NATIONALGEOGRAPHIC.COM/MAGAZINE MARCH 2006

NATIONAL GEOGRAPHIC

The Greatest Journey Ever Told

THE TRAIL OF OUR DNA

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ZIP USA: Survival of the Richest 148

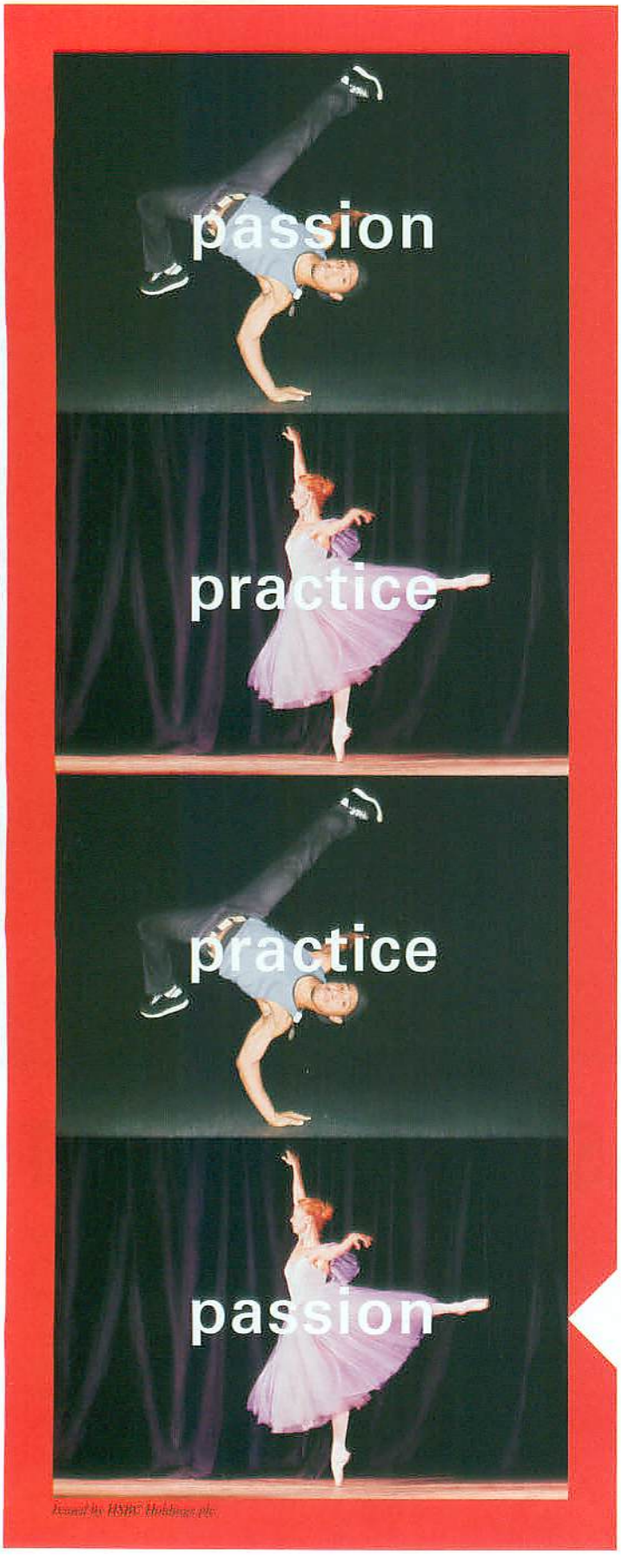
Celebrations of the World

Spinning for hours in rhythmic precision, Turkey's Whirling Dervishes celebrate the power of prayer. By entering a deep meditative trance, they seek to empty themselves of earthly distractions and open their bodies to the energy, love, and truth of Allah.

ISTANBUL, TURKEY "Although a very personal, sacred act, this whirling dance has become part of Turkish custom and culture known around the world. The dervishes practice a mystical form of Islam, and their dance commemorates the death of Rumi, the 13th-century philosopher, poet, and founder of the sect. The endurance, strength, and concentration this ritual requires are incredible. They whirl on one foot, circling the stage with one hand extended to the heavens and the other facing the earth, symbolizing the spinning of the planets around Allah. As their meditation grows deeper, the turns gather force, and the music gains intensity—it's a flawless, beautifully done masterpiece."

NATIONAL GEOGRAPHIC
Mission Programs

James L Stanfield, National Geographic Society Photojournalist



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In the world of dance, there are people who think you can't get anywhere without a personal passion for the art form, others that out of practice comes perfection.

