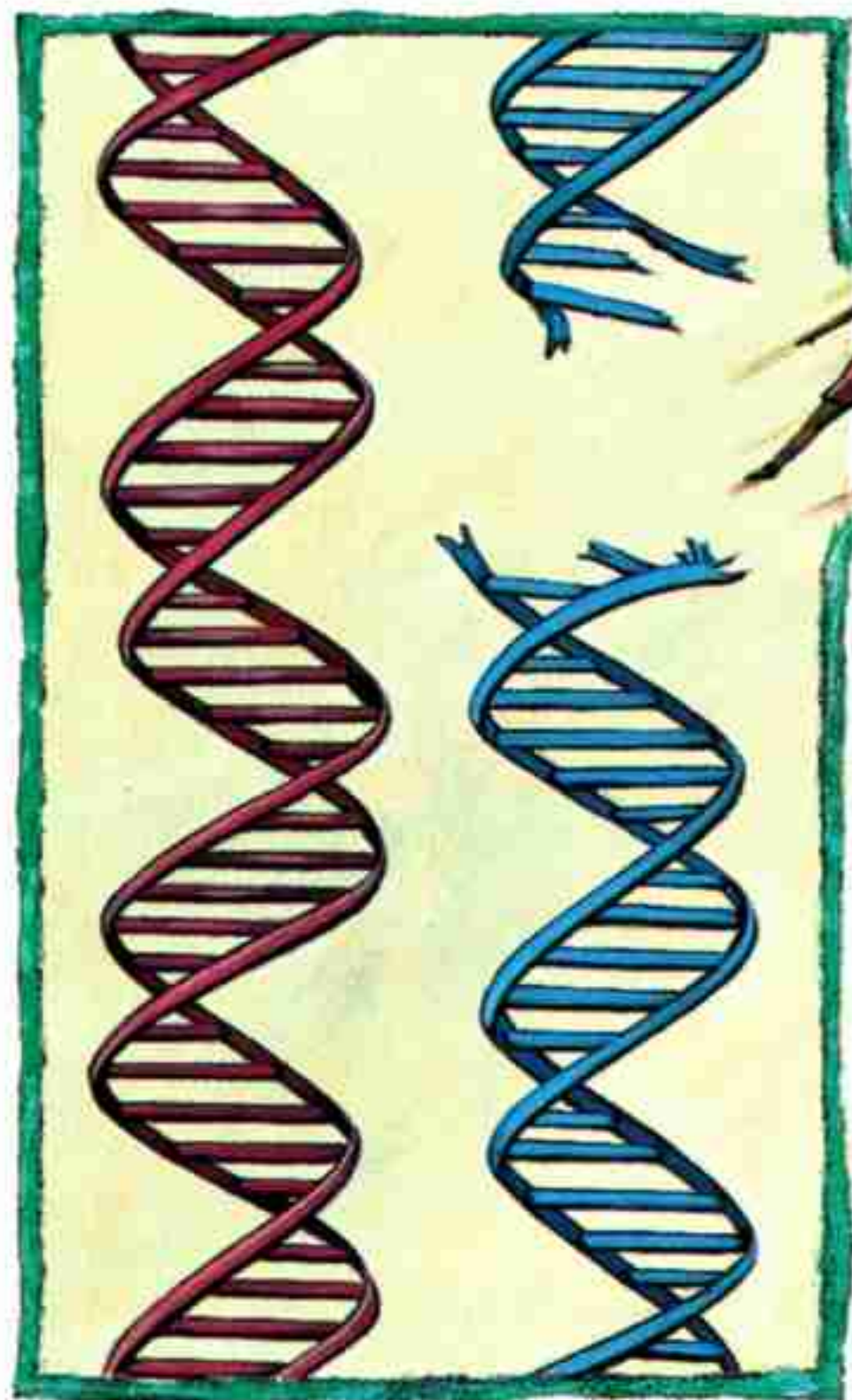
■ NGS RESEARCH GRANT

There's Life in the Old Galaxy Yet

When astronomers peer through a telescope at nearby galaxies—those less than a mere 130 million light-years or so away—they usually see a single bright region, signifying that the galaxy is primarily composed of old stars far past their prime. But looks can be deceiving. For a different view, Nick Devereux of Arizona's Embry-Riddle Aeronautical University filtered out most of the radiation stars emit, leaving only a wavelength of light called H-alpha, which can show hydrogen gas glowing when ionized by energy from "hot" young stars. A lone bright area dominates normal images, at top, of galaxies NGC 1398 (left) and NGC 7552 (right). In H-alpha images, at bottom, NGC 1398 exhibits only a scattering of new stars, while NGC 7552 has many brightly glowing areas, suggesting that large clusters of stars are being born.

NICK DEVEREUX, EMBRY-RIDDLE AERONAUTICAL UNIVERSITY, AND SALMAN HAMEED, NEW MEXICO STATE UNIVERSITY

Slam-dunking a Leaping Gene



WARREN GEBERT

When biologists isolated a gene that leaps from one chromosome to another within a cell of the green alga called *Volvox*, they naturally named it after a master leaper, basketball legend Michael Jordan. Now the team from Washington University in St. Louis has taken Jordan to new heights, making the gene leap at their direction so that scientists can use it as a DNA marker to isolate other genes. The trick: stress the cells by growing *Volvox* at cool temperatures. "Genes like this, called transposons, move around more frequently under stress," says David Kirk, captain of the biology team.

Monkey Crossing!

Fast-moving traffic on a mile-long stretch of road in the Jozani Forest Reserve in Zanzibar has killed hundreds of endangered red colobus monkeys since the road was paved in 1996. But after the December 1998 *Geographica* noted the problem, authorities heeded the plea of the Zanzibar Commission for Natural Resources-Forestry and installed four speed bumps. Only one monkey has been killed since then.

TEXT BY BORIS WEINTRAUB



LATIN DANCE
JAVA PROGRAMMING
HEDGEHOGS AS PETS

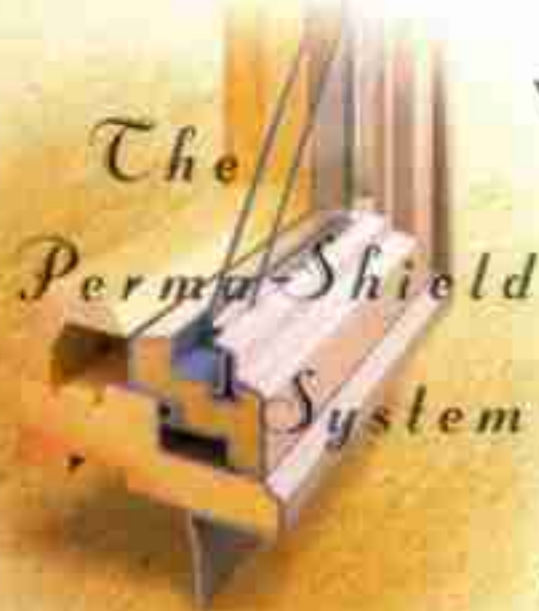
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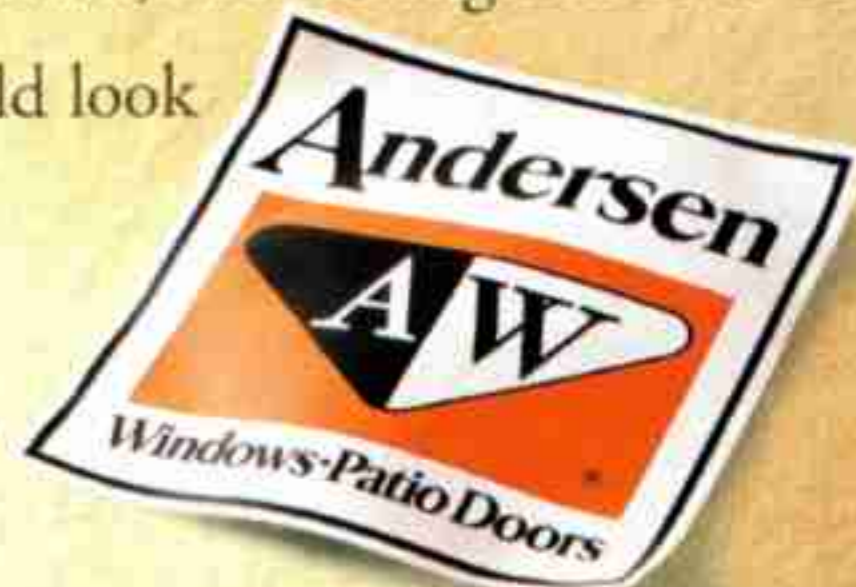
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Forum

Careful readers of the November issue noticed an intriguing similarity between the photographs on pages 37 and 81. One wrote: "The Inca Empire was on the west side of South America, and Afar is on the east side of Africa, several thousand miles away. The Inca lived five centuries ago, yet with all those years and miles of separation, the two hairdos appear to be identical. Some things never change."

Eyewitness Iraq

We are witnessing the transformation of the cradle of civilization into a mass graveyard populated by Saddam's victims, the starving survivors, and secret police organizations. How many thousand Marsh Arabs have to be poisoned or Kurds have to be bombed with chemicals before the world takes action against this brutal tyrant? I, like many fellow Iraqis in exile, dream of the day when we can return to a free, democratic, and pluralist Iraq. At every Iraqi gathering you hear, "Next year in Baghdad!"

MOHAMMED H. AL-SADR
Dublin, Ireland

You fail to point out that the poor condition of Iraq's infrastructure—water, power, sewage—is the result of deliberate U.S. bombing of these resources during the war. Clearly Saddam Hussein is no Santa Claus, but it is the people of Iraq, and not the dictator, who are suffering.

DAVID LAZARUS
Windham, Connecticut

Ten cents a gallon for gasoline sounds very inexpensive when compared with international prices, but at an average income of only ten dollars a month, this would make the gas very expensive.

GÜNTER TSCHIEDEL
San Dimas, California

Your article reminded me of my childhood in Baghdad. Children are the ones most affected by Saddam's power over daily life, taught through the media to believe him a hero. While watching Saddam grumbling as usual on TV, I pointed to him and said my very first word: "Addam! (Saddam!)."

NAME WITHHELD
Ajman, United Arab Emirates

Frozen in Time

What Johan Reinhard brought to light from the Inca past both fascinates and repels. The beauty of the children and the pristine heights of the mountaintops belie the nature of the event that took place. Regardless of the ethnic assimilation achieved

by the sacrifices, the cooperation of the parents, or the numbing effect of *chicha* and the altitude, there is no good way to kill innocent children.

RUSS HOBBS
Edinburg, Texas

It is amazing that sites like these are found at all. I laughed, however, when I read the sentence about the Inca not being "the brutal conquerors the Spaniards were." Is human sacrifice or the forced removal of children from their families not considered brutal?

COURT PATTON
San Diego, California

I am deeply saddened that the remains of South American human sacrifices are still being dug up and removed from their resting places. Since these are relatively recent remains of rituals well documented by the Spanish, such grave robbing must have limited scientific and historical value. Had an English body of similar antiquity been exhumed, there would have been an outcry. Some historians believe that those sacrificed suffered horribly on their way to the summit. They now deserve to rest in peace, close to their gods.

MARK WILLIAMS
Peterborough, England

In response, author Johan Reinhard writes, "Though Spaniards recorded tales of Inca human sacrifice, none ever wrote of witnessing such a ritual. Burial sites on summits are impossible to protect from looting, and it is only a matter of time before all will be thoroughly destroyed. If their contents are to be preserved, there is no alternative to the scientific excavation of such sites."

I was struck by the beauty of these children, especially the young girl with braids. I have braided my own daughter's hair. It is a task that takes patience by both parties and involves a great deal of touching. It can take hours. I can only imagine how the mother felt when the last braid was completed.

JANNA VIRDEN
Morrilton, Arkansas

Panama's Rite of Passage

Like most nations of Latin America, Panama has her share of poverty. But as a nation, Panama is generally at peace with herself and her neighbors. It would have been a more balanced article to mention that along with Costa Rica, Panama has the highest literacy rate and life expectancy in that part of the world. Shoeshiners and the poor are not what Panama is all about.

HILARIO A. WILSON
West Covina, California

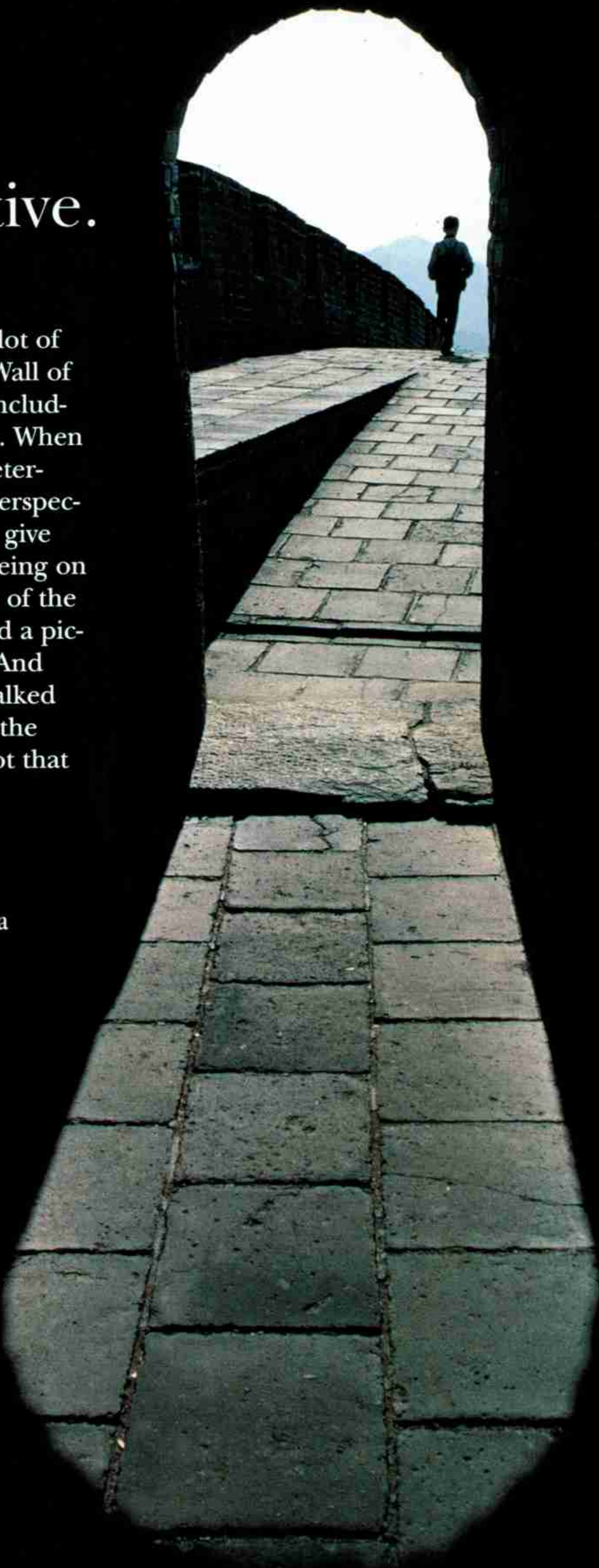
I was taken aback by your article's not-so-subtle suggestion that Panamanians look to the American departure from the Canal Zone as a negative and harmful event for their country. I found that Panamanians are hopeful for the future and look to the year 2000 as an opportunity for a new beginning

A different perspective.

“Over the years, I’d seen a lot of photographs of the Great Wall of China. Most were similar, including mine from my first visit. When I went there again, I was determined to find a different perspective. Something that would give viewers a feel for actually being on the wall. I crouched in one of the guard towers and composed a picture through the archway. And waited. Finally, someone walked by, and for just one frame, the composition was there. I got that different shot I was after.”

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A photographer’s perspective:
Todd Gipstein





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and true independence. The concluding quote on page 77, "It was a great ride while it lasted," may embody the American attitude and exploitative presence, but for many Panamanians it was a ride characterized by destruction, oppression, and neo-colonialism, interspersed with uneasy tolerance of the American presence.

KATY MAMEN
Ottawa, Ontario

I realize most people probably don't care, and it definitely sounds better to be a "bullfighter" than a "cowfighter," but in the picture on page 76 your wannabe matador is really playing with a mad cow, not a bull.

RICHARD RODDIS
Lordsburg, New Mexico

African Marriage Rituals

Your article left me profoundly depressed. While admiring the beauty of these women and girls, I could not escape what seems to be the main message: women as property.

KAREN MCKELLIPS
Lawton, Oklahoma

The real essence of humankind is the diversity of people. This review of African rituals, from Arabs to black Africans, shows how different and yet how similar humans are.

JAVIER LARA
Queretaro, Mexico

With the exception of the tearful Masai, little is said about the reality of these women's lives. How many of them endured another ritual, genital mutilation, to become a desirable bride? Are they regarded as property by their husbands? Will they be accepted if they fail to produce children? Do they ever see their own families again after the ceremony? The women of Africa have little voice of their own. We have an obligation to tell their stories in their entirety.

REBECCA HECKING
Greenville, Pennsylvania

Feathers for *T. rex*?

After observing a new feathered dromaeosaur specimen in a private collection and comparing it with the fossil known as *Archaeoraptor* [pages 100-101], I have concluded that *Archaeoraptor* is a composite. The tail portions of the two fossils are identical, but other elements of the new specimen are very different from *Archaeoraptor*, in fact more closely resembling *Sinornithosaurus*. Though I do not want to believe it, *Archaeoraptor* appears to be composed of a dromaeosaur tail and a bird body.

XU XING
Institute of Vertebrate Paleontology and Paleoanthropology
Chinese Academy of Sciences
Beijing, China

Xu Xing is one of the scientists who originally examined Archaeoraptor. As we go to press, researchers in the U.S. report that CT scans of the fossil seem to confirm the observations cited in his letter. Results of the Society-funded examination of Archaeoraptor and

details of new techniques that revealed anomalies in the fossil's reconstruction will be published as soon as the studies are completed.

After the Deluge—Hurricane Mitch

I was a Peace Corps volunteer in Honduras when the storm passed through, and I experienced first-hand the response of the community of Duyure. Amid the grim circumstances that have continued to grip the region, the profound strength exhibited by the citizens provides hope for the future.

MAXWELL BOYKOFF
Santa Cruz, California

Geographica

What a surprise to find our former San Francisco home of 14 years in glossy color in your magazine! The house is made entirely of cable cars built in the 1880s, and the bedroom car shown in the photograph once ran on Castro Street. I remember carefully stripping at least 17 layers of paint to unearth its number, 135. From that information we were able to trace its origin and former route.

San Francisco's many cable car lines were badly damaged by the 1906 earthquake, and since electric cars were available, only the cable lines that served hilly streets were repaired. The surplus of solid oak cable cars was then sold for use as temporary housing by earthquake survivors. So far as we could ascertain, this is the last surviving Carville house, which makes it all the more special.

MARYANN JACKMAN
Coos Bay, Oregon

Earth Almanac

The short piece about the plight of California's Sierra Nevada bighorns should finally bring national attention to the critical condition of these majestic but besieged animals. The irony is that mountain lions, which were never endangered in the state, were given free rein to devour prey species that truly are endangered. California recently passed a bill that will finally allow the removal of problem lions that are specifically harming endangered sheep populations. It's a good step forward.

BROOKS A. PANGBURN
Mountain Lion Information Center
Duarte, California

Letters for FORUM should be sent to National Geographic Magazine, PO Box 98198, Washington, DC 20090-8198, or by fax to 202-828-5460, or via the Internet to ngsforum@nationalgeographic.com. Include name, address, and daytime telephone. Letters may be edited for clarity and space.

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OnScreen



JIM VECCHIONE; COMPUTER GRAPHICS BY ARTISTIC IMAGE

■ EXPLORER, MARCH 12

Crittercam Cameo

A digital school of Crittercams surrounds their creator, marine biologist and Geographic filmmaker Greg Marshall. Attached harmlessly to creatures ranging from alligators to whales, each unit contains a camera, lights, and instruments recording sound, depth, light level, and temperature. *Tiger Shark*, the latest film project to employ the two-and-a-half-pound device that has revolutionized what we know about marine life, reveals previously unknown tiger shark behavior. "These creatures are taking us into their secret world," says Marshall. "It's up to us to use those secrets wisely."

■ PROGRAM GUIDE

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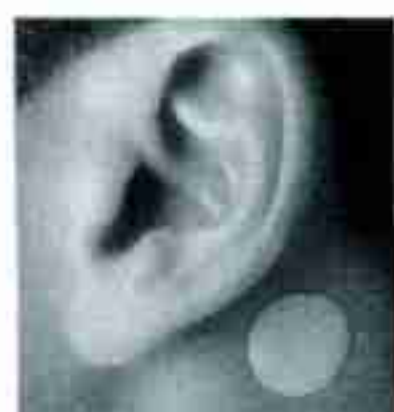
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The Transderm Scōp® patch is clinically proven more effective than Dramamine®*



Transderm Scōp is more effective and longer lasting than Dramamine at preventing the nausea and vomiting of motion sickness.** Just peel off the backing and press it behind your ear at least four hours

before boarding and relax. The medicine is consistently absorbed for up to three days. You can even shower with it. For shorter trips, remove the patch when no longer needed and the effects wear off.

In clinical studies, 5 out of 6 people did not report drowsiness with Transderm Scōp.

Ask your doctor about Transderm Scōp when you make your travel plans.

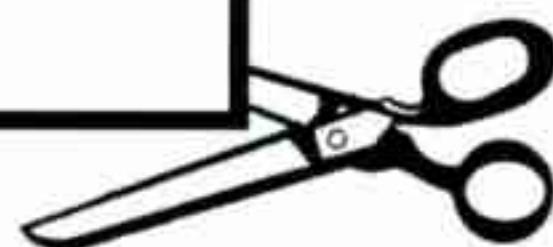
Not for children or those with glaucoma, difficulty in urinating, or an allergy to scopolamine or other belladonna alkaloids. In clinical studies, some side effects were noted, including blurred vision, dryness of the mouth (in two-thirds of users) and drowsiness (reported incidence less than 1 in 6). While using this product, you should not drive, operate dangerous machinery or do other things that require alertness. Avoid using alcohol. If you are elderly, your physician should exercise special care in prescribing this product. See adjoining page for additional information on potential adverse reactions or side effects.

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Brief Summary

(For full prescribing information, see package insert.)

INDICATIONS AND USAGE: Transderm Scop is indicated for prevention of nausea and vomiting associated with motion sickness in adults. The patch should be applied only to skin in the postauricular area.

CONTRAINDICATIONS: Transderm Scop is specifically contraindicated in persons who are hypersensitive to the drug scopolamine or to other belladonna alkaloids, or to any ingredient or component in the formulation or delivery system, or in patients with angle-closure (narrow angle) glaucoma.

WARNINGS: Transderm Scop should not be used in children and should be used with special caution in the elderly. See PRECAUTIONS.

Since drowsiness, disorientation, and confusion may occur with the use of scopolamine, patients should be warned of the possibility and cautioned against engaging in activities that require mental alertness, such as driving a motor vehicle or operating dangerous machinery.

Potentially alarming idiosyncratic reactions may occur with ordinary therapeutic doses of scopolamine.

PRECAUTIONS

General: Scopolamine should be used with caution in patients with pyloric obstruction, or urinary bladder neck obstruction. Caution should be exercised when administering an antiemetic or antimuscarinic drug to patients suspected of having intestinal obstruction.

Transderm Scop should be used with special caution in the elderly or in individuals with impaired metabolic, liver, or kidney functions, because of the increased likelihood of CNS effects.

Caution should be exercised in patients with a history of seizure or psychosis, since scopolamine can potentially aggravate both disorders.

Information for Patients: Since scopolamine can cause temporary dilation of the pupils and blurred vision if it comes in contact with the eyes, patients should be strongly advised to wash their hands thoroughly with soap and water immediately after handling the patch. In addition, it is important that used patches be disposed of properly to avoid contact with children or pets.

Patients should be advised to remove the patch immediately and contact a physician in the unlikely event that they experience symptoms of acute narrow-angle glaucoma (pain in and redness of the eyes accompanied by dilated pupils). Patients should also be instructed to remove the patch if they develop any difficulties in urinating.

Patients should be warned against driving a motor vehicle or operating dangerous machinery while wearing the patch. Patients who engage in these activities should also be aware of the possibility of withdrawal symptoms when the patch is removed. Patients who expect to participate in underwater sports should be cautioned regarding the potentially disorienting effects of scopolamine. A patient brochure is available.

Drug Interactions: Scopolamine should be used with care in patients taking drugs, including alcohol, capable of causing CNS effects. Special attention should be given to drugs having anticholinergic properties, e.g., belladonna alkaloids, antihistamines (including meclizine), and anti-depressants.

Carcinogenesis, Mutagenesis, Impairment of Fertility: No long-term studies in animals have been performed to evaluate carcinogenic potential. Fertility studies were performed in female rats and revealed no evidence of impaired fertility or harm to the fetus due to scopolamine hydrobromide administered by daily subcutaneous injection. In the highest-dose group (plasma level approximately 500 times the level achieved in humans using a transdermal system), reduced maternal body weights were observed.

Pregnancy Category C: Teratogenic studies were performed in pregnant rats and rabbits with scopolamine hydrobromide administered by daily intravenous injection. No adverse effects were recorded in the rats. In the rabbits, the highest dose (plasma level approximately 100 times the level achieved in humans using a transdermal system) of drug administered had a marginal embryotoxic effect. Transderm Scop should be used during pregnancy only if the anticipated benefit justifies the potential risk to the fetus.

Nursing Mothers: It is not known whether scopolamine is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when Transderm Scop is administered to a nursing woman.

Pediatric Use: Children are particularly susceptible to the side effects of belladonna alkaloids. Transderm Scop should not be used in children because it is not known whether this system will release an amount of scopolamine that could produce serious adverse effects in children.

ADVERSE REACTIONS: The most frequent adverse reaction to Transderm Scop is dryness of the mouth. This occurs in about two thirds of the people. A less frequent adverse reaction is drowsiness, which occurs in less than one sixth of the people. Transient impairment of eye accommodation, including blurred vision and dilation of the pupils, is also observed.

The following adverse reactions have also been reported on infrequent occasions during the use of Transderm Scop: disorientation; memory disturbances; dizziness; restlessness; hallucinations; confusion; difficulty urinating; rashes and erythema; acute narrow-angle glaucoma; and dry, itchy, or red eyes.

Drug Withdrawal: Symptoms including dizziness, nausea, vomiting, headache, and disturbances of equilibrium have been reported in a few patients following discontinuation of the use of the Transderm Scop system. These symptoms have occurred most often in patients who have used the system for more than three days.

OVERDOSAGE: Overdosage with scopolamine may cause disorientation, memory disturbances, dizziness, restlessness, hallucinations, confusion, psychosis, convulsions, bronchospasm and respiratory depression, and muscular weakness. Should these symptoms occur, the Transderm Scop patch should be removed immediately, adequate hydration should be maintained, and appropriate symptomatic treatment initiated.

CAUTION: Federal law prohibits dispensing without prescription.

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Born of NASA technology, the latest remote-sensing device is a hyperspectral imager. Used with data collected on the ground, the state-of-the-art imagery can detect pollution, inventory a forest, tell farmers which crops to fertilize, and help devise tactics to fight a wildfire.

Taken from a helicopter in Yellowstone National Park, two images reveal dramatically contrasting views of the Lamar River watershed. The one at right uses just red, blue, and green light bands to simulate human vision; it reveals few details. But the hyperspectral image, at far right, uses 128 bands. According to ecologist Bob Crabtree, "It can even detect individual logs." Woody debris is shown in pink near an upper bend of the river; the reddish hue at upper left is sagebrush. "At this scale the old Landsat technology would be just a blur," Crabtree adds.



JOE BOARDMAN, ANALYTICAL IMAGING AND GEOPHYSICS FOR YELLOWSTONE ECOSYSTEM STUDIES



ALEXANDER SLIWA

Black-footed Cat: A Mighty Mite

Lurking in a rodent's abandoned den, Africa's smallest cat keeps watch for a meal. Almost anything is fair game. Found mainly in South Africa, Botswana, and Namibia, black-footed cats weigh only two to five pounds but pack a ferocious punch, biologist Alexander Sliwa has discovered. Though they prey mostly on rodents, birds, and even hares as big as they are, they are known to attack much larger animals. Sliwa watched one stalk a 180-pound ostrich for more than half an hour. The cat was lucky: The bird fled.

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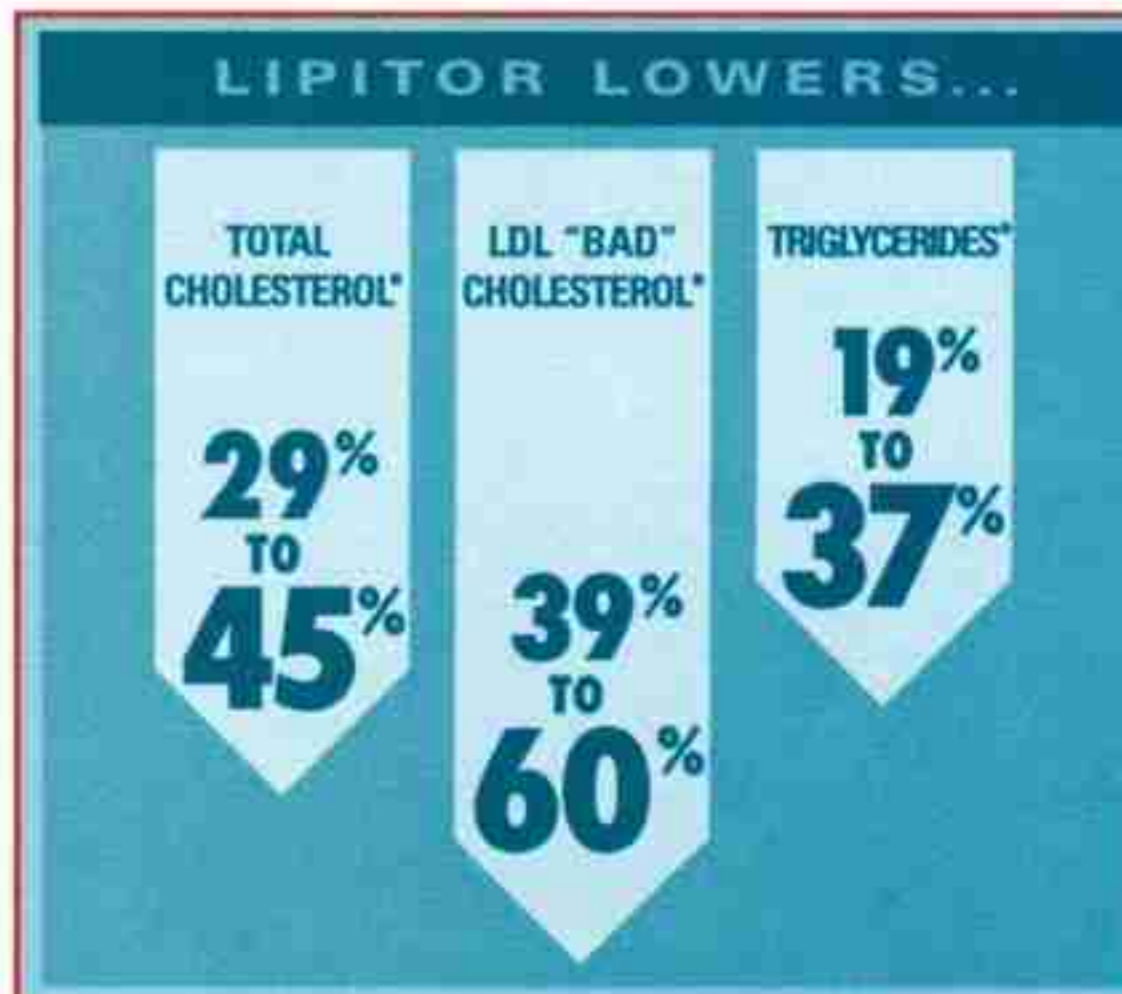


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*Results of two placebo-controlled dose-response studies of 10 to 80 mg of LIPITOR in high cholesterol patients.

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LIPITOR® (Atorvastatin Calcium) Tablets
Brief Summary of Prescribing Information

CONTRAINDICATIONS: Active liver disease or unexplained persistent elevations of serum transaminases. Hypersensitivity to any component of this medication. **Pregnancy and Lactation:** Atherosclerosis is a chronic process and discontinuation of lipid-lowering drugs during pregnancy should have little impact on the outcome of long-term therapy of primary hypercholesterolemia. Cholesterol and other products of cholesterol biosynthesis are essential components for fetal development (including synthesis of steroids and cell membranes). Since HMG-CoA reductase inhibitors decrease cholesterol synthesis and possibly the synthesis of other biologically active substances derived from cholesterol, they may cause fetal harm when administered to pregnant women. Therefore, HMG-CoA reductase inhibitors are contraindicated during pregnancy and in nursing mothers. **ATORVASTATIN SHOULD BE ADMINISTERED TO WOMEN OF CHILDBEARING AGE ONLY WHEN SUCH PATIENTS ARE HIGHLY UNLIKELY TO CONCEIVE AND HAVE BEEN INFORMED OF THE POTENTIAL HAZARDS.** If the patient becomes pregnant while taking this drug, therapy should be discontinued and the patient apprised of the potential hazard to the fetus.

WARNINGS: Liver Dysfunction — HMG-CoA reductase inhibitors, like some other lipid-lowering therapies, have been associated with biochemical abnormalities of liver function. **Persistent elevations (>3 times the upper limit of normal [ULN] occurring on 2 or more occasions) in serum transaminases occurred in 0.7% of patients who received atorvastatin in clinical trials. The incidence of these abnormalities was 0.2%, 0.2%, 0.6%, and 2.3% for 10, 20, 40, and 80 mg, respectively.** One patient in clinical trials developed jaundice. Increases in liver function tests (LFT) in other patients were not associated with jaundice or other clinical signs or symptoms. Upon dose reduction, drug interruption, or discontinuation, transaminase levels returned to or near pretreatment levels without sequelae. Eighteen of 30 patients with persistent LFT elevations continued treatment with a reduced dose of atorvastatin. **It is recommended that liver function tests be performed prior to and at 12 weeks following both the initiation of therapy and any elevation of dose, and periodically (eg, semiannually) thereafter.** Liver enzyme changes generally occur in the first 3 months of treatment with atorvastatin. Patients who develop increased transaminase levels should be monitored until the abnormalities resolve. Should an increase in ALT or AST of >3 times ULN persist, reduction of dose or withdrawal of atorvastatin is recommended. Atorvastatin should be used with caution in patients who consume substantial quantities of alcohol and/or have a history of liver disease. Active liver disease or unexplained persistent transaminase elevations are contraindications to the use of atorvastatin (see CONTRAINDICATIONS). **Skeletal Muscle — Rhabdomyolysis with acute renal failure secondary to myoglobinuria has been reported with other drugs in this class.** Uncomplicated myalgia has been reported in atorvastatin-treated patients (see ADVERSE REACTIONS). Myopathy, defined as muscle aches or muscle weakness in conjunction with increases in creatine phosphokinase (CPK) values >10 times ULN, should be considered in any patient with diffuse myalgias, muscle tenderness or weakness, and/or marked elevation of CPK. Patients should be advised to report promptly unexplained muscle pain, tenderness or weakness, particularly if accompanied by malaise or fever. Atorvastatin therapy should be discontinued if markedly elevated CPK levels occur or myopathy is diagnosed or suspected. The risk of myopathy during treatment with other drugs in this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, erythromycin, niacin, or azole antifungals. Physicians considering combined therapy with atorvastatin and fibric acid derivatives, erythromycin, immunosuppressive drugs, azole antifungals, or lipid-lowering doses of niacin should carefully weigh the potential benefits and risks and should carefully monitor patients for any signs or symptoms of muscle pain, tenderness, or weakness, particularly during the initial months of therapy and during any periods of upward dosage titration of either drug. Periodic creatine phosphokinase (CPK) determinations may be considered in such situations, but there is no assurance that such monitoring will prevent the occurrence of severe myopathy. **Atorvastatin therapy should be temporarily withheld or discontinued in any patient with an acute, serious condition suggestive of a myopathy or having a risk factor predisposing to the development of renal failure secondary to rhabdomyolysis (eg, severe acute infection, hypotension, major surgery, trauma, severe metabolic, endocrine and electrolyte disorders, and uncontrolled seizures).**

PRECAUTIONS: General — Before instituting therapy with atorvastatin, an attempt should be made to control hypercholesterolemia with appropriate diet, exercise, and weight reduction in obese patients, and to treat other underlying medical problems (see INDICATIONS AND USAGE in full prescribing information). **Information for Patients** — Patients should be advised to report promptly unexplained muscle pain, tenderness, or weakness, particularly if accompanied by malaise or fever. **Drug Interactions** — The risk of myopathy during treatment with other drugs of this class is increased with concurrent administration of cyclosporine, fibric acid derivatives, niacin (nicotinic acid), erythromycin, azole antifungals (see WARNINGS, Skeletal Muscle).

Antacid: When atorvastatin and Maalox® TC suspension were coadministered, plasma concentrations of atorvastatin decreased approximately 35%. However, LDL-C reduction was not altered.

Antipyrine: Because atorvastatin does not affect the pharmacokinetics of antipyrine, interactions with other drugs metabolized via the same cytochrome isozymes are not expected. **Colestipol:** Plasma concentrations of atorvastatin decreased approximately 25% when colestipol and atorvastatin were coadministered. However, LDL-C reduction was greater when atorvastatin and colestipol were coadministered than when either drug was given alone. **Cimetidine:** Atorvastatin plasma concentrations and LDL-C reduction were not altered by coadministration of cimetidine.

Digoxin: When multiple doses of atorvastatin and digoxin were coadministered, steady-state plasma digoxin concentrations increased by approximately 20%. Patients taking digoxin should be monitored appropriately. **Erythromycin:** In healthy individuals, plasma concentrations of atorvastatin increased approximately 40% with coadministration of atorvastatin and erythromycin, a known inhibitor of cytochrome P450 3A4 (see WARNINGS, Skeletal Muscle). **Oral Contraceptives:**

Coadministration of atorvastatin and an oral contraceptive increased AUC values for norethindrone and ethinyl estradiol by approximately 30% and 20%, respectively. These increases should be considered when selecting an oral contraceptive for a woman taking atorvastatin. **Warfarin:** Atorvastatin had no clinically significant effect on prothrombin time when administered to patients receiving chronic warfarin treatment. **Endocrine Function** — HMG-CoA reductase inhibitors interfere with cholesterol synthesis and theoretically might blunt adrenal and/or gonadal steroid production. Clinical studies have shown that atorvastatin does not reduce basal plasma cortisol concentration or impair adrenal reserve. The effects of HMG-CoA reductase inhibitors on male fertility have not been studied in adequate numbers of patients. The effects, if any, on the pituitary-gonadal axis in premenopausal women are unknown. Caution should be exercised if an HMG-CoA reductase inhibitor is administered concomitantly with drugs that may decrease the levels or activity of endogenous steroid hormones, such as ketoconazole, spironolactone, and cimetidine. **CNS**

Toxicity — Brain hemorrhage was seen in a female dog treated for 3 months at 120 mg/kg/day. Brain hemorrhage and optic nerve vacuolation were seen in another female dog that was sacrificed in moribund condition after 11 weeks of escalating doses up to 280 mg/kg/day. The 120 mg/kg dose resulted in a systemic exposure approximately 16 times the human plasma area-under-the-curve (AUC, 0-24 hours) based on the maximum human dose of 80 mg/day. A single tonic convulsion was seen in each of 2 male dogs (one treated at 10 mg/kg/day and one at 120 mg/kg/day) in a 2-year study. No CNS lesions have been observed in mice after chronic treatment for up to 2 years at doses up to 400 mg/kg/day or in rats at doses up to 100 mg/kg/day. These doses were 6 to 11 times (mouse) and 8 to 16 times (rat) the human AUC (0-24) based on the maximum recommended human dose of 80 mg/day. CNS vascular lesions, characterized by perivascular hemorrhages, edema, and mononuclear cell infiltration of perivascular spaces, have been observed in dogs treated with other members of this class. A chemically similar drug in this class produced optic nerve degeneration (Wallerian degeneration of retinogeniculate fibers) in clinically normal dogs in a dose-dependent fashion at a dose that produced plasma drug levels about 30 times higher than the mean drug level in humans taking the highest recommended dose. **Carcinogenesis, Mutagenesis, Impairment of Fertility** — In a 2-year carcinogenicity study in rats at dose levels of 10, 30, and 100 mg/kg/day, 2 rare tumors were found in muscle in high-dose females: in one, there was a rhabdomyosarcoma and, in another, there was a fibrosarcoma. This dose represents a plasma AUC (0-24) value of approximately 16 times the mean human plasma drug exposure after an 80 mg oral dose. A 2-year carcinogenicity study in mice given 100, 200, or 400 mg/kg/day resulted in a significant increase in liver adenomas in high-dose males and liver carcinomas in high-dose females. These findings occurred at plasma AUC (0-24) values of approximately 6 times the mean human plasma drug exposure after an 80 mg oral dose. *In vitro*, atorvastatin was not mutagenic or clastogenic in the following tests with and without metabolic activation: the Ames test with *Salmonella typhimurium* and *Escherichia coli*, the HGPRT forward mutation assay in Chinese hamster lung cells, and the chromosomal aberration assay in Chinese hamster lung cells. Atorvastatin was negative in the *in vivo* mouse micronucleus test. Studies in rats performed at doses up to 175 mg/kg (15 times the human exposure) produced no changes in fertility.

There was aplasia and aspermia in the epididymis of 2 of 10 rats treated with 100 mg/kg/day of atorvastatin for 3 months (16 times the human AUC at the 80 mg dose); testis weights were significantly lower at 30 and 100 mg/kg and epididymal weight was lower at 100 mg/kg. Male rats given 100 mg/kg/day for 11 weeks prior to mating had decreased sperm motility, spermatid head concentration, and increased abnormal sperm. Atorvastatin caused no adverse effects on semen parameters, or reproductive organ histopathology in dogs given doses of 10, 40, or 120 mg/kg for two years. **Pregnancy: Pregnancy Category X** — See CONTRAINDICATIONS. Safety in pregnant women has not been established. Atorvastatin crosses the rat placenta and reaches a level in fetal liver equivalent to that of maternal plasma. Atorvastatin was not teratogenic in rats at doses up to 300 mg/kg/day or in rabbits at doses up to 100 mg/kg/day. These doses resulted in multiples of about 30 times (rat) or 20 times (rabbit) the human exposure based on surface area (mg/m²). In a study in rats given 20, 100, or 225 mg/kg/day, from gestation day 7 through to lactation day 21 (weaning), there was decreased pup survival at birth, neonate, weaning, and maturity in pups of mothers dosed with 225 mg/kg/day. Body weight was decreased on days 4 and 21 in pups of mothers dosed at 100 mg/kg/day; pup body weight was decreased at birth and at days 4, 21, and 91 at 225 mg/kg/day. Pup development was delayed (rotorod performance at 100 mg/kg/day and acoustic startle at 225 mg/kg/day; pinnae detachment and eye opening at 225 mg/kg/day). These doses correspond to 6 times (100 mg/kg) and 22 times (225 mg/kg) the human AUC at 80 mg/day. Rare reports of congenital anomalies have been received following intrauterine exposure to HMG-CoA reductase inhibitors. There has been one report of severe congenital bony deformity, tracheo-esophageal fistula, and anal atresia (VATER association) in a baby born to a woman who took lovastatin with dextroamphetamine sulfate during the first trimester of pregnancy. LIPITOR should be administered to women of child-bearing potential only when such patients are highly unlikely to conceive and have been informed of the potential hazards. If the woman becomes pregnant while taking LIPITOR, it should be discontinued and the patient advised again as to the potential hazards to the fetus. **Nursing Mothers:** Nursing rat pups had plasma and liver drug levels of 50% and 40%, respectively, of that in their mother's milk. Because of the potential for adverse reactions in nursing infants, women taking LIPITOR should not breast-feed (see CONTRAINDICATIONS). **Pediatric Use:** Treatment experience in a pediatric population is limited to doses of LIPITOR up to 80 mg/day for 1 year in 8 patients with homozygous FH. No clinical or biochemical abnormalities were reported in these patients. None of these patients was below 9 years of age. **Geriatric Use:** Treatment experience in adults age ≥70 years with doses of LIPITOR up to 80 mg/day has been evaluated in 221 patients. The safety and efficacy of LIPITOR in this population were similar to those of patients <70 years of age.

ADVERSE REACTIONS: LIPITOR is generally well-tolerated. Adverse reactions have usually been mild and transient. In controlled clinical studies of 2502 patients, <2% of patients were discontinued due to adverse experiences attributable to atorvastatin. The most frequent adverse events thought to be related to atorvastatin were constipation, flatulence, dyspepsia, and abdominal pain. **Clinical Adverse Experiences:** Adverse experiences reported in ≥2% of patients in placebo-controlled clinical studies of atorvastatin, regardless of causality assessment, are shown in the following table.

Adverse Events in Placebo-Controlled Studies (% of Patients)					
BODY SYSTEM	Placebo	Atorvastatin	Atorvastatin	Atorvastatin	Atorvastatin
Adverse Event	N = 270	N = 863	20 mg N = 36	40 mg N = 79	80 mg N = 94
BODY AS A WHOLE					
Infection	10.0	10.3	2.8	10.1	7.4
Headache	7.0	5.4	16.7	2.5	6.4
Accidental Injury	3.7	4.2	0.0	1.3	3.2
Flu Syndrome	1.9	2.2	0.0	2.5	3.2
Abdominal Pain	0.7	2.8	0.0	3.8	2.1
Back Pain	3.0	2.8	0.0	3.8	1.1
Allergic Reaction	2.6	0.9	2.8	1.3	0.0
Asthenia	1.9	2.2	0.0	3.8	0.0
DIGESTIVE SYSTEM					
Constipation	1.8	2.1	0.0	2.5	1.1
Diarrhea	1.5	2.7	0.0	3.8	5.3
Dyspepsia	4.1	2.3	2.8	1.3	2.1
Flatulence	3.3	2.1	2.8	1.3	1.1
RESPIRATORY SYSTEM					
Sinusitis	2.6	2.8	0.0	2.5	6.4
Pharyngitis	1.5	2.5	0.0	1.3	2.1
SKIN AND APPENDAGES					
Rash	0.7	3.9	2.8	3.8	1.1
MUSCULOSKELETAL SYSTEM					
Arthralgia	1.5	2.0	0.0	5.1	0.0
Myalgia	1.1	3.2	5.6	1.3	0.0

The following adverse events were reported, regardless of causality assessment in patients treated with atorvastatin in clinical trials. The events in italics occurred in ≥2% of patients and the events in plain type occurred in <2% of patients.

Body as a Whole: Chest pain, face edema, fever, neck rigidity, malaise, photosensitivity reaction, generalized edema. **Digestive System:** Nausea, gastroenteritis, liver function tests abnormal, colitis, vomiting, gastritis, dry mouth, rectal hemorrhage, esophagitis, eructation, glossitis, mouth ulceration, anorexia, increased appetite, stomatitis, biliary pain, cheilitis, duodenal ulcer, dysphagia, enteritis, melena, gum hemorrhage, stomach ulcer, tenesmus, ulcerative stomatitis, hepatitis, pancreatitis, cholestatic jaundice. **Respiratory System:** Bronchitis, rhinitis, pneumonia, dyspnea, asthma, epistaxis. **Nervous System:** Insomnia, dizziness, paresthesia, somnolence, amnesia, abnormal dreams, libido decreased, emotional lability, incoordination, peripheral neuropathy, torticollis, facial paralysis, hyperkinesia, depression, hypesthesia, hypertonia. **Musculoskeletal System:** Arthritis, leg cramps, bursitis, tenosynovitis, myasthenia, tendinous contracture, myositis. **Skin and Appendages:** Pruritus, contact dermatitis, alopecia, dry skin, sweating, acne, urticaria, eczema, seborrhea, skin ulcer. **Urogenital System:** Urinary tract infection, urinary frequency, cystitis, hematuria, impotence, dysuria, kidney calculus, nocturia, epididymitis, fibrocystic breast, vaginal hemorrhage, albuminuria, breast enlargement, metrorrhagia, nephritis, urinary incontinence, urinary retention, urinary urgency, abnormal ejaculation, uterine hemorrhage. **Special Senses:** Amblyopia, tinnitus, dry eyes, refraction disorder, eye hemorrhage, deafness, glaucoma, parosmia, taste loss, taste perversion. **Cardiovascular System:** Palpitation, vasodilatation, syncope, migraine, postural hypotension, phlebitis, arrhythmia, angina pectoris, hypertension. **Metabolic and Nutritional Disorders:** Peripheral edema, hyperglycemia, creatine phosphokinase increased, gout, weight gain, hypoglycemia. **Hemic and Lymphatic System:** Ecchymosis, anemia, lymphadenopathy, thrombocytopenia, petechia. **Postintroduction Reports:** Adverse events associated with LIPITOR therapy reported since market introduction, that are not listed above, regardless of causality assessment, include the following: anaphylaxis, angioneurotic edema, bullous rashes (including erythema multiforme, Stevens-Johnson syndrome and toxic epidermal necrolysis), and rhabdomyolysis.

OVERDOSAGE: There is no specific treatment for atorvastatin overdose. In the event of an overdose, the patient should be treated symptomatically, and supportive measures instituted as required. Due to extensive drug binding to plasma proteins, hemodialysis is not expected to significantly enhance atorvastatin clearance.

Consult package insert before prescribing LIPITOR® (Atorvastatin Calcium) Tablets.

Rx only

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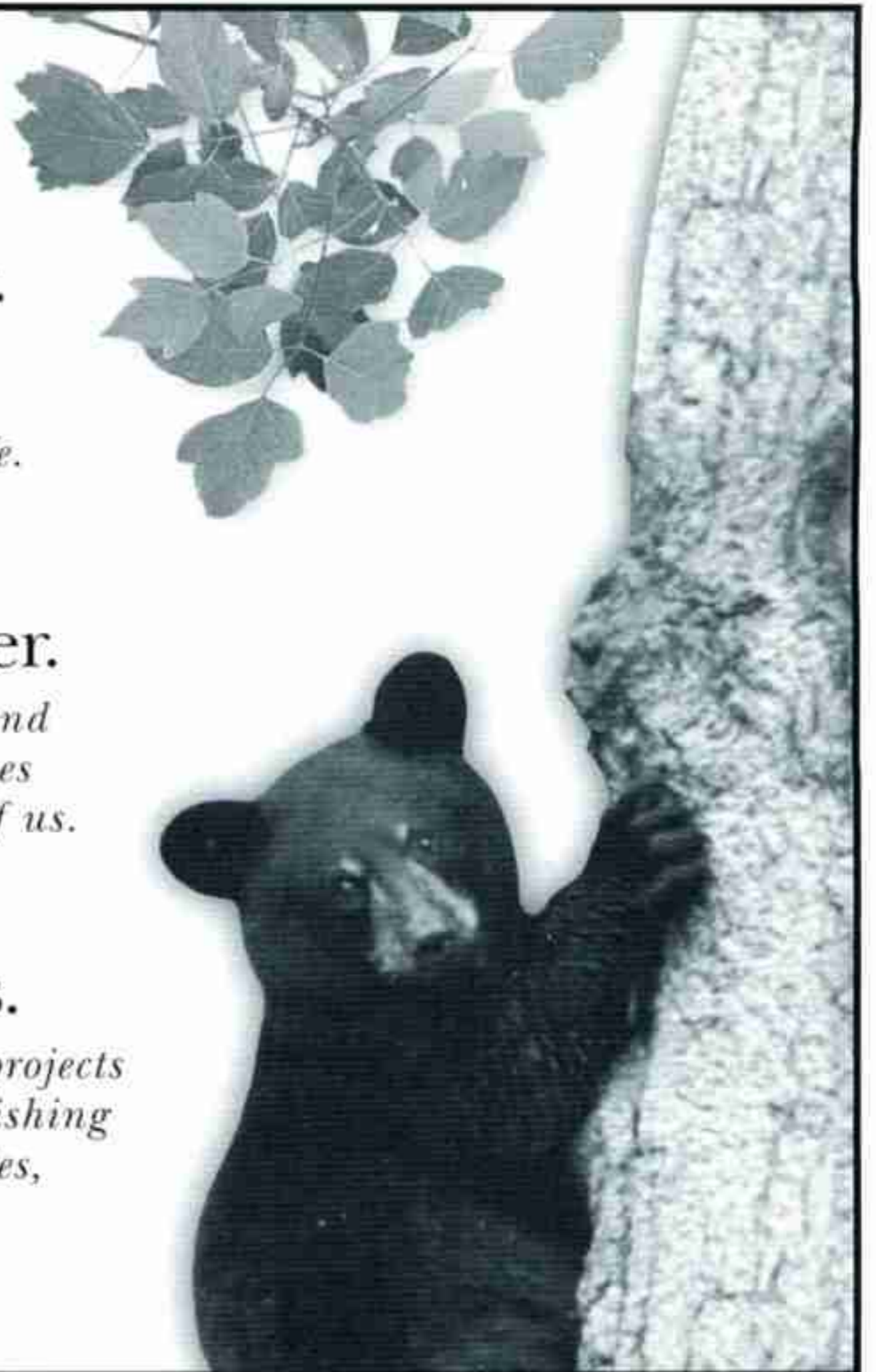
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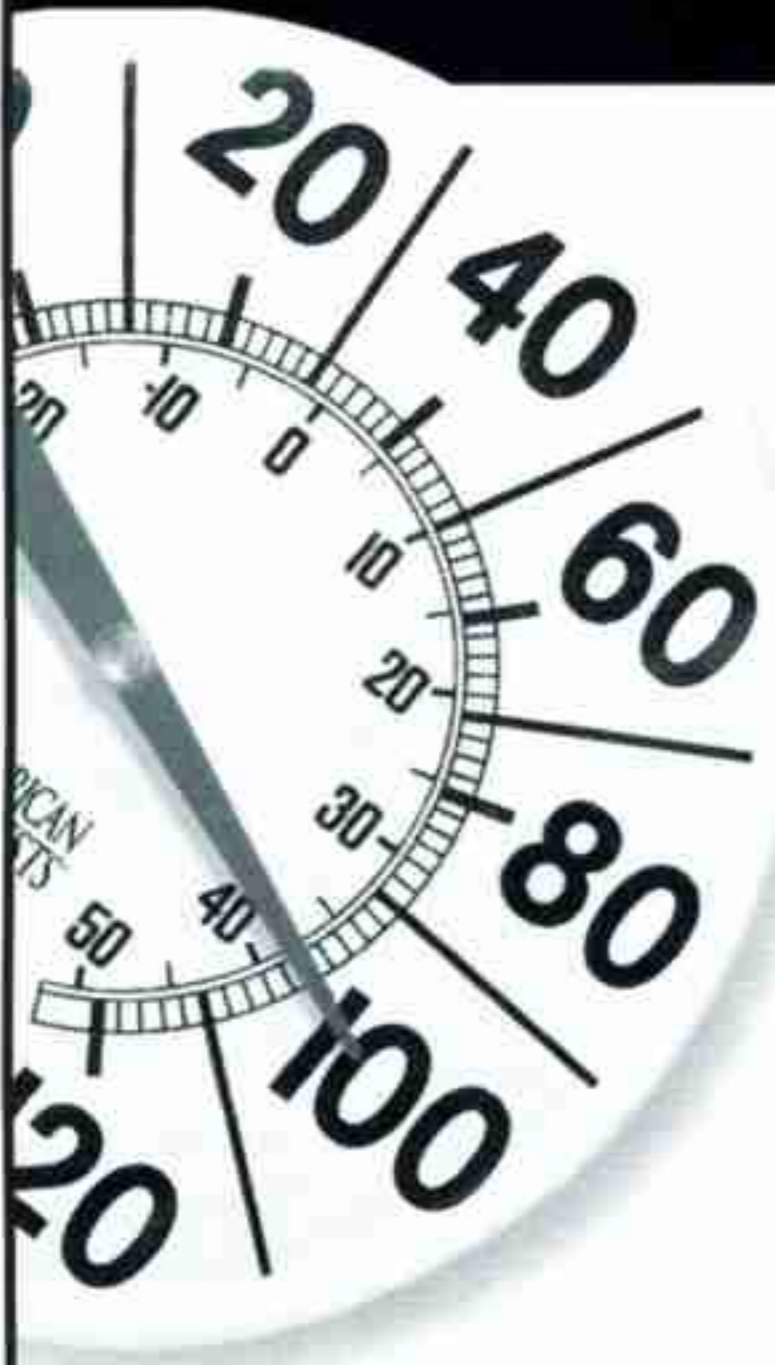
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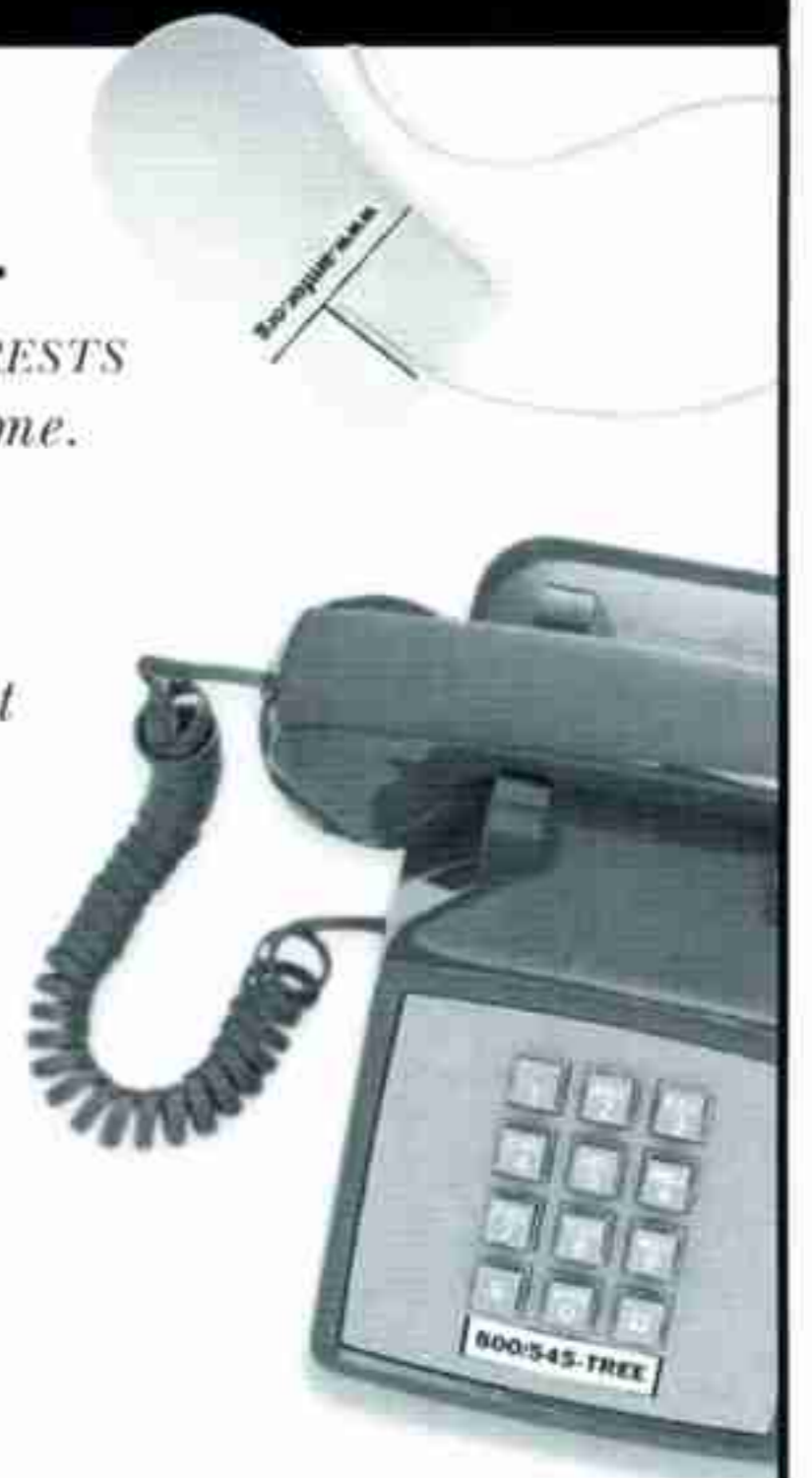


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At Home—From the Beginning?

Elephants love water, and three Australian researchers think they know why. Their ancestors may have been aquatic. Ann Gaeth and her colleagues at the University of Melbourne studied an elephant embryo and fetuses from a culling project in South Africa. They found kidney ducts akin to those of fish and frogs, and early, well-developed trunks that they believe could have been snorkels. Fossils support their findings.

ROBERTO RINALDI, THE COUSTEAU SOCIETY



LYSMATA WURDEMANNI, RAYMOND T. BAUER

Lively Sex Life of Peppermint Shrimps

Many fish and other aquatic creatures can change their sex, but peppermint shrimps are the life of the party. Dwelling in the Atlantic, the Gulf of Mexico, and the Caribbean, the shrimps begin life as males. Then most change to a female phase—with a twist. “These ‘females’ retain their male ducts, produce sperm, and fertilize other female-phase shrimps even when incubating their own embryos,” says University of Louisiana biologist Raymond T. Bauer, who calls them simultaneous hermaphrodites.

TEXT BY JOHN L. ELIOT

Anglers Getting the Lead Out—of Birds Too

In 11 years Mark Pokras has examined nearly 150 loons in New England that were poisoned by swallowing lead fishing gear. Director of Tufts University’s wildlife clinic, Pokras has won a victory in New Hampshire—the first state to restrict lead tackle. Sinkers, like this one in a loon’s x-ray, by law can be no smaller than an ounce, and jigs no shorter than an inch. Lead shotgun pellets were banned for U.S. waterfowl hunters in 1991.



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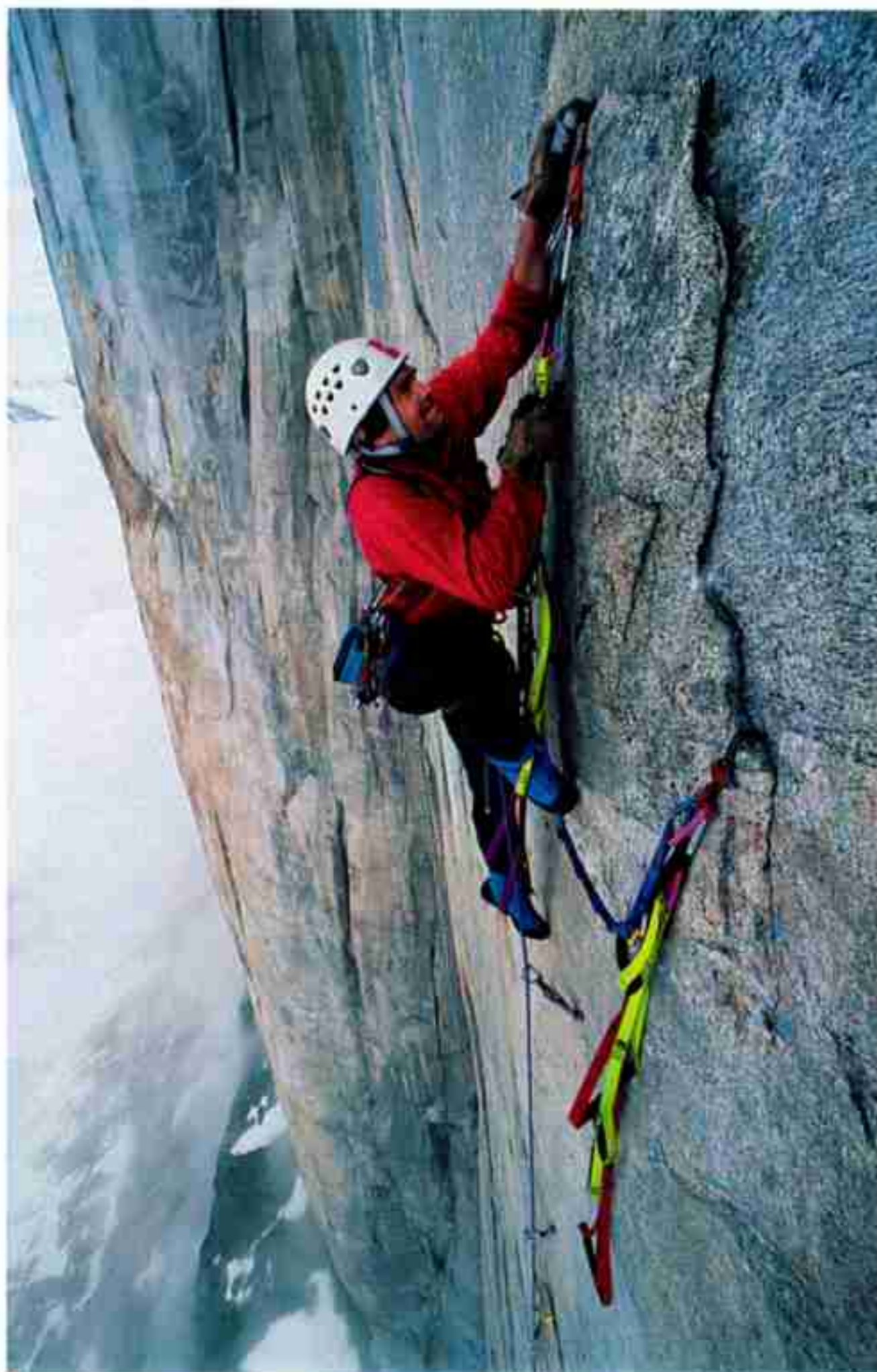
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From the Editor

FOR SOME OF US an adventure is taking a different route to work or making a salad with Romaine lettuce instead of iceberg. But there are those whose lives are led with the volume turned on high, who are as at home suspended in a hammock 2,000 feet up a cliff as on their living room couch . . . perhaps even more so.

Such folks seem drawn to NATIONAL GEOGRAPHIC, and such a person was Alex Lowe, one of the world's leading climbers. Alex—part of a team whose dizzying ascent up the sheer face of Antarctica's Razor was our February 1998 cover story—died in an avalanche October 5. His body lies beneath the snows of Xixabangma, the world's 14th highest mountain, in Tibet. The sentimental might say he would have wanted to go that way. But those who knew Alex understand that his love of climbing was in no way tarnished by recklessness. I'm sure that as he scaled Xixabangma, he had no thoughts other than reaching the top, skiing down safely, and returning to his wife and three children in Montana—before heading off on his next trip, a 300-mile Geographic-sponsored expedition across Antarctica's Ellsworth Mountains.

The adventurous face inevitable risks, and over the years those risks have claimed many good friends of the Geographic. With every challenge they met, the world seemed a little less daunting. We miss them all.

Bill Allen



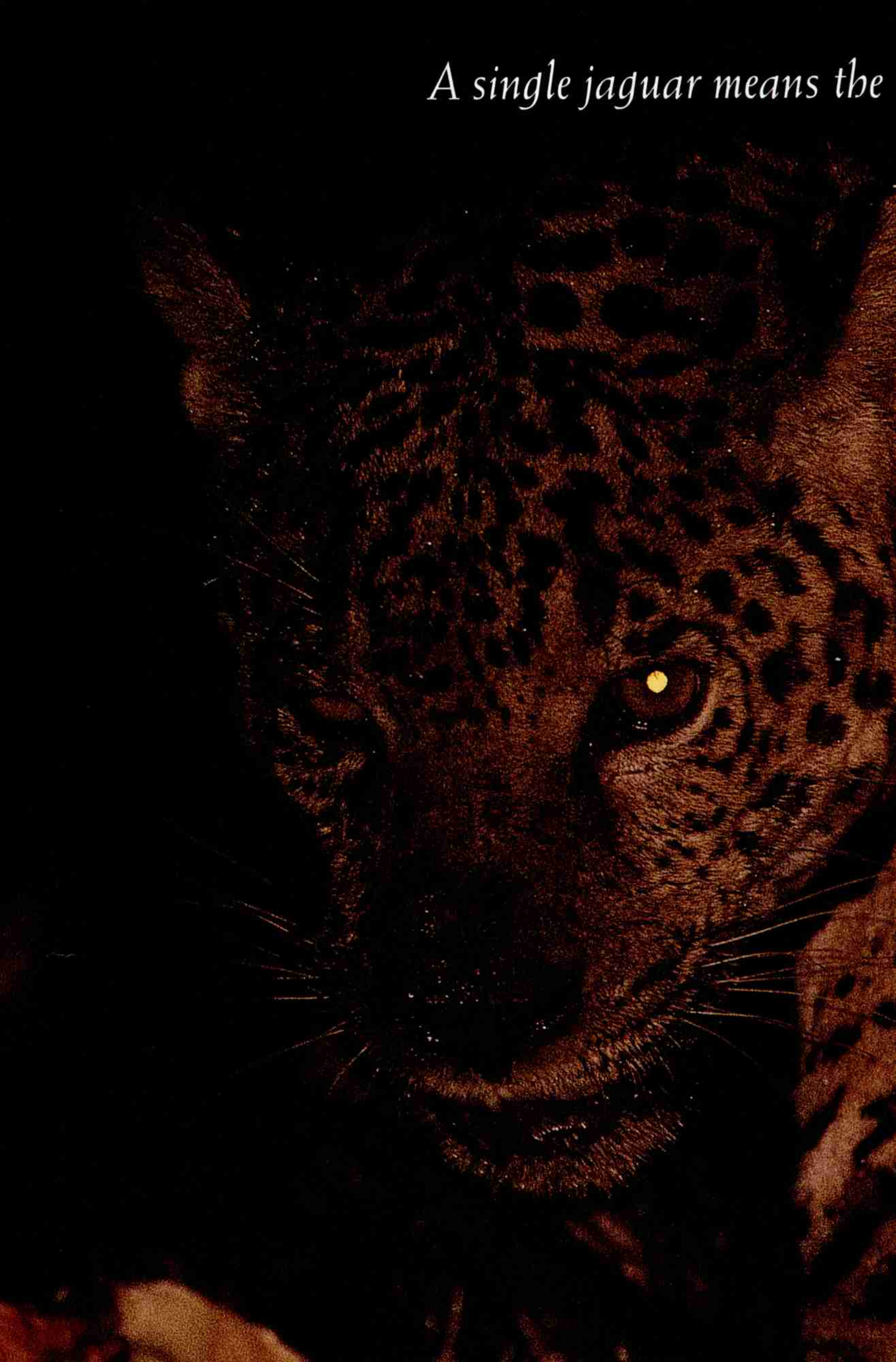
A close-up photograph of a sloth hanging from a tree branch. The sloth's body is dark and hairy, with its limbs wrapped around a light-colored, textured branch. The background is a dense, vibrant green forest with various types of leaves and foliage, creating a rich, textured backdrop. The lighting is soft, highlighting the textures of the sloth's fur and the tree bark.

Taking life slow, a three-toed sloth hangs out on an ambaibo tree along the Río Tuichi in Madidi National Park. A planned hydroelectric dam may permanently inundate this area—claiming one of South America’s most biologically diverse rain forests even before it has been fully explored.

Madidi

**WILL BOLIVIA DROWN
ITS NEW NATIONAL PARK?**

A single jaguar means the



ecosystem is healthy. We saw four in one day.

BLOODIED IN BATTLE, a rain-speckled jaguar bears fresh wounds from a fight with piglike peccaries. Sometimes the jaguars win such conflicts, other times the peccaries do.

BY STEVE KEMPER

PHOTOGRAPHS BY JOEL SARTORE

At Cargadero we lost a horse to a jaguar. At Mojos we lost another to a venomous snake. By that point one of our mules had a botfly maggot wriggling in its chest, and the neck of another was caked with dried blood from the bite of a vampire bat. We humans had been much luckier—a bit of altitude sickness in the Andes, minor gashes and bruises from slips on rocky trails, bites from throngs of ticks, flies, and mosquitoes. But compensations were all around us: breathtaking landscapes, abundant birdlife, utter wildness as far as the eye could travel.

With Rosa María Ruiz, a Bolivian environmental activist, and Charles Munn, an American conservation biologist, I spent a month exploring a new Bolivian national park called Madidi. Covering 4.7 million acres—a bit smaller than New Jersey—Madidi encompasses 19,000-foot glaciers in the west, rain forest in the east, pampas in the north, and cloud forest and dry forest in between.

These varied habitats and their intersections nurture distinct flora and fauna, making the park one of the richest in the diversity of plant and animal life in South America. The continental United States and Canada hold about 700 species of birds; Madidi, with one-tenth of one percent as much area, contains an estimated 1,000 species.

A series of valleys in the park's midsection is so rugged no one lives there or even ventures into it. "What undescribed species of fauna and flora live in this lost world is anyone's guess," said Munn, who works out of Lima, Peru, for the Wildlife Conservation Society. Munn has been involved with Madidi since the Bolivian government hired him as a consultant in 1992 to help define the park. "Manu National Park

in Peru is widely thought to be the best eco-tourism destination in the Amazon," he said, "but Madidi beats Manu hands down."

Or will, if it can be protected from a proposed dam that would drown a huge piece of it. At the moment, tourist accommodations are almost nonexistent. Madidi's 1,700 or so inhabitants live in scattered villages accessible only by rough trails or rivers. Though the Bolivian government established the park in September 1995, it isn't yet well-known even to scientists. Conservationists, tour operators, and Bolivian officials expect that to change as soon as lodges go up and word gets out.

The western gateway to Madidi is Pelechuco, a small Andean town hemmed in by intimidating peaks wreathed with cloud. It was a dismal place whose mayor screamed commands at his constituents through loudspeakers on the square. Still, it intermittently offered electricity, plumbing, and a phone—the last such amenities we would see for a month.

Ruiz led Munn and me out of town in a chilly drizzle, bound for the village of Puina, two days north. Ruiz's braided pigtail hung below her waist, and her cheek bulged with a wad of coca leaves. She has spent much of her life in the eastern part of Madidi. She now directs a small grassroots group called Eco Bolivia and is Madidi's fiercest protector. Though slight and soft-spoken, she once grabbed the barrel of a shotgun held by a logger cutting trees illegally in the park and told him to clear out.

At dusk we camped on a high, grassy plateau near several stone huts and a corral of llamas and alpacas. Our muleteers bought dried dung from the herders to make a fire. Ahead, a glacier caught the last daylight. At daybreak frost glazed our tents and shagged the llamas' coats.

The trail climbed toward the glacier. Chests heaving, we stopped often to gulp the thinning oxygen. I filled my cheek with some of Ruiz's

STEVE KEMPER has also traveled in South America to write about anacondas and Indian corn beer. Freelancer JOEL SARTORE, a resident of Nebraska, has photographed 14 other stories for NATIONAL GEOGRAPHIC.

coca leaves, but the mild alkaloid didn't stop my legs from complaining. In late morning we reached the first of the day's two high passes, the Cumbre de Sanchez, just under 16,000 feet. (The area still hasn't been accurately charted. Maps misplace some villages, include others that don't exist, and reroute rivers.)

The second pass, Yanacocha, was higher and gloomier than Sanchez, its slabs of black rock slippery with cloud mist. My head pounded from the altitude. We descended on wobbly legs into the wide valley of Utañani, stopping occasionally to watch viscachas scamper in the scree. With the ears of a rabbit, tail of a squirrel, and body of a groundhog, the viscacha looks like a rodent designed by committee.

Puina is a Quechua community scattered for miles along the serpentine Río Puina. Ruiz hadn't visited there in four months, and she wanted to tell the villagers about their new rights and obligations. In 1992, financed in

part by the Wildlife Conservation Society, Ruiz had traveled for months by foot, mule, and balsa raft to ask the indigenous communities in the Madidi area to support a park. It was the first time anyone from outside had asked their opinion, so they considered her an ally and looked forward to her rare visits.

At the stone homestead of Evin Cusi Fernández we ate our first hot meal since Pelechuco. A puma had recently killed three of Cusi's llamas, and Cusi had saved what he could from the kill, including a fetus that was drying on a stone wall. The fetus would bring a good price in Pelechuco as a charm to be buried in the corner of a new house.

The puma was another story. Under the park declaration Madidi's inhabitants can continue to cut trees and hunt for their own use, but they can't sell wood or meat from the park or shoot animals indiscriminately. Cusi can shoot the llama-killing puma if he gets the



CALL OF THE WILD is a series of high-pitched whistles from the photographer's lead guide, Choco Mano, who tries in vain to summon monkeys from their hiding places. Like other local people, he hopes to make a living showing tourists around the new park.

Glaciers in the west, rain forest in the east,

A CLOUDY FUTURE awaits Madidi National Park as the government and conservationists square off over the proposed Bala dam, to be built in a narrow gap, far right, in the Andes foothills through which the Río Beni flows. A blanket of clouds obscures the river, whose rising waters would flood the basin in the foreground to form a lake of a thousand square miles. Although the dam's hydroelectric output would far exceed Bolivia's most ambitious future needs, Bolivian officials insist that energy-hungry neighbor Brazil would buy every spare kilowatt, providing much-needed cash for South America's second poorest country. Opponents point to the indisputable outcome of the dam's completion: permanent loss of yet another parcel of the continent's rain forests. Others dismiss the dam as impractical due to the remote site and the rapid buildup of silt that would occur behind it. Cost estimates for construction alone range up to three billion dollars.

pampas in the north, cloud forest in between.



chance, but he won't be compensated by the government for the loss of his llamas. Ruiz and Munn hope that someday, when tourism comes to Puina, the puma will be worth more to Cusi as a live attraction than as a dead pest.

Word of Ruiz's arrival rolled down the valley with the news that there would be a community meeting in downtown Puina—two small cement-block buildings and a rocky soccer field with crooked tree trunks as goalposts.

In the unheated school 19 kids, age 6 to 12, sat at long desks. Strangers rarely appeared here, so the teacher was delighted to see us. He was the sixth teacher posted to Puina this year. Each of his predecessors had quit after a few weeks, defeated by frustration and isolation. None of the teachers, including this one, knew Quechua, the Indian language spoken by the children. The teacher didn't even know that Puina sat in a national park named Madidi.

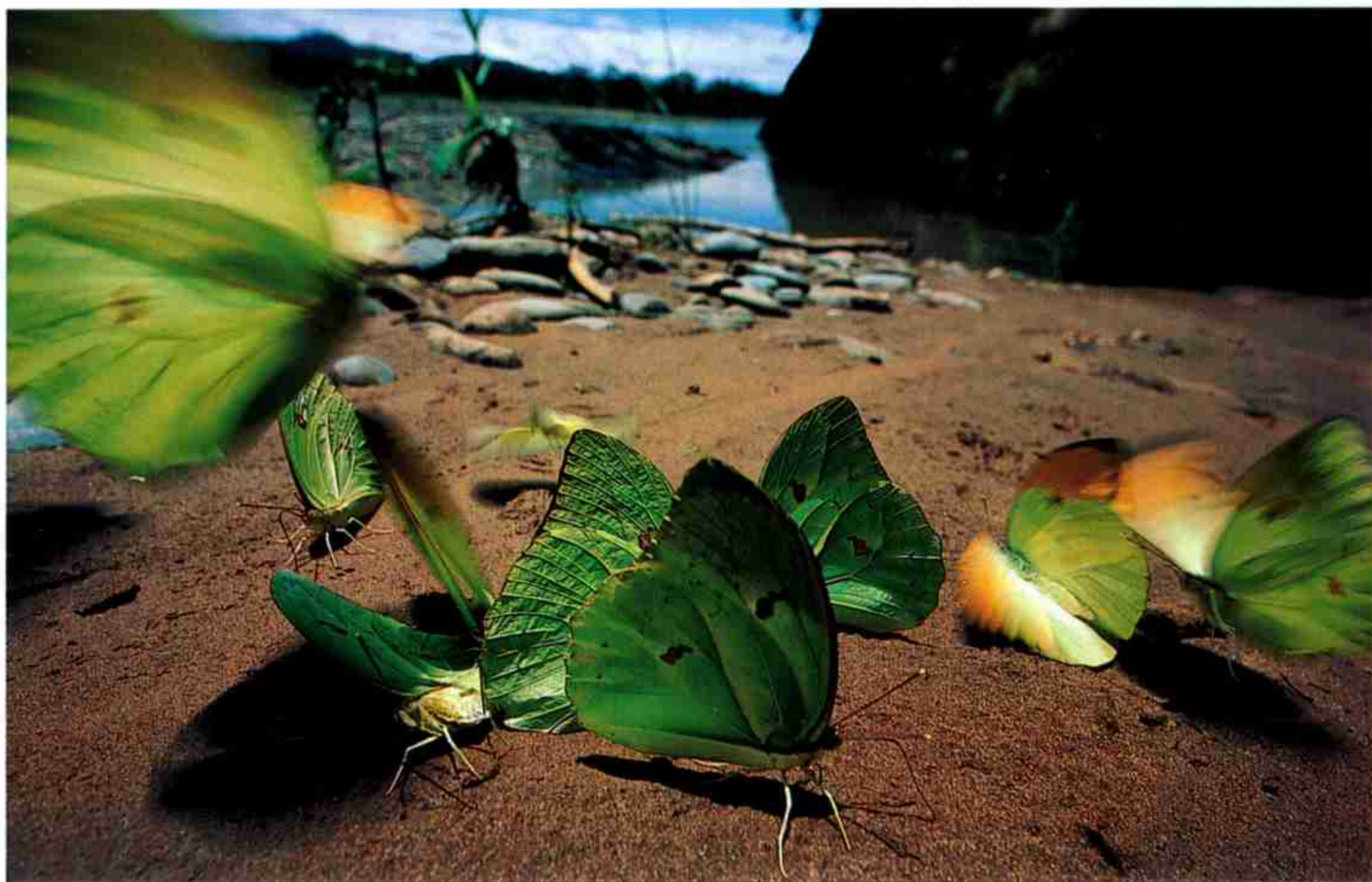
"You're lucky to live among condors, viscachas, and spectacled bears," Ruiz told the children. "If you take care of them, tourists will come, and you'll have jobs when you grow up."

Meanwhile, about 30 villagers had gathered in the dirt plaza nearby. Ruiz stood on a stone

bench as the evening fog drifted in, explaining how the communities in Madidi were supposed to benefit from any enterprise associated with the park, including tourism and mining. "Whatever riches are here should be for the people here," she said. Tourism could pay for clean water, medical care, and better education.

We then waited in the dark schoolhouse while the villagers discussed their future. After 45 minutes we were summoned. The headman announced that the village wanted to cooperate with other communities, learn tourism, and work with Eco Bolivia. Then he read aloud what had transpired at the meeting, as written down in the official community record. Everyone signed or marked the page, with handshaking all around. And so Puina took the first step toward the remote dream of community-based tourism. Even if Ruiz can find funding for training, Puina isn't likely to see any money for several years, until Madidi becomes better known and the village can accommodate tourists.

Ruiz believed that if the villagers understood that foreigners would pay to see wildlife and unspoiled landscapes, they would kill fewer



LEAVES WITH LEGS, delicate pierid butterflies gather on a beach along the Tuichi. Such waterside appearances are common for these rain forest insects, which are often seen swarming by the thousands.

Madidi

NATIONAL PARK

For decades engineers have seen the Bala narrows of the Río Beni as an ideal site for a hydroelectric dam. Environmentalists oppose the plan because the resulting lake would inundate more than a thousand square miles of forest. Some less invasive hydroelectric sites have been identified upstream.



Pampas

These flat grasslands are home to jabiru storks, pampas deer, and black caimans.



Lowland rain forest

Heavy rains support rich plant and animal life in niches from forest floor to treetops.



Dry forest

Long dry seasons create thickets of bushes and cactuses beneath bare trees.



Cloud forest

Pushed up from mountain valleys, warm, moist air condenses into perpetual fog.



High Andes

Peaks shelter animal and plant species found nowhere else. Shrubs and grasses crowd the snow-line.



- ▲ Ecotourism site
- Proposed ecotourism site
- Road
- - - Trail
- LECO Indigenous people

0 mi 20
0 km 20

NATIONAL GEOGRAPHIC MAPS
ART BY SHAWN GOULD
SOURCE FOR ART: TIMOTHY J. KILLEEN, MISSOURI BOTANICAL GARDEN
SOURCES FOR MAP: CONSERVATION INTERNATIONAL; NATIONAL PROTECTED AREAS SERVICE, BOLIVIA

animals, burn fewer trees to clear fields, and damage fewer rivers and mountains by mining. If they also learned how to provide guides, lodging, and transportation, they could control the flow of tourists through their homelands as well as profit from it.

To Ruiz and Munn this community-based tourism represents the best way to balance protection and progress. Munn said that this idea had begun to work in a few places, including Manu. But the concept is hard to implement in remote areas such as Madidi, where the people need training in everything from speaking English to cooking for foreign tastes to changing a way of life their families have followed for many generations.

AFTER PUINA the terrain grew more lush as we descended into high cloud forest, one of the rarest habitats in the world; much of it has been destroyed by slash-and-burn agriculture. While 90 percent of the cloud forest in the northern Andes has been destroyed, here in Madidi

it covers layers of mountains to the northern horizon. "You can see more high cloud forest from here than is left in all of Central America," said Munn. But to the east the green was scarred by huge patches of burned forest.

It was raining as we headed down a burned-over mountainside, stripped to our Skivvies to cross the Río Mojos, and climbed steep switchbacks. Even the mules scrambled to keep their footing, urged upward by shouts from the muleteers. After five hours we reached the village of Mojos. The Spanish founded it in the 17th century, and it soon became a *reducción*, a mission where Indians were forcibly settled, proselytized, and put to work. The settlement had once thrived on trade in corn and cattle, but almost no one used the arduous route to Mojos anymore. The church's walls had long since crumbled, leaving only a stone tower with a crooked crucifix and two chipped bells without clappers. About 15 Quechua farmers and herders lived here in mud huts.

I was awakened that night by the cries of an inconsolable child. In the morning Ruiz and I



FLOATING ASSETS head downstream as timber workers guide a raft of illegally cut mahogany on the Tuichi (above). Although trees are felled in the park year-round, January floods expand the area of cutting by deepening tributaries. Most of Madidi's mahogany, legal and illegal, goes to the United States. Other forest treasures, like macaw feather headdresses (right), are taken out of the country by visitors.



found two-year-old Juan Carlos Fernández in the arms of his weeping mother. He was limp and semiconscious from three days of vomiting and diarrhea. The brown skin around his mouth and nose was frosted with a ghastly pallor. The village healer had told the boy's parents he would die that day.

Ruiz crushed an antidiarrhea pill, mixed it with chlorinated water, and forced it into the child's mouth. Then she made a rehydration solution with sugar, salt, and treated water and pushed it into him spoonful by spoonful. After a long time Juan Carlos spluttered and protested weakly. Ruiz instructed his parents to spoon-feed him the solution all day and left several pills. When we checked him five hours later, his color had returned and the diarrhea had stopped. There would be a ceremony that night so the village healer could save face, but Juan Carlos would live because visitors with a dollar's worth of pills happened to pass through Mojos.