When you listen to millions of different customers across the world, you learn that what drives one person can be different to the next.

But at HSBC, it's our ability to listen to them that keeps us on our toes.

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The world's local bank

Hirola *(Beatragus hunteri)*
Size: Head and body length, 120 - 200 cm; shoulder height, 100 - 125 cm; tail, 30 - 45 cm
Weight: 80 - 118 kg **Habitat:** Arid, grassy plains bound by semi-desert inland and coastal forests in Kenya and Somalia **Surviving number:** Estimated at 500 - 1,200

Photographed by Cyril Ruoso

WILDLIFE AS CANON SEES IT

The "four-eyed antelope" needs all the eyes it can get. The hirola actually has just two; it earned its nickname because of its pronounced preorbital glands. Among the most endangered antelopes on earth, it has to keep its eyes open for threats. One of its strategies for safeguarding its young is a brief "lying up" phase, where the mother leaves her calf hiding in the grass while she forages for food. This reduces the risk that the much-slower calf will be targeted if a predator gives chase. But predators aren't the only problem. Habitat loss, poaching, disease and competition with livestock all jeopardize the survival of this singular species.

As an active, committed global corporation, we join worldwide efforts to promote awareness of endangered species. Just one way we are working to make the world a better place—today and tomorrow.

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NATIONAL GEOGRAPHIC

MARCH 2006 · VOL. 209 · NO. 3

Ukraine: The Morning After
Perched on a park wall, a bride poses in Kyiv, heart of the "Orange Revolution" that in late 2004 brought President Viktor Yushchenko to power. This month voters will decide whether Yushchenko will keep control of parliament despite divisions within his ranks, a weak economy, and the slow pace of reform.

ANTHONY SUAU

Features

Endangered Revolution 32
Ukraine, Europe's second largest country, lurches on toward democracy as an election looms that may change its course.
BY ANDREW MEIER PHOTOGRAPHS BY ANTHONY SUAU

Human Journey 60
Genetic trails left by our ancestors are leading scientists back across time in an epic discovery of human migration.
BY JAMES SHREEVE

The Celtic Realm 74
Outsider status has helped Celtic languages and culture endure.
BY TOM O'NEILL PHOTOGRAPHS BY JIM RICHARDSON

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The Coal Paradox: Coal is plentiful—and polluting. Can an energy-hungry world afford to wait for this fuel to clean up?
BY TIM APPENZELLER

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When Mountains Move: The quest for Appalachian coal has led to mountaintop removal, a process that's been called "strip-mining on steroids."
BY JOHN G. MITCHELL PHOTOGRAPHS BY MELISSA FARLOW

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Why is the Ethiopian wolf the rarest canid on the planet?
BY VIRGINIA MORELL PHOTOGRAPHS BY ANUP SHAH

Battle of Hampton Roads 136
When the currents of history and technology collided off Hampton, Virginia, in March 1862, naval warfare changed forever.
BY JOEL K. BOURNE, JR. PHOTOGRAPHS BY IRA BLOCK

COVER Namibia's Ju/'hoansi people carry DNA markers that could predate modern-human migrations out of Africa. **PHOTO BY CHRIS JOHNS**

Cover printed on recycled-content paper

OFFICIAL JOURNAL OF THE NATIONAL GEOGRAPHIC SOCIETY

THE WORLD'S HELP DESK

CALLER: SCIENTISTS TRACING THE HISTORY OF MANKIND

PROBLEM: The Genographic Project hopes to trace 60 millennia of human migration through tiny genetic variations. On their wish list: enough computing power to catalog and compare over 100,000 DNA samples.

SOLUTION: A collaboration between IBM and National Geographic that provides next-generation IT and life sciences technology, including a global DNA database.

HELPED BY: Researchers at IBM's Computational Biology Center

☐ environment ☐ healthcare ☐ education ☑ science

signed: Dana A.