"The indigenous people were basically slaves until 1952," said Ruiz. That year the old order

was displaced by a government that nationalized mines, broke up the large estates, and gave all Bolivians the vote. Subsequent reforms strengthened Indian rights, but centuries of oppression shaped a subservient mind-set that still cripples people in remote areas. They are easily exploited by outsiders. Ruiz was encouraging them to develop skills that could lead to economic independence and allow them to do things for themselves rather than wait for government help.

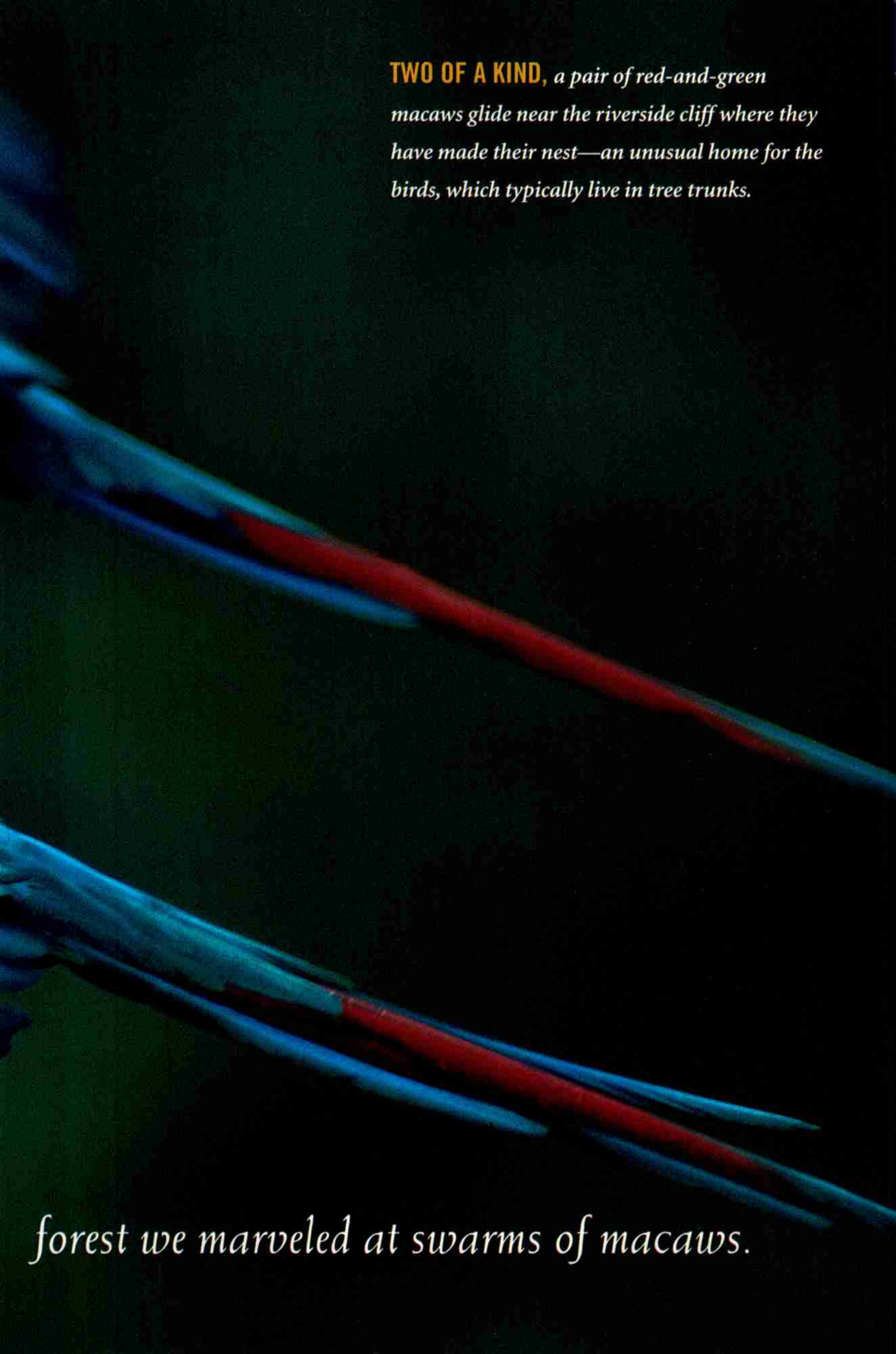
The villagers of Asariamas had recently done something for themselves—allowed loggers to take out a big haul of mahogany illegally for a cut of the profit.

About 30 families were living in Asariamas, which lies on the Río Tuichi in the eastern lowlands of Madidi. Two dozen people came to Ruiz's meeting and asked worried questions about the land rights of colonizers moving into their territory. (To prevent migration into the park, Madidi is reserved for the current inhabitants and their descendants.) I asked if any villagers knew about loggers illegally cutting





From a bluff overlooking the

A photograph of two red-and-green macaws in flight against a dark, overcast sky. The birds are captured in a side profile, gliding from the upper left towards the lower right. Their wings are spread, showing the characteristic red and green plumage. The background is a dark, textured sky, suggesting a high-altitude or mountainous environment. The overall mood is serene and majestic.

TWO OF A KIND, a pair of red-and-green macaws glide near the riverside cliff where they have made their nest—an unusual home for the birds, which typically live in tree trunks.

forest we marveled at swarms of macaws.

mahogany nearby. Finally Ubaldina Morales, a talkative, pugnacious woman in a billed cap, said, "All right, I'll tell you everything." The village's fretful headman spoke to her sharply in Quechua, but she told the story anyway.

Two 30-man mahogany crews were discovered downriver in May 1996. They had brought boats into the park from Rurrenabaque, a town downstream. The villagers agreed to accept about \$1,100 for 55,000 board feet. The loggers stayed until November, then disappeared without making the final payment.

The people of Asariamas knew that logging was illegal in Madidi, but the temptation of a fast buck was irresistible since they have so few other financial offers or possibilities. "Basically we just shrugged and said 'Go ahead,'" Morales told me. The headman again spoke earnestly to her in Quechua. She looked scornful. The room was humming. The village's schoolteacher spoke angrily to several people and abruptly left. Outside, he said the loggers had cut more like 300,000 board feet.

The logging worried Ruiz and Munn, but they pointed out that the direct damage was not too severe. Since mature trees grow widely separated, not in stands, cutting them doesn't raze a forest. Far more destructive is the practice of using the forest animals for food. I asked Morales if the crews had eaten forest animals. "Oh, yes, monkeys, deer, parrots, tapir—the works." Commercial hunters also sell meat from Madidi in the bordering towns. Spider monkeys have been especially hard hit.

DOWNRIVER from Asariamas the Río Tuichi entered lush lowland forest. We were traveling by raft now, and late one afternoon we glided onto a long sand beach full of tapir tracks. Three red howler monkeys studied us and retreated, but a group of saddleback tamarins, their white eyebrows and goatees framing black faces, couldn't resist the beach's fig trees and fed there for another hour.

We were on the Tuichi to check its potential for white-water adventure. The ride had been fun but not risky until we reached a Class IV rapid that required investigation—and skillful paddling. It began with a drop, turned sharply left into a crowd of rocks, then gathered into another big rapid that smashed against a massive boulder in the middle of the river.



Miss the turn and you would hit the rocks on the shore. Miscalculate the turn and you would hit the rocks in the river. Fail to straighten out after the turn and you would hit the boulder broadside. Munn took one look and said, "I'm walking around it." After 15 minutes of study Stephan Zumsteg, one of our river guides, announced, "It's a good Class IV, but it's runnable." Our raft went first.

With Zumsteg shouting commands, we shot over the drop and cranked around the turn. Digging furiously with our paddles, we skimmed past the rocks, then back-paddled until the raft swung downstream again.



KNIFE IN THE DARKNESS, a ten-foot-long black caiman cuts through the inky nighttime waters of the Beni. Hunted to a mere fraction of their population of a hundred years ago, caimans have been successfully reintroduced in the Beni.

Zumsteg yelled, “Forward paddle!” and we zipped past the boulder into the clear, 15 seconds from when we started.

When the rapids petered out, we boarded two motorized longboats for the flat-water run to Rurrenabaque, a day and a half away. Along a tributary we came upon a logging camp. Most of the loggers faded into the forest, but Eduardo Cortez Bomber stayed to talk. A bearded young man in an Oakland Raiders

cap, he and a crew of 25 had been cutting trees for four months and planned to stay for one more. He stood in front of a six-foot-high block of mahogany logs cut into beams ten feet long by one foot square. When the rains raised the river, the crew would rope as many as 80 of these blocks together into a *callapo* and float them downriver to sell in Rurrenabaque. Cortez expected to take out 100,000 board feet of mahogany worth about \$50,000.

The locals say palm trees here



STANDING ON STILTS, Madidi's "walking" trees, at right, appear to move as their shadyside roots wither. The palms may need strong root structures to quickly reach optimum height.

grow legs and walk to find more sunlight.



Sure, he knew logging was illegal. “But the problem is that Bolivia is a very poor country.” No one tried to stop them. In fact, he said, the park guards occasionally visited the camp. And no, he wasn’t afraid that his mahogany would be confiscated in Rurrenabaque. “In Bolivia one can pay someone to make illegal things possible.” He said his crew had paid off the head of the guards 45 days ago. He shrugged mournfully, as if he regretted a state of affairs that tolerated rogues like him. “I’m an ecologist,” he added. “I’m just taking out one load of mahogany, and then I’m finished forever.”

THE TOWNSPEOPLE of San José de Uchupiamonas had longer term plans. With financial and administrative help from Conservation International, a group that promotes biological diversity and environmentally sound enterprises in native communities, they were building Chalalán Ecolodge. The villagers had done all the construction and gradually would assume full ownership as they learned the business of

tourism. Profits from the lodge, which opened in June 1998, would go to community projects.

Conservation International had drawn attention to the Madidi area in 1991, starting the process that led to the park’s creation. A team of Conservation International scientists visited Madidi and reported a “diversity of flora and fauna that rivals the richest known sites on the globe.” They urged immediate protection. At first the Bolivian government planned a small park of 125,000 acres, but Munn, Ruiz, and others pushed for more land. The government eventually enlarged the park to 4.7 million acres, making it the central piece of a huge protected area that connects Ulla Ulla reserve on the southwest, indigenous territories on the east, and Peru’s Tambopata-Candamo reserve on the west—about 20,000 square miles.

Ruiz had a happy homecoming at Caquiaguara, where Eco Bolivia maintains a rustic research and security station. About a dozen Tacana Indians live in thatch-roofed houses here. They had almost finished building a small lodge for tourists on the other side of



the river. Ruiz would train them how to run it.

From the top of a bluff overlooking the forest we marveled at swarms of red-and-green macaws, chestnut-fronted macaws, and white-eyed parakeets gliding to their nests in the cliff just below. "This is the best place to see macaws in South America," said Munn.

Because Ruiz is a hermit at heart, ten years ago she built a hut far from any trail on a marshy pond fed by the Río Hondo. She took me to this hidden water—hushed, lovely, but seething with flies and mosquitoes. "That's one reason I think local people are best to protect these areas," said Ruiz, "because it takes someone as crazy as I am to like being in them."

As we drifted along, we saw hoatzins, macaws, aningas, greater anis, purple gallinules, and a handsome black-collared hawk fishing for breakfast. Floréncio "Choco" Mano, a Tacana renowned for his forest skills, was fishing too. He perched barefoot on the front of our log boat, his bow nocked with an arrow, and scanned the shallows for the slow swirl of a feeding *sábalo* (shad). There! Choco's

arrow sang. We would have *sábalo* for supper.

Morning light sharpened the river's edge. A Tacana named Marcelo Quemervo led Munn, Ruiz, and me into the forest to a salt lick. We climbed to a platform, and Quemervo began calling in white-lipped peccaries, making a loud *thock* against the roof of his mouth with his tongue in imitation of the creatures' habit of clicking their teeth. The answering *thocks* got closer, and then bristly black shapes materialized from the undergrowth, big males in the lead. There must have been 50 of them. One moment they were snuffling in the mud or lifting their rubbery noses to investigate us; the next, spooked, they had vanished in a tumult of crackling brush and frantic grunts.

Where the Río Hondo meets the Beni, we turned upriver toward Charque, a beautiful new lodge built entirely by local people that Munn predicted would become one of the top destinations in South America for birders and other tourists. But at the moment the lodges at Charque and Caquiahua remain closed while Eco Bolivia, the Bolivian



POACHING'S TOLL, a baby peccary cuddles up to a worker at a camp in Madidi (left). The peccary's mother may have been killed for food; the infant survived for just a few days. An orphaned black-faced spider monkey (above) was raised as a pet by the logger who killed and ate its mother. "I named it Pulgoso," he says. "Full of fleas." Under current law indigenous peoples can use the park's resources, including its animals, to maintain their traditional way of life.

government, and indigenous groups argue over permits and financial arrangements. Ruiz believes that when the lodge at Charque eventually opens, the Tacana, Mosen, and Tsimane Indians who built it will earn their living from tourism—quite a switch from their traditional lives as nomads.

IN SAN BUENAVENTURA, a quiet town of rutted streets across the Río Beni from Rurrenabaque, Munn and I met with Ciro Oliver, director of Madidi National Park. Oliver explained that his first duty was to protect the park's resources, but his annual budget was small—\$198,000. He had only two patrol boats and 15 park guards, all in the eastern third of the park, but hoped to hire ten more.

When his office opened in January 1997, he said, "No one was in favor of the park because 90 percent of the people lived from wood exploitation." By August the guards had found 48 lumber camps. To avoid violence, Oliver told the loggers that when the rivers rose, they could take out whatever they had already cut "but not a single tree more." Now the guards checked these camps every week. All logging had ceased except for the activities of two or three renegade groups. Oliver said that illegal lumber was confiscated when it reached Rurrenabaque. He scoffed at Eduardo Cortez Bomber's claims about bribery and complacent guards.

Oliver's budget and resources certainly were dismal for such an immense and important park. Perhaps logging and hunting had slowed, but we had seen active lumber camps and callapos heading to Rurrenabaque and had watched mahogany being loaded onto trucks.

Ruiz had told me that Oliver, like most officials, resented her work. When I asked about Eco Bolivia, Oliver reacted strongly. "Rosa María Ruiz promised a lot and lied a lot, and when she got financing, she forgot about the people she had promised. We have interviewed all the communities where she has worked, and none said anything positive."

This contradicted everything I had seen. The villagers within Madidi welcomed Rosa María as a friend and champion. While many people found her headstrong, I suspected that some of Ruiz's accusers lived outside the park and were motivated by frustrated greed.

Gabriel Baracatt, the director of Bolivia's



National Protected Areas Service, had been on the job for just over a month when we spoke by phone. He intended to strengthen protection in Madidi by hiring 40 more guards if he could find the funding. He also planned to inform the communities of their rights and potential benefits and wanted to train them to manage Madidi and develop tourism. These admirable goals were undermined by the meager budget for the park.

In August 1998 the park's future received a blow when the Bolivian National Congress passed a law authorizing a gigantic dam just upstream of Rurrenabaque. Hydroelectric



CLEANSING WATERS, *the Tuichi and its tributaries run through the ancestral home of the Tacana people. A group of Tacana guides, bathing at day's end, are the vanguard of those who will welcome outsiders to Madidi—and try to protect it from their influences.*

power from the dam would be sold to Brazil. The dam would flood over a thousand square miles, displace native peoples, drown irreplaceable flora and fauna, and wipe out the new lodges at Chalalán, Caquahuara, and Charque. Ruiz and others are fighting to stop the project.

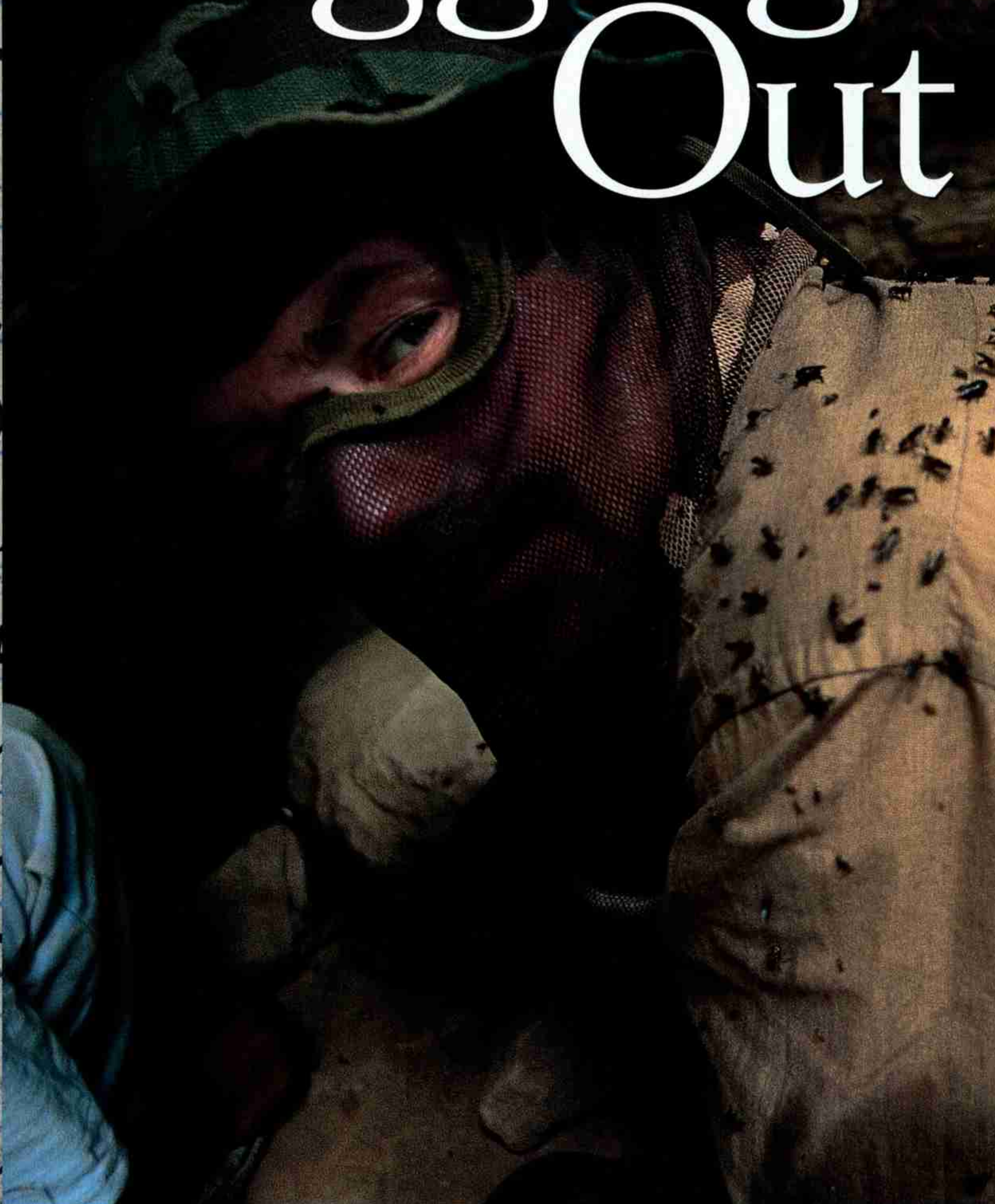
Next to Guyana, Bolivia is the poorest country in South America. Most of its people worry more about survival than about the environment, and so its politicians, even the honest

ones, face strong pressure to support policies that will provide immediate jobs and thus preserve votes, not wildlife.

The best hope for Madidi's future may be in places such as Chalalán, Caquahuara, and Charque, where the inhabitants are learning to be partners in the area's future. If most of the park's residents protect the wildlife and forests and learn to manage tourism, Madidi will remain incomparable. □

INTO MADIDI'S TEEMING JUNGLE:

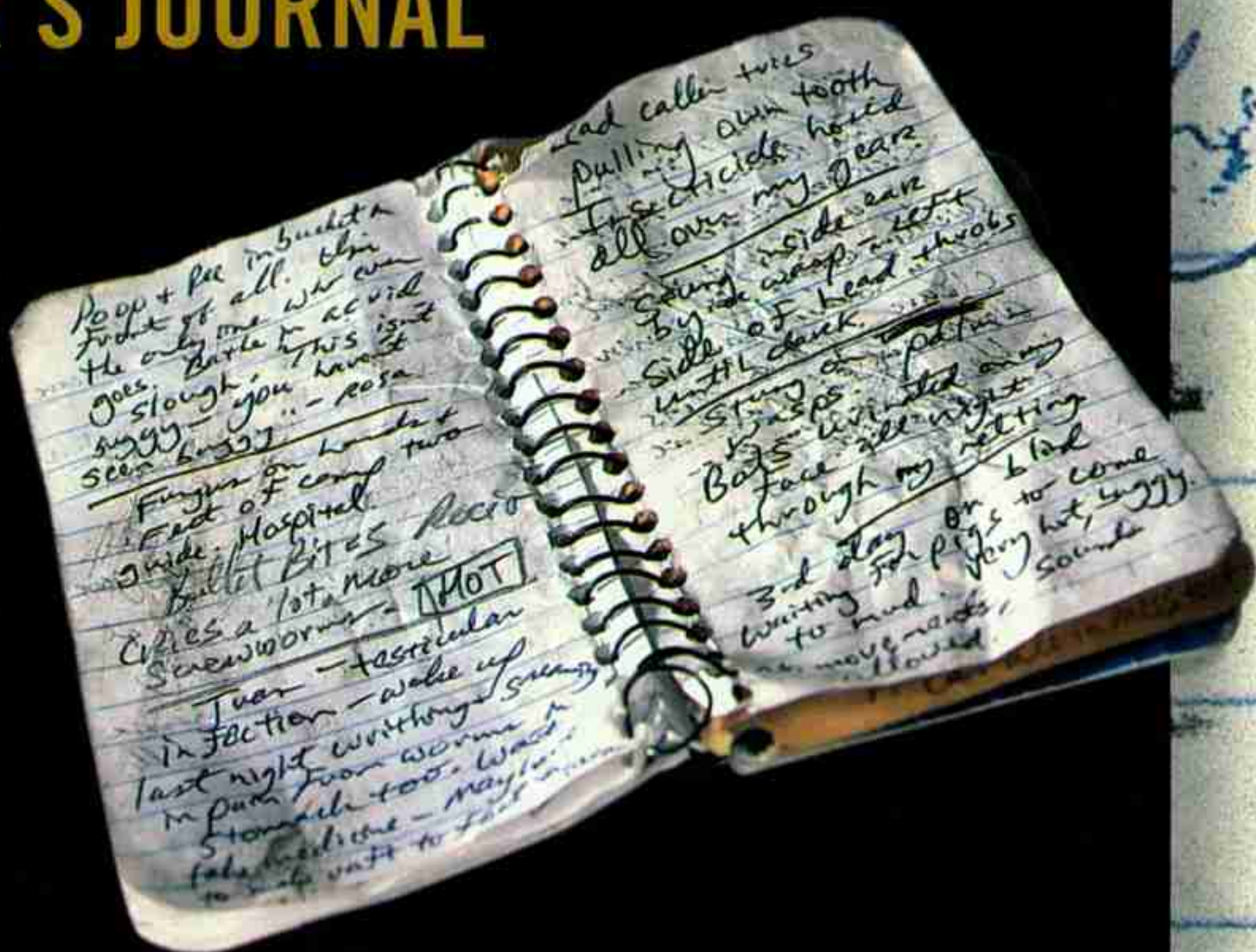
Bugging Out



through shirt

A PHOTOGRAPHER'S JOURNAL

He's photographed many wild places, so Joel Sartore knew his visit to Madidi would be no walk in the park. But he didn't count on the drone of sweat bees, or the burrowing maggots, or the flesh-eating parasite.



NOV. 22 A.M. . . . 36 hours of flying from Lincoln [Nebraska] to La Paz. Ears totally blocked. After one hour I get altitude sickness (the elevation here is 12,000 feet or so). Soldiers, machine guns, drug dogs sniffing luggage.

NOV. 22 P.M. . . . Fly to a grass landing strip, then a three-hour boat ride to a camp that'll be my home in the jungle for the next three weeks. Two thatched huts, ten bearer-guides, one cook, and it's hotter than hell. Soaked in sweat every minute. My host, Rosa María Ruiz, digs a live botfly maggot out of her calf at the dinner table. "Boro," she shrugs. "It's nothing."

NOV. 23 . . . Things scream here all night. Birds and bugs, I'm told. So many species that each has developed a specialized call. One bird sounds like water pouring out of a bottle. Another like a digital alarm clock. The locals say palm trees here grow legs and walk to find more sunlight.

NOV. 27 . . . In town we visit a woman named Palmira, bedridden for six weeks with a stingray bite. "Stingrays hurt so bad for so long, I've seen grown men cry like babies," Rosa María says.

NOV. 29 . . . I touch a moth tonight, then wipe sweat from my face. I spend the next few hours with my face and

hands on fire. Bugs here are toxic, Rosa María says. A man at one of Rosa María's other camps had fungus on his hands and feet so bad he could barely radio for help.

Lay in my own urine on the beach for several hours, hoping to draw butterflies in to photograph them. Not nearly as many butterflies here as there are bees and wasps I learn, as they funnel up my shirt.

DEC. 1 . . . One of my knees swells up. Hard to walk. Our lead animal caller, a 51-year-old man nicknamed Choco, has a tooth that's killing him. I think he tried pulling it with a shoestring.

Rosa María, Choco, Marcelo, and I move to a small wooden platform above a jungle mud hole to wait for wild pigs [peccaries] to come in. Stung on both palms by wasps. We bathe in an acrid slough to mask our scent. No leeches.

I lay in my own urine on the beach, hoping to draw butterflies in to photograph them. Not nearly as many butterflies as bees and wasps I learn, as they funnel up my shirt.

DEC. 2 . . . Day two on the platform. Still no pigs. We poop and pee in a wooden box in front of each other. Can't leave platform. Might scare pigs.

DEC. 3 . . . Day three. No pigs, but plenty of bats urinating on my face each night through the mosquito netting. I lie on my back and take it. Too hot to sleep on stomach.

DEC. 4 . . . Pigs still not here, so we're leaving, thank God. That was a combo of prison and being lost at sea. Nothing to do, very buggy, and no movement allowed (too hot and might scare pigs). Marcelo, our lead boat driver, tells a quick pig story as we pack up to leave.

"We were hunting the chanchos [pigs] last year near the Río Beni, not far from here. We saw a group of fifty. We killed ten. This made them mad. They charged us. We ran and climbed trees. One of my friends didn't get high enough, and the chanchos pulled him down. We heard screams for a while, then waited to come down. When we found him, we found only pieces. Many pieces. We took the pieces of him to his parents' house. We were sad our friend had died such a terrible death."

Even the pigs can kill you here. A man Rosa María knows survived a pig attack but now has no butt. He didn't get quite high enough in the tree, and the pigs bit it all off.

DEC. 11 . . . Juan is up all night, screaming and writhing in pain from parasitic worms in his stomach.

DEC. 12 . . . More than half the crew have boros in them, including the cook's nine-month-old baby. The infant also has swollen welts all over her legs. Aquatic fungus, I'm told.

Choco, who's always happy and singing, is in terrible pain because of his tooth. Rosa María has Marcelo fire up the boat to take him to the local "dentist." No fillings or repair work done in this part of the world. Teeth are simply pulled, usually without anesthetic.

DEC. 13 . . . Choco returns, now with a big hole in his smile. Marcelo admits he got Palmira pregnant during one of his boat runs to town. Vows he'll marry her on the last night of our trip.

Choco says that tonight we'll call in a jaguar. He says the calling he's been doing—a low, repeated grunting sound made by strumming rawhide

Bugs - 10x10, head - 10x10
Rash on my lower jaw



"Marcelo, our lead boat driver, said he could catch a leaf-nosed bat. And he did [above]. These are the sorts of things that are flying around your camp all night. We thought our dining tent was insect proof, but I guess not [below]. A swarm of termites got in. I wasn't very hungry after that."



gear. Lost one camera too

Laid in down a vine

stretched over a milk can—has lured jaguars in. He brought a cow's head back with him from town the other day, and it's now sufficiently pungent to use as bait. We sit on a platform at dusk about 20 yards away, and indeed a big orange-and-black jaguar with paws the size of coffee-can lids comes in.

DEC. 14 . . . To get up into the canopy, a tower made of painters' scaffolding arrives by boat today. We set it up near the parrot cliff, and I find myself swaying in the breeze 130 feet up.

DEC. 16 . . . I find my first boro, buried deep in the back of my left hand. Choco tries to suffocate it by covering its breathing hole with a mixture of his own spit and the residue from a hand-rolled cigarette. No luck. Later in the day something much worse happens: While on a hike I run out of toilet paper. Some leaves have painful toxins on them. I discover this the hard way.

DEC. 17 . . . Choco shows me his foot, which has big red ants with enormous black pinchers hanging off it. He walked two hours through the jungle with

He walked two hours through the jungle with the ants clinging to him. Their jaws are so strong they are used like stitches to clamp both sides of a wound.

the ants clinging to him just to show me. Their jaws are so big and strong that they are used like stitches to clamp both sides of a wound together.

DEC. 20 . . . Later, at the dinner table, my feet are covered with tiny, stinging black ants. Turns out they were defending their food source, a dead bat under my chair.

DEC. 21 . . . We boat back to town. Our flight is tomorrow evening, but first we're going to the wedding of Marcelo and Palmira. No church, just a room with two dogs fighting in one corner and a TV blasting a Spanish-dubbed rerun of *Dynasty* in the other. The bride and groom, fully dressed in the best wedding attire they could find, are completely soaked with sweat.

Through the windows I see several people staring in amazement. We sit and they stare. Turns out they are the Ese Ejja, the last nomadic tribe in the area, Rosa María says. The lumber companies recently started giving them alcohol in return for leading them to the big trees in the forest. Now some beg for a living. I saw them earlier, picking bugs out of each other's hair and eating them. "That's a traditional pastime," Rosa María says.

DEC. 22 . . . Rosa María visits the doctor, who removes a boro more than an inch long from her leg. She saves it in a little vial.

It's almost Christmas, and I'm more than ready to go home. I feel for the people here. Poverty abounds. Everything is worn out or broken. The kids in town swim in raw sewage. Rosa María points out that most of the world lives like this.

I know she's right. But I'm beat, and I just want to sleep.

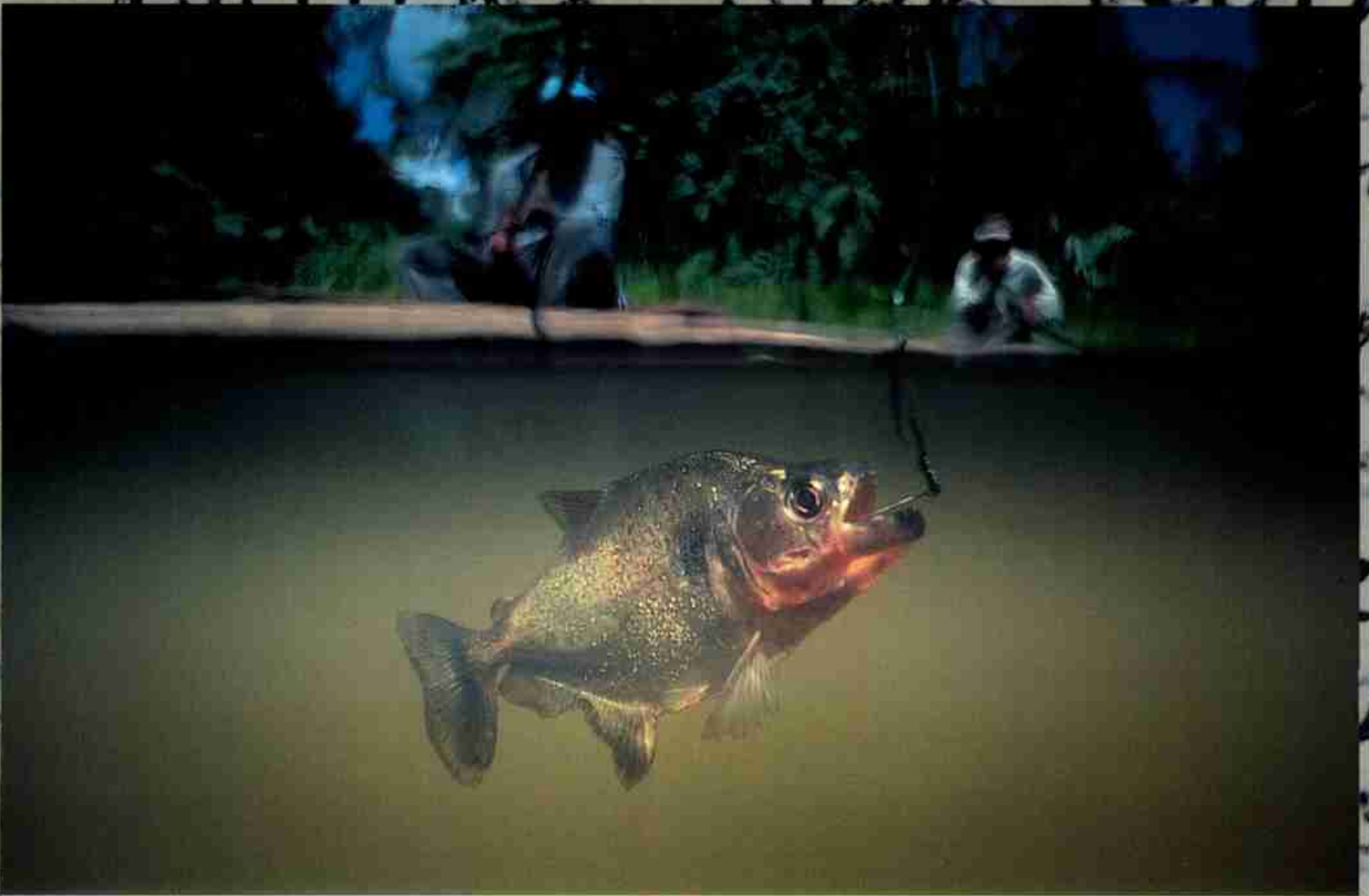
Now, if only the boro in the back of my hand would do the same. □

EDITOR'S NOTE: Eight weeks after Sartore returned from a second trip to Bolivia, a wound on his lower right leg began to grow. He had contracted leishmaniasis—caused by a flesh-eating parasite—through the bite of a sand fly. The infection spread to his lymph system and created a hole in his leg the size of a silver dollar. The infection was eventually controlled by a combination of surgery and a 21-day intravenous treatment of an antimony compound. He'll know in ten years if he's fully cured.

Go behind the scenes with photographer Joel Sartore to see more images of Madidi at www.nationalgeographic.com/ngm/0003/madidi.

Lead caller twice

pulling a tooth



"To get a picture of piranha [above], I tried swimming in a wet suit smeared with insect repellent. The guys on shore still thought I was crazy. Probably was. For four days four of us stayed put on a platform waiting for wild pigs [below]. The pigs never came. They were the smart ones."



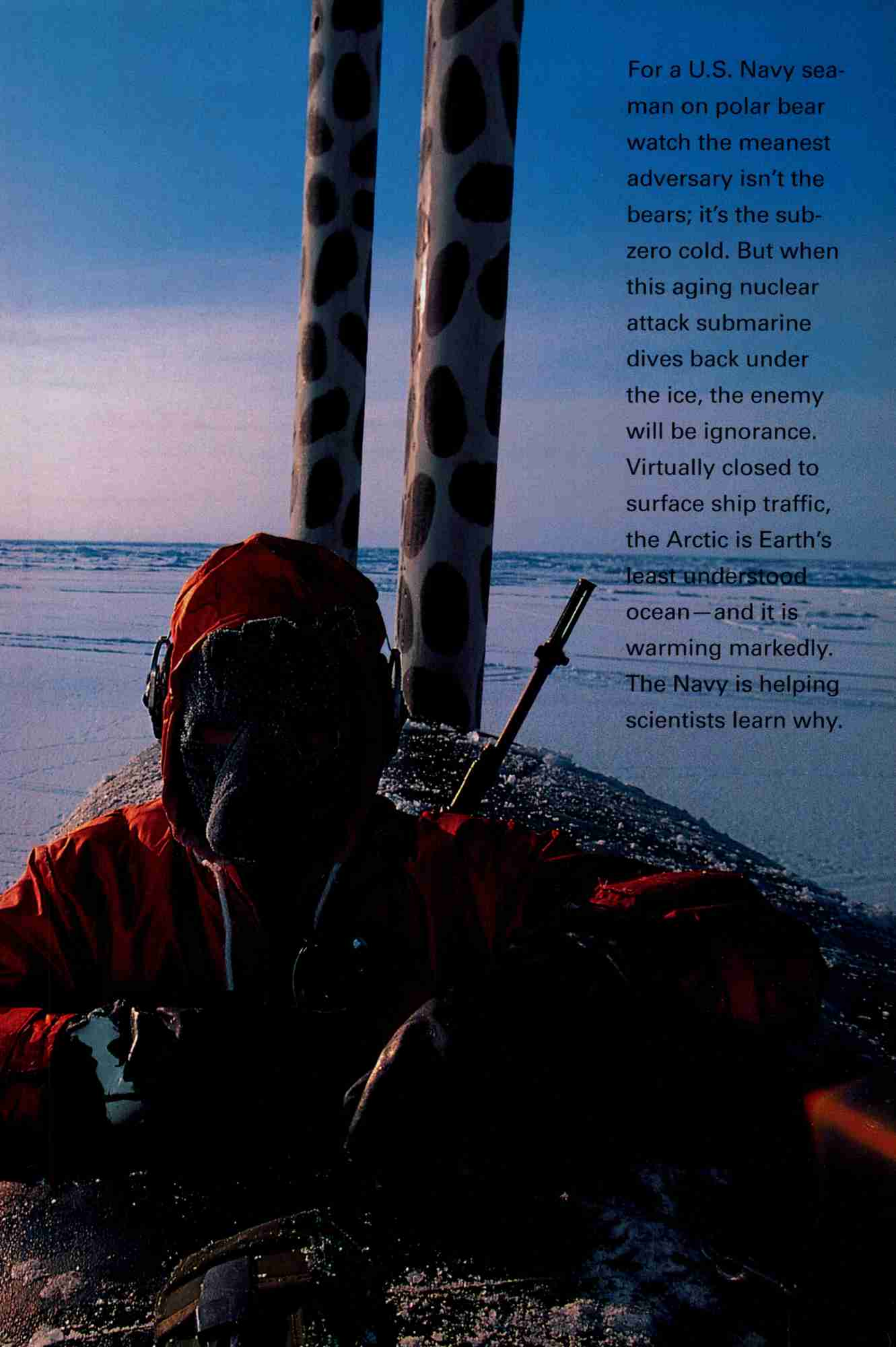
3rd day on blind
for pigs to come

THE NEW COLD WAR

STALKING ARCTIC
CLIMATE CHANGE
BY SUBMARINE

BY GLENN HODGES
NATIONAL GEOGRAPHIC EDITORIAL STAFF

PHOTOGRAPHS BY JAY DICKMAN



For a U.S. Navy seaman on polar bear watch the meanest adversary isn't the bears; it's the sub-zero cold. But when this aging nuclear attack submarine dives back under the ice, the enemy will be ignorance. Virtually closed to surface ship traffic, the Arctic is Earth's least understood ocean—and it is warming markedly. The Navy is helping scientists learn why.

I

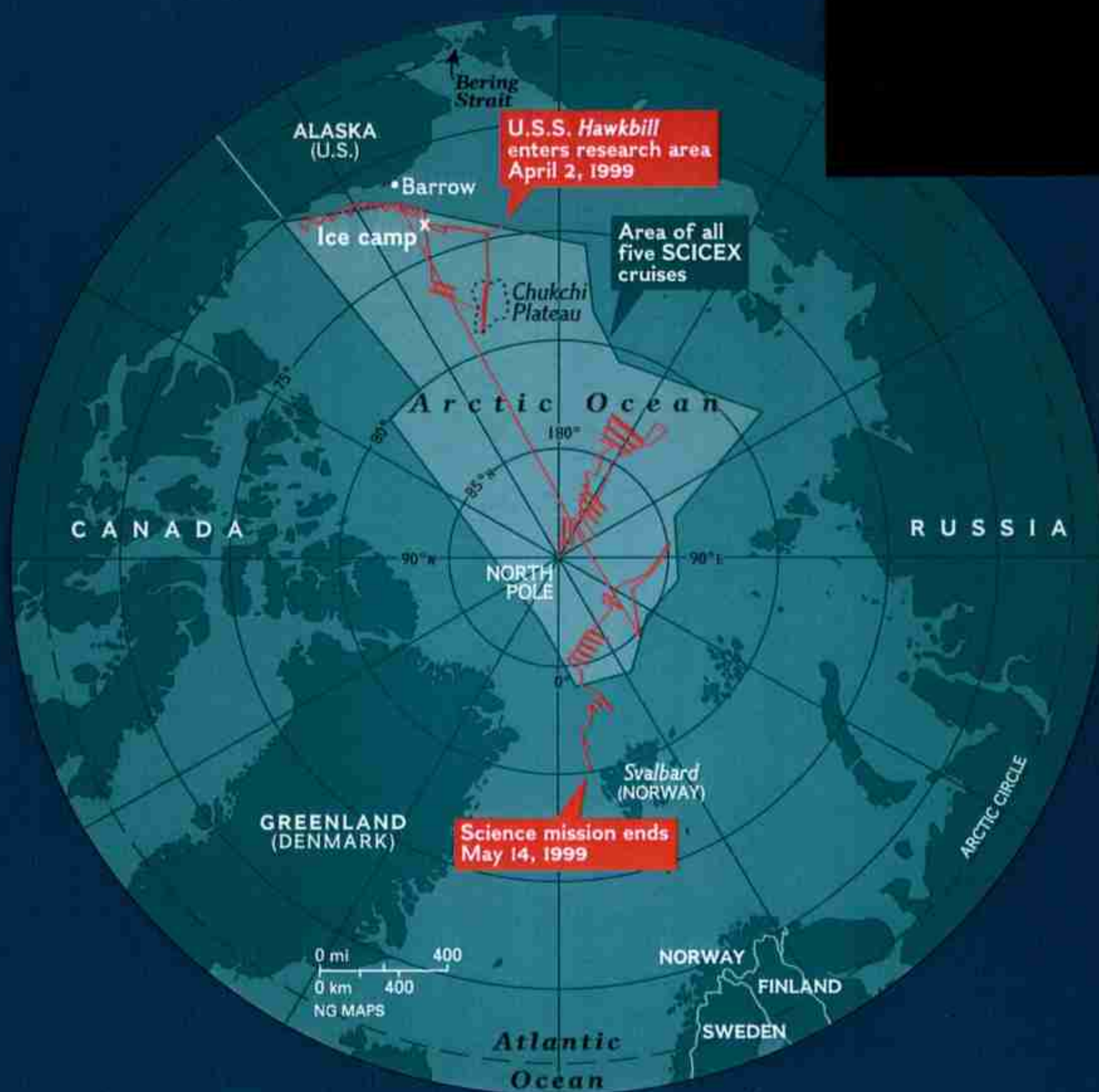
N A WORLD that's been almost completely mapped, it's easy to forget why cartographers used to put monsters in the blank spots. Today we got a reminder. The submarine captain had warned us that we were in uncharted waters: "We're making the charts as we go along," he had said.

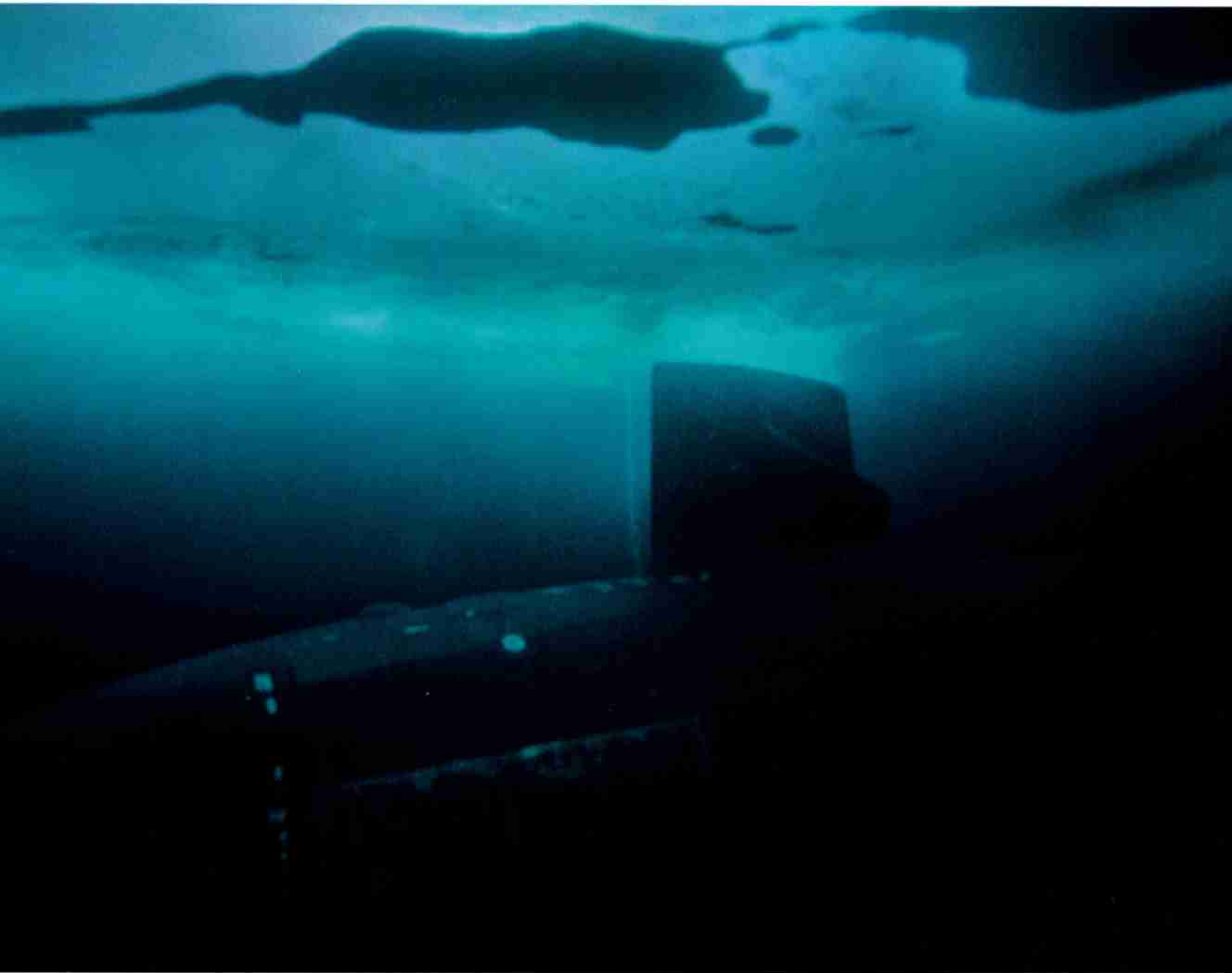
"That's common in the Arctic." Yet the first days of our cruise through this ice-covered ocean, Earth's least explored frontier, were as smooth as you'd expect in this age of recreational adventure. Even when we passed over a mile-high mountain that no one on the planet knew existed, the reaction was one of quiet enthusiasm—"Neat."

That all changed when the sonar told us we were about to crash. The ship's loudspeaker bellowed "RED SOUNDING!"—a warning, the captain explained, that "you need to do something, or you're going to run aground."

ARCTIC DIVIDEND

Embracing a new mission at the Cold War's end, the U.S. Navy in the 1990s committed to a series of scientific submarine cruises. Called SCICEX, this program has more than doubled the store of Arctic Ocean data. Last year the U.S.S. *Hawkbill* (above right, in a rare below-the-ice view) mapped parts of the Arctic's mostly uncharted seafloor.





In that instant the U.S.S. *Hawkbill*'s crew came face-to-face with the fact that they didn't know what their surroundings held for them. Outside the frenzied control room I asked the Chief of the Boat (COB) Gary Olivi if he'd ever encountered a red sounding. He hadn't. How long had he been a submariner? "Since 1983."

Fortunately the COB got a story for his grandkids and nothing more. After a few tense minutes it became clear that we had found not a mountain but a monster—one of those scary apparitions that dwell in unknown places. The main sonar had gone off-line, and a backup system picked up a false echo that registered as a seamount. We were safely above the bottom the whole time. This monster we dispatched

This is photographer JAY DICKMAN's fifth assignment for NATIONAL GEOGRAPHIC magazine. While in the Arctic he plunged through the ice into freezing water but managed to scramble to safety.

for the cost of a few gray hairs—or in the case of the captain, Comdr. Robert Perry, "two years off my life." As Arctic monsters go, though, it wasn't a very big one.

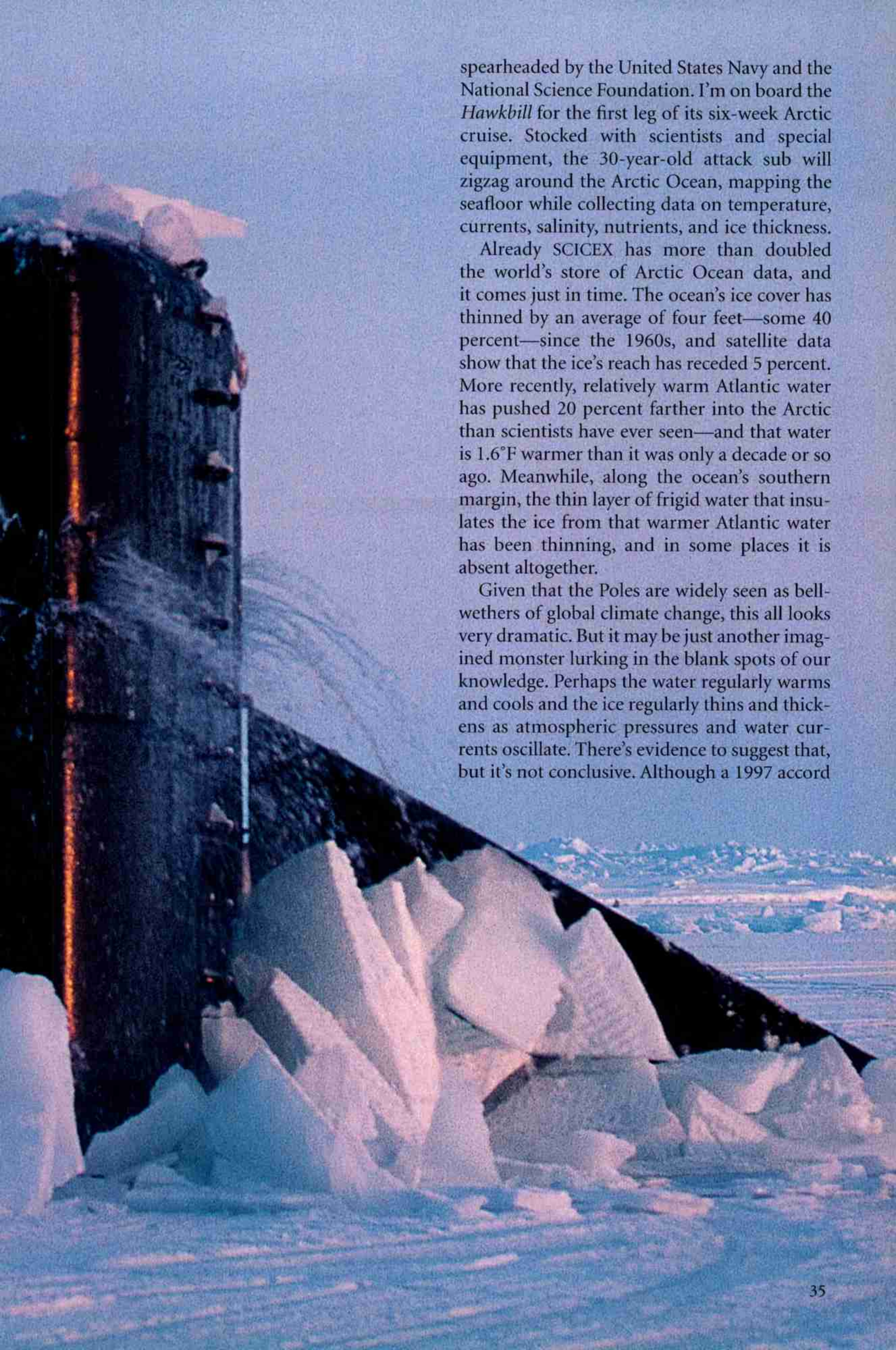
The Arctic, you see, has warmed markedly in the past two decades, and scientists have only a hazy understanding of why this is happening and what it means—partly because climate questions are inherently hard to untangle and also because knowledge of the Arctic lags decades behind that of the world's other oceans. Covered by ice year-round, the Arctic is virtually inaccessible to ship traffic and has been the province largely of nuclear subs on cat-and-mouse missions for the past half century.

But the close of the Cold War opened a new door for Arctic research, and now, for the fifth year in a row, a nuclear submarine is hosting a scientific mission in the Arctic as part of the SCICEX (Science Ice Expeditions) program,

HARDER THAN ICE

When the U.S.S. *Hawkbill* punches through nearly three feet of sea ice, it's hard to argue with the Navy adage that "only a fool would travel north of the Arctic Circle clad in anything less than a nuclear submarine." With hardened "sails" (conning towers) and diving planes that can rotate to a vertical position, Sturgeon-class subs can go through up to five feet of ice. The football-field-length subs can remain submerged for months at a time.





spearheaded by the United States Navy and the National Science Foundation. I'm on board the *Hawkbill* for the first leg of its six-week Arctic cruise. Stocked with scientists and special equipment, the 30-year-old attack sub will zigzag around the Arctic Ocean, mapping the seafloor while collecting data on temperature, currents, salinity, nutrients, and ice thickness.

Already SCICEX has more than doubled the world's store of Arctic Ocean data, and it comes just in time. The ocean's ice cover has thinned by an average of four feet—some 40 percent—since the 1960s, and satellite data show that the ice's reach has receded 5 percent. More recently, relatively warm Atlantic water has pushed 20 percent farther into the Arctic than scientists have ever seen—and that water is 1.6°F warmer than it was only a decade or so ago. Meanwhile, along the ocean's southern margin, the thin layer of frigid water that insulates the ice from that warmer Atlantic water has been thinning, and in some places it is absent altogether.

Given that the Poles are widely seen as bellwethers of global climate change, this all looks very dramatic. But it may be just another imagined monster lurking in the blank spots of our knowledge. Perhaps the water regularly warms and cools and the ice regularly thins and thickens as atmospheric pressures and water currents oscillate. There's evidence to suggest that, but it's not conclusive. Although a 1997 accord



X Marks the Spot

Sophisticated navigation equipment got the *Hawkbill* from Hawaii to the general vicinity of its surfacing site, but in the end it all came down to an X shoveled on the ice, visible from the sub via video camera. Aim is not precise, as two sailors learned when the sub surfaced where they were standing (bottom). The surfacing site was about a mile from a temporary ice camp (facing page), which served as both a staging area and a science laboratory. Arctic science was once largely done from such camps, capable of delivering only a tiny fraction of the data a submarine can.



gave scientists access to decades of historical Arctic data collected by the Soviet and U.S. governments,* the record is far from complete and before 1950 largely nonexistent. So the questions remain: Will currents and temperatures revert to more familiar patterns? Or is the Arctic showing signs of global warming?

If the Arctic continues to warm, the consequences could be grave. Some scientists think there's a chance—remote but conceivable—that the ocean's summer ice cover could completely melt at some point in coming decades. "The absence of ice in the Arctic would completely change climate patterns for the Northern Hemisphere," says Dave Clark, a marine geologist at the University of Wisconsin. "In computer modeling if you take off the ice, even the circulation of the ocean reverses."

Some scientists think that the Arctic Ocean may have lost its summer ice 400,000 years ago, when the Earth was as warm as it is now. The Earth has a history of warming and cooling dramatically in just decades or even years as environmental factors amplify each other. In the Arctic, for instance, sea ice reflects most solar energy, but open water absorbs up to 90 percent. So as ice cover shrinks, the ocean absorbs more heat, potentially melting more ice until a cycle of increased heating and melting eliminates the permanent ice pack.

But this is a simple model, and the Arctic is no simple environment. "The problem in the Arctic is there's a lot of variability," says Mike Ledbetter, a program director at the National Science Foundation's Office of Polar Programs. "Conditions can be very different from one year to the next, so identifying trends is difficult." Drew Rothrock, a University of Washington research scientist who identified the thinning ice, says, "People may jump on this and say the ice cover is disappearing. Well, who knows? Everything may rebound now for the next ten years. I don't think you'd find many Arctic scientists willing to say, 'Yes, it's all melting up there, and in another decade we won't have any sea ice.' Only the future will tell us."

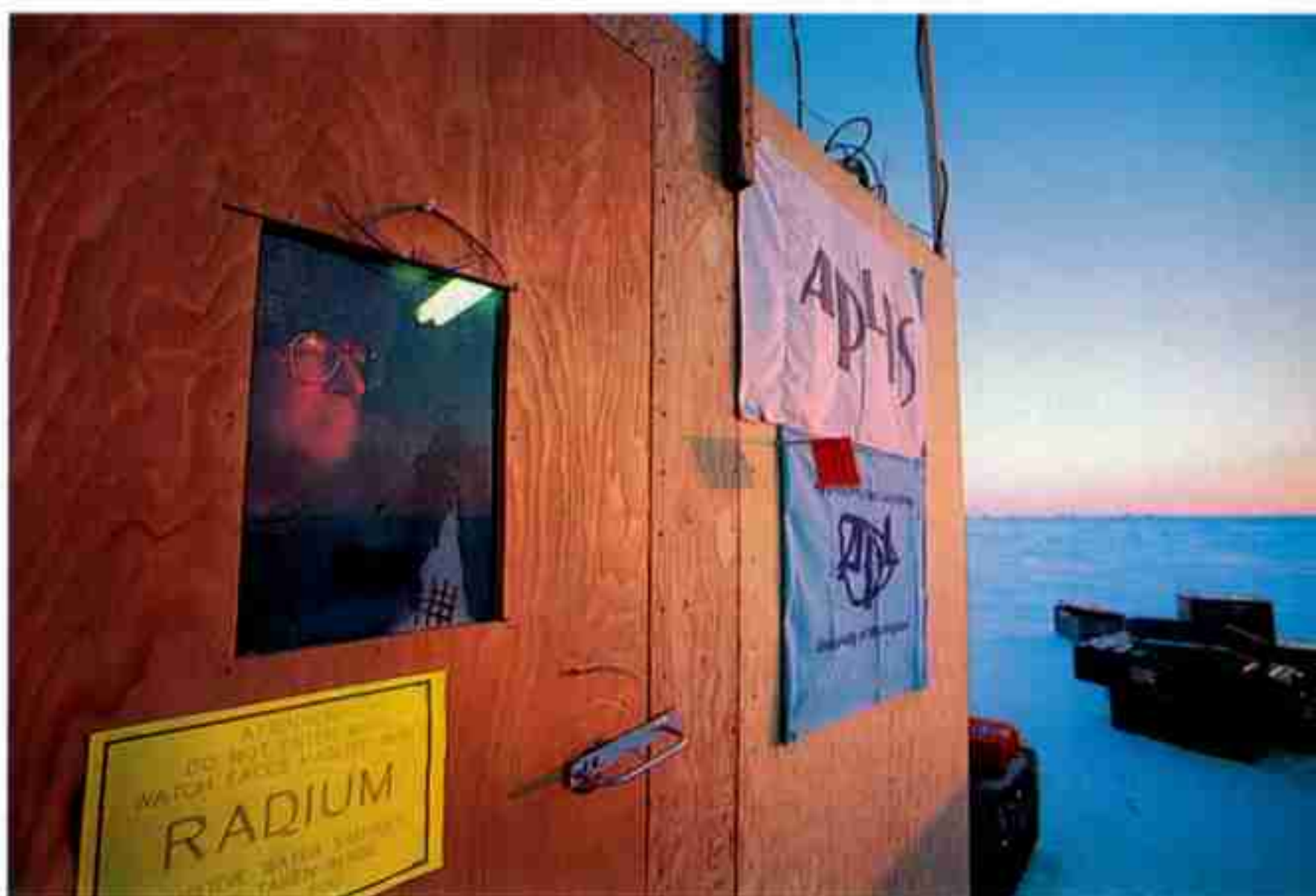
WHEN THE *Hawkbill* is not in the throes of an emergency, the best action can be found in the torpedo room, which for this mission has been transformed into a science center. Instrument monitors, racks of water

samples, and assorted equipment line a narrow walkway running lengthwise through the garage-size room.

For this mission the *Hawkbill* is equipped with an array of instruments known as SCAMP—the Seafloor Characterization and Mapping Pod—which includes a side-scan sonar that produces high-resolution images of the ocean floor.

On the first morning of the cruise the chief scientist, Margo Edwards of the University of Hawaii, explains the first phase of our mission: to explore the Chukchi Plateau, a Denmark-size underwater feature about 700 miles north of the Bering Strait, and examine the seafloor for gouges made by ice sheets during past ice ages. "We're trying to get a handle on what the Arctic was like at the coldest point of the last ice age," she says.

So far no one has found strong evidence of ice sheet scours in this part of the Arctic Ocean. But not 24 hours into the trip I find her



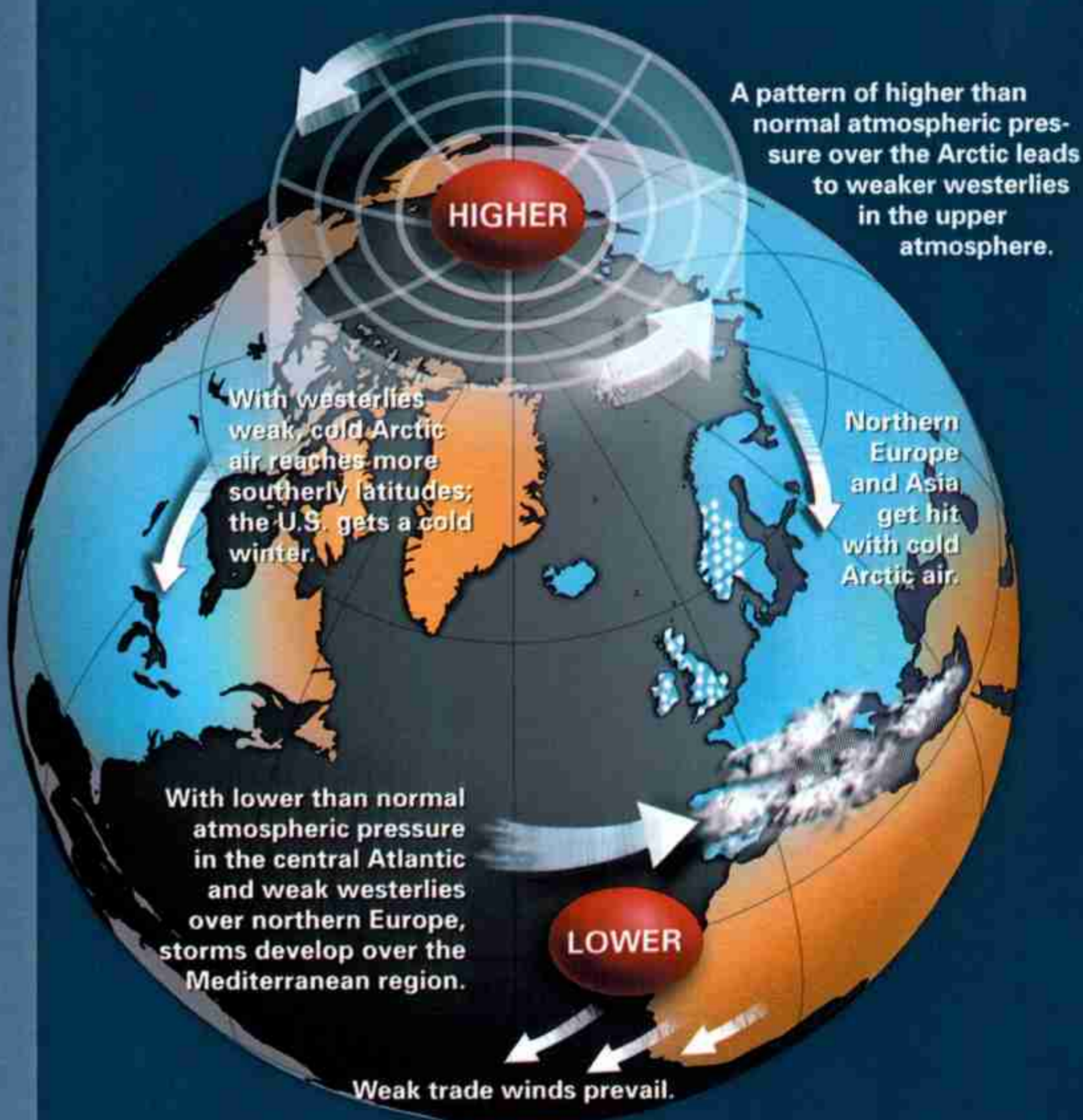
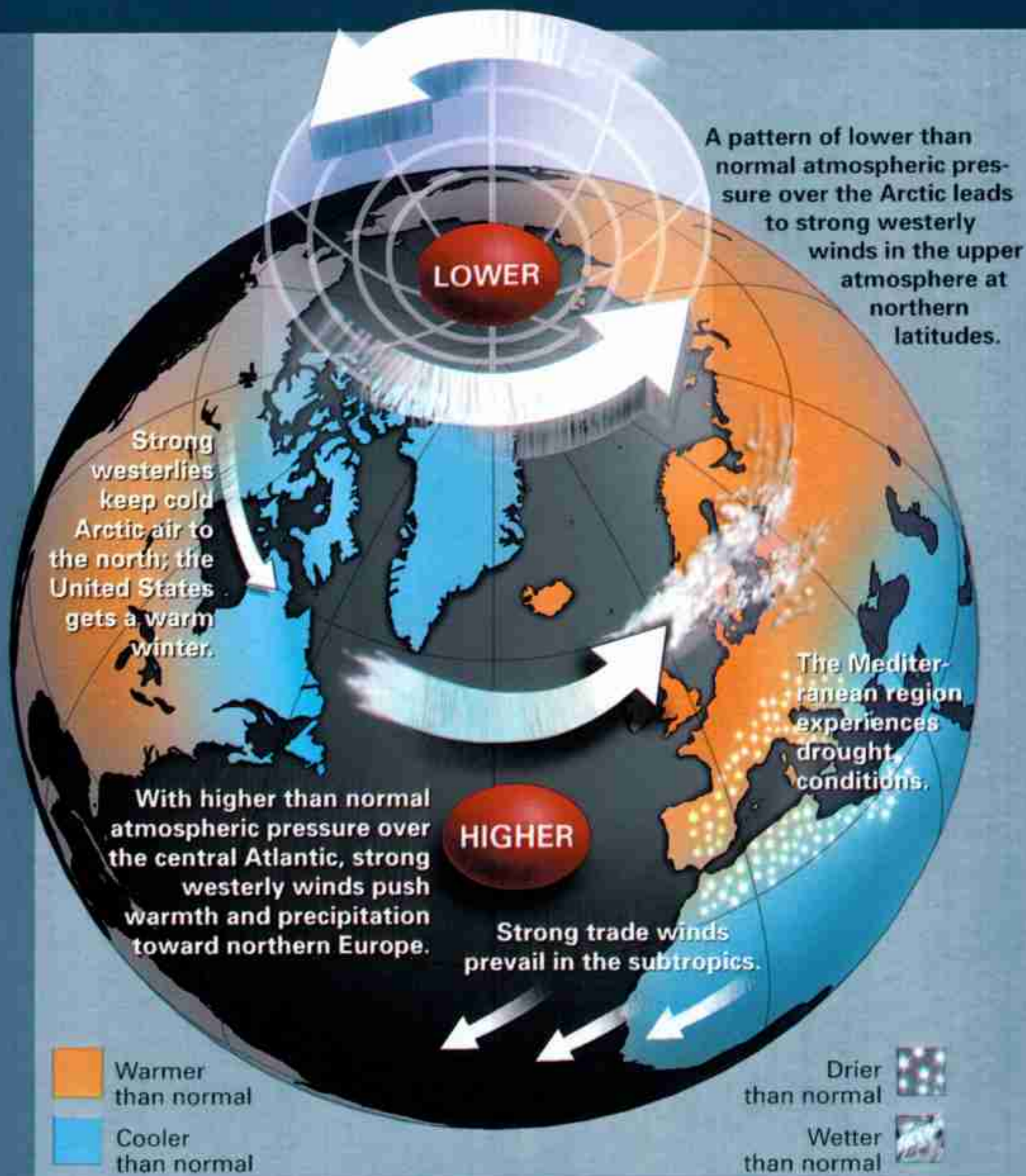
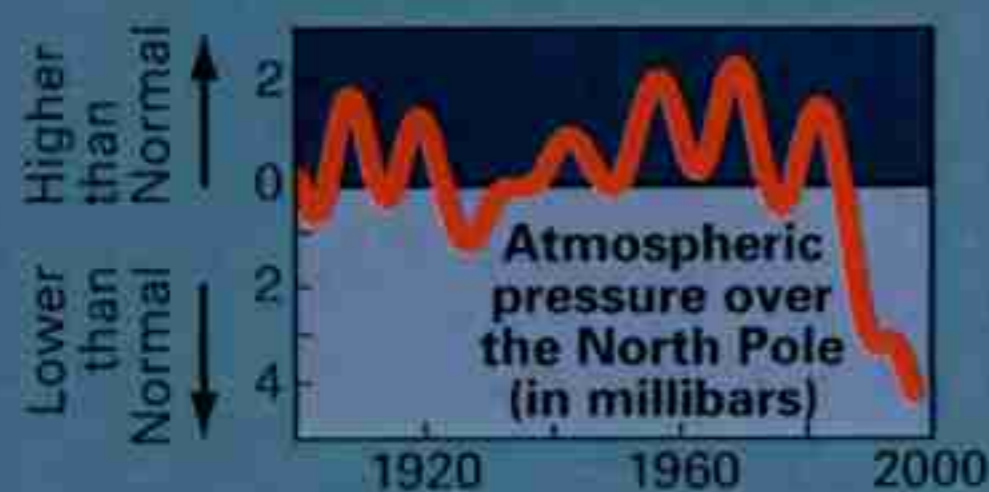
beaming in front of the main SCAMP monitor, looking at signs of ice sheet scours 1,200 feet below the surface. "I've never seen anything like this!" says Edwards, who has been studying marine geology for 14 years. The scours look like tracks from a thick-bristled broom dragged across a sandbox. One gouge is 60 feet deep. "Wow. I never thought the bathymetry would get this good this fast."

The next day it gets even better. Edwards finds what appears to be a moraine, a pile of debris deposited by an ice sheet. "It's pretty good evidence that an ice sheet came out this far." She asks the navigator to change course so

*See "An Arctic Breakthrough," by Don Belt, NATIONAL GEOGRAPHIC, February 1997.

Stuck on the Warm Switch?

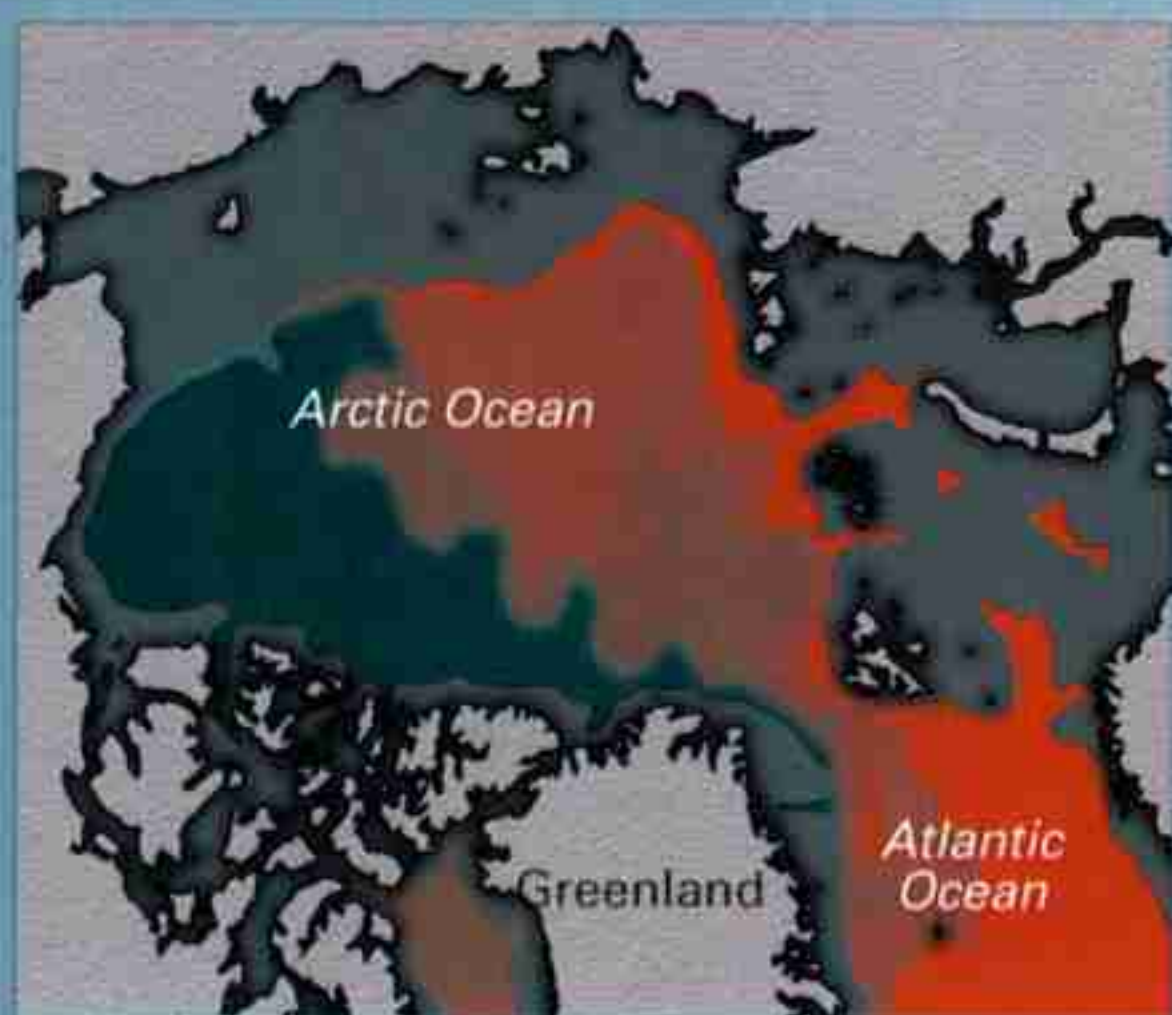
The Pacific weathermaker known as El Niño may get all the press, but another phenomenon known as the North Atlantic—or Arctic—Oscillation drives weather trends in much of the Northern Hemisphere. More than 200 years ago European missionaries in Greenland noticed that harsh winters there corresponded with mild ones in Europe, and vice versa. It turns out that this is due to seesawing differences in atmospheric pressure between the Arctic and lower latitudes. The pattern generally cycles between decade-long warm and cold phases. (A cold phase, in fact, helped stall Hitler's campaign against Moscow.) Now the oscillation, responsible for the past three decades of record-warm winters in Europe and the eastern United States, appears to be stuck in an unusually strong low-pressure warm phase (graph, below)—“a change bigger than anything in the past hundred years,” says atmospheric scientist John M. Wallace. Many scientists suspect that global warming is the culprit, but it's too soon to tell if this is just a dramatic blip or a long-term trend.



SOURCES: DOUG MARTINSON, WIESLAW MASLÓWSKI, DAVID THOMPSON, AND JOHN M. WALLACE; ART BY ALAN DANIELS

WARM PHASE

The recent warm phase has brought a number of startling changes to the Arctic Ocean. New wind and water currents have drawn relatively warm, salty Atlantic water 20 percent farther into the Arctic than usual (below). Meanwhile, the layer of especially cold water that insulates sea ice from the warmer Atlantic water has thinned across much of the Arctic—and so has the sea ice itself, by an average of four feet.



Cooler Arctic water Warmer Atlantic water

MODEL DEPICTS WATER LAYER AT 920-1,180 FEET BELOW SEA LEVEL.

COOL PHASE

In cooler periods strong surface winds maintain a powerful clockwise gyre, or circular current, in the western Arctic that keeps Atlantic water at bay. These wind and water currents also distribute the ocean's colder, fresher insulating water layer more evenly, which inhibits the melting of ice. Until the recent warm phase, this was considered the Arctic's "normal" pattern.



Cooler Arctic water Warmer Atlantic water

that the sub can return to the area and map it more thoroughly. "The submarine is an ideal platform; there's no other way to do this."

Submarines can collect so much data so quickly that scientists will be busy analyzing the information from this and previous SCICEX cruises for years. But they're also working on new ways to collect Arctic data. Though the Navy plans to piggyback some scientific work on future Arctic missions, the last of the Sturgeon-class subs used for SCICEX cruises will be scrapped in 2001, and the Navy's shrinking sub fleet probably won't have room for science-only cruises in the near future.

After a week on the *Hawkbill I* disembark at the camp where I boarded—a half-dozen tents and plywood shacks on the sea ice 165 miles north of Barrow, Alaska. There two teams of scientists are working on projects to help fill the post-SCICEX void.

"**A**H, THE SMELL of burning plastic," says Peter Mikhalevsky, the ice camp's chief scientist, as he walks into the tent where a three-man team from Scientific Solutions, Inc. (SSI), is trying to fix the latest malfunction in their project—a buoy for an autonomous underwater vehicle (AUV) designed to record ocean climate data. I've been watching these guys for a couple of days, thoroughly captivated by the long procession of breakdowns and foul-ups they've encountered.

"You're getting firsthand knowledge of what really goes on behind all those fancy equations and papers," says Armen Bahlavouni, the buoy's engineer.

With a projected range of more than 600 miles, far beyond that of any current AUV, the vehicle they're developing the buoy for will help monitor changes in the Arctic Ocean's temperature and salinity. But one of the big engineering obstacles is how to get the data out of an ice-covered ocean, and that's where SSI comes in. It's building a yard-long buoy that will carry data from the AUV to the ocean's surface. When the buoy hits the ice, a chemical reaction heats seawater in its nose cone until the steam melts through the ice. Then a transmitter emerges to send the data to a satellite.

From what they tell me, they're fighting an uphill battle to make this buoy work. They're confident they can do it, but not everyone else

LAST RUN

A 180-degree panorama of the *Hawkbill's* control room catches only a sliver of her expensive equipment and crew. In six weeks the sub mapped 40,000 square miles of ocean floor, gathered thousands of gallons of water samples, and continuously measured the ocean's temperature, salinity, and currents. But the 30-year-old sub has now been retired, leaving only one of its class remaining—and leaving scientists in search of new ways to get their data.



NOVEL GEAR

With submarines no longer at their beck and call, Arctic scientists must resort to cheaper alternatives. At the ice camp one team tested a buoy (left) that would carry data from a computer-operated underwater vehicle to the surface, melt through the ice, and transmit to a satellite.

is. Peter Stein, president of SSI, says they met with a colleague at Woods Hole Oceanographic Institution who joked before their meeting that he'd give the buoy a snowball's chance in hell of working; after their meeting he upgraded his appraisal to "a snowball's chance in Phoenix."

After a series of leaky seals, broken switches, and burned-out pumps, we finally head to the test site—a hole in the ice a few hundred feet from camp. The pump runs, but nothing happens. Back in the tent Bahlavouni concludes that a pinched tube prevented acid from reaching a chemical. An easy thing to fix, he

says, but "in the meantime we accidentally squirted acid on a conductor and probably shorted out the battery."

It may be just as well that the camp shuts down for an hour that afternoon. The hum of the generator stops, and everyone heads indoors to avoid crunching across the ice because the other science team—Peter Mikhalevsky and Mike Lents from Science Applications International Corporation—needs perfect quiet while receiving an acoustic transmission from a Russian source on the opposite side of the ocean, 1,600 miles away. In the science hut



they'll lower a receiver array through a hole in the six-foot-thick ice to hear the signal. By timing how long it takes the signal to cross the ocean, they can determine the average temperature of the water it travels through. When the ACOUS (Arctic Climate Observations Using Underwater Sound) system is completed, with as many as three sources and six receivers (two of each will be in place by 2002), it will provide a broad view of temperature changes across the Arctic Ocean in real time, year-round—something even submarines can't do.

In a 1994 pilot project ACOUS's transmission signal traveled through the Atlantic water layer two seconds faster than predicted, based on historical climate records, indicating a temperature increase of 0.7°F. The first reading at this ice camp four days ago revealed another 0.9° increase since 1994, which is consistent with SCICEX submarine data. Today, when the signal comes, it verifies the latest reading. The system is working, and everyone is happy.

Meanwhile, back in the SSI tent a switch is broken, and the team has no idea what happened to it. "It figures," Bahlavouni says. "We

hadn't changed *that* switch." They change it and head back for a second try. Again the pump runs, but to no avail. Back in the tent Bahlavouni sees the problem; they've been using fresh water to test the flow through the tubes, but it's freezing in the 29° seawater. They pump the water out, position the buoy under the ice, and start it up. The pump runs, and a milky green cloud wafts through the water. The chemical is reacting.

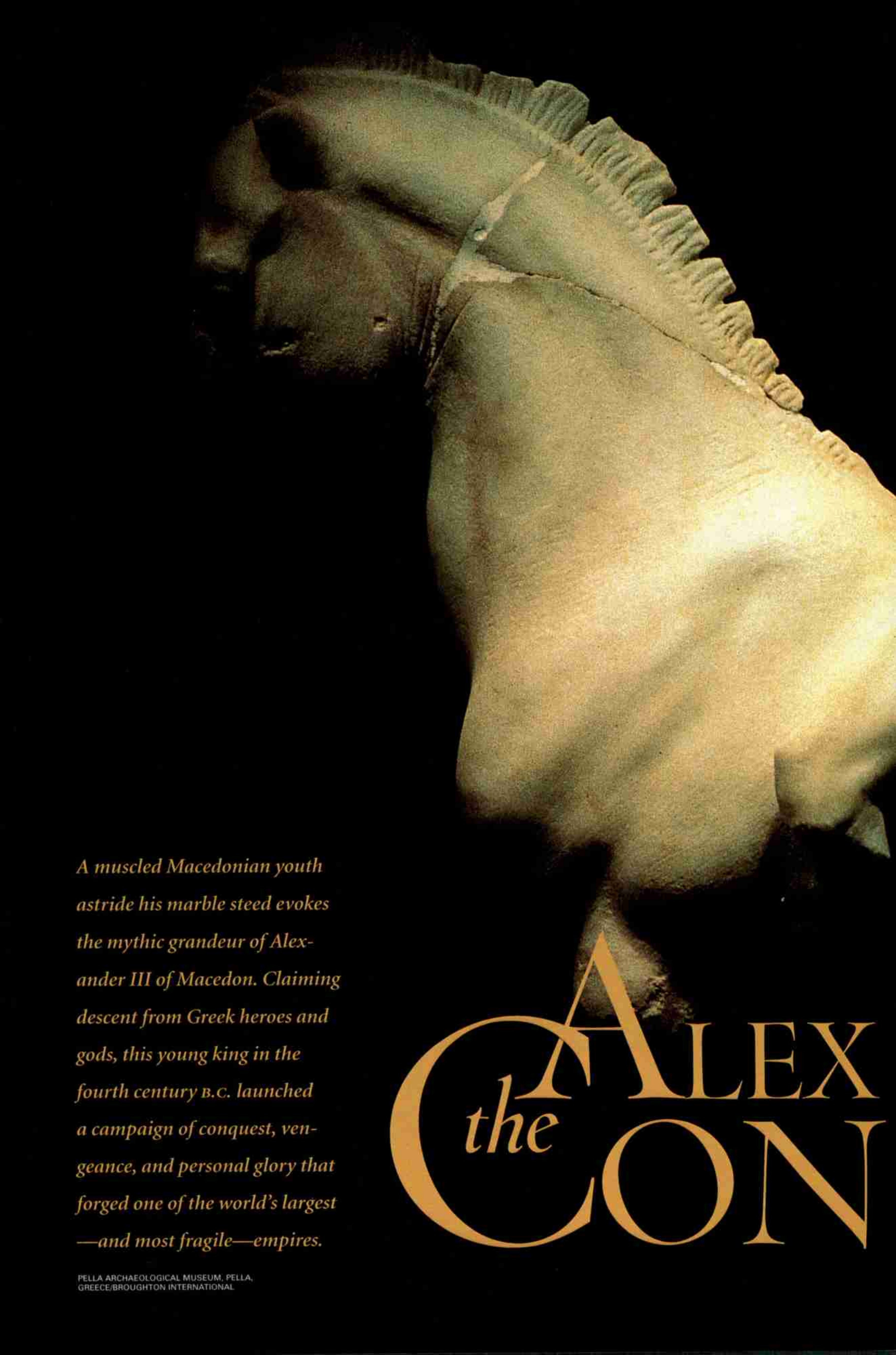
"Yay! Hooray!" After a few short minutes steam squirts from a hole in the ice, and the buoy's nose cone pops up.

"We did it!" Stein shouts.

"I can sleep tonight," Bahlavouni says.

Fortunately science never sleeps. With so many eyes on the Arctic now, scientists will find ways to get the data they need to make sense of changes in the climate. Of course, everyone hopes that the Arctic Ocean will cool again, leaving us not with catastrophic climate change but simply with a better understanding of one of the planet's least known places. □

For more about science in the Arctic get an update at www.ngnews.com/arcticscience.

A close-up photograph of a marble sculpture depicting the head of a horse with a rider. The horse's head is on the right, facing left, with a detailed mane. The rider's head is on the left, partially obscured by the horse's head. The sculpture is set against a dark background.

*A muscled Macedonian youth
astride his marble steed evokes
the mythic grandeur of Alex-
ander III of Macedon. Claiming
descent from Greek heroes and
gods, this young king in the
fourth century B.C. launched
a campaign of conquest, ven-
geance, and personal glory that
forged one of the world's largest
—and most fragile—empires.*

ALEX *the* CON



ANCIENT GREECE PART III

ANDER

By CAROLINE ALEXANDER

Photographs by

JAMES L. STANFIELD

QUEROR



Dawn reveals in stark relief the ruins of the temple of the oracle of Zeus-Amun in the Siwa Oasis of Egypt, where a lone night watchman tends his fire on a path once trod by Alexander. Hailed for ending Persian oppression in Egypt, Alexander in 332 B.C. was



accepted as pharaoh, a god incarnate. Hoping to confirm his divine status—and secure favorable omens for an invasion of Asia—Alexander trekked to the famed oracle at Siwa. He was greeted as the son of Amun-Re, a title that fueled his growing sense of invincibility.



The sure gaze of schoolgirl Nasreen Bibi looks toward a future as hazy as her people's past. Her kin, the Kalash of northwestern Pakistan's Hindu Kush, claim to be descendants of Alexander's troops, who fought throughout this region. A famous ancient tale tells of



Alexander's bacchanal with mountain dwellers claiming descent from Dionysus. They were likely the forebears of the Kalash, who still worship a pantheon of gods, make wine, practice animal sacrifice—and resist conversion to Islam.

The Boeotian plain, at the foothills of Mount Parnassus northwest of Athens, lay naked to withering summer sun. Only steps from the roadside the statue of a colossal marble lion some 28 feet high squatted on its haunches under the welcome shade of overhanging trees. Other than this apparently random statue, no other feature of

the landscape, man-made or natural, betrayed that this had been the site of a desperate, bloody battle. Here in the hot August of 338 B.C., near the ancient town of Chaeronea, an alliance of Athenian, Theban, and other Greek forces was decisively defeated by Philip II, king of Macedonia, ruler of the rugged northern reaches of the Greek-speaking world. The fallen warriors from Thebes' legendary crack unit, the Sacred Band, true to their code of honor, had fought to the death and been buried in a common grave overseen by the monumental lion.

Commanding the Companion Cavalry, Macedonia's elite mounted unit, in this decisive campaign was King Philip's precocious 18-year-old son, Alexander. It was he who, taking advantage of a break in the enemy line, had led the attack against the Sacred Band. As promising as this debut performance was, few at the time could have guessed that in only 14 years Alexander would conquer the known world to the east and change the course of history.

A number of biographies of Alexander III of Macedon, the young man who came to be known as Magnus, or the Great, survive from ancient times, most written centuries after his death. From these sources come the familiar anecdotes that have been passed down through popular history: The young Alexander's taming of Bucephalas, the horse who became the loyal companion of his campaigns; the episode at Gordium, where Alexander solved the riddle of the Gordian knot, a rope so intricately knotted that local legend held that whoever could undo it would be lord of Asia (he cut it with his sword); his numerous acts of both savagery and gallantry in war. Even in the space of his own brief lifetime Alexander was a legend, and now, some 2,300 years after his death, he can seem at times more like a figure from mythology than the flesh and blood of history. For good or for ill he is one of a handful of men who in striding across the stage of life left the world marked forever by their presence.

Alexander's conquests opened up what is called the Hellenistic Age, dated from his death in 323 B.C. to 31 B.C., a period in which Greek culture spread through northern Africa and southwestern Asia, leaving remnants in Egypt, Libya, Iraq, Iran, Afghanistan, and Pakistan, among other countries. The fusion of Greek, Persian, and other cultures colored every aspect of life: language, government, art, literature, and religion—little was left unchanged. The era can fairly be said to have been a first giant step toward an international culture.

At one time it was fashionable to credit Alexander with the vision to have forged this multicultural era. The reality, however, is that it is unlikely he ever intended these effects. His military genius is undisputed, but opinion is divided over his other traits. Everyone has his own Alexander.

CAROLINE ALEXANDER and JAMES L. STANFIELD again join forces to complete their three-part series on ancient Greece. Parts I and II appeared in December and February.

A German biography published in 1949, for example, depicted Alexander as the heroic destroyer of the old order and creator of a new world state. For William Tarn, a British scholar of private means writing before World War II from the comfort of his Scottish estate, Alexander was a sort of decent sporting chap, very much like the English gentry.

“It is interesting that we agonize over Alexander in a way we do not over other conquerors, like Caesar,” I was told by Frank Holt of the University of Houston. “We yearn to see something noble in him.”

When I set out in search of Alexander, I knew in advance that I would



Exquisitely carved in ivory, a bearded Dionysus frolics with Pan and a lady love—a light touch in a boy’s tomb in ancient Macedonia’s earliest capital, Aigai, now Vergina. The boy may have been Alexander’s son, murdered in a power struggle after his father’s death.

Belief in divine roots ran deep in Alexander, who claimed kinship with Zeus, the Greek hero Heracles, and the great Homeric warrior Achilles—whom Alexander idolized and aspired to surpass.

VERGINA ARCHAEOLOGICAL MUSEUM

never find him. But my hope was that he would at least reveal himself, if not as who he was, then as who he was not.

LIKE A CANNY SUPERSTAR who controls his own image, Alexander granted the right to do his portrait to three artists of his time: Lysippos, a sculptor; Apelles, a renowned painter; and a gem cutter called Pyrgoteles. Surviving copies of Lysippos’ work and other portraits, as well as literary descriptions, offer a consistent picture. Like Napoleon, Alexander was strikingly short, probably standing not much over five feet, and stockily built. He was famously good-looking, with a mane of long curling hair and fair skin that had “a ruddy tinge . . . especially upon his face and chest,” according to Plutarch, who wrote a biography of Alexander in the first century A.D. He held his head slightly to the left and had a “melting look” in his eyes, traits that have led some modern doctors to suggest that he suffered from a rare eye condition known as Brown’s syndrome. If this diagnosis is accurate, the characteristic tilt of Alexander’s head enabled him to see straight.

Apparently unable to grow a full beard, he set a fashion for being clean-shaven. But his soft good looks belied a stubbornly competitive nature that was apparent even as a boy. “My father

(Continued on page 54)



A FATHER'S ROYAL LEGACY

Peering with grim intensity, Philip II of Macedon comes to life in a speculative reconstruction based on ancient bones. Blinded in one eye by an enemy's arrow, Philip was an insightful

leader unrivaled by any but his famous son, Alexander. In 359 B.C., at about age 23, Philip became king of Macedonia, a jumble of fractious clans. He built a mighty army, well drilled and armed

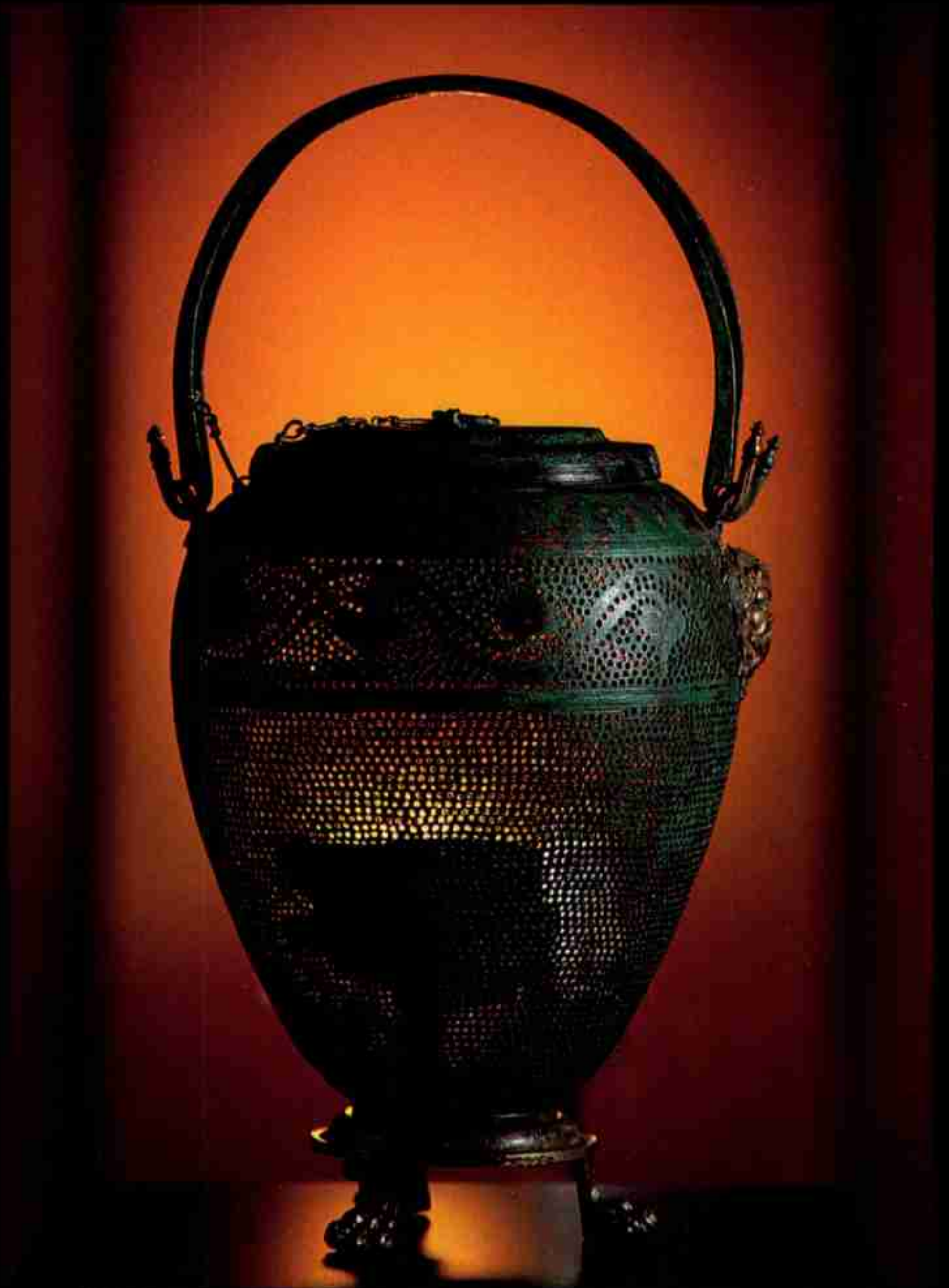




a regal wreath of gold oak leaves and acorns (left). Scholars believe the tomb held the bones of either Philip II or Philip III. Scientists at the University of Manchester in England used the skull for their portrait of the king who laid the foundation for Alexander's conquests.

with 16-foot pikes called sarissae. With shrewd diplomacy and brute force, Philip conquered much of Greece and became head of a Greek league formed to invade Asia Minor. In 336 B.C. an assassin's sword ended Philip's life—leaving the invasion to his ambitious son.

In 1977 archaeologists unearthed a tomb at Vergina. It held a perforated bronze lantern (right), perhaps designed to protect the flame from splashes when the corpse was washed. A gold larnax with a Macedonian star (left) held charred remains adorned with



RECONSTRUCTED HEAD: MANCHESTER MUSEUM, UNIVERSITY OF MANCHESTER; LANTERN: VERGINA ARCHAEOLOGICAL MUSEUM/BROUGHTON INTERNATIONAL; VERGINA ARCHAEOLOGICAL MUSEUM



At the foot of Mount Olympus, the thundering gallop of a stallion recalls a famous tale of Alexander's youth. Here, in the fields of Greece, Alexander mounted and rode a spirited horse that Philip had proclaimed unmanageable. Seeing his son's triumph, Philip said,



*"My boy, seek a kingdom to match yourself. Macedonia is not large enough to hold you."
The horse, Bucephalas, carried Alexander to conquests on three continents. After dying of
wounds at age 30 in Central Asia, by ancient accounts, Bucephalas had a royal funeral.*

Inseparable in art as in life, Alexander and Bucephalas face eternal battle in ancient bronze. A handsome man with flowing locks, Alexander wielded his intense charisma like a sword to inspire and intimidate his troops. In all his victories Alexander led the cavalry charge, which often proved decisive. Fearless, even reckless, he once self-servingly told his men, "There is no part of my body . . . which has not a scar . . . and all for your sakes, for your glory and your gain."

MUSEO ARCHEOLOGICO NAZIONALE,
NAPLES/BROUGHTON INTERNATIONAL

will be the first to win everything," Alexander complained to his playmates on learning that Philip had conquered a new city. "For me he will leave no great and brilliant action."

While it is Alexander who is known as "great," it was his father, Philip, one of the most brilliant generals of his day, who consolidated the kingdom of Macedonia and increased its wealth and status by conquest, trade, and astute alliances, often involving a politic marriage—at least seven in all. Philip's family had ruled Macedonia for more than 300 years, and the political organization of this absolute monarchy had far more in common with the tribal states of northern Greece than the city-states of the south. Indeed, by the fourth century B.C. such an "old world" monarchical kingdom with its regime of hunting, fighting, and drinking was regarded as an anachronism. "To other Greeks the Macedonians were barbarian, half wild," said historian Peter Green of the University of Iowa.

While Alexander owed much of his tactical genius to his father, emotionally he was closer to his mother, Olympias, a princess from Epirus, in northwest Greece. She was strong-willed, proud, and breathtakingly ruthless (shortly after Philip's death she roasted his last and youngest wife alive). Deeply religious, she was also a bacchante, a member of a female band who worshiped the god Dionysus through ecstatic, orgiastic revels; her handling of live snakes as part of these revels was said to have unnerved even Philip. From his mother Alexander acquired a susceptibility to superstition and a cherished belief that he was a descendant of Achilles, the legendary hero of Homer's *Iliad*.

IN NORTHERN GREECE, less than an hour from modern Thessaloniki, lie the ruins of Pella, the Macedonian court and Philip's capital. The surrounding countryside is mountainous and wild, and it is not difficult to imagine the Macedonian nobility hunting and skirmishing on the wooded heights. Here Alexander was born around July 20, 356 B.C., and here he was to pass all but 11 years of his short life. Although the son of a king, his upbringing was spartan. Of an early mentor, Alexander used to say that his idea of breakfast was a long march at night, and of supper, a light breakfast. With the example of Philip and his companions constantly present, Alexander was reared among professional soldiers and hunters, hard-drinking roughriders. The code he learned young was that upheld by the warriors in his beloved *Iliad*: Glory in war was life's highest honor.

Despite some friction between them, Philip groomed his son to inherit the kingship. In 343 B.C. he acquired a former student of Plato's called Aristotle to be Alexander's tutor. "Aristotle was the son of a man who had been court physician under Philip's father," Ernst Badian, a professor emeritus at Harvard University, told me. "He was personally known to Philip and would 'know his place' in court society."

Philip's ultimate goal was to attack Persia, Greece's old enemy across the Aegean Sea. But in 336 B.C., at the age of 46, Philip was assassinated by a bodyguard, possibly his former lover (like most Greek upper-class men Philip was bisexual). Acting swiftly to forestall usurpers, the 20-year-old Alexander securely installed himself on his father's throne.

Two years later at the head of some 6,000 cavalry and 43,000 infantry, Alexander crossed the Hellespont, the strait now known as the Dardanelles, to Asia Minor. This was stage one of his grandiose campaign to fulfill Philip's ambition of taking Greek cities back from Persia, whose

empire extended from modern Turkey to Pakistan. Officially Alexander claimed to be leading a Panhellenic campaign of vengeance for the Persian invasion of Greece in the days of Xerxes a century and a half earlier. In fact, his own Macedonians apart, few Greek troops joined the expedition.

Once across the Hellespont, Alexander set out for Troy, a site that had haunted his imagination since childhood. “He regarded the *Iliad* as a handbook of the art of war and took with him on his campaigns a text annotated by Aristotle,” Plutarch writes, “which he always kept under his pillow together with a dagger.” At the fallen walls of Troy, he and his closest companion, Hephaestion, paid tribute to the alleged tombs of Achilles and Patroklos—their self-styled alter egos—anointed altars with oil, and offered sacrifices.

Alexander’s first engagement with the Persians took place northeast of Troy at the Granicus River (now the Kocabaş) in May 334 B.C. In the summer of my visit the riverbed lay dry and bare, helpfully exposing its terrain to clearer scrutiny. The yellow-green Granicus plain extended on both sides of the river, backed at some distance on the opposite shore by a low ridge. Here the Persians had arrayed themselves for battle, with up to 15,000 cavalrymen in front and 16,000 infantry, a third of them Greek mercenaries, on the advantageous high ground behind. Alexander, ignoring the advice of Philip’s general Parmenio to delay attack, impetuously forged into the river and up the steep opposing bank to where the Persians waited. In hand-to-hand combat he and his men broke the enemy lines and surrounded the Greek mercenaries of the Persian king.

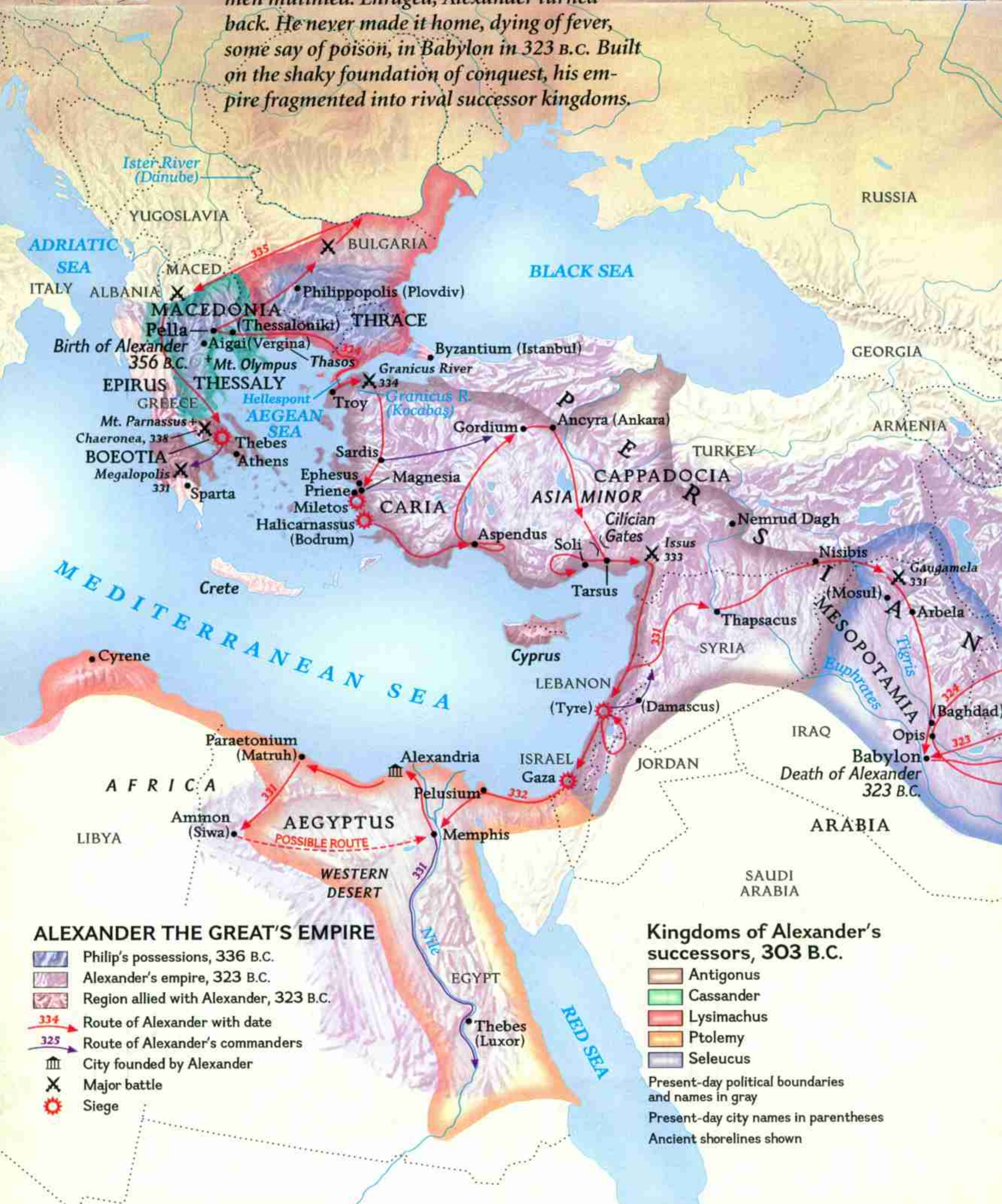
Many of the features of this first important victory were to be characteristic of victories to come. Alexander was directly helped by his father’s legacy: In addition to having Philip’s Companion Cavalry, he had the Macedonian phalanx, which had been refined by Philip into a highly mobile unit of foot soldiers equipped with wooden thrusting pikes up to 16 feet long. It was the length of these pikes—as much as nine feet longer than the average spear—that protected his men as they clambered up the riverbank from their vulnerable position below the enemy.

Above all else Alexander was a tactical genius, blessed with the gift of leadership. When he gave his command to make a frontal attack, he knew his men would confidently follow. “We have learned that the key to leadership under the toughest possible circumstances is that officers and men



FLEETING EMPIRE

Alexander led an army into Asia Minor in 334 B.C. to liberate Greek cities ruled by Persia and avenge the Persian invasion of Greece 150 years earlier. By consent or by carnage, he took lands from Egypt to what was then India, where his men mutinied. Enraged, Alexander turned back. He never made it home, dying of fever, some say of poison, in Babylon in 323 B.C. Built on the shaky foundation of conquest, his empire fragmented into rival successor kingdoms.





undergo the same training,” Adm. Ray Smith told me of the notoriously demanding Navy SEALs regime. “Men know their officer is not asking them to do anything he couldn’t do, or hasn’t done.”

Alexander instinctively honored this code. His ego and pride demanded that he be the best at everything. He himself had led the cavalry charge at Granicus, conspicuous in a white-plumed helmet. In particular his empathy for his men was a necessary part of the Macedonian warrior code.

“For the wounded he showed deep concern,” wrote Arrian, the second-century A.D. Greek historian whose account of Alexander’s campaigns is considered one of the best of the ancient sources. “He visited them all and examined their wounds, asking each man how and in what circumstances his wound was received, and allowing him to tell his story and exaggerate as much as he pleased.”

The battle of Granicus put the Persians on notice. While their forces fled inland, Alexander made a triumphant march along the coastline liberating the region’s Greek cities from their Persian overlords. Ephesus, Magnesia, Priene, all were now free—on the condition, as one historian wryly observed, that they were obedient to Alexander.

After campaigning along the seaboard, Alexander turned inland to Gordium, then cut down toward the Mediterranean’s eastern shore, relentlessly moving in on his prey, Darius III, King of Persia. They met at last outside Issus, near the present-day Turkish-Syrian border. Exhausted from a two-day march, his men were also outnumbered—a Macedonian force of about 50,000 to as many as 70,000 Persians. Nonetheless Alexander, rallying his troops, hastened to the confrontation, himself leading the charge into the Persian lines. Amid the dust and brawl of the battle Alexander spotted Darius in his war chariot and made straight for him, followed by his cavalry. When Darius fled, the battle was lost for the Persians.

Darius escaped, but the battle of Issus, fought in the fall of 333 B.C., made clear that Alexander was not a mere nuisance but a menace to Persia’s might. Until now his main accomplishment had consisted of overpowering and consolidating fractious Greek city-states and small tribes. Skeptical Persians could regard the victory at Granicus as a lucky fluke. But now the young Macedonian, at 23 years of age, had met the great King of Persia one-on-one and routed him. Additionally Darius had been forced to leave his baggage and his family at his camp. The Macedonians captured both, delighting in the extraordinary wealth of spoils but, on Alexander’s orders, leaving the Persian king’s wife and daughters unharmed.

FROM ISSUS Alexander headed down the Mediterranean coast, where city after city allied to Persia opened its gates and surrendered to him. He met his first significant resistance at Tyre, which was situated on an island half a mile offshore, a strategic site on account of its fabled sea power. Alexander’s retinue included a special engineering unit much like the modern Seabees, and they began to construct a causeway to the island. It took the Macedonians seven months to gain the city, and when they did, they fell upon its inhabitants with determined fury. Seven thousand were slain outright, 2,000 young men crucified, and 30,000 sold into slavery.

“Blood was the characteristic of Alexander’s whole campaign,” Ernst Badian told me. “There is nothing comparable in ancient history except Caesar in Gaul.”



The toppled marble of Athena’s temple at Priene on the Turkish coast marks once sacred ground for ancient Greeks—and for their Macedonian king. Tutored by Aristotle and enthralled by Homer’s Iliad, Alexander visited Priene shortly after his first Asian victory, the defeat of Persia’s army

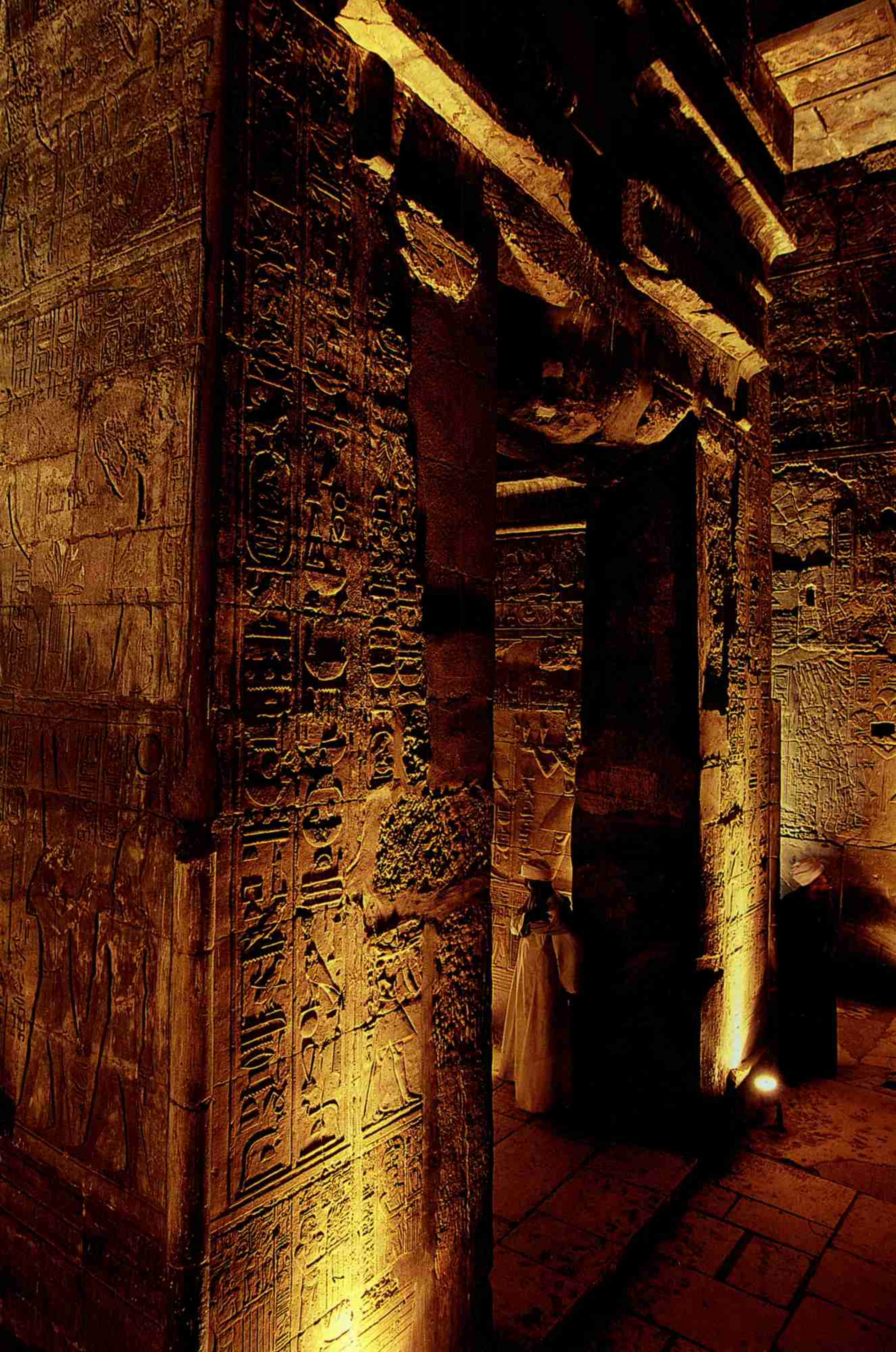


at the Granicus River in 334 B.C. This temple was under construction, and Alexander was granted his request to dedicate the shrine to Athena—an honor earlier denied at Ephesus, wounding his colossal pride. Pragmatically devout, Alexander made daily sacrifices to sway the gods.

Alexander continued south, neutralizing Persian allies, into Egypt. Here he was met with a riotous welcome. Egypt, once a mighty power, had been an unwilling vassal of Persia on and off for nearly 200 years. In Memphis, the Egyptian capital, Alexander was recognized as pharaoh, the legitimate ruler of the vast, wealthy, and ancient culture. And more: In Egyptian tradition, the pharaoh was the son of Amun-Re, the supreme god.

Far from the scant ruins of Memphis in the bleak Western Desert lies a lush oasis called Siwa. Here one twilight I made my way amid the jumble of mud-brick homes that form the small settlements of this remote desert island, up a short hill to a starkly simple, ancient building. In Alexander's day this had been the temple of Zeus-Amun—a melding of Greek and Egyptian deities—and the site of one of the most important oracles in the Greek world. Once across the sandy threshold I knew that I was standing, literally, in Alexander's footsteps.

Early in 331 B.C. Alexander the pharaoh had made a pilgrimage more than 300 miles across the blazing desert to this temple. For once there was no overriding military purpose to his excursion; susceptible as ever to omens and superstition, he had come to consult the oracle on a matter of



great personal importance. “He . . . had a feeling that in some way he was descended from Amun,” wrote Arrian. “He put his question to the oracle and received (or so he said) the answer which his heart desired.” Only three years earlier Alexander had paid homage at Troy with what seems in retrospect almost naive enthusiasm for his belief that he was descended from Achilles. Now, at the age of 25, he was revered as divine by one of the most ancient civilizations on Earth.

In Egypt too Alexander left one of his most farsighted and enduring legacies—Alexandria, one of the greatest cities of its time. Today it is still

Preserved in hieroglyphs of stone, Alexander’s tale adorns the walls of the temple in Luxor, Egypt. Damaged by Persian conquerors, it was restored by Alexander, whose public worship of Egyptian gods earned him adulation. Pharaoh at age 25, he founded Alexandria on Egypt’s Mediterranean shore. Depicted as a ship-crowned woman in ancient art (right), this pivotal port became the cultural heart of the Hellenistic Age—the 300 years following Alexander’s death.

GRAECO-ROMAN MUSEUM,
ALEXANDRIA



a thriving cosmopolitan harbor city, with old world cafés, parks, and promenades encompassing its few remaining Greek and Roman ruins. Egyptians, Turks, Levantines, Nubians, Greeks and other Europeans crowd its streets and ethnic quarters. All this modern bustle came to be because 2,330 years ago in the spring of 331 B.C. Alexander, deploying his unerring instinct for the lay of the land, saw in the naked shoreline and natural harbor the possibility of a mighty city. Outlining it in the shape of a *chlamys*, or military cloak, “he himself designed the general layout of the new town,” says Arrian, “indicating the position of the market square, the number of temples . . . and the precise limits of its outer defenses.”

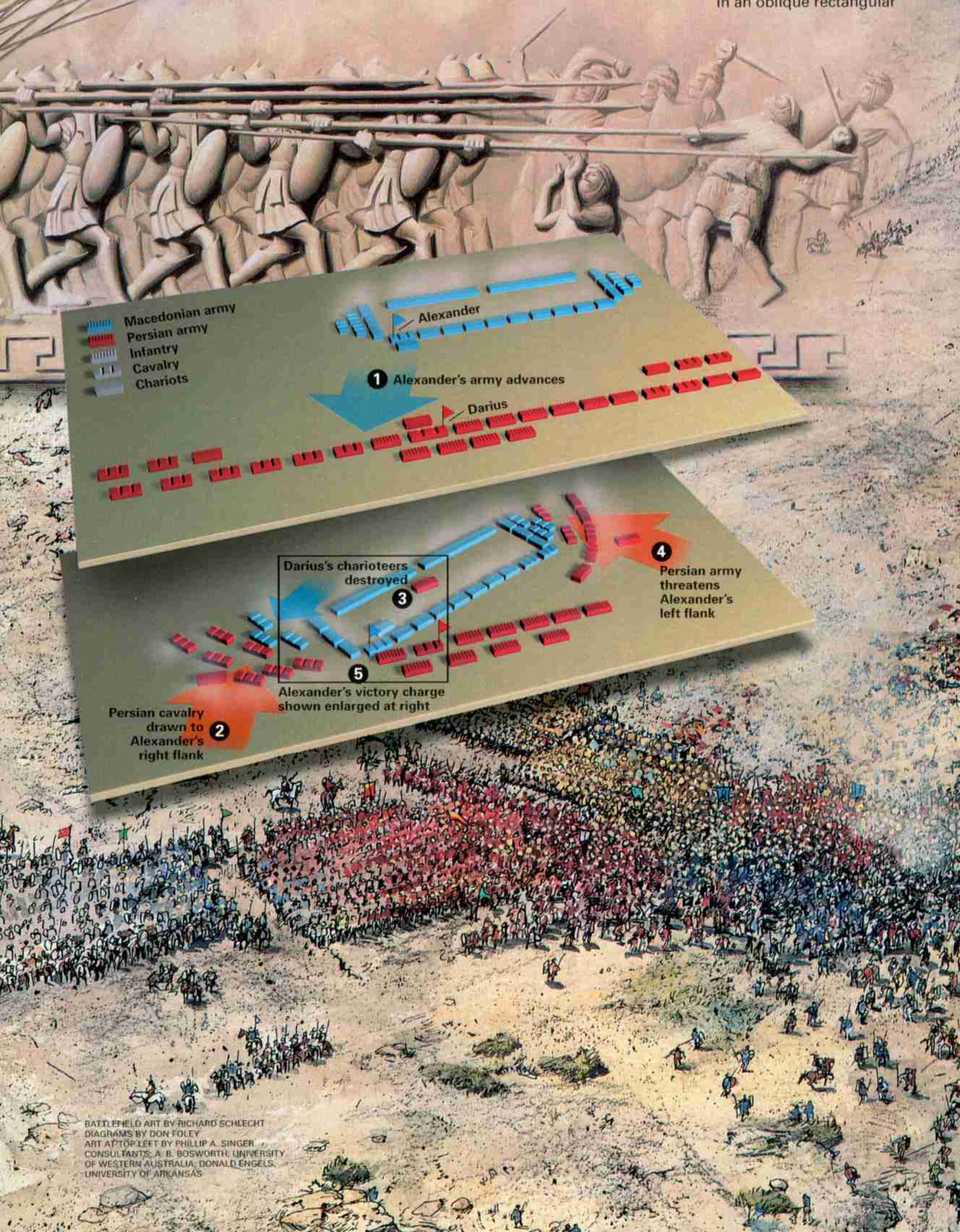
After the battle of Issus, Darius had sent two letters to Alexander, offering grants of land and a daughter in marriage in exchange for peace; both letters were haughtily rejected. Darius, seeing there was no way out, resignedly prepared for all-out war. He reinforced and equipped his troops, drawing from the almost unlimited manpower of his vast empire.

The armies engaged on October 1, 331 B.C., at Gaugamela, north of modern Baghdad—a battleground shared in a later age by the 1991 gulf war. (“Alexander would not have waited five months before launching an attack,” a U.S. officer told me dryly.) Once again it was Darius who determined the battle arena, arraying his troops along a wide plain that was

VICTORY AT GAUGAMELA

The clash of arms at Gaugamela reverberates to this day. There Alexander displayed the military genius that was his greatest gift. Against heavy odds he routed the Persian army of Darius III in a battle still studied by strategists. The victory enabled Alexander to march triumphant through Persia's heart.

Darius chose the plain of Gaugamela for his fateful stand. He cleared away hills and trees, the better to use his cavalry and chariots. Ancient historians and modern scholars suggest that Alexander deployed some 40,000 infantry and 7,000 cavalry in an oblique rectangular



- Macedonian army
- Persian army
- Infantry
- Cavalry
- Chariots

1 Alexander's army advances

3 Darius's charioteers destroyed

4 Persian army threatens Alexander's left flank

2 Persian cavalry drawn to Alexander's right flank

5 Alexander's victory charge shown enlarged at right

formation, facing a polyglot Persian force perhaps five times as large.

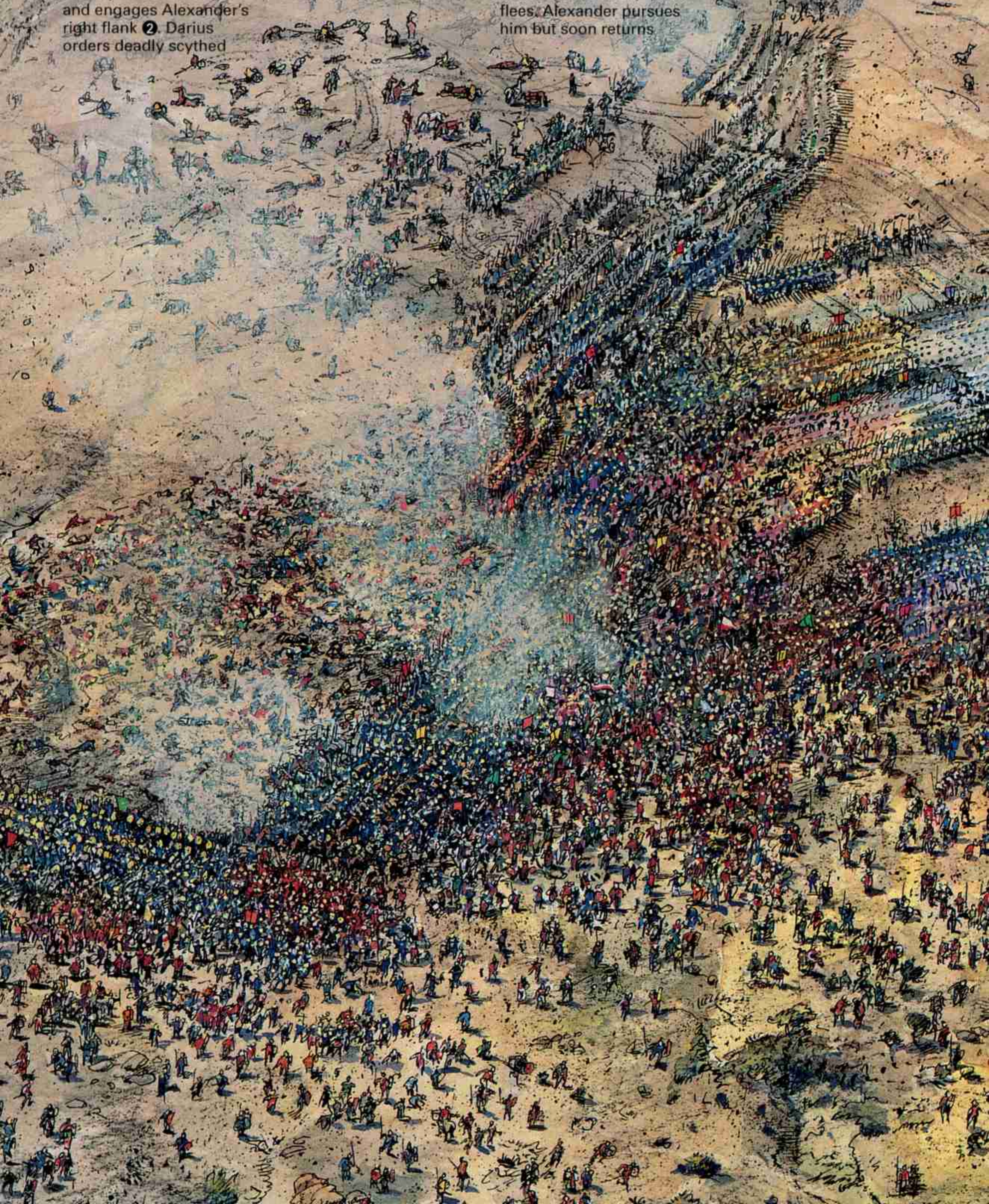
October 1, 331 B.C. In glorious armor Alexander assembles and exhorts his troops. Leading his elite Companion Cavalry on the right flank, Alexander moves his army right ① to draw Darius toward uncleared ground. Persia's crack Bactrian cavalry takes the bait and engages Alexander's right flank ②. Darius orders deadly scythed

chariots into action, but Alexander's disciplined troops merely move aside, then close in, allowing archers and javelin men to dispatch the drivers ③. Nearly encircled on the left, Macedonian general Parmenio holds ground in a desperate defensive fight ④. Alexander's reinforcements on the right draw more Persian cavalry away from the center.

There the enemy line thins, almost imperceptibly. Alexander sees his chance. Like a raptor he swoops into the breach ⑤, leading the wedge point of the charge, then aims for Darius. Chaos ensues. Alexander's tightly packed phalanxes, bristling with pikes, move forward en masse. The Persian line collapses. With defeat sealed, Darius flees. Alexander pursues him but soon returns

for a vicious final engagement with the remaining Persian troops.

Accounts of what occurred in the roiling dust of that decisive day vary in detail. It's clear that thousands died. Darius, disgraced, fled eastward. And Alexander, proclaimed lord of Asia, set his sights on Persia's lavish capitals.



The lapis eyes of an Achaemenid prince found in the ruins of Persepolis bore blind witness to his city's horror in 330 B.C. Called Parsa by the Persian dynasty that built it, Persepolis was a holy city founded by Darius the Great, who had invaded Greece in the fifth century B.C. Here Persia's



NATIONAL MUSEUM, TEHRAN



kings received tribute from subject lands. Repository of riches, it was sacked with Alexander's blessing. Its citizens were butchered and its palaces torched. This desecration by a violent usurper of the Achaemenid throne fueled hatred for the man still known in Iran as Alexander the Accursed.



ideal for his outstanding cavalry and chariots equipped with lethal scythes. From high ground Alexander had gazed at the immense army that so outnumbered his: Bactrians, Dahae, Arachosians, Parthians, Medes, Indians, Babylonians, Mardians—the Persian cavalry, perhaps 34,000 strong, outnumbered his by five to one. Taken aback by the spectacle before him, Alexander checked his characteristic impulse to make an immediate attack. First conducting a minute examination of the terrain, he convened his officers for a pep talk, then gave orders for his men to rest and eat, while he went to bed.

“When his officers came to him in the early morning, they were astonished to find him not yet awake,” wrote Plutarch of the morning before the most important battle of Alexander’s life. While Alexander slept, Darius and his men had maintained their strategic position on the plain, standing at nervous attention in their resplendent armor throughout the night. The Macedonians assembled facing Darius, who was dead center in his line of formation, surrounded by bodyguards. On command the Macedonians advanced in perfect order, with Alexander on the right; but instead of moving straight ahead, their line swung out, placing Alexander at the tip of a wedge, facing Darius. Alexander, knowing he was utterly outflanked anyway, had decided to lure Darius to his wings, then attack the weakened Persian center. The ploy worked. With both flanks desperately engaged—his cavalry at one point held its own against a Persian force ten times its strength—Alexander spotted the anticipated fatal weakening in the enemy line. Charging at the head of his Companion Cavalry, he broke through, cutting Darius off from his second-in-command. As at Issus, Darius fled, and Alexander won the day.

“Alexander’s tactics were offensive,” Col. Cole Kingseed, a military historian at West Point’s U.S. Military Academy, told me. “He anticipated what the enemy would do, forced the enemy to react to him. Alexander went with the arm of decision—that’s one thing we stress, that the commander’s place is where the decisive action is.”

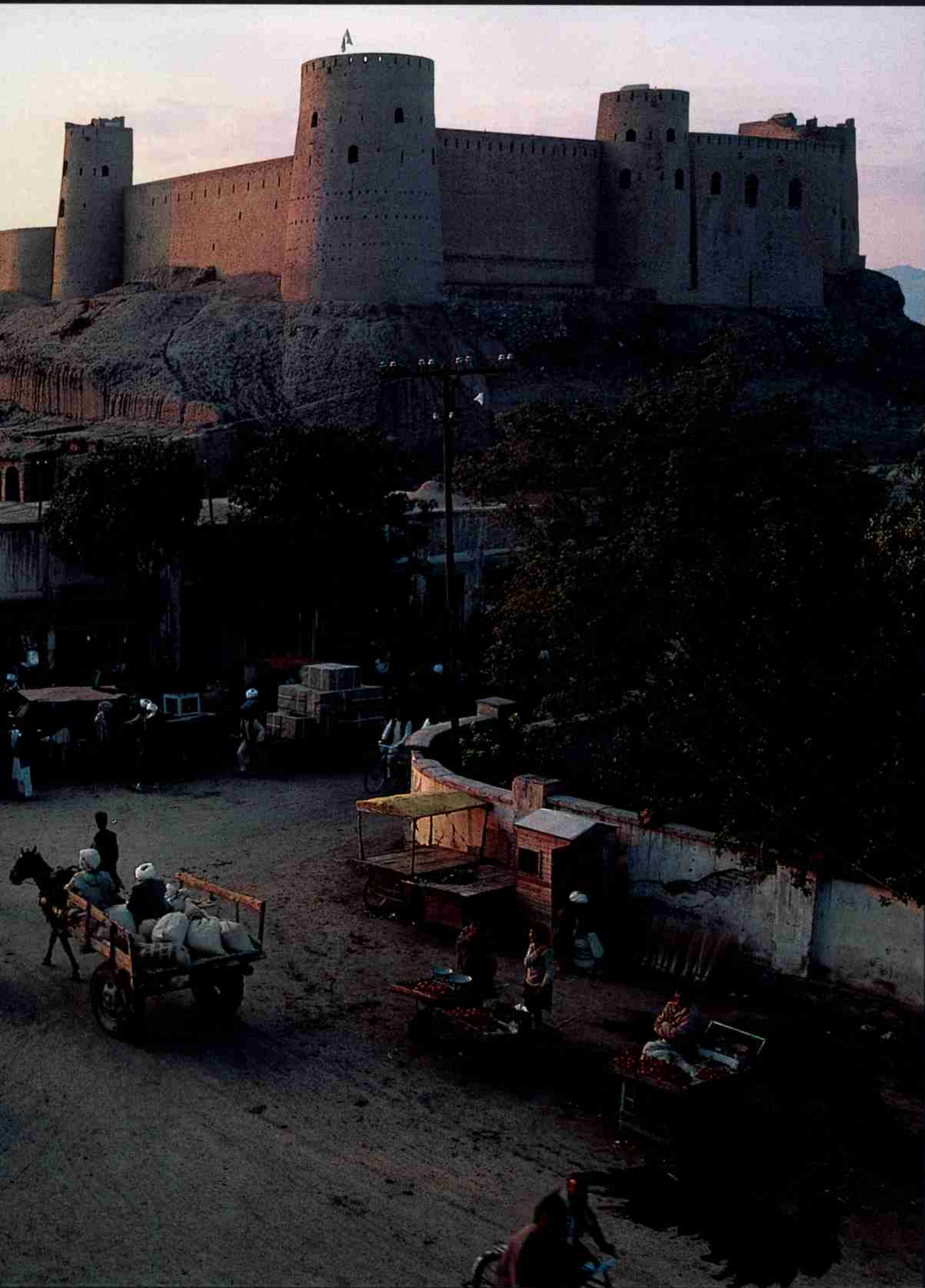
AFTER GAUGAMELA Alexander marched to Babylon and later Susa, receiving a reinforcement of 15,000 Greek troops along the way. By January 330 B.C. Alexander had reached Persepolis, the ceremonial capital of Persia. The handsome remains of the magnificent palace complex can still be visited today, set on a bluff overlooking a harsh, barren landscape—and the extravagant tents erected in 1971 by the last shah of Iran for the celebration of the Persian monarchy’s 2,500th anniversary.

Alexander turned the city over to his troops. With unrestrained violence they looted its rich art and killed adult males. Later Alexander torched the palaces. “The story that Alexander burned Persepolis by accident in a drunken orgy is untrue,” my guide told me. “The archaeologists found that the fire was not haphazard but started in the quarter known as Xerxes’ palace.” Perhaps this was in part a gesture to the Greek troops, vengeance for Persia’s attacks on their homelands in the fifth century.

With the holiest city of the Persians in hand, along with its treasury of perhaps 100,000 talents of gold (worth billions of dollars today), Alexander was lord of Asia. There was one loose end to tie up; Darius still remained at large, reportedly in Ecbatana, southwest of modern Tehran. When Alexander reached the city, Darius was gone. By forced marches in blistering heat Alexander pressed urgently ahead, driving his troops so



Peaceful trade belies the violent past of Herat, where an imposing citadel rises from the ruins of a fort built by Alexander. Here in the ancient province of Areia began the first bloody uprising against Alexander's regime. Because of the region's strategic importance



—and to stem dissent elsewhere—Alexander quickly and brutally quelled the revolt. He then founded Alexandria Arcion, now Herat, the first of many eastern garrison towns established to defend conquered lands, encourage trade, and house troops weary of war.

hard that men and horses fell by the wayside. Then another unsettling report: Darius had been arrested by Bessus, the ruler of Bactria and claimant to the Persian throne.

In relentless pursuit, Alexander caught up with the abandoned Persian baggage train and began a frantic search for Darius. One of Alexander's men noticed a wagon that had meandered off the trail, pulled by two wounded oxen. Curious, he looked inside to find Darius shackled and mortally wounded, a single loyal dog at his side. Having drunk some water brought by the sympathetic Greek soldier, Darius died.

"When Alexander came up, he showed his grief and distress at the king's death, and unfastening his own cloak, he threw it over the body," wrote Plutarch. An aristocrat to his fingertips, Alexander was in his way respectful of other kings; he may even have looked forward to exercising his magnanimity, as he had done toward Darius's women. Darius's body was returned to Persepolis for burial, while Alexander led his army to the nearby city of Hecatompylus for a much needed rest.

Here the rumor spread among his weary men that the campaign was ended and they were going home. Alarmed, Alexander assembled his generals and, according to first-century A.D. Roman historian Curtius, "with tears in his eyes, complained that he was being brought to a halt in the middle of a brilliant career." Later Alexander chose men of noble birth from his Persian captives to be trained as administrators of captured territory; his fellow Macedonians had revealed their limitations, and he was shrewdly preparing new subordinates for the next stage of his apparently endless campaign.

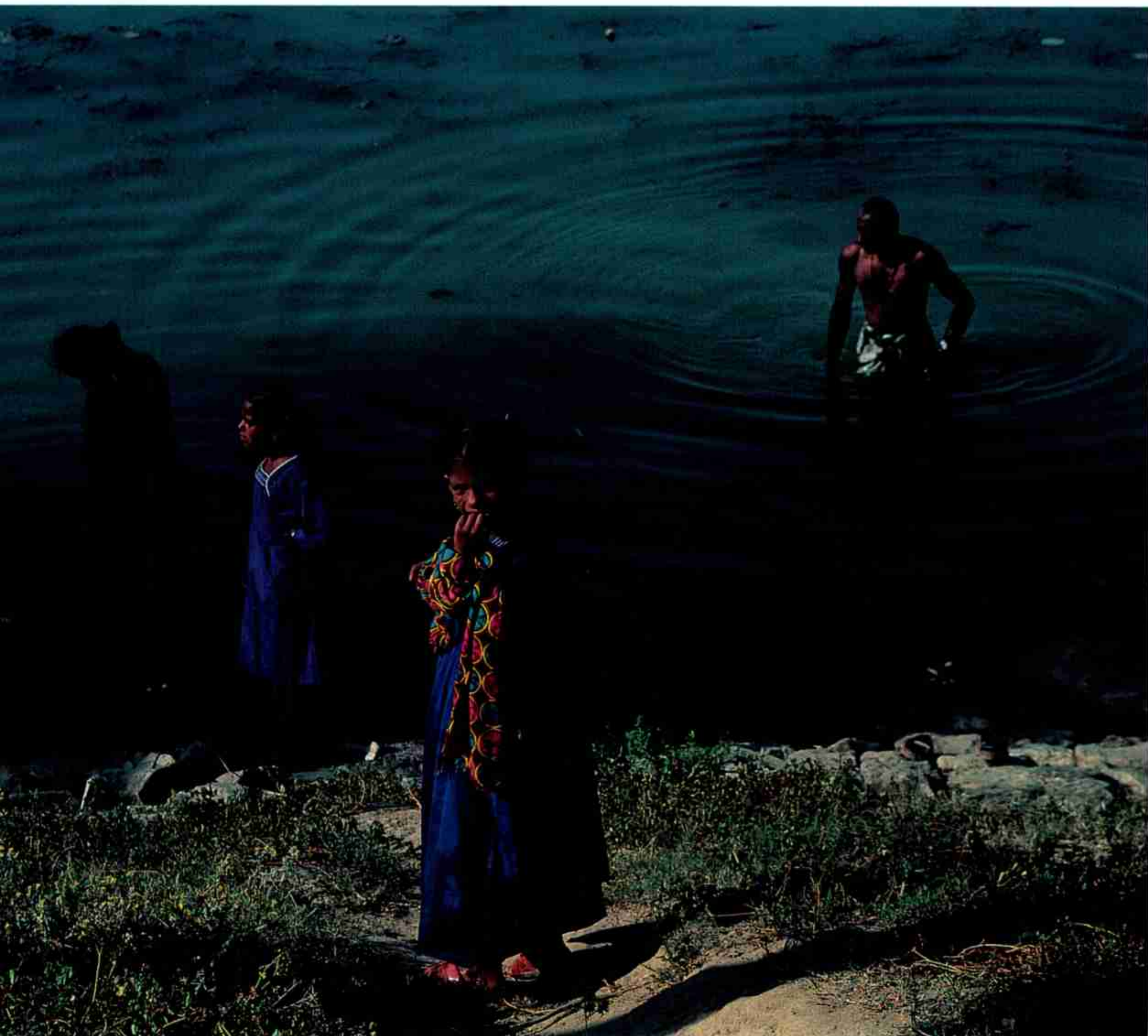
Alexander now turned his attention to further Asian conquests and the rebel Bessus, who had retreated from the rugged hill country of Bactria into neighboring Sogdiana. Alexander's year-long pursuit of Bessus took him into the wild northern fringes of the Persian Empire, through treacherous and unknown terrain. From the high snowbound passes of the Hindu Kush, north across the Oxus River into the blistering plains of Sogdiana, his increasingly unhappy men succumbed to frostbite, altitude sickness, and heat. The huge territory he had so far conquered had been known to the Greek world from advance reports made by traders, diplomats, and soldiers. Knowledge of the geography and people of the lands that lay ahead, however, was obscure and confused.

In the summer of 329 B.C. Bessus was arrested by his own panic-stricken allies and turned over to Alexander, who ordered him stripped naked and tied to a post beside the road to endure the jeers of passing troops. Eventually he was mutilated and dismembered—a Persian traitor's death. Alexander intended this severe treatment to show his new Persian associates that he had righteously avenged Darius, the implication being that he, Alexander, was the rightful lord of Asia.

BUT ALEXANDER'S CAMPAIGN in Central Asia did not end with the death of Bessus. Unexpectedly, a more challenging foe arose in the person of a Bactrian noble called Spitamenes, who joined forces with nomadic horsemen from the north to harry Alexander's men by making lightning attacks and then retreating into the steppe. These attacks caught the men at a vulnerable time. Worn out from the debilitating march that had brought them into this new territory, veterans from his father's army, along with Thessalian volunteers, petitioned Alexander to be sent home. Dangerously short of manpower,



Hushed and tranquil for a leisurely dip, the Jhelum River was a raging hell in 326 B.C. Swollen with monsoon rains, the river lay between Alexander and his foe, Indian King Porus. With characteristic cunning Alexander divided his army to confuse the enemy and led an assault force upriver.



They crossed at night in relentless rain. Duped by Alexander's maneuvers, Porus's army fell. His fearsome war elephants rampaged in agony, pierced with spears. So horrific was the mud, blood, and chaos that Alexander's men began a slide toward mutiny. This was his last great battle.

Alexander had no option but to recruit from the local Bactrians he had recently subdued.

“Alexander kept his army supplied by recruiting from the enemy,” Nicholas Hammond of Cambridge University said. “The fact that he could successfully do this speaks volumes about his leadership.” Despite their diverse nationalities his troops remained remarkably loyal.

Alexander's entry into the northern frontier country accompanied a series of incidents that indicate a dark shift in his character. As the composition of his army changed, bitter tensions arose between the new recruits and the old guard. Alexander adopted modified Persian dress and customs, to the distress of the Macedonians—distress that Alexander, increasingly paranoid, was quick to read as evidence of disloyalty, punishable by death. A number of old companions fell victim to his suspicions: the aged Parmenio, Philip's loyal general, and Parmenio's son; Cleitus, who had saved Alexander's life at Granicus; and Callisthenes, Aristotle's nephew—all were either executed or murdered. In Hyrcania on the Caspian Sea Alexander was given a eunuch named Bagoas, whom he made his lover. While the Macedonians took bisexual relationships



A caravan crosses a landscape of death in Pakistan's Gedrosia desert. With costly hubris Alexander marched much of his army through these blistering sands. Steered inland by the Makran Coast Range, at top, they faced a wilderness without forage and with little



water. Thousands died of starvation, thirst, and heat. Most women, children, and pack animals drowned in a flash flood. The march took 60 days and some 60,000 lives, "poor castaways in the ocean of sand," wrote historian Arrian. It was Alexander's worst defeat.

Imbued with a godly aura in later Greek sculpture (facing page), Alexander seemingly gained in death what he had sought in life: divinity. Even before his death at age 32 in 323 B.C., many Greek cities recognized Alexander as a god—an honor he undoubtedly encouraged. Ironically, his rising paranoia, despotism, and demands for obeisance alienated the Macedonian troops who had laid Asia at his feet.

THASOS ARCHAEOLOGICAL MUSEUM,
THASOS, GREECE/BROUGHTON
INTERNATIONAL

in stride, the unnatural effeminacy of the beautiful eunuch may have offended them.

More offensive to the Macedonians was Alexander's insistence on the practice of *proskynesis*. In a form of adoration that the Greeks reserved for the gods but which the Persians bestowed on their king, the worshiper kissed and prostrated himself before Alexander. Catering to Persian tastes was pragmatic, as Alexander needed Persian loyalty and manpower for future conquest, but such extravagant practices clearly also suited his belief in his divine descent.

"In his honor myrrh and other kinds of incense were consumed in smoke; a religious stillness and silence born of fear held fast all who were in his presence," reported Ehippus, a writer contemporary with Alexander. "For he was intolerable, and murderous, reputed in fact to be melancholy mad." Ominously, he was drinking heavily.

In early 327 B.C., with Alexander closing in, Spitamenes was run to ground and assassinated by his own allies, and his head was brought to Alexander as a peace offering. That spring, still combating sporadic rebellions, Alexander captured a mountain stronghold of the Sogdians and took Roxane, the daughter of the captured leader, as his wife. Accounts state that he was smitten with the beauty of the girl, who was perhaps 12 at the time, but the marriage was also another pragmatic move, making a powerful ally out of one of his most troublesome enemies.

Shortly afterward Alexander wrapped up the two-year campaign in Central Asia, leaving behind him a string of military garrisons manned by both Greek-speaking and "barbarian" forces.

IN THE BRITISH MUSEUM in London I studied an improbable image on a small, worn coin: a tiny man on a prancing horse brandishing a pike at a departing elephant. This coin was struck to commemorate one of Alexander's most difficult and brilliant victories, in the region known to him as India (now northeast Pakistan). According to the wisdom of his time it lay close to the all-encircling ocean—at the farthest end of Earth.

In the spring of 327 B.C. Alexander led his army of perhaps 75,000 troops, of whom only 15,000 were now Macedonians, back over the Hindu Kush. By June of the following year he was at the banks of the Hydaspes (now Jhelum) River, preparing to meet one of the most formidable adversaries of his career. Porus, who stood nearly seven feet tall, was the ruler of extensive territory in the Punjab. Across the river he had arrayed his 50,000 infantry troops, cavalry, and war elephants, especially fearsome to the Macedonians' horses. From this defensive position he awaited Alexander. "Porus himself rode an elephant which towered above the other beasts," wrote Curtius. "His armor, with its gold and silver inlay, lent distinction to his unusually large physique."

Under the eyes of his watchful enemy, Alexander—determined to create as much confusion as possible—drilled his men up and down the riverbank as if preparing for action. Campfires were lit erratically. To the watching Indians, the Macedonians seemed to be perpetually on the brink of a decisive action. Eventually tiring of false alarms, Porus pulled many of his night watches, and Alexander saw his opportunity.

His scouts had found the ideal crossing 17 miles upriver, where a wooded island masked the river. Dividing his forces into three distinct groups, Alexander led the crossing under cover of night aided by a severe

thunderstorm, and he appeared before Porus at dawn. Concealing part of his cavalry, Alexander led the rest in a charge, counting on the fact that Porus would commit his forces to what appeared to be an easy win. When Porus took the bait, the hidden cavalry engaged, and Alexander was joined by his other contingents. Amid the mud, the rain, and the trumpeting of the elephants, the Macedonians surrounded Porus, who, wounded, made a slow retreat on his war elephant and was soon captured.

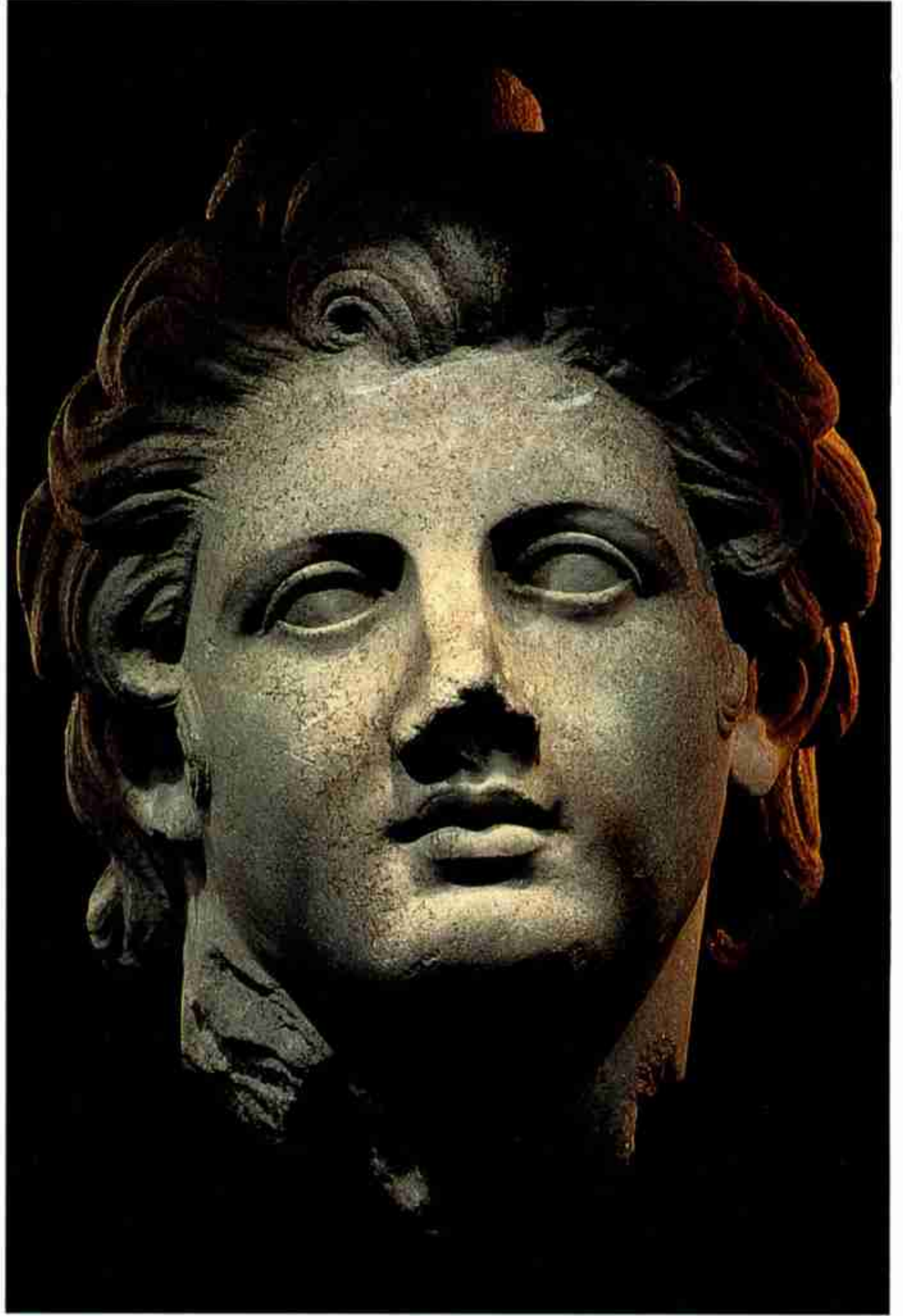
When Porus was brought before Alexander and asked how he wished to be treated, he replied simply, "Like a king." These were words Alexander understood, and he restored Porus to his kingdom on the condition that he remain loyal to Alexander. Impatient to continue to where the end of the world beckoned, Alexander paused to found a city, Bucephala, in memory of the beloved horse that had died shortly after the battle—of wounds or perhaps old age. Bucephalas had been with Alexander from his boyhood.

It was the monsoon season, and Alexander's men were demoralized by the incessant rain. On the banks of the Hyphasis (now Beas) River, some distance farther east, Alexander's troops at last rebelled, ending the dream of world conquest. "Alexander was basically screwed by ignorance of geography," Peter Green told me. "He had been telling his men, We'll just go over the hill, boys—and then suddenly he had the whole of the Ganges plain before him." The geographers were wrong; there was no end of the world in sight. Exhausted and wounded and with the memory of elephants shrieking amid the mud and bloody confusion of Hydaspes, their most nightmarish battle, Alexander's men, for the first and only time, refused him. Enraged, Alexander, taking a cue from the

Iliad, sulked Achilles-like for three days in his tent. When his men did not budge, he emerged to consult the omens, which conveniently indicated that he should turn back. Alexander would bow to gods but not to men.

The return to Persia saw Alexander at his most savage. Establishing Greek garrisons at key points along the way, he eliminated all resistance by what can only be called genocide. It was as if, having learned the world was too big to conquer, he struck in compensation at everything in his way. As Harvard's Badian says, "In the end Alexander didn't establish anything lasting in India. By his death most of his conquests there had already been lost."

At a point north of modern Karachi Alexander divided his troops.



Some, under the command of his boyhood friend Nearchus, sailed from the Indian Ocean into the Persian Gulf. He himself led others across the Gedrosia desert, straddling Pakistan and Iran. With little food, no fodder for the animals, and water scarce or undrinkable, Alexander's men and their retinues fell along the way. This retreat was the most costly campaign Alexander waged. Perhaps 85,000 people, including the baggage train, entered the desert; as few as 25,000 came out.

During this retreat what ancient historians regarded as one of his most noble deeds took place. A scouting party had found a trickle of brackish water and brought some back in a helmet to their king. Alexander "took the helmet, and in full view of the troops poured the water on the ground," writes Arrian. He would not drink if his men could not.

On an August evening I arrived in Ahwaz, an Iranian desert city close to the Iraqi border. The temperature at six in the evening was 124°F. Some 60 miles north of the city lie the ruins of Susa, the winter capital of the Persian Empire. It is now a blasted site, flat brown earth with tufts of green weed and shrub poking from the mud-brick palace foundation, the few flagstones, and the shattered chunks of fluted columns.

Staring from a tomb of snow, the massive head of a stone god surveys Nemrud Dagh in Turkey. King Antiochus I of Commagene built this eerie shrine as his burial place, adorning it with oddly blended Greco-Persian gods. Claiming kinship with both Alexander and Persia's Achaemenids,



Antiochus in some ways symbolized the Hellenistic Age, when Greek language and culture linked lands from the Atlantic Ocean in the west to the Indus Valley in the east. Such was the unwitting legacy of Alexander—a king whose only goal was conquest.



Alexander returned to Susa from the desert in March 324 B.C. Soon afterward he welcomed the arrival of some 30,000 Persian noble youths who, on his orders, had been taught Greek and instructed in Macedonian warfare. Potential replacements for his aging inner circle of Macedonians, he called them the Successors. In the same season Alexander held a mass wedding for himself and more than 80 other Macedonian officers to Persian noblewomen. He himself took two wives, one a daughter of Darius. Persia, not Greece, was now his base of operations. Despite the setback at the Hyphasis River his ambition remained undiminished, and he began plans to conquer Arabia, and perhaps Carthage, or Italy. . . .

SOMETIME IN THE AUTUMN of that year, in Ecbatana, Hephaestion, his companion since boyhood, took ill and died of undetermined causes. Alexander's grief was extravagant; Hephaestion had been Patroklos to his Achilles, and he now mourned his friend in heroic fashion—and crucified Hephaestion's unfortunate physician. Alexander's own health was impaired by a brutal chest wound received in India—one of many injuries—and he was subject to the mood swings and murderous rages of an alcoholic.

But in early 323 B.C. Alexander set out for Babylon to prepare for the Arabian expedition. At a banquet on May 29 he was gripped with abdominal pain and retired to his quarters. Over the next two weeks he was taken with fever, and although able to make sacrifices to the gods and conduct intermittent business, he never left his bed. His troops, terrified by rumors that he was already dead, insisted on seeing him with their own eyes.

“Nothing could keep them from the sight of him, and the motive in almost every heart was grief and a sort of helpless bewilderment at the thought of losing their king,” Arrian records. “Lying speechless as the men filed by, he struggled to raise his head, and in his eyes there was a look of recognition for each individual as he passed.”

On June 10, 323 B.C., Alexander died. Modern science attributes his death variously to drink, malaria, or a perforated ulcer. Recently it has been suggested that a rare symptom of typhoid fever called ascending paralysis may have been the cause of death. If so, he would have appeared to have been dead for some time before he actually was, accounting for the ancient sources' observation that his body did not begin to decompose until days after his death. He was just short of his 33rd birthday.

Centuries after Alexander's death the Roman Emperor Augustus expressed astonishment that “Alexander did not regard it as a greater task to set in order the empire which he had won than to win it.” But Alexander's white-hot ambition had been for conquest, pure and simple, not administration. Nevertheless, the cultural landscape of the East had been changed in the wake of his conquests, and his death marked a new era. The Hellenistic Age, which spread Greek culture and language throughout the East, lasted from the year of his death until Ptolemaic Egypt fell to Rome in 31 B.C.

Before turning back from the Hyphasis River, Alexander is said to have erected an extraordinary monument to his campaign, no trace of which has ever been found. It consisted of 12 altars to an eclectic collection of gods, Greek and eastern, and a brass obelisk bearing the simple words: “Alexander stopped here.” □

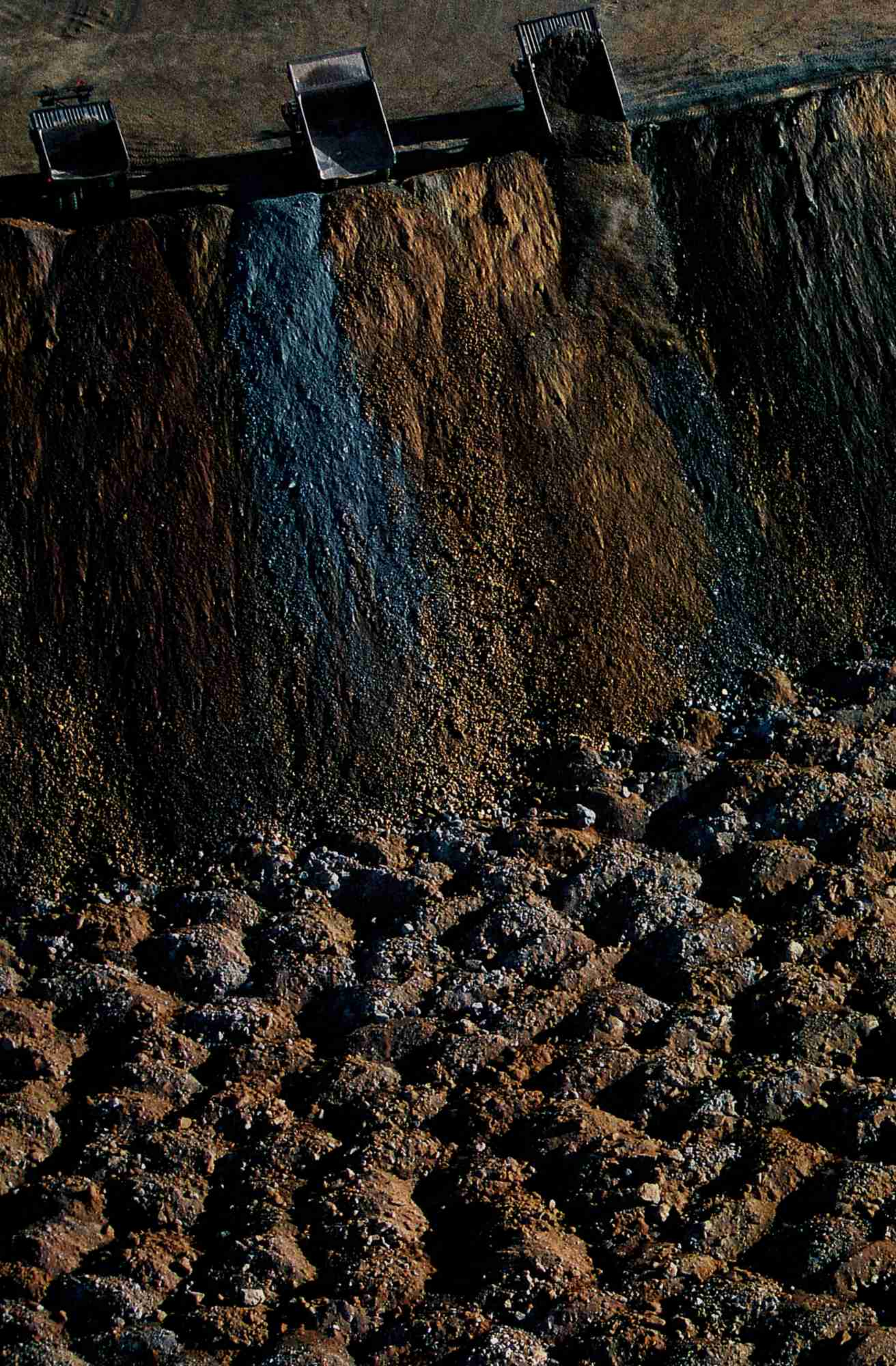


Miners at San Manuel, Arizona—the largest underground copper mine in North America—dug 54,000 metric tons of ore daily. Low prices shut down the operation in 1999, wiping out 2,700 jobs.



MINES IN THE WEST STILL RIDE CYCLES OF BOOM AND BUST, BUT DECADES OF RISING ENVIRONMENTAL STANDARDS NOW DEMAND THAT THEY PRODUCE WITHOUT REPEATING THE DISASTERS OF THE PAST. BY T. H. WATKINS • PHOTOGRAPHS BY PETER ESSICK

HARD ROCK LEGACY





DISGORGING ROCK

Trucks the size of houses dump 200-ton loads of waste rock from an open pit mine in Nevada. Deposits of gold, silver, platinum, copper, lead, zinc—"hardrock" minerals—still beckon prospectors to the western United States. The industry has been harshly criticized for causing serious environmental damage, much of it on public lands. Yet demand for its products remains voracious: Each year the U.S. consumes 24,000 pounds of new nonfuel minerals per person.

In the Malakoff diggings of California's Sierra Nevada lies the wreckage of an old dream. It is a bizarre man-made canyon sculpted into grim spires and fins, cream-white surfaces streaked with red, the whole tortured architecture capped by a fringe of nearly black forest.

More than a century ago miners sent water racing down the Sierra through networks of ditches and wooden flumes. The water, building pressure with every mile, funneled into huge nozzles and from them struck the ancient slopes of the foothills with such terrible force that they dissolved into mud that oozed like surging lava over wooden riffles. The riffles were in place to separate gold from the slurry, which was then sent through a system of tunnels into the South Yuba River and from there, via the Feather, to the Sacramento—so much slurry that with every spring flood the productive farms of the Sacramento Valley were smothered under yet another layer of mud.

Such unregulated destruction is no longer permitted in the United States. But the Malakoff site still dribbles slurry into the watershed of the Sacramento, and this weird, human-carved landscape remains as a useful symbol of the West's long infatuation with the

dream of treasure and with the legislation created to service that obsession: the General Mining Law of 1872, one of the oldest land laws still on the books.

The law was designed to promote and codify the use of public lands for mining purposes, and in its major provisions it did so with admirable simplicity. It declares all federal land not otherwise restricted, as in national parks and other reservations, to be open to the prospecting and discovery of gold, silver, copper, iron, nickel, and other hardrock minerals.

Under the 1872 law miners can stake a lode claim to an underground ore body or stake a placer claim, where loose minerals are worked at the surface. To keep a claim valid, the claimant need only pay an annual \$100 holding fee. Upon proof of a valid mineral discovery and an investment of \$500 in development, the miner could patent—actually buy—the land for \$5 an acre for lode claims and \$2.50 an acre



for placer claims. Although miners are still free to stake claims, Congress last year placed a moratorium on patenting them.

The hardrock mining industry and its supporters say that the law remains as essential to the development of the West as it was in 1872. Economist John Dobra of the University of Nevada, for instance, estimates that in 1998 gold and silver mining alone pumped 7.7 billion dollars into local economies, accounted for 84,000 jobs, provided more than two billion dollars in household income, and supported hundreds of communities scattered from the wilderness of Alaska to the deserts of Nevada. For most of this, supporters say, many thanks to the General Mining Law of 1872.

Others consider the law a malevolent antique that destroys the environment and robs the taxpayer as well. It is estimated, for example, that more than 240 billion dollars (overall value adjusted for inflation) in gold, silver, copper, lead, and zinc have been extracted from lands made available by the General Mining Law. The sum total of patent fees paid to the government is unknown. What *is* known is that the 1872 law does not require the miner to pay any royalty whatsoever to the federal government.

Even in the West the industry the law supports is facing increasing opposition. Responding to an initiative promoted by the Montana Environmental Information Center and other regional conservation organizations, the citizens of Montana have voted to impose a ban on new or expanded open-pit, cyanide-leach mining in their state.

Local disaffection is echoed in some federal agencies. In February 1999, Forest Service Chief Mike Dombeck announced a two-year moratorium on mining claims in a hundred-mile stretch of Montana's Rocky Mountain Front, a move heartily endorsed by Interior Secretary Bruce Babbitt. No friend to the General Mining Law, Babbitt once described it as "an obscene example of corporate welfare."

Not too many years ago, such an outburst from a Secretary of the Interior would have been unthinkable. After all, a case could be made that the General Mining Law of 1872 built the West. After the discovery of gold in January 1848 on California's American River, tens of thousands of people scurried to California and from there into all the nooks and crannies of the interior West. Development capital from San Francisco, Chicago,

GOLD FEVER

Only a few who rushed to the western treasure fields found anything like the "Whopper" (right), a 141-ounce gold specimen dug from California's Sixteen to One Mine. Aided by a metal detector and a burro named Jack, Dwight Cantley (left) makes a modest living scouring land near Quartzsite, Arizona, for placer, or surface, gold. Today such independent miners are a rare breed.



THE VAST MAJORITY OF THE MINERS I WORK WITH WANT TO PROTECT THE ENVIRONMENT. THEY WANT TO KNOW HOW TO DO IT, AND THEY WANT TO DO IT RIGHT.

—BLM Surface Protection Specialist Gary Rowell

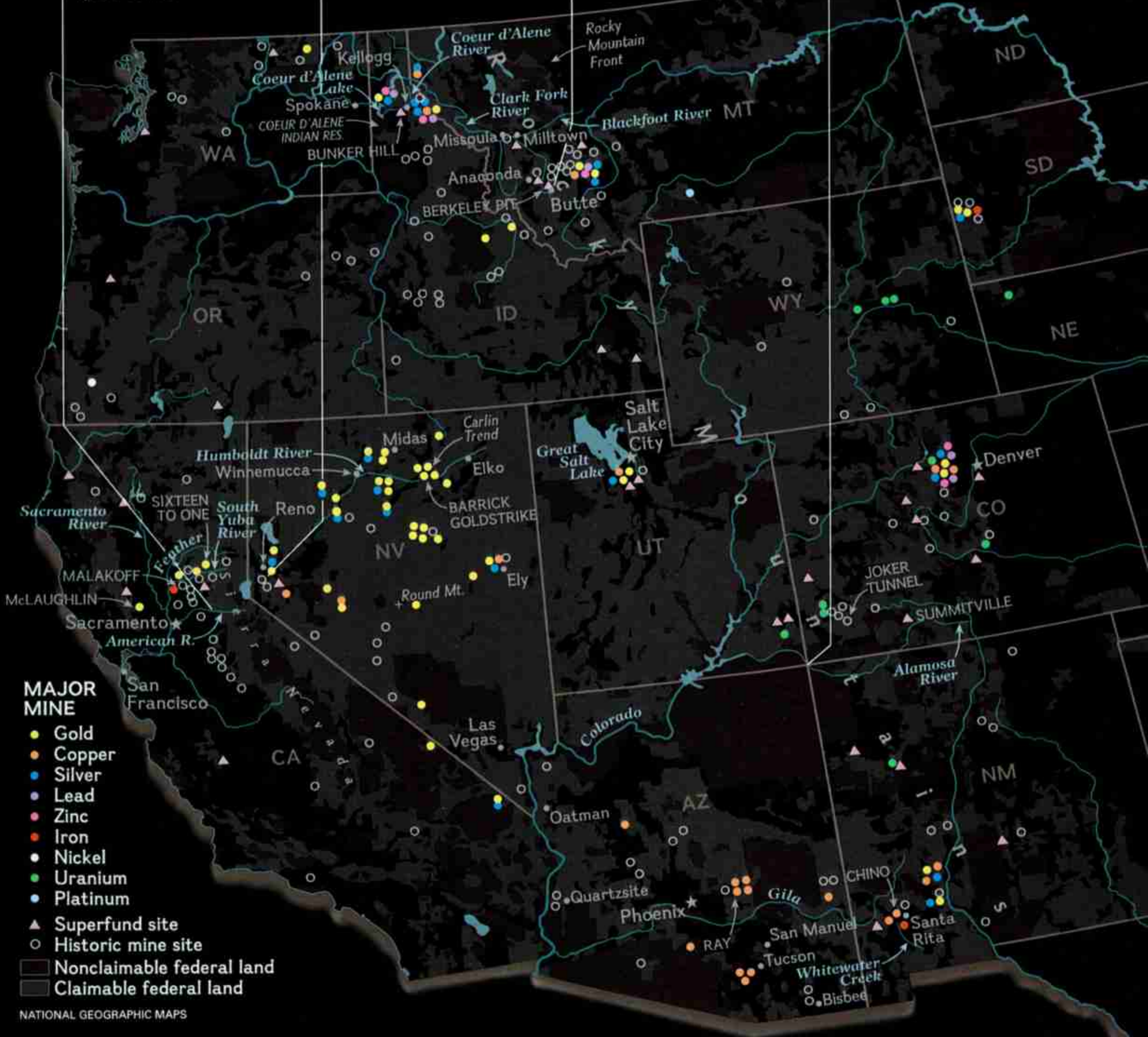
PRIVATE ENTERPRISE ON PUBLIC LANDS

January 1848: Building a mill on the American River for John Sutter, James Marshall sees sparkles in the millrace and touches off the California gold rush with the words "Boys, I believe I've found a gold mine."

"Blue stuff" that hinders gold mining in Nevada's Washoe district turns out to be rich silver ore. The 1859 discovery of the Comstock Lode spurs a rush over the mountains from California.

Working a silver mine in 1882, Marcus Daly strikes a copper vein 35 percent pure. By the end of the century Butte, Montana—"the richest hill on earth"—is the biggest copper city in America.

In the 1950s uranium frenzy strikes the Four Corners when the U.S. Atomic Energy Commission offers cash bonuses for newly discovered deposits.



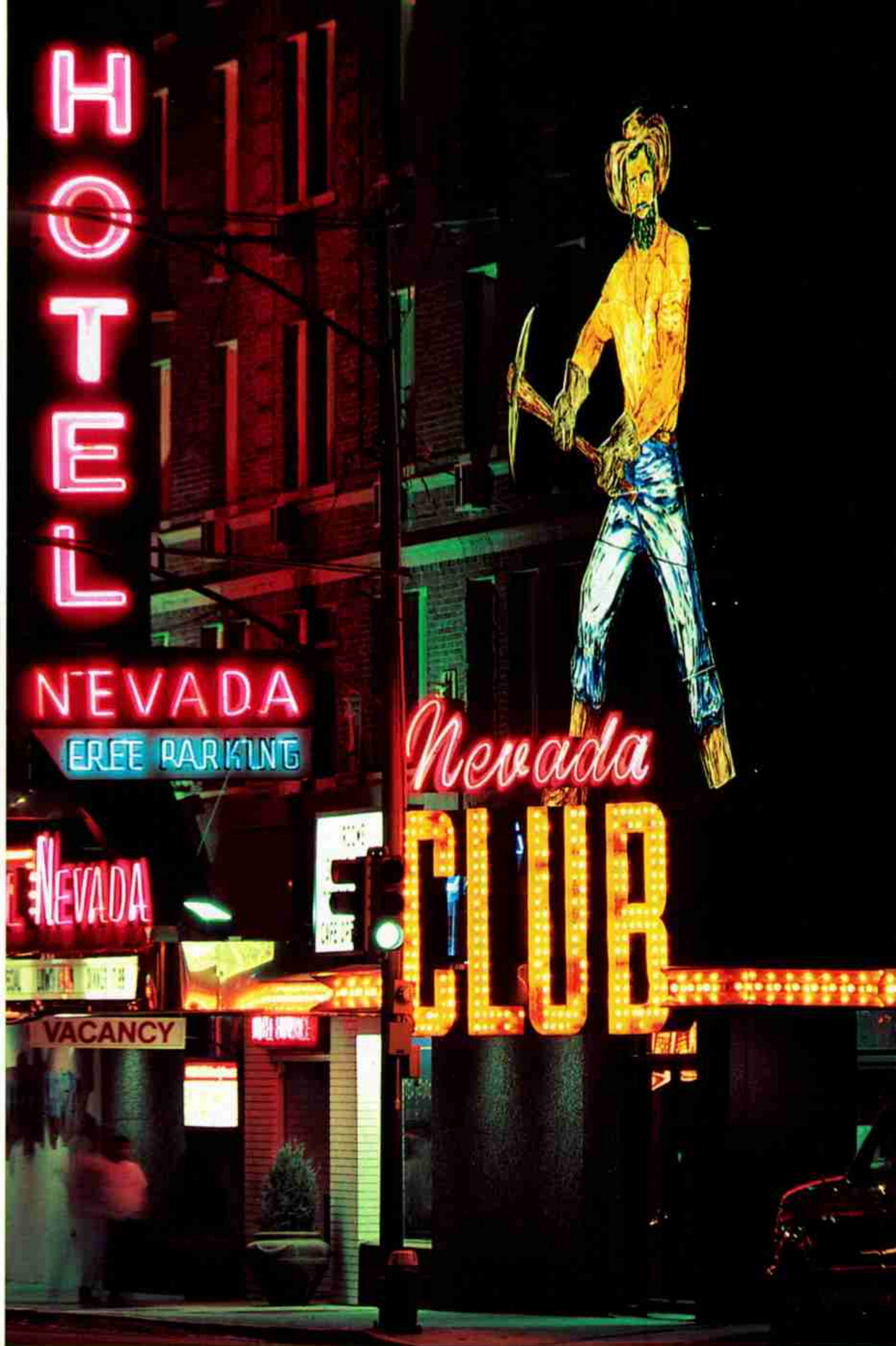
"The search for new mineral deposits is costly, time consuming, and without guarantee of success," says University of Nevada economist John Dobra. To encourage development in the vast and then largely unpopulated West, Congress passed the General Mining Law of 1872. It established a process that allowed citizens to "claim" surface or underground mineral

deposits on public land and mine them at minimal charge. After proving that the claim could be mined profitably, operators could "patent," or take ownership of, the claimed land for a small fee. Like most industries at the time, mining was otherwise largely unregulated. As land-use priorities have shifted, some 45 percent of federal lands have been

closed to miners' claims and patents, including (above, in dark brown) national parks, wildlife refuges, recreation and wilderness areas, and military facilities. In the past 30 years federal laws, from the Clean Water Act to the Endangered Species Act, have brought the once freewheeling mining industry under increasingly stringent environmental control.

HIGH STAKES

The pickax prospector enjoys neon immortality in Ely, Nevada. To the northwest his descendants extract some four million ounces of gold annually—one-third the U.S. total—from a 250-square-mile area geologists call the Carlin Trend. Carlin gold particles are so small it takes an electron microscope to see them, so scattered that it can take 50 tons of ore to yield just an ounce of the precious metal.



New York, and London poured in. With money came clattering mills, stinking smelters, spur-line railroads, and armies of laborers arriving from all over the world. Primitive wilderness camps were transformed into smoking industrial towns ringed by waste piles.

There was little to stop the miners and no

T. H. WATKINS, Stegner Professor at Montana State University, is the author of the recently published *Redrock Chronicles: Saving Wild Utah*. PETER ESSICK photographed “Life Beyond Earth” for the January 2000 issue.

overall mining law to guide them until 1866. Claims were jumped and blood occasionally flowed. But chaos could not be tolerated for long, not when big money was to be made on public lands. So, at the behest of the mining industry and western lawmakers, Congress supplemented its earlier statutes, described by one historian as “an empty vessel,” by enacting the General Mining Law on May 10, 1872.

So what’s wrong with this historically inevitable and eminently lucid law? Very little, say modern miners. “If the law is reformed, the

THE PRICE OF GOLD

Sprawling over 8,000 acres in northeastern Nevada, the Barrick Goldstrike has produced 14 million ounces of gold since 1987 and has 27 million ounces in reserves. Barrick paid less than \$10,000 for title to nearly 2,000 acres of the site in 1994; some 130 separate federal, state, and local permits and 1.8 billion dollars in capital investment were required to bring the property to present production.





real losers will be the American people," says Mike Miller, president of the Original Sixteen to One Mine in the Sierra foothills. "The mining law fed the dream of what America symbolized—being able to go out and stake your claim, work hard, and find success. Reform would take away your right, my right, my children's right to go out into godforsaken, wonderful land, stake a claim, and pursue it."

But the image of the independent prospector striking into the backcountry with hand tools is no longer as relevant as it used to be. That kind of mining is virtually history, an experience buried in the memories of a few surviving men and women whose hardrock times run back to the 1930s. Ask a man like

long-retired Jack Murdock of Winnemucca, Nevada, what it was like prospecting out near Midas during the Depression, and he'll tell you it was no bonanza. "A poor man has poor ways," he says. "We had to go out single-jacking with a piece of steel. You hit and turn, hit and turn till you got a hole in the rock to put down the dynamite. Take you hours just to get five or six inches. Course, some men made money, but we didn't. The little man didn't have much of a chance. Doesn't now. The mining is gone for the little man. It's all for the companies now."

On a half dozen occasions over the past three years I set out through the West on my own prospecting trip to discover



what some of the legacies of the General Mining Law of 1872 might be. My first sortie brought me to a quiet room in the U.S. Fish and Wildlife Service (USFWS) office in Spokane, Washington. On a stainless steel table lay several carcasses—two tundra swans, a golden-eye, a couple of wood ducks, a mallard. Their eyes were glazed by death, necks and wings frozen into ugly contortions. Freezers contained dozens more like them. “We’ve found 311 dead birds so far this spring,” Dan Audet, a field manager for the USFWS, told me. “What bothers us is that this recent die-off is the largest in this area since the 1950s.”

What was killing the birds? Mostly lead, and it was happening throughout much of the Coeur

d’Alene River Basin. It was here, a little more than ten years after passage of the General Mining Law, that the South Fork of the Coeur d’Alene in Idaho became the site of one of the West’s biggest silver strikes. The river and its tributaries were deemed valuable mainly as sewers to carry away the waste tailings laced with lead, cadmium, and other metals. In 1917 a lead smelter opened and within a few years the *Coeur d’Alene Press* was publishing headlines about the “River of Muck” and the “Valley of Death.” In all, some 72 million tons of tailings have been dumped into the South Fork in the century that mining has been pursued here.

The river runs cleaner these days, partly because remedial measures have been taken but also because most of the mines, mills, and the lead smelter have shut down entirely. Still, the river remains badly contaminated. When streams flood, then recede, they leave poisoned sediments behind, raising soil contamination to dangerous levels. Much of what doesn’t get spread around on floodplains ends up in the area’s recreational treasure, Coeur d’Alene Lake. There are an estimated 75 million cubic yards of contaminated sediments spread over the lake bottom to a depth of 15 inches.

Part of the region lies within the Coeur d’Alene Indian Reservation. In 1991 the tribe filed suit against nine companies for damage to the land and water, as provided for in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980—a mouthful more conveniently known as the Superfund Act. The lawsuit is pending.

Across the mountains in Montana, I found a legacy of contamination continuing at the point where the Blackfoot River joins the Clark Fork River just above Missoula. Here begins the Upper Clark Fork Basin Superfund complex, the largest Superfund cleanup effort in America. The site runs about 140 miles along the river and its tributaries from Milltown to Butte—most of it the product of the Anaconda Company, which staked out its mining claims on federal land and began mining copper here in the 1880s.

ARCO bought the Anaconda operation in 1977, but after copper prices slipped, it sold off some of its holdings and shut down the rest. Still, it was ARCO that the Environmental Protection Agency (EPA) now expected to pay for the cleanup. A big job. According to an estimate

HARD LABOR

When gold prices slumped in 1998, operations at the Gold Road Mine near Oatman, Arizona, were suspended indefinitely, sending Mike Gleghorn (left) and 120 other workers into a layoff limbo as gruelingly familiar to miners as the job’s physical demands. Underground work sites smell “like a fresh head-on, two-car collision,” writes mine veteran Ralph Pray. “There’s no level place to stand on. Everything is wet, grimy or hot and nothing is soft.”



from the nonprofit Mineral Policy Center in Washington, D.C., as many as 200 million cubic meters of tailings could contain 9,000 metric tons of arsenic, 200 tons of cadmium, 90,000 tons of copper, 20,000 tons of lead, 200 tons of silver, and 50,000 tons of zinc.

The three mineral-related Superfund sites in the basin were designated in 1983. By the 1990s ARCO was digging things up and moving earth around with beaverlike industry—buying out homeowners where necessary, removing or capping and revegetating old tailings piles in Butte, Anaconda, and other towns. The work continues, as it will for years to come, and at some considerable cost. “At this point,” Sandra Stash, ARCO’s environmental manager, told me, “we are more than 300 million dollars into the cleanup and expect it will be a couple of hundred million more by the time we’re done.” More than that, actually. ARCO ultimately settled part of a lawsuit brought by the state of Montana and other parties for some 240 million dollars. But cleanup and restoration efforts must continue until they are completed to the EPA’s satisfaction.

What I saw in Anaconda is not unique. No less deadly consequences of the

General Mining Law’s failure to address environmental concerns can be found all over the West. There are about 30 hardrock mining and mineral processing sites in the West that have made the EPA’s Superfund list, and no one I talked with suggested that the reclamation work done, being done, or about to be done at these sites is ever likely to be truly complete.

Even more sobering is the fact that the EPA’s Superfund list does not include some 16,000 abandoned mining sites—again, all but a fraction of them on General Mining Law claims—that pose serious water contamination problems, but where spades may never get turned in the name of reclamation. If spades ever do get turned, the cleanup cost will be astronomical.

These and similar problems continue to drive demands for reform. One aim of the effort is to give the Bureau of Land Management and the Forest Service the power to bar mining on environmentally sensitive lands. Another is to establish national standards for environmental protection and site reclamation and to set up an abandoned hardrock mine reclamation program to begin the task of cleaning up those 16,000 historic mistakes.

In order to pay for effective reclamation, reformers would establish a royalty system



similar to that which has been in effect for coal, oil, and gas resources on the public lands for 80 years. Many environmental groups, such as the Mineral Policy Center, favor an 8 percent royalty on the “net smelter value”—the value of the mineral after milling and processing (the royalty for coal, oil, and gas ranges from 8 percent to 16 percent). Under such a royalty system the 740 million dollars in gold and silver produced from unpatented federal lands in 1998, for instance, would have garnered taxpayers somewhere around 59 million dollars, instead of—well—nothing. Other reformers, like Interior Secretary Babbitt, would accept a royalty of 5 percent. All say an additional mining fee should be instituted to help pay for cleanup efforts and that the current moratorium on patents should be made permanent. Too many patents, they say, turn out to be windfalls, and, while it may be an extreme example, they cite the 60 acres of patented land outside the city of Phoenix that cost the “miner” who purchased them from the government a total of \$150. Ten years later he sold the property for \$400,000. It is now part of a golf resort worth millions of dollars.

Most miners say such reforms would be misguided overkill. Indeed, the Sixteen to One’s

Mike Miller thinks the government may be too quick to label an area “sensitive” and thereby bar its exploration. “You can’t mine except where God and nature put the minerals,” Miller said. “You can’t go out and run a gold mine anywhere but where there is an economical gold deposit.” Miller also insisted that any kind of royalty would “kill the little guys and the independent operators.”

Defenders of the industry also insist that new reclamation standards are not needed. Today’s miner is not the bad guy of the past, they say. He is environmentally aware, not least because a plethora of federal laws, from the Clean Water Act to the Endangered Species Act, as well as many state laws and regulations, make it impossible for him *not* to be aware.

Only last fall, however, a report to Congress from the National Research Council faulted federal land managers for inadequately enforcing regulations. Among other recommendations in the report, the council’s Committee on Hardrock Mining on Federal Lands urged the Bureau of Land Management and the Forest Service to improve their oversight of mining companies’ permit compliance.

In its effort to deflect major regulatory change, the industry often cites Homestake’s

TOXIC WASTE

Water filling Montana’s mile-wide Berkeley Pit (left) is so polluted that a flock of migrating snow geese died within hours of landing on its surface. In Kellogg, Idaho, lead emissions from the Bunker Hill smelter poisoned children living miles away. Directed by the U.S. Environmental Protection Agency, cleanup crews (right) continue to strip contaminated topsoil from playgrounds and yards.




WHAT’S NEEDED NOW IS EXPLICIT ACTION TO ENSURE THAT CURRENT REGULATIONS WORK AS THEY ARE SUPPOSED TO.

—Perry R. Hagenstein, National Research Council’s Committee on Hardrock Mining



MINING THE PAST

An aerial photograph showing a massive, dark, textured mountain of waste rock from an open-pit copper mine. The rock face is highly eroded and layered. At the base of the waste rock, several small, simple houses with brown roofs are visible, illustrating the scale of the mine's impact on the town of Bisbee, Arizona.

A mountain of waste rock from an open-pit copper mine hulks over homes first built in the early 1900s for mining-company grandees outside Bisbee, Arizona. The last active mine closed here in 1976, but the town does a bustling trade in Old West nostalgia. "There are two factions in Bisbee," says *Pay Dirt* magazine editor Bruce Rubin. "Some want mining to stay a thing of the past. Others hope mining will come back and bring jobs that don't rely on the whims of tourists."

McLaughlin gold mine near Lower Lake, California, to demonstrate the extent to which miners have mended their ways. The mine is featured in TV ads. This is gold mining today, the ads proclaim—beautiful hills, waving fields of grass, prancing mule deer, a glimmering lake. The hills are real and so are the grasses, the deer, and the lake. I saw them all during a tour of the mine in the company of Raymond Krauss, the mine's environmental manager. I saw waste rock piles shaped into eye-pleasing mounds, the milling operation that recycles and contains all processed water, and the huge tailings pond that, over time, will become a 600-acre wetland. I saw the sophisticated monitoring system for the early detection of contamination in the groundwater. I even saw the gate placed over the mouth of a tunnel to protect the maternity roost for a local population of Townsend's big-eared bats.

Clearly it is state-of-the-art reclamation, the McLaughlin, and kudos for it have included a commendation from the Sierra Club. What he was doing here, Krauss told me, made perfect business sense too. "When you look at the total environmental cost, it is roughly 2 percent of our capital cost for the whole project. We want to protect our stockholders' investment.

Creating an environmental liability doesn't serve their interests or ours."

"The McLaughlin is pretty good," concedes Steve D'Esposito, executive director of the Mineral Policy Center, "but it's hardly typical. While many mines do perform a lot of reclamation work, I don't know of another operation that goes as far as the McLaughlin. Some mines ignore or subvert the law. Some are just incompetent."

As evidence, reformers point to a number of dramatic modern failures: The Phelps Dodge Mining Corporation's Chino copper mine near Santa Rita, New Mexico, for example, where spills, leaks, and other unlawful discharges have dumped more than 180 million gallons of contaminated wastewater into Whitewater Creek since 1987. Or the Ray Complex in Arizona, where in 1990 rainwater flushed some 324,000 gallons of wastewater loaded with copper sulfates into the Gila River. Or the Summitville gold mine in southern Colorado, operated by a Canadian corporation. Touted from the beginning as a model for what modern mining could do, it had hardly opened for business in 1986 before it began leaking cyanide, acid, and heavy metals into the Alamosa River, poisoning some 17 miles of the stream.



The company declared bankruptcy in 1992, the EPA took the mine over as yet another Superfund site, and the U.S. Justice Department has had no luck getting Canadian courts to freeze the company's assets for reimbursement of the hundred million dollars already spent to try to clean up the mess.

Many problem mines

are capable of producing gold that can be seen only with a microscope. The process involves extracting ore containing as little as .02 ounce of gold to the ton, grinding it, then piling it onto the land in enormous pads, some of them 200 feet high. A cyanide solution is dripped over the top of the pad and leaches through it, picking up gold along the way. The solution is then collected from beneath the pad and piped off to a refinery for final processing.

If there is a center for the open-pit, heap-leach gold mining industry, it would be northern Nevada. Since 1990 Nevada has disgorged nearly 22 billion dollars in gold, producing 70 percent of U.S. output and ranking Nevada—if it were a separate nation—third in worldwide production. The bulk of it has come out of the northern portion of the state, where mining is to many towns what gambling is to Las Vegas.

Nowhere is this more true than in Winnemucca, a town of 8,800 people along I-80 and the Humboldt River. Mining is not the only industry in the area, but it is far and away the biggest. There are 19 operating mines in the Winnemucca region, and 12 of them are producing gold (several also produce silver). Mining directly accounts for more than 3,500 jobs in the region. "Our town has just about doubled in population over the past 12 years or so, primarily because of the mining industry," city manager Steve West told me last summer. "As a result we've been able to do a lot of nice things for our community—our infrastructure, our parks, our water system."

West is no fan of mining reform. "It could cost a lot of us our jobs. What it would do is push the industry overseas or to South America. There's no doubt about it." Besides, he added, "I don't think these mines are having a major impact on the environment."

While no more in favor of drastic reform measures than West (he would support a net proceeds royalty, however), John Milton, the chairman of the Humboldt County Board of Commissioners and a member of the Humboldt River Basin Water Authority, was less certain about the absence of major

OLD BURDENS

Signature stains of acid mine drainage marked the mouth of Colorado's Joker Tunnel (left) for more than 90 years. Recent reclamation efforts block the exposure of sulfur-rich rocks to air and water, preventing future acid formation. Old mines can fascinate, as a father and son on Nevada's Round Mountain learn (right), but unmarked and unstable they can become deadly traps.



A S THE WEST'S POPULATION EXPANDS, MORE PEOPLE ARE AT RISK OF COMING INTO CONTACT WITH ABANDONED MINES SCATTERED ABOUT THE REGION.

—National Mining Association

environmental impact. Ordinarily, the Humboldt River is reduced to a trickle by the end of the summer, he said. "But now, so much water is being discharged into the river from mining operations that the river runs high into October. Farmers can't get to their irrigation works to repair and maintain them in the fall, like they used to. Some of the alfalfa fields are getting saturated." Still, he emphasized, "I don't want to see any more mines close down in Humboldt County. Planned shut-downs because of declining ore resources are one thing, but if someone passes a law that makes mining unprofitable all of a sudden, that's hard on an economy like ours."

There were other hits to worry about, he admitted, hits having more to do with the boom-and-bust nature of the business than anything environmentalists have been trying to impose. Because central banks in several nations have been selling or leasing much of their gold reserves, the price of gold has dropped in recent years. In February 1996 it stood at \$414.80 an ounce, but by the summer of 1999 it had plummeted to \$253. "The hope is always there that the mines will remain viable and the price of gold will go back up," Milton said. "Most people don't think past that. But in reality the life of mines is shorter now than two years ago, all because of the drop in prices."

That very afternoon, as it happened, Placer Dome, a Canadian company that had purchased two Humboldt County mines in May 1999, called a press conference to announce that because of declining gold prices it was suspending all production at one mine and milling operations for both—this less than two months after the company had taken over. Two hundred full-time employees out of 600 would be laid off immediately.

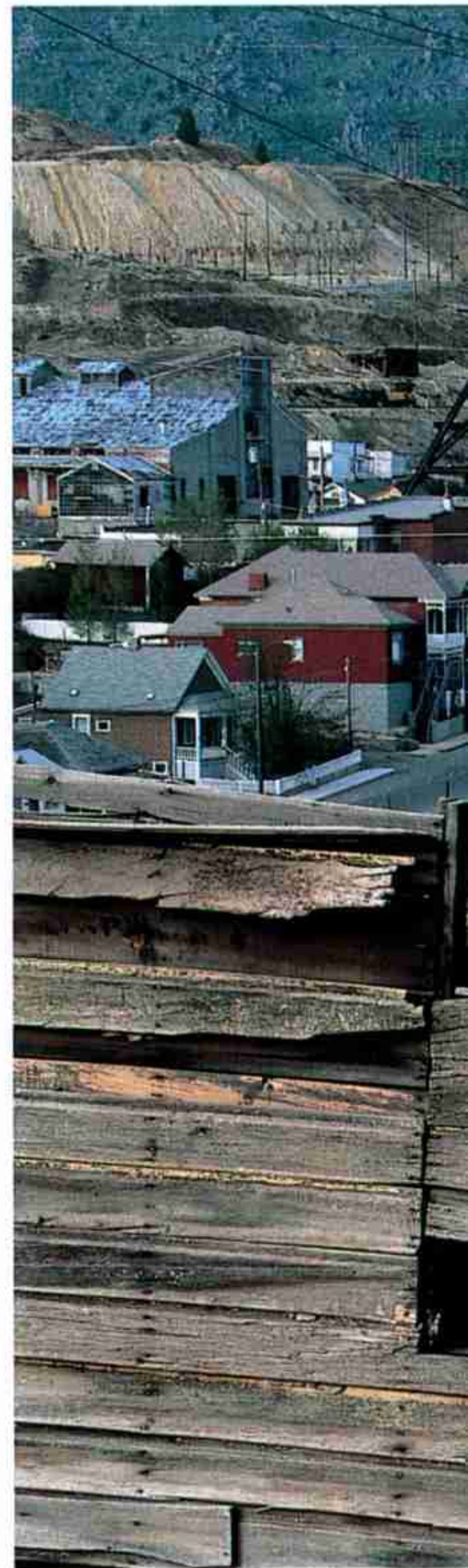
Thirty years ago I wrote a history of gold and silver mining in the American West. There was much in that book that celebrated mining's importance to the opening of the West and its colorful history and folklore. Driving out of Winnemucca the day after Placer Dome's layoffs, I wondered if I had said enough in that history about the transient nature of the business, the folly of trying to build an economy on the exploitation of finite precious metals whose value is entirely abstract and dependent on the whims of nations. And

while I was wondering about that, I recalled the day in 1997 when I hired a plane to fly over the Carlin Trend, a 50-mile-long swath that provides the ore for much of Nevada's gold production. The desert below was marked by open pit after open pit, heap-leach pad after heap-leach pad, tailings pond after tailings pond. What I saw from the air that day gave weight to the critics' claim that hardrock mining produces more solid waste annually than the amount that spills out of America's cities. That was a legacy I might have anticipated in that history book 30 years ago, but didn't.

After the flight I had coffee in the Elko airport with my fellow observer Glenn Miller, a professor of environmental and resource

LONG TERM

Mines in Butte, Montana, still boast a 25-million-dollar payroll. But that is dwarfed by the hundreds of millions of dollars it will cost to fix the 140-mile-long expanse of safety hazards and toxic dumps that a century of hardrock mining left in the Clark Fork River Basin between Butte and Missoula. Heavily invested in more environmentally sound operations, the mine industry says it's already a cleaner, safer neighbor. Experience counsels caution and vigorous oversight.



sciences at the University of Nevada, Reno, and a founder of Great Basin Mine Watch, a grassroots organization devoted to monitoring the effects of mine development. “The mines down there,” he said, “are going to have a substantial impact on the groundwater system in the Humboldt River Basin because of the amount of water they’re pumping out of the pits in order to keep them dry. Over the next ten years we figure it will create a groundwater deficit in the Humboldt River Basin equal to 20 years of the total flow of the Humboldt River at Winnemucca. And once the cost of mining and pumping the water exceeds the value of the ore, the companies will say ‘That’s it’ and stop the pumps. That means groundwater will flow

into the pits and create lakes. Many, if not most will be so contaminated the water will be unfit for human consumption or agriculture.”

Leaving Nevada I thought about those dead lakes shining in the desert sun, the dead birds I had seen in Spokane, the hundreds and thousands of abandoned mines still leaking poisons into the West’s water, the sprawling chemical filth of the flats below the Anaconda smelter stack, the blowouts that still corrupt rivers and water tables. At what ultimate cost, I finally wondered, have we held so fiercely to this antique law, dreaming the long dream of treasure that I once saluted with such enthusiasm? □

For more about hardrock mining go to www.ngnews.com/hardrockmining.





In the dead of winter at the bottom
of the world, four climbers race
storms up an unforgiving mountain.

S t o n e C o l d



A s c e n t

Swiss alpinist Stefan Siegrist labors near the base of Argentina's Cerro Torre. No one has climbed its west face in winter.



Cerro Torre—the icy, triangular peak at center—greet the team at the Cirque of the Altars. The granite spires of the Cerro Torre massif rise from glaciers like a row of tyrannosaur teeth.



“SUPERMOUSE, SOON YOU WILL BE A DEAD MOUSE!” sings David Fasel at the top of his lungs, in the style of the heavy-metal bands he so admires. A winter storm continues to rage outside our crude hut. Three nights ago the mouse in question ravaged David’s last pouch of tobacco, and he declared war. Last night he finally killed the mouse, and still in the flush of victory

he roars his tuneless battle song again. From a detached perspective it sounds moronic, but out here on the edge of the Southern Patagonian Ice Field every time I hear the refrain I collapse with laughter.

To me, laughter is as important as food to the success of an expedition, but among us it can take ten minutes to bring off a simple piece of adolescent humor. We have a language problem. David, Thomas Ulrich, and Stefan Siegrist come from Switzerland and speak Swiss-German and simple English. I'm from California and have only a few stock phrases of Swiss-German. We're in the depths of the Patagonian Andes, trying to pull off the first winter ascent of the treacherous west face of Cerro Torre, and at times communication is a real muddle.

A week ago during our first attempt, on

any situation where we have to reach a complicated and serious decision by yelling through a storm from opposite ends of a 200-foot rope.

Fortunately the Swiss and I do have a common basis for communication: the love of high and wild places. Forty-eight hours after the storm that penned David and me in the hut abated, we find ourselves in just such a place, 700 feet below the summit of Cerro Torre. Yesterday we climbed the bottom two-thirds of the west face—the easy part. This morning we launched ourselves at the upper tower. Right now it's late afternoon, and we're up against a hundred-foot headwall of vertical ice that separates us from the upper west shoulder of Cerro Torre. Flat ground lies a mile of gravity-defying terrain below.

A needle lancing into the southern sky, Cerro Torre might be the world's perfect mountain. Its west face occupies a place in modern climbing circles similar to that of the north face of Switzerland's Eiger in the 1950s. But to Thomi and Stefan, who live in the shadow of the Eiger, its north face is a training climb. Cerro Torre is not only much more technically difficult than the Eiger, but the Patagonian weather—lashing wind, churning clouds, stinging snow—is much nastier. The conditions more than make up for the fact that Cerro Torre, at 10,177 feet, doesn't count extreme altitude as a weapon.

Just over my left shoulder is a savage winter landscape of ice, snow, mountain, and sky. But I don't dare look. The

weather is obviously deteriorating, and I can't handle another eyeful of the lenticular clouds over the peaks to the west and the graying horizon beyond. To calm myself, I inspect the slings, carabiners, and ice screws anchoring me to the vertiginous ice, scan the rope for tangles, and examine the belay device through which my gloved hands feed the rope to my partner above. Still, waves of fear surge through me. I feel like an egg balanced atop a flagpole.

Thomi Ulrich clings by the metal points of his two ice axes and his crampons to the ice



On a nine-day haul to the base of Cerro Torre, one of the packhorses falls through a frozen river. It is pulled onto the ice only minutes from death. The team saves the animal with frantic body massaging.

what I interpreted as David's explicit, face-to-face instructions, I unfixed a rope and clipped it to my harness in order to drag the rope to the next higher anchor. Moments later I was yelling, "Stop! Stop!" as I felt David begin to commit his weight to the newly unfixed (and unsafe) rope. Disaster was averted, but I dread

GREGORY CROUCH says climbing Cerro Torre made U.S. Army Ranger School, a 58-day endurance test, look easy. Adventure photographer THOMAS ULRICH, who lives in Interlaken, Switzerland, has been obsessed with Cerro Torre for more than a decade.

above. Two hundred feet below, David and Stefan prepare to climb to my small platform chopped out of the ice. Thomi bangs one ax into the bulletproof surface, and a dinner plate of ice shatters loose and whacks the top of my helmet. He hacks again, securely imbeds his ax into the ice, and tests the placement with a tug. He kicks the front points of his crampons into the ice, and steps up while a fresh flurry of ice fragments ricochets off my lid—*thunk, chunk-chunk*. I hunch my shoulders and shrink my neck in an effort to hide my whole body beneath my helmet.

We're trying to shoehorn our blitzkrieg into a lull between storms, and I'm afraid that we might have committed to one of the dreaded "almost good enough" windows of fair weather

that Patagonia frequently serves up—one that will catch us high up the walls of the peak when the inevitable comes. Storms slam into Cerro Torre with the pounding fury of a cavalry charge. This is because the Patagonian Andes plunge deep into the heart of the great Southern Ocean. Here, athwart what sailors refer to as the roaring forties and furious fifties, storms spawned over the ocean encounter only one obstacle as they tear around the bottom of the globe—Patagonia.

WE HAVE NO CHANCE of reaching the top today. I shiver, thinking about the deteriorating weather and another long night on an icy ledge with the temperature well below zero Fahrenheit. We have no

A needle of stone and ice



What draws climbers to Cerro Torre? At 10,177 feet it's not the height, and other ascents may be as technically demanding. The mountain's frosted west face (right) hints at its greatest challenge: Cerro Torre rises between windswept oceans like a skyscraper in a tempest. The first barrier that storms hit when they roll in from the Pacific is the Andes. Moisture-laden winds cap Cerro Torre with lumpy ice formations that thwarted climbers until two controversial ascents in 1959 and 1970—the first unconfirmed, the second aided by a machine for driving bolts into rock. Since then many teams have scaled the east side, but only seven have climbed the west, and never in winter. The route taken by Thomas Ulrich, Greg Crouch, Stefan Siegrist, and David Fasel is shown in red.



radio, no emergency beacon, and no hope of rescue if anything goes wrong. We left no umbilical cord of rope strung out behind us to secure our descent. That much rope would be too heavy and slow to install, a laborious tactic that would expose us to the dangers of weather and icefall for much, much longer. Safety depends on a quick and efficient climb up and down. The winter cold and the few winter hours of daylight complicate everything. We need more clothing, heavier sleeping bags,

threaded hollow tube that will arrest any fall.

I'm just below the upper left-hand corner of a massive dihedral, where the ice-covered walls of granite come together like the pages of an open book. Because the west side of the Torre faces squarely into the winds that blast in from the Pacific, it is festooned with monstrous white blobs of rime ice, ice like the crunchy ice in a freezer condensed directly from the humid atmosphere. These rime mushrooms grow into wild, twisted shapes; the biggest are the size of

Patagonia is gonna make us pay.



"Our only hope is to wedge a fast climb between storms," says Crouch. The sun emerges the morning after their arrival, and they charge up the mountain to the base of a massive ice mound called the Helmet (right). Then a wind starts to blow, and clouds fill the sky as they bivouac for the night. Conditions deteriorate the next day (above). "There's only one place to go," Ulrich says. "Down."



more headlamp batteries, more fuel, and more calories than we would in the summer. It's a double bind, because every additional ounce means we climb more slowly.

The rain of ice on my helmet stops, and I chance a look around. The line of clouds to the west seems a little darker, the wind a little stronger. Thomi, suspended 30 feet above by a cord from his harness to his right ice ax, uses both hands to twist in an ice screw, an eight-inch-long, one-and-a-quarter-inch-diameter

houses. They are almost impossible, and always terrifying, to climb—often the rime can't support your weight. Our route weaves up between the mushrooms and links solid stretches of blue, gray, or translucent ice. Far above, the biggest, most twisted rime formations on the entire peak shine a ghoulish white in the sunlight. They guard access to the summit, and they look utterly impregnable.

Only years of dedication to the alpine trade earns a climber the right to stand on such a

peak. Fasel, Ulrich, and Siegrist have paid their dues in the Swiss Alps. David, who is 27, realized last April that he didn't want to spend his adult life in the cubicle world of the software industry, so he quit his job to come on this expedition. He plans to devote his life to the mountains. He's a warhorse. His pack always seems heavy, and I've never heard him complain.

Of all the people I know, Thomas Ulrich might be the best at making things happen.

normal circumstances he's strong enough to drag all of us to the summit, but here he is caught in a stew of emotions: his commitment to Ulrich and our climb on the one hand and on the other his desire to be back in Switzerland with his girlfriend, Karin, who is seriously ill with cancer. Karin had insisted that he join the expedition. Wrestling with his own doubts and worries, he has to struggle to push himself on.

I'm the old man at age 33. I come from the



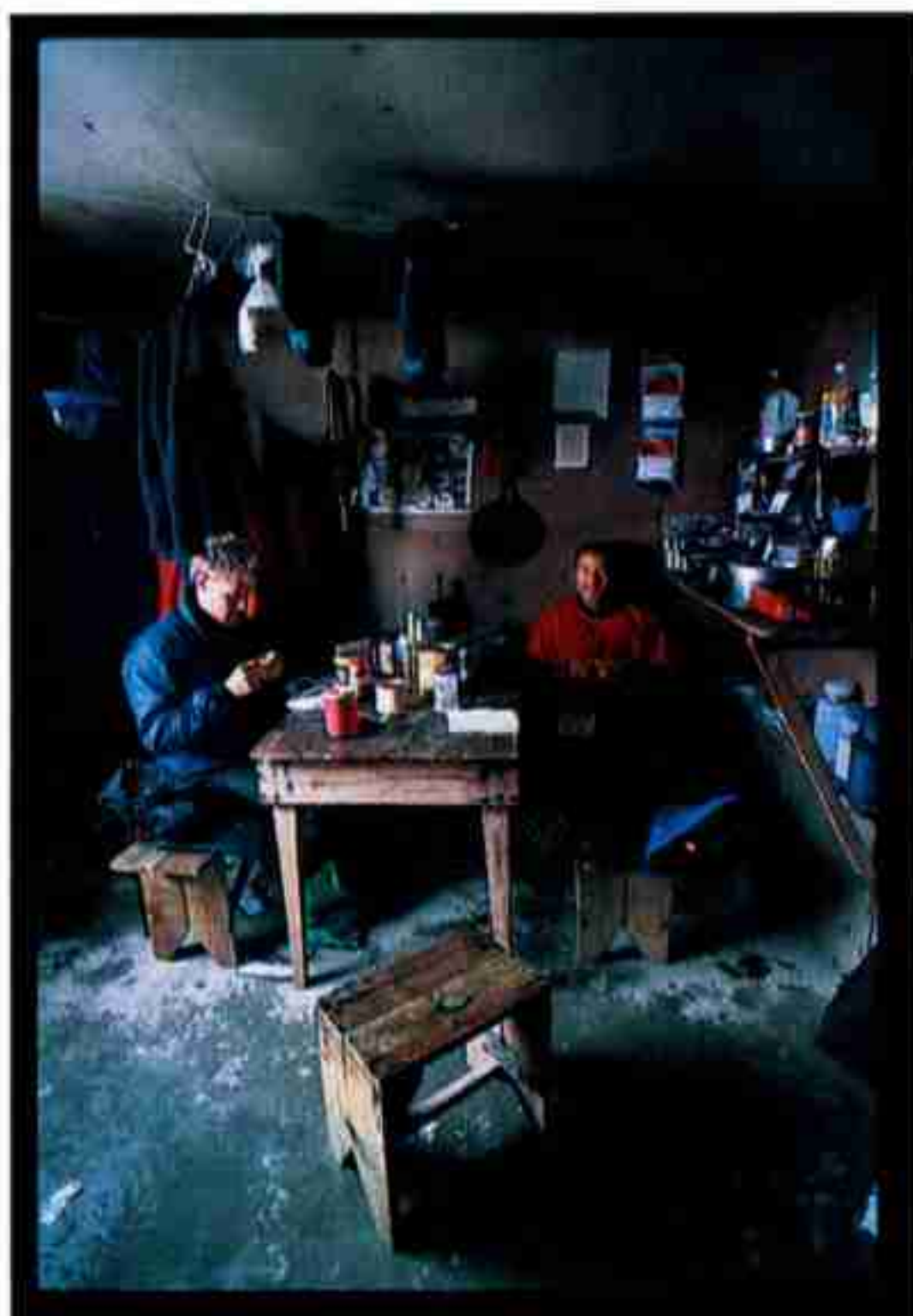
This entire undertaking is his brainchild, and in fine Swiss tradition he is an incredible organizer. "It's a mythic mountain," says Thomi. "It gets in your blood, and the dream keeps you going." Married and the father of two, Thomi also has a child's sense of humor coupled with relentless drive. He wanted to make this climb in winter because only then would we have the Patagonian Andes to ourselves.

Of the four of us Stefan Siegrist has the most experience on extreme rock and ice. Under

non-alpine terrain of Santa Barbara, California, and have been hopelessly in love with the mountains of Patagonia since I first saw them in 1994. This is my seventh expedition into the Patagonian crucible of fear, agony, and hope.

AS I EYEBALL the rime mushrooms, below and to the right Stefan labors toward my anchor using his ascenders, metal clamps that help him climb the rope. "Greg," Thomi calls from above in his Swiss lilt, "this

Brief days and interminable nights



The climbers retreat to a primitive hut built for glacier researchers (left) and wait for the weather to break. Boredom becomes the enemy. Three long, idle nights drain battery and food reserves. The team skis to a cache near the hut (facing page), but they need more supplies, so Ulrich and Siegrist head for the nearest village, 15 miles away, to resupply. Crouch and Fasel hang on for five more days.

is the best. This is sooo radical.” I’m glad he’s having such a good time; I’m so afraid, I might vomit.

Beneath Stefan, David waits his turn sheltered below a gargoyle of rime. I can just make him out as he ducks his head inside his yellow jacket—and calmly lights a cigarette. Forty minutes later Thomi disappears over the top of the headwall. I muster enough courage to fumble with my ascenders and follow him up. I’m panting when I reach him, and beneath my two union suits, fleece sweater, insulated jacket, and storm shell I’m bathed in greasy sweat. The sun shines weakly on us for the first time today, 15 minutes before it drops behind the mountains to the west. The low-angle light makes the rime formations shine a brilliant yellow. We’re in another world.

Inspired by Thomi’s performance, I claim the next lead. I head 20 feet left, then up into a groove. I’m knackered from our two full days on this hill. Steeper and steeper ice forces me to use only the front points of the crampons under the toes of my boots. I focus on making smooth, controlled swings with my axes and refuse to give in to my quivering calves.

The sun has vanished. It’s 6 p.m. It’ll be 10 a.m. before we see it again. Meanwhile I’m still leading, and any fall would almost certainly result in serious injury. In gathering darkness I pick and kick my way to the end of the pitch and rig the rope to two ice screws. Then

I descend and join my teammates, who are digging out a sleeping spot under a rime mushroom that rears up like a band shell. I scrape up a mound of rime along the edge to make me feel safe for the long winter night. I don’t want to roll off in my sleep and take the death dive. As I work, my hands ache, the wind chills my sweat-damp clothing, and I think about tomorrow. More pain. I smile, remembering the scene in *Rocky III* when a journalist asks Clubber Lang, the champion, for his prediction for the fight. His answer: “Pain!” I explain it to the team. We laugh.

Our last 20 days have passed in a blur of physical effort. We carried and sledged more than 400 pounds of gear to the base of Cerro Torre. We slogged monster loads through forests, across a frozen lake, four times up a 3,000-foot pass, across rock moraines, and then ten miles up the huge Viedma glacier under the cold light of a full moon. Even with help from three Argentine friends—Alejandro Caparrós, Max Odell, and Gerardo Javier Spisso—and the use of Don Guerra’s packhorses for two days, that labor took nine days.

On our previous attempt we got two-thirds of the way up the mountain before being rejected by a storm. Then David and I endured eight foul-weather days in Supermouse Hut, 12 miles south of Cerro Torre, while Thomi and Stefan skied and hiked back to civilization to get more headlamp batteries. Those are the big sufferings. Our little sufferings include blisters, ankles swollen by uncomfortable ice boots, always being cold, freeze-dried food, no showers, smelly clothes, and instant coffee.

WHEN THOMI sprang this idea on me during a transatlantic telephone conversation seven months ago, I grabbed my spot as fast as I could blurt out “Hell yes!” The opportunity to score a first on such a peak



hooked me instantly. Cerro Torre is the scene of one of the mountaineering world's greatest controversies, and no other mountain exerts such pull on me.

I'm not alone. In the late 1950s Cerro Torre stood unclimbed, but its savage beauty captured the imagination of many top climbers. Rival factions raced to make the first ascent. Italians Walter Bonatti and Carlo Mauri led an attempt on the unknown west face in 1958, while another expedition explored

have climbed it in the warmer seasons.)

Meanwhile on the opposite side of the mountain the expedition leader, Bruno Detassis, lost heart soon after the mountain emerged from a storm to show its perfect form. He declared Cerro Torre impossible. But two members of the expedition, Cesare Maestri and Cesarino Fava, were not so easily deterred. Maestri and Fava, along with Toni Egger, an Austrian, returned the following season. In a desperate all-out six-day push Maestri and



the more accessible east side. Bonatti and Mauri reached a platform more than halfway up beneath a wicked rime mushroom they named the Helmet, but they were unable to get past it. As they descended through the southwest col, the high pass that separates Cerro Torre from Cerro Adela, they christened it the Col of Hope. (Their vision of a route up the west face was finally realized in the summer of 1974 by an Italian team led by Casimiro Ferrari. Since then six other teams

Egger, supported by Fava, claimed to have done it, climbing up the east and north faces. The stormy descent cost Egger his life—he was swept away by falling ice.

In a clear hack at Bonatti and Mauri, Maestri named the north col, through which he and Egger had climbed, the Col of Conquest. He wrote that “in the mountains there is no such thing as hope, only the will to conquer. Hope is the weapon of the poor.”

Contemporaries trumpeted the climb by

Maestri and Egger as the greatest climb of all time, and so it would stand if such a storm of controversy hadn't sprung up since 1959. Year after year top alpinists have attempted to duplicate Maestri's feat—and in 40 years no one has succeeded. Indeed, those who have come closest report significant differences between the terrain they encountered and what Maestri reported.

In 1970 Maestri, intending to silence the growing band of critics, returned to Cerro

titled "Cerro Torre: A Mountain Desecrated!"

In fairness to Maestri the majority of his "compressor route" consists of hard, high-quality climbing on natural features. I climbed it, and so did Thomi and Stefan, in 1996; it was an experience that gave me the confidence to push out onto the cutting edge—to Cerro Torre's west face in winter.

We're not feeling much confidence as we arrange our sleeping perches just above the headwall. Thomi faces the blackness to the

Wake up boys. Today we climb.



A lucky break: The day after Ulrich and Siegrist return to the hut, the storm passes, and the team begins its second attempt. The climbers ascend quickly above the Col of Hope where the ice is firm (left). They inchworm up the mountain at a top speed of 200 feet—one rope length—every half hour, held by ice axes and the steel front points of their crampons (above). Siegrist takes the lead here.

Torre and forged a route up the southeast ridge, which soars 4,500 feet like a flying buttress on a Gothic cathedral. But rather than pulling off a tour de force of courage, commitment, and skill, like the purported 1959 climb, he used a 150-pound air compressor to drill 350 bolts into steep sections of stone, then strung up thousands of feet of rope to link his team to safety. This drew loud protest from climbers worldwide, most famously in an article in the British magazine *Mountain*

west, then turns. "Boys," he says in English, "I'm not religious, but tonight we are in the hands of God."

He's right. If the storm holds off, we go up and finish this thing. If not, down we go.

At six o'clock in the morning, pulses from a wristwatch alarm shatter my sleep. I stir and fight the Velcro tabs, draw cords, and zippers that close my sleeping bag and bivvy sack from the freezing air. Ice crystals, frozen onto the inside of the sack, rain onto my face and

These rime mushrooms



grow into wild, twisted shapes. . . .

Cerro Torre is capped with rime, brittle ice filled with air pockets—a creation of humid oceanic winds. The heights look like they're covered with blown insulation. "Bad rime is unclimbable," says Crouch. "You can push your arm in up to the shoulder." The climbers look for gray patches—good ice where they can insert screws to secure their ropes.

melt. A dream of lying on a beach under a hot sun with my beautiful wife, DeAnne, hangs in my mind. Outside the sleeping bag, reality is a world of ice. Automatically I check the dark sky for an approaching storm. The brightest stars shine fuzzy through a layer of high clouds. A breeze tickles my nostrils with moisture and hints of pain to come. "Wake up boys. Today we climb."

I fish my headlamp up from the depths of the sleeping bag, turn it on, and fumble to fire up the stove. The midwinter sun is hours away, but with the stove hissing and roaring, I won't drop back to sleep. Beside me the Swiss are now also in a preparation frenzy. We pull on clothes, devour muesli, adjust ice boots, harnesses, and crampons, load rime and snow into the pot to fill water bottles, stuff sleeping bags and backpacks—all on the brink of what seems to be the drop off the edge of the world. We're hopeful for the top, so we leave our sleeping and cooking gear behind and pack just clothing, hardware, water, snack food, and cameras. It takes three full hours to get ready.

I serve up my best sportscaster imitation, "Clubber, what's your prediction for the fight?"

And in unison my three Swiss friends howl, "Pain!"

In two hours we climb 500 feet above our bivouac and—boom—we're face-to-face with the summit mushrooms we saw from below. They overhang the north and west faces like the prows of half a dozen *Titanics*. If we can't find a groove through these barriers or a traverse around them, our ascent stops right here.

Stefan takes the lead and finds a possible route down and then up around to the left. He attacks a groove while David belays and Thomi takes photos. I scan the range. The view over the rock towers and glaciers of Patagonia is sublime; the weather isn't. The lines of lenticular clouds along the mountain range to



the west are thicker and blacker, and beyond is a murky torrent of approaching cloud. On all the mountains around us strong wind blows snow through cols and tears it from ridges, but for some odd reason that defies logic, here, 200 feet below the summit of Cerro Torre, I could light a match.

David looks over and asks, "What do you think, Greg?"

"I think we're gonna make it," I reply, "but I'm sure Patagonia is gonna make us pay."

Stefan fights his way up 70 feet of shoddy, rotten rime in the groove he's found, then finds a patch of ice solid enough to hold a screw. He clips the rope through and has David lower him back down to the belay. He's exhausted.

Thomi takes the lead and disappears up the rime groove. David feeds the rope out. Twenty minutes later a steady shower of ice chunks comes flying down from above. Thomi is hacking open the top end of a 20-foot-long closed tube of ice that goes up through the heart of the steepest rime mushroom. We each follow Thomi in succession. The vertical culvert is the wildest ice feature I've ever encountered. I'm quiet with awe as I climb through it.

The culvert is the key to the climb. Thirty feet above it I join my friends on the summit of Cerro Torre. Or, better said, almost on the summit. We cavort on a plateau beside a



Siegrist wedges himself into a niche of rime, with Monte Fitz Roy beyond. The summit is only 200



feet or so overhead, but the team is stymied until Ulrich hacks into a vertical shaft within the rime.



Once on top, Ulrich, Fasel, Siegrist, and Crouch take time for a quick portrait; then comes preparation

30-foot mushroom that leans like a frozen breaking wave, but we can't find enough solid ice to climb to the very top. Thomi pulls his camera aside from in front of his face and uncovers a Cheshire cat grin.

I won't relax and celebrate until we're safe in a bar sipping whiskey, but I soak up the view. The ice field and a sea of mountains stretch away north, south, and west. The sun glints off Laguna del Desierto to the left of the enormous wedge of Monte Fitz Roy. The rocky teeth of the range stand close at hand. Everywhere other than here, it seems, is being scrubbed by fierce wind. "OK boys, that's enough fun. We're out of here."

Stefan buries a three-foot-long aluminum stake sideways in the summit snows, ties a sling to its middle, and anchors two ropes knotted together to the sling with a snaplink.

I go down first and try not to think about the three-foot stake that supports my future. The first rappels go easily, and back on the bivvy ledge we retrieve our stashed gear. Suddenly the wind makes war. David and I work together atop the headwall. I catch his eye as I prepare to rappel past the edge. "Now we pay!" I yell over the wind. "Pain!" he shouts back, grinning. I continue to rappel first but can't dangle straight down the headwall; the building gale tosses me back and forth. At the end of the rope I reach for the anchor, but an invisible hand pushes me away. Finally, a lull; I lunge with the point of my ice ax, catch the anchor, and pull myself over.

To the west the sun is perched on a wall of clouds, and the wind rages like a mob of demons. Below the headwall I must go down and to the right, but the wind tangles the rope



for the descent—and for a Patagonian send-off: Another storm is bearing down.

around lumps of rime. I yank on the rope as hard as I can to snap off the snags. Some won't break, so I swing over like a pendulum, tiptoeing on my crampons, and smash them with my ax.

We come to the small saddle that crosses over to the Helmet. Wind screams up the ice slope from below. I belay David, and he staggers across the saddle to disappear behind a rime monolith. The wind draws the rope between us into a 130-foot ballistic arc. The sun is gone, the sky is blood-red; we're fighting for our lives. Too scared to walk on the flat section, I crawl and feed rope through my rappel.

Two hours later we're descending by headlamp through the Col of Hope, a gigantic funnel for wind off the ice field. It's a maelstrom. Golf-ball-size chunks of ice blast up the

45-to-60-degree slope. The updrafts blow my clothes full of frigid air. Well after midnight we suffer down the final glacier in blackness broken only by our headlamps. Streaks of snow blur sideways through the pools of light. My face is stung by snow; a gust knocks us to our knees. Then the slope runs out into flatness, and it's over.

In my sleeping bag at last, I can't locate a part of my body that doesn't ache or throb, but before I lose consciousness, my memory stumbles across the words that have carried me through many ordeals before—words from the Bible that were the motto of my high school cross-country team. "We also rejoice in our sufferings, because we know that suffering produces perseverance; perseverance, character; and character, hope. And hope does not disappoint us." □



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Beijing

NEW FACE FOR THE

BY TODD CARREL PHOTOGRAPHS BY STUART FRANKLIN



After watching China's economy stagnate for decades, Communist Party leaders took a gamble: Could they relax economic controls yet still manage to keep a firm grip on political power? In Beijing, the nation's capital, the bet is paying off with new

ANCIENT CAPITAL foreign investment and a dizzying array of new construction. As pedestrians scan newspapers along the Avenue of Eternal Peace (above), Beijingers adjust to the shifting ground rules of their new material whirl.



NEW OBLITERATES OLD during a massive makeover of downtown Beijing,



where during imperial times no building was permitted to rise higher than the emperor's throne.

Two young women

giggled under their white straw hats as they emerged from the Beijing Railway Station. Strolling arm in arm, they passed rooftops capped with satellite dishes and headed for a shopping complex where an obelisk with competing messages displayed on each side marked the way.

“March ahead along the road of building socialism with Chinese characteristics,” said one sign in Chinese script. “Descendants of the dragon use the Dragon Card,” said another sign, urging consumers to use a new bank credit card. Both messages seemed to be vying for market share in the minds of Beijing’s people.

In this and other ways today’s Beijing is awash with change, where the old Confucian ideals of personal cultivation and family values clash with a new emphasis on money and the market, where a bureaucratic culture designed to hold people in check is replaced by a rootless mobility, where a construction boom is reshaping Beijing’s low-slung profile and cramped alleys with soaring skyscrapers of glass and steel, where car traffic clogs streets that once rang with bicycle bells, where dust mixes with vehicle exhaust to form a near-constant polluted haze, where unemployment and gross underemployment create unease, where corruption has brought thousands of protesting citizens into the streets.

“Before, we were controlled by the Communist Party bosses,” said a Beijinger who has lived in America for a decade but returns home for regular visits. “Now it’s the bosses of companies. The change has been tremendous.” His friends and family, once certain of jobs and stable prices, now worry that the new money-driven economy will leave them behind.

“This has a big influence on relationships within families and among friends and across the social structure,” he said. “There is real discontent and anxiety, but people are adjusting.”

Over the centuries the people of Beijing have become expert at adjusting. Like the willows planted around the capital, people have survived by being flexible, yielding to strong winds, then springing back as stillness returns.

A few blocks from Tiananmen Square, at the center of Beijing, I ran into one of the city’s many adaptable characters, a lifelong citizen I’ll call Q. A trishaw driver who spends his days pedaling passengers around the capital in his rusty coach, Q was taking his noon break,

ENTERTAINING
well-to-do investors, party bureaucrats, and a budding cadre of entrepreneurs requires something more than operas preaching the glories of socialism. At a dinner theater modeled after the Moulin Rouge in Paris, showgirls perform French-style cabaret, complete with the cancan.

TODD CARREL, formerly ABC News bureau chief in Beijing, now lectures at the University of California. While covering Tiananmen Square in 1989, STUART FRANKLIN photographed a lone protester confronting a tank—an image now emblematic of the massacre.



which consisted of a cup of fiery white liquor, a steaming bowl of beef noodles, and a Temple of Heaven cigarette. He motioned for me to join him at a round folding table on the edge of the sidewalk under a locust tree.

“Now all anybody cares about is money,” he yelled. “If Deng Xiaoping were alive today, I wouldn’t let him ride on my trishaw,” he said, referring to the late top leader who began economic reforms in China. “I’d never study anything Deng Xiaoping said!”

Dressed in a sacky T-shirt, black canvas shoes, and bright green running shorts, Q has no home and no family. He sleeps under an overpass and complains about corruption in high places. “The children of officials get the door opened for them. They take all the booty and go to Switzerland,” said this fifth-generation Beijing man.

He has no regrets about his solitary life. “Look,” he said, jabbing his finger at the sky. “God above is number one. I’m number two, and the old Earth is number three.” Then he added: “What use would it be to have a son

anyway? None of the young people have jobs.”

As often happens in Beijing, which thrives on gossip, a bystander horned into our conversation. She was rail thin and outspoken, a former factory worker who now dished out noodles for curbside customers like Q. She was laid off from her factory job six months earlier. I asked if she was embarrassed.

“Are you kidding?” she said. “There’s no loss of face for me. There are probably 300,000 people in this city who’ve been shucked off. Why should we be embarrassed?”

Those two were having hard times, but their temperament seemed typical for Beijing. “The people here are like thermoses—cold on the outside, warm on the inside,” one official had told me on my first visit to the city more than two decades ago. Standoffish at first, they open up with a little encouragement, eager to talk about life in the West, politics, culture, personalities—no morsel is too small. I found Beijingers hospitable and generous. They were frank, opinionated, and cheeky, as evidenced by their jokes about the *People’s Daily*, the





THE GREAT HALL OF THE PEOPLE, home of China's nominal legislature,



stretches two city blocks—a concrete reminder of the broad reach of the Communist Party.

communist newspaper: "The only thing you can believe in that paper is the date."

They were, in short, as tough as dragon's hide, the ultimate survivors in a city that has seen all manner of rulers rise and fall. Beijing emerged as a capital of the Liao dynasty in the tenth century. Then came Jerchen raiders, followed by Mongols under Genghis Khan, who left the capital in flames. It was rebuilt by successive dynasties—the Ming and Qing, one layer at a time. Then came nationalists, warlords, mercenaries, Japanese invaders, and, finally, after a bloody spasm of civil war, the communists took power under Mao Zedong.

Now the blocky Soviet-style monuments built by Mao look dull and dated, overtaken by the bright lights of McDonald's, Kentucky Fried Chicken, and thousands of new private restaurants, festooned with Christmas tree lights on neighborhood streets once shuttered and sleepy.

"To me," said one Beijinger, "the old city is gone. Old things like the Forbidden City or a temple are scattered between skyscrapers like toys thrown here and there. Old Beijing is dismembered," he said. We spoke as he walked his bicycle through alleyways where clouds of brick dust, the scrape of shovels, and the ramming of steel provided the evidence of Beijing's economic boom.

Since Deng Xiaoping's experiment in free enterprise began 20 years ago, China's production has been steadily climbing at a rate of nearly 10 percent a year, although it has fallen in recent years with a tide of deflation. Per capita annual income for city dwellers has almost doubled since 1990 to more than \$600. But prices have risen, and foreign investment has flooded the country. Businesses, eager for a share of this vast market, have rushed in, hoping the Chinese government will soften its tough trade tactics.

Beijing's building spree is sweeping away a characteristic detail of the old city, the low-slung *hutong*, which have survived centuries of wind whipping across the North China Plain, giving the capital a constant polishing of grit. These walled alleyways cut back and forth across the residential heart of Beijing, where life takes place on a human scale, where the itinerant

bicycle repairman works in the shade of a plane tree, the knife sharpener grinds his blades, the cobbler nails on a new heel for a customer on the sidewalk. A few of the old family compounds remain, most of them with three generations living together behind thick walls of gray brick, protected from invasions of dust and unwanted visitors.

"This is our otherworldly paradise," said Ye Xiaomo, looking around her family's quiet courtyard, where we sipped tea in the ample shade of persimmon trees and lilacs. "We're here. It's our home," said Ye, whose family has marked the seasons by the buzzing of cicadas and the blossoming of crab apples.

Such compounds are increasingly rare. The city government is moving perhaps 2.5 million of Beijing's 11 million residents out to the suburbs to relieve crowding. One preservationist told me that only 25 of the capital's original 2,600 hutong will be saved, leaving less than one percent of the old homes intact.

The relocation program is making room for new tourism centers, expensive apartment compounds, and department stores where Beijing's new wealth and foreign investment dollars are getting spent.

"Pretty soon Beijing will look like Kuala Lumpur," said Zhao Jingxin, a trim 81-year-old standing in the courtyard of his hutong at No. 22 Fine Arts Museum Rear Road. Dragonflies droned under the walnut tree in his yard, where a white kitten darted among neatly tended roses. Zhao's house dates back to the beginning of the Qing dynasty in 1644.

"That's longer than United States history," Zhao said. Despite its history, Zhao's home, surrounded by one of the city's new developments, is marked for demolition. "It's no damn good at all. We can't build anything as good as the Empire State Building. Later they'll regret this," said Zhao, shaking his head.

Leaving Zhao, I crunched my way across his gutted neighborhood, where houses were reduced to rubble and bulldozers sat parked in puddles. Beyond Zhao's northern wall I saw a pit in the ground, marking construction on a new east-west thruway called Peace Boulevard. The cleared land led to a Protestant church, a brick

FORBIDDEN CITY (map) was once considered the stable core of the empire and the cosmos. These days the bustle and blur of the new economy brings volatility—and resentment from the unemployed.



structure looking forlorn in the stark landscape. A few hundred worshipers showed up there on a recent Sunday to hear a sermon on eternal life, after which the minister bowed his head and led the congregation in prayer: “We must pray because our church will be torn down. We just don’t know when.”

Outside, I fell into conversation with a parishioner, a wispy woman with painted blue toenails and platform sandals, but we were soon interrupted by a woman in a billowing muumuu and feral eyes who came barging in to join us.

“It’s the millennium,” she stormed. “The world is coming to an end! People all over the globe are bad!”

The prophetess of doom left as quickly as she appeared, leaving me to consider how Beijing people would deal with the new century, given the turmoil of the one just past. They have known war, civil unrest, and a dizzying succession of political shifts, yet somehow they manage to keep their dignity. One anchor is family. Another is humor, which is usually acrid and never far beneath the surface. Many Beijingers also cling to the small rituals that provide order and meaning.

Just as the light begins crawling across the city, people drift into Beijing’s parks to greet the day, jogging or stretching or dancing to limber up. Older citizens still go through the slow-motion breathing and posturing of *qi gong* or the martial routine called *tai ji quan*, which looks like soft ballet. Others gather

Beijingers . . . were, in short, as tough as dragon’s hide, the ultimate survivors.

LOOKING BACK to the days before communist rule, gentlemen at a tea-house sing traditional songs, tell stories, and remember. One recent change: *hutong*—blocks of low courtyard homes that once housed half of Beijing—are being demolished, their residents relocated (right), most to housing projects in the suburbs.



along shaded benches and gossip, read newspapers, or chant old opera tunes. They look inward to fortify themselves.

The youth look outward. In the Xisi shopping district a store assistant named Xu Ke was watching customers in the Paris Bridal Shop. A patron in a white wedding dress was getting her hair wrapped into a tight bun while her fiancé, wearing a tuxedo, got ready to pose for a long round of wedding pictures.

"It costs them between 1,000 and 6,000 yuan [\$120 to \$725] for the day," said Xu Ke, who expressed no interest in getting married.

"I won't even think about that until I've built an economic foundation," she said, indicating her plan to keep living with her parents, to save money, to prepare for the college entrance exams. "My work here is only temporary," she

said. "I'm going to use my brains to get ahead. I'm thinking about leaving the country some day. I like Western culture because it seems so natural."

Her sense of self seemed to encapsulate the character of many young Beijingers I met: rooted in the ways of the past, determined to cultivate personal skills, ambitious and independent, restless to see the world.

She was ready to flower, thinking of the future. Across town, Min Wanbao, 75, was living for the present, going out for a morning stroll with his pet bird.

Min seemed relaxed sauntering down an avenue lined with ginkgos, willows, and pines. He carried an exquisite bamboo cage covered with a blue cloth. He hooked the cage to a branch, unzipped the cover, and smiled as his



AT FIRST LIGHT soldiers of the People's Armed Police drill outside the Forbidden City. State security forces help squash dissent, such as last year's crack-down on the Falun Gong spiritual group. "But usually there's no need for lots of overt security," says photographer Stuart Franklin. "There's an implied authority in the air that makes people behave."



pet—a thrush—greeted the morning with a chorus of chirps and trills.

Min had just fed it a breakfast of crushed peanuts, egg yolks, walnuts, and insects, with a strip of cucumber garnish.

As the bird sang, Min mused about how life had changed since he was young, working as a cook in Beijing. Like others of his generation, who lived a hard life barely above the level of organized poverty, Min was proud of his past. "Now it takes at least three young people to do the work that one of us could do," he said. "We all worked so hard. These days the young only watch other people work." Then he reared back his head and laughed.

"The young just want to eat well and wear nice clothes," said the crew-cut Min, dressed simply in blue shorts and a white T-shirt. "They don't care about work," he said. But he didn't dwell on the complaint. Min has learned to keep his expectations low, taking his pleasure in small things, like birdsong.

EARLY ONE MORNING I watched a woman in a blue smock and wearing a face mask as she herded dust down the Avenue of Eternal Peace with a broom. Another woman walked onto the scene from the opposite direction, shouting the day's headlines and selling newspapers.

"Chen Xitong gets 16 years!" she called, handing me a copy. Chen, who until his arrest had been the mayor of Beijing and a member of the party's ruling Politburo, had just been sentenced to prison for embezzling about four million dollars in city funds to build two villas where he is said to have entertained friends and business associates on a lavish scale.

But I heard from many Beijingers who felt that Chen's real crime was delivering development rights for a choice piece of old Beijing to a Hong Kong tycoon named Li Ka-shing. Li and his partners have invested about two billion dollars in the Oriental Plaza, a controversial high-rise complex that sits alongside



the Avenue of Eternal Peace in the Wangfujing neighborhood, Beijing's upscale shopping district. Even in a city known for gigantic buildings, the scale of the Oriental Plaza is enormous. It will have about 200 acres of floor space and will dwarf the nearby Gate of Heavenly Peace, the main entrance to the old Forbidden City, where emperors once lived in splendid isolation behind maroon walls.

"We all think it's too big," said Fan Yaobang, a city planner whose eyes darted behind thick, black-rimmed glasses.

"Is it a crime?" he asked. "Well, no. Not legally speaking. It's a failing in understanding by the officials. The developer may think it won't have a huge influence on the city. He doesn't live here. But the project destroys the old city."

Some critics of Li's Oriental Plaza argue against its placement for traditional reasons—that it spoils the natural north-south grid pattern on which the city was established long ago. This original layout, aside from being logical, is

based on the ancient Chinese art of geomancy, or *feng shui*, literally "wind and water." This idea holds that buildings must be set in proper alignment to natural forces to take advantage of energy (*qi*) that flows through all things. Thus the proper placement of a house or temple attracts positive *qi* and good luck, but the wrong siting has the opposite effect, inviting disaster.

Whether inattention to *feng shui* is at fault, the alliance between developers and Beijing's Communist leaders seems to have hit a few rough spots. The party, sometimes combining public funds with private money from foreign investors, planned an ambitious construction program to improve the infrastructure around Beijing—including new highways, office buildings, a new hospital, and a natural gas line. But the construction boom shows signs of waning, due to overbuilding. About a third of the space in newly constructed offices and malls sits unused, according to city planners. And nine new Beijing malls have closed down owing to poor



BORN INTO THE MADNESS of the Cultural Revolution, painter Fang Lijun laments



the psychological trauma inflicted on China. "But for some people, opportunity comes from chaos."

location, bad management, or bankruptcy. Gated villas in the suburbs are selling slowly.

None of that fazes Mou Qizhong, a Chinese capitalist and self-proclaimed democrat who sees himself at the forefront of his country's new commodity economy. He came to Beijing from Sichuan Province more than a decade ago for business reasons, just as China's economic boom was starting.

"In Beijing you're closer to the fount of politics and policymaking, and therefore protected if you're on the cutting edge," said Mou, a friendly man who bears an uncanny resemblance to Mao Zedong, the late party chairman. Mou got rich from small beginnings, shipping windup clocks, sewing machines, and motorcycles from Sichuan to Shanghai.

"To succeed here, you need to understand our national sense," said Mou, a tireless self-promoter who has published books on his business theories. He scoffs at Hong Kong developers like Li Ka-shing, dismissing him as an interloper.

"If Li understood our national sense, he would never build the Oriental Plaza. I'm looking to build a new economic system," said Mou, who has imported Korean refrigerators, bartered trainloads of Chinese pork and down jackets for Russian planes, and launched himself into a Sino-Russian satellite business. He boasts of a plan to build a new cross-border city between Inner Mongolia and Russia, which he says will become "the Hong Kong of the North." Meanwhile, he is eyeing new

Like the willows planted around the capital, people have survived by being flexible.

SCAVENGING

for anything they can sell, migrants from Sichuan Province earn about \$50 a month—a small fortune compared with what they earned back on the farm. About 25 percent of Beijing's population is transient. A small contingent of Westerners reside at the East Lake Club (below), far beyond the means of most Beijingers.





business schemes in Mexico, where he would combine Chinese technical expertise with Mexican labor to produce toys and calculators for sale in the United States.

Charges of swindling have long dogged Mou, and he was recently tried for fraudulently obtaining huge loans. One critic said it's hard to tell if Mou is a hero or a crook.

"They say that I cheated on the airplane deal, that I cheated on the refrigerators, and that I'm the number one cheat under heaven," he said. Then he looked up through the pines at the edge of the ancient Tanzhe Temple and howled with laughter. When he calmed down again, he talked about advantages of doing business in China.

"We're more stable than India. We're a dictatorship and cannot explode. If you try to

overthrow the Communist Party, there will be a violent conflict. And that could push society back even further."

Stability is a constant concern to those who govern this nation of 1.2 billion. The leaders fear that the populace could easily spin out of control in times of economic or political turmoil. That is why Communist leaders get edgy as June 4 approaches each year—the anniversary of the Chinese Army's attack on demonstrators in central Beijing. The attack on unarmed citizens, which killed perhaps as many as 2,000 people, came in 1989 after more than six weeks of peaceful protests in and around Tiananmen Square calling for an end to government corruption.

As the Beijing bureau chief and correspondent for ABC News, I covered that movement,



as well as the subsequent protests on each anniversary. So it happened that in June 1992, three years after the initial bloodshed in Beijing, I reported for ABC on a man who, all alone, showed up at Tiananmen Square to unfurl a protest banner. He got arrested for his troubles and has since been detained in a psychiatric hospital.

My price for documenting his actions was severe and unexpected. I was kicked and punched by a group of plainclothes policemen, one of whom flailed my head with a bag of rocks. The beating left me hobbled with lasting injuries. I still have difficulty walking, sitting, and standing. These injuries forced me to leave China, a place I had grown to love.

Recalling China's official antipathy toward foreign reporters, it was with a tinge of apprehension that I returned to Beijing for this assignment. But I was immediately touched by the kindness of ordinary citizens and embarrassed by the grandiose apologies I received.

Just as I had been criticized years ago for some of my television reports that had "offended the entire Chinese people," according to Communist officials, now some officials made private apologies to me "on behalf of the entire Chinese people."

I was also allowed back onto Tiananmen Square but only to watch the officially choreographed pageant of soldiers from the People's Liberation Army at a flag-raising ceremony.

Chinese tourists, visiting Beijing from the provinces, watched too, awed by the spectacle

They have known a dizzying succession of political shifts, yet somehow manage to keep their dignity.

LOSING FAITH in the old catechism of communism, seekers find meaning in tightly controlled churches like Beitang (above), a cathedral where the state prohibits Catholic priests from publicly acknowledging the authority of the pope. In the doctrine embodied by Mao Zedong (portrait at right), the government remains the godhead.



in the hundred-acre square. I quizzed one of the tourists, Guan Yueying, a junior high school teacher from Jiangsu Province, about her feelings for Tiananmen Square.

"It's the symbol of China," she said without hesitation. Like others from the provinces, she found no ominous associations in the place, which was to her a source of pride, at the heart of the nation's capital.

Then she was off to see the other tourist spots. If she had taken a bus past the Gate of Heavenly Peace, she might have heard the rumbling echo resulting from the impression of tank treads that scarred the roadbed, a ghostly reminder of the 1989 massacre. But even those markers were torn up and replaced in time for China's 50th anniversary celebration of Communist rule in October 1999.

The square could be put right again, but the memory of that surprise attack cannot be erased from the minds of some Beijing residents, who refer to the June 4 killings as *kai qiang*, meaning when the army "opened fire" on citizens.

People were generally open in such conversations, but I noticed how quickly the mood iced over if a bystander sidled into hearing range. Small wonder, since neighbors sometimes feel dutybound to report unauthorized foreign contact to authorities. Those citizens who challenge the regime's version of events face intimidation, deportation, or jail. Some dissidents have had their computer records and lists of supporters confiscated.

The Communists remain deeply fearful of any unauthorized activity involving large





numbers of people. That is why they arrested hundreds of adherents of the Falun Gong group, which practices breathing and exercise rituals to seek spiritual well-being. The government waged a vigorous campaign to ban the group in 1999, even though many of its members are elderly. The Falun Gong people did the unthinkable, protesting the government's interference in their private affairs by turning out, 10,000 strong, to meditate quietly in front of Zhongnanhai, the imposing compound where party leaders live. The group's organizational abilities unnerved those leaders.

IN BEIJING people find their victories in small ways, as I was reminded one morning when the unmistakable sounds of Strauss drew me toward the Temple of Heaven complex, where emperors once communed with the gods about harvests. The place was filled with couples in their 50s and 60s, gliding over the dusty hardpan, twirling in

their measured joy to music from boom boxes scattered around the improvised dance floor. I thought back to 1978 and to a factory worker I met in a park. "The Chinese need the right to free expression," he had said. "But the thing we need most, and the thing I cherish most, is the right to dance."

Now Beijing's youths gyrate to the throb of disco music at nightclubs like the Hot Spot, where the girls have tattoos on their shoulders and glitter on their eyelids. By day they visit the city's new cafés and bars and show off their beepers and cell phones, symbols of success. They seem fairly normal, following a deep impulse to be modern and to separate themselves from an older generation.

I found Wang Yingchun and her boyfriend practicing their bowling technique in the basement of an apartment building, where the crack of bowling pins mingled with piped-in clarinet tunes. She was dressed in a fashionable short skirt shredded like Robin Hood's tunic,



NO MONUMENTS in Tiananmen Square mark the massacre of demonstrators or memorialize any other events that disrupt the official narrative of socialism. But what does muzzling the collective memory do to a people with deep roots in history? “If you lose the past,” says ninth-century poet Meng Jiao, “the will easily crumbles.”

with a pixie haircut and a jade bracelet. A college graduate, she planned to continue study at a business school in America.

And what do young Beijingers want? “To get on the Internet, to play sports, to dance at the discos,” she said.

Among the youths like Wang, you find a sense of vibrancy, an urge for self-expression, and a willingness to spend money for the latest technology. You find hundreds of customers poring over the latest equipment at computer fairs like the one I visited in a Beijing mall, where IBM, Hewlett Packard, and local brands like Legend and Great Wall were on display.

Nearly one percent of Beijing’s households have an Internet connection, and that figure will undoubtedly rise. Annual computer sales are expected to hit ten million nationwide in the near future. “It’s a trend,” said a public relations spokeswoman for the computer show. “More and more people will want to get this know-how.”

Access to the outside world, though restricted by the government, is freer than it used to be, which gives some Beijingers a new sense of autonomy. “The government doesn’t bother us,” said an engineer I met at a job fair. “We’re independent. I think our society is fair to people under 30.”

This new possibility for a greater sense of independence explains precisely why so many parents are investing so much in their children—eagerly buying them computers, hiring private tutors, enrolling them in special classes. No one wants the children to lag behind. A generation burdened by successive political traumas and frightened by new economic contractions has fortified its children with love and education, and the hope that they will have a chance to chart a new path for their city and their country. □

Where is China headed? Will more access to the outside world lead to greater change? Comment online at www.nationalgeographic.com/ngm/0003.

FLASHBACK



HERBERT G. PONTING

■ FROM THE GEOGRAPHIC ARCHIVES

All Along the Watchtower

“Imagine a city where camels go up and down the streets upon legitimate business, not in a circus parade!” wrote James Arthur Muller about “Peking, The City of the Unexpected” in our November 1920 issue. “There are dozens upon dozens of them lining the sidewalk, up the street and down.” This caravan of Bactrian camels, photographed around the time that the article was published, exits one of Peking’s nine Tatar City gates. The 40-foot wall and its ten-story watchtower were built by Ming rulers in the 15th century, but both structures were demolished in the early 1960s to make room as Peking (Beijing) sprawled northward.

This photograph has never before been published in the GEOGRAPHIC.

To Make It In Ms. Carson's Class, You Have To Learn How To Handle Pressure.

High

The students in René Carson's science class know all about pressure. Not to mention temperature, humidity and the other aspects of meteorology. Because Ms. Carson has turned these junior high school students into full-fledged weather forecasters.

Ms. Carson had her students take all they learned in class about weather fronts, and how pressure systems affect things like temperature and barometric readings, and put it to work. Dividing the class into small groups, she had each pick a location across the country and attempt to accurately predict the weather. Then, after spending days consulting weather maps, satellite photos and the Internet, each group made a detailed presentation of their weather forecast which was critiqued by the entire class.

And, quite predictably, they all learned a lot about how weather really works.

For giving her students the kind of education they can depend on, rain or shine, State Farm is proud to present René Carson of the Little Rock, Arkansas Instructional Resource Center with our Good Neighbor Award® and to donate \$5,000 to the school district in her name.



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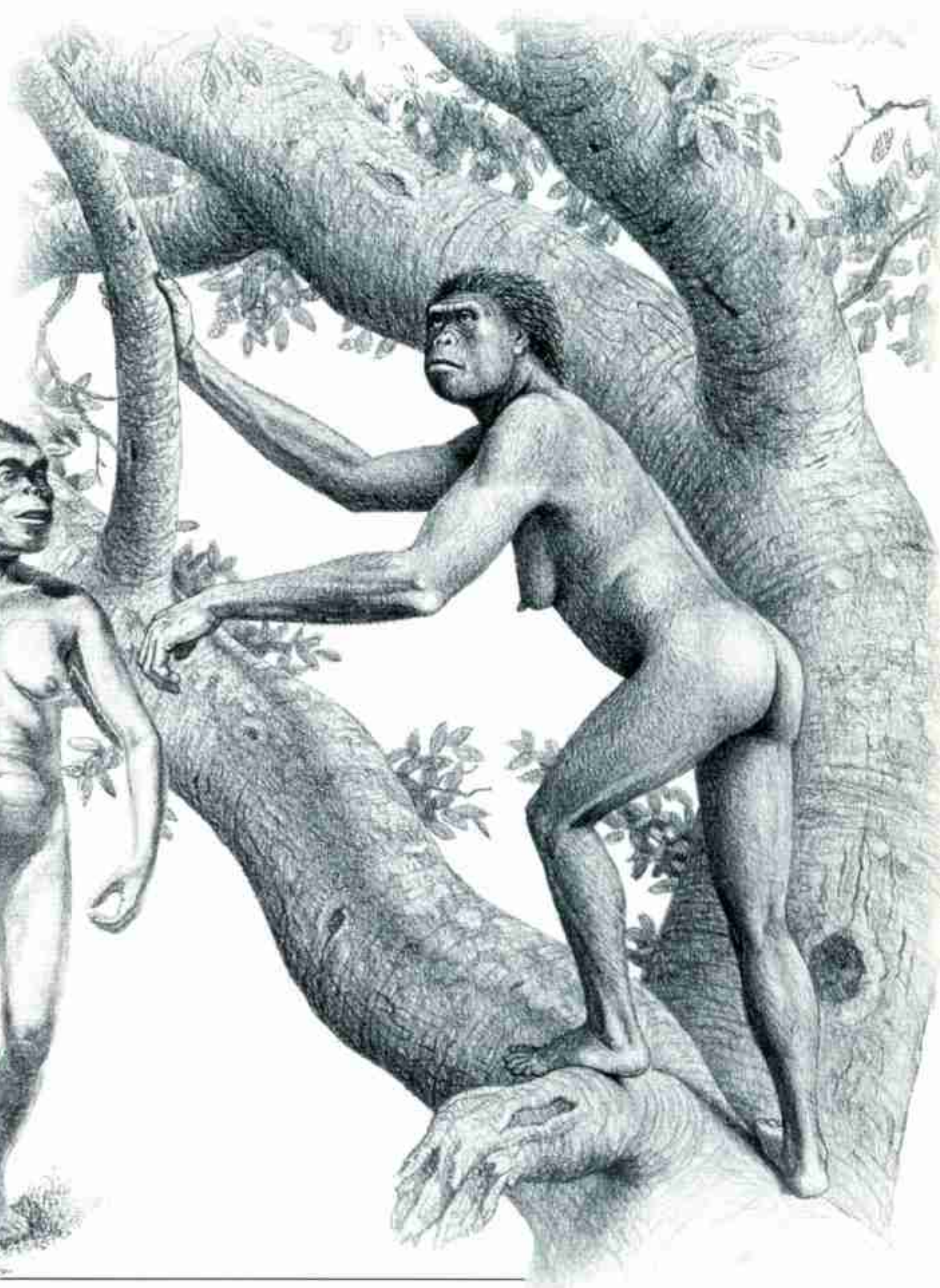
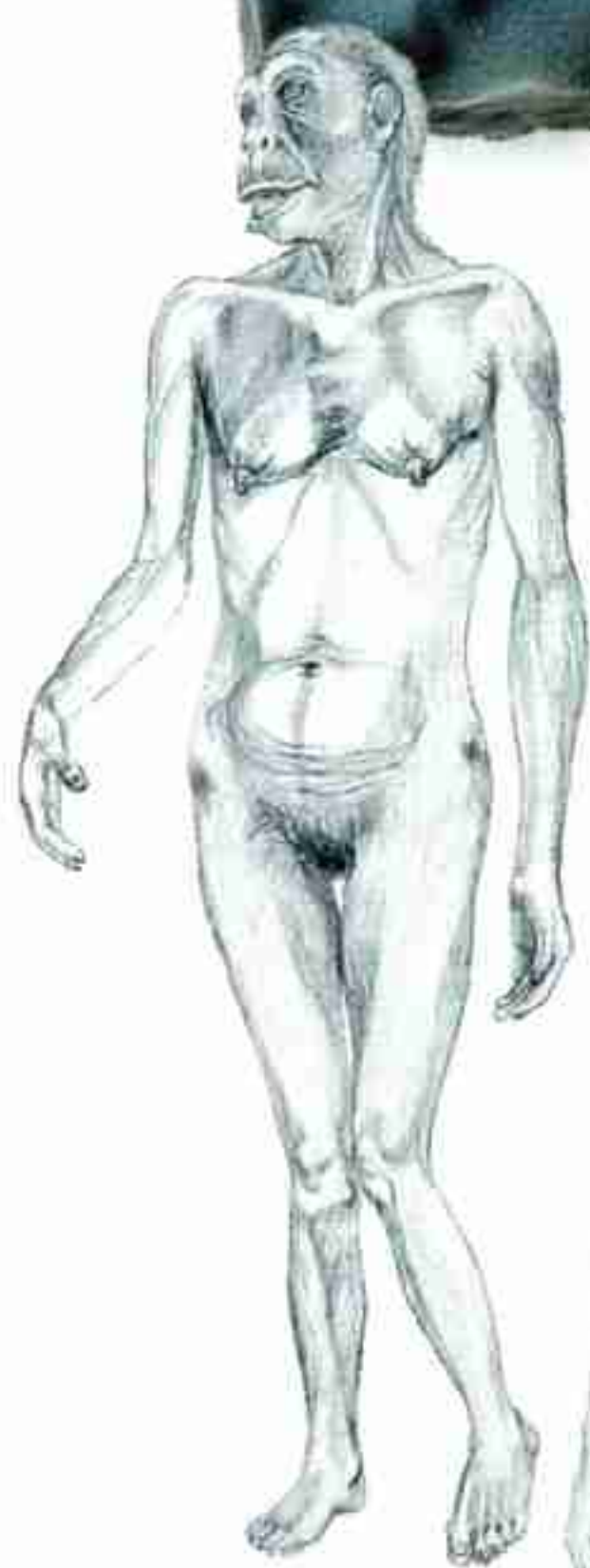
The Good Neighbor Award was developed in cooperation with The National Science Teachers Association.

Behind the Scenes



New Artists From Old Bones

It's hard to find someone who can draw a realistic-looking early hominid. That's why the GEOGRAPHIC's art department conducted a search for new talent. Four artists were picked to receive casts of two-million-year-old female *Homo habilis* fossils (left). From these bits of evidence they were to sketch—in skeletal and fleshed-out form—the hominid to whom the bones belonged. "Each artist had two weeks with the bones before they were sent on to the next person," says coordinator Kris Hannah. "Research was completely up to the individual. That's why their work looks so different. There's no one way to draw her." Paleoanthropologists reviewed the results. Intrigued with all four entries, the art department has invited the artists to paint finished versions based on input from the consultants.



MARK THIESSEN, NGS (TOP); ART BY (LEFT TO RIGHT) PORTIA SLOAN, JOHN DAUGHERTY, KAZUHIKO SANO, MAURICIO ANTON



KATHY SARTORE (ABOVE); ART BY RICHARD THOMPSON

Hazards of the Job

Sometimes it's the little things that get you—like the sand fly that bit photographer Joel Sartore's leg in Bolivia's Madidi National Park while he was working on this issue's story. The bite never healed, and the wound kept getting bigger. A

few months later Joel, shown above with nurse Julie Hinds, was diagnosed with leishmaniasis, an illness that affects an estimated two million people a year, mainly in tropical climes. After a grueling course of intravenous medication Joel seems fine. "And wearing a lot more bug spray," he says.

NGM From A to Z

You never know what will jump out from the new ten-year NATIONAL GEOGRAPHIC index. Entries from articles and columns such as Earth Almanac and Geographica include *Bridges of Madison County* and the Beatles. Why the Beatles? "Four asteroids were named after them," says index editor Anne Marie Houppert. "And Lucy the hominid was named for 'Lucy in the Sky with Diamonds.'"



Using Horse Sense to Help a Bad Back



TODD GIPSTEIN (ABOVE); JAMES L. STANFIELD

He's a longtime horse lover, even chose his Virginia home partly to be near the wild ponies of Assateague Island. So Jim Stanfield—with the thousandth roll of film for his ancient Greece series (above)—was eager to photograph a modern-day Bucephalas, the steed on which Alexander the Great conquered southwestern Asia. In Thessaly, the famous stallion's home turf, horse veterinarian Theo



Antikas found this Bucephalas look-alike, about the age of Alexander's horse when they set off. It wasn't the first good deed the vet had done for Stanfield. Earlier, after weeks of hauling cameras, Jim had been immobilized by back pain. But he was soon back in the saddle, thanks in part to Antikas's medical skill.

TEXT BY
MAGGIE ZACKOWITZ

■ FOR INFORMATION

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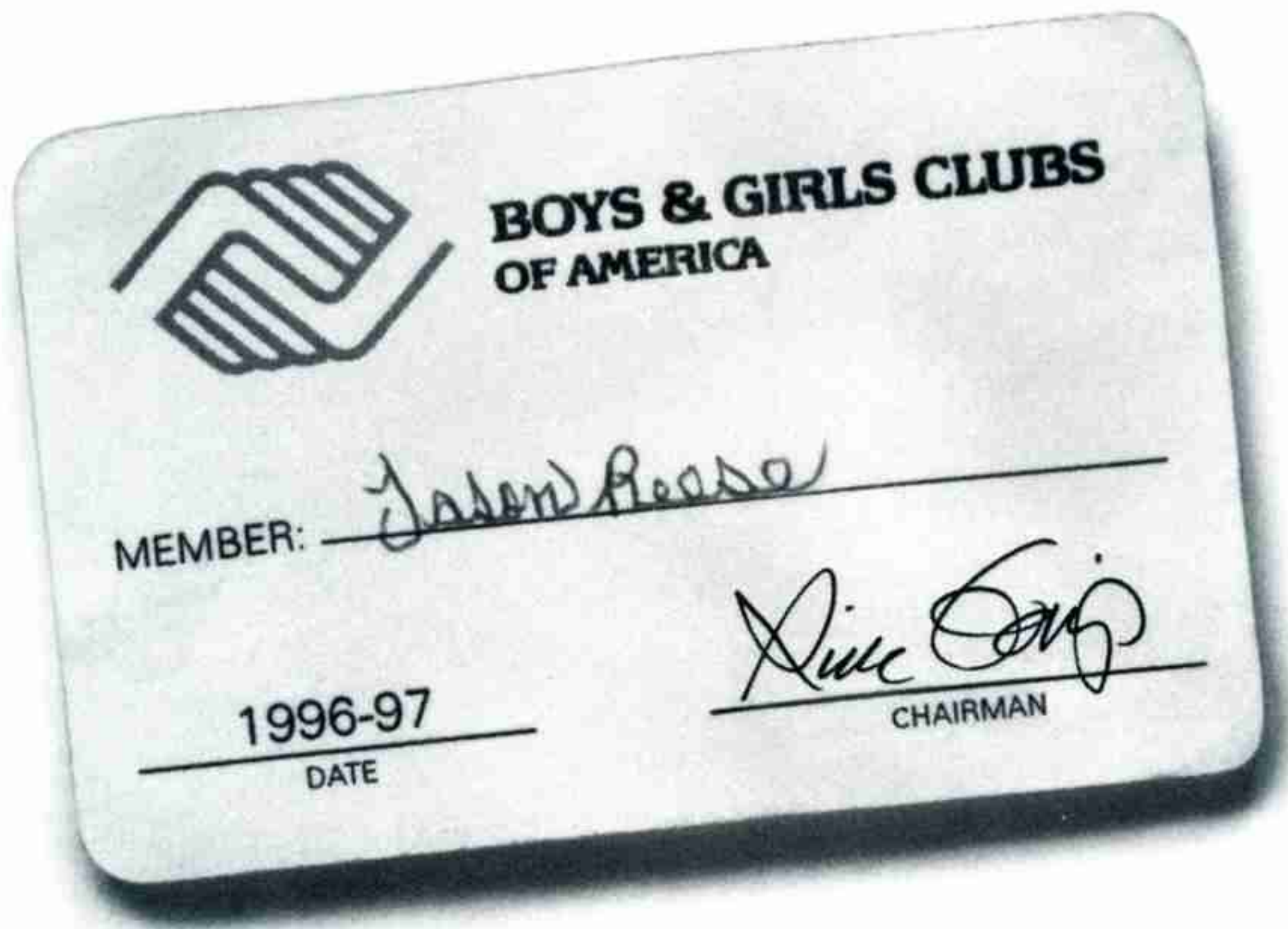
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DAVID DOUBILET (ABOVE); KIP F. EVANS

The Fragile Frontier

Water blankets 70 percent of our planet, yet much of the ocean seems as alien as outer space. Our website lets you plunge into the Pacific to explore the riches of Monterey Bay National Marine Sanctuary. Pilot a submersible through a kelp forest where you'll encounter exotic creatures, or fly over an under-sea chasm twice as deep as the Grand Canyon at www.nationalgeographic.com/monterey.

■ Where will the 21st century take China? Read "Beijing" (pages 116-37) and comment at .../ngm/0003.

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