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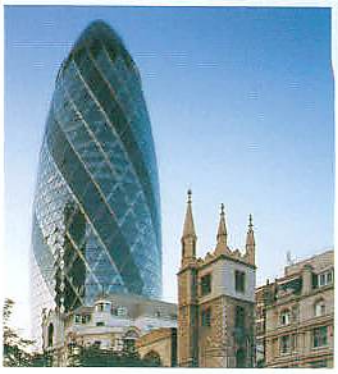
Swimming Sloth

Drivers for Hire



London's Eco-friendly Pickle

Departments

VISIONS OF EARTH
Hawaii
Bahamas
India

WILDLIFE — **Swimming Sloth**

GEOGRAPHY — **Bird Flu Takes Wing**

FAMILY OF MAN — **Drivers for Hire**

ENVIRONMENT — **London's Eco-friendly Pickle**

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SCIENCE — **Chemistry of Life**
BY JOEL ACHENBACH

ZIP USA — **77019 Houston, TX**
BY MIMI SWARTZ
PHOTOGRAPHS BY MICHAEL O'BRIEN

Miscellany

EDITOR'S NOTE
LETTERS
YOUR SHOT
PHOTO JOURNAL
INSIDE GEOGRAPHIC
FLASHBACK

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EXPLORE THE BOTTOM OF THE EARTH
Journey to Antarctica via an interactive map. Meet the fearless explorers of this frozen frontier, get a close look at icebergs, and enjoy the sights and sounds of penguins, seals, and other wildlife. Then test your polar knowledge with a quiz and download wallpaper at **ngm.com/antarctica.**

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LEXUS
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Lexus has just raised the bar again. It's no longer about cars that respond to your needs. It's about cars that address your needs even before they arise. The Smart Key Entry System in a Lexus now unlocks the door just by sensing the key in your pocket. The intelligent transmission smoothens the ride by sensing when you wish to shift gears. An Intuitive Park Assist System senses parking obstructions. Sensors around the car keep you comfortable by setting the seats and air-conditioning in your preferred position and making sure the instruments are visible at all times. More sensors ensure your safety by monitoring everything from tire pressure to the amount of rain on the windshield. And that's not all. With its tasteful interior, Mark Levinson audio system, sculpted lines and the perfect balance of boldness and subtlety, the Lexus is designed to delight your own senses. Visit your nearest Lexus dealer for a guest drive. Somehow, we can sense you want one.

LEXUS

THE RELENTLESS PURSUIT OF PERFECTION

EDITOR'S NOTE

A landscape I didn't know existed is portrayed in Melissa Farlow's photographs this month—and it's within 150 miles of my home. Surface mining, including mountaintop removal, a new method of coal mining, has affected more than 400,000 acres in Appalachia.

While our story "When Mountains Move" brings to light the human and environmental costs of mountain removal, it's important to remember that coal-burning power plants provide half of this nation's electricity. The U.S. is the Saudi Arabia of coal, with enough to last for centuries. That's the good news—and the bad.

A West Virginia mountain bears the terraced scars of mining.

This year some two billion tons of carbon dioxide will go up the smokestacks of U.S. coal plants. Over 20 years that figure could increase by a third. But the threat that coal burning poses to global climate could be blunted by new technologies. Tim Appenzeller's story, "The High Cost of Cheap Coal," explains the coal paradox.

Also in this issue we mark the debut of our redesigned Departments section. You'll see old favorites like "Visions of Earth" in expanded form, new features like "Your Shot," and a few other surprises. You'll also find the subjects you expect: wildlife, geography, environment, health, and science. A magazine, like a symphony, is a mix of pacing and cadence. We hope our new composition resonates with you.

Chris Johns

PHOTO: MELISSA FARLOW

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LETTERS

November 2005 *Many readers wrote about our story on longevity. While several noted their own secrets for a long life, others commented on the way of life—including, for some, the vegan diet—that our longevity all-stars follow. The "War Letters" article prompted two readers to write about an emotional connection made after more than 50 years.*

Voice opinions about March stories at **ngm.com**.

New Wrinkles on Aging

I was intrigued by the article on longevity. I am 85 and thought I was in good health for that age. I walk to the YMCA to exercise three times a week, and my doctor says I will live to 100, but the people in the article put me to shame.

PAUL A. HUNTER
Newport News, Virginia

I am Lydia Newton's great-grandson, and she has been an inspiration all my life. My brother and I call her Nana. She taught me that one of the secrets to her longevity is simply not to worry. She always said, "Life is tough enough, why complicate it with worrying?" I have just learned that my Nana passed away today. I am very sad that she is gone but will remember her spirit and lessons for life always. Thank you Dan Buettner, David McLain, and NATIONAL GEOGRAPHIC for your inclusion of my Nana in your story. She enjoyed the experience.

TODD NEWTON
Corvallis, Oregon
From our online forum
ngm.com/0511

I take exception to your statement that regular churchgoers appear to live longer than non-churchgoers. This is a nice anecdotal comment, but diet, exercise, and moderation of alcohol are more of an indicator of longevity than attendance at any religious service.

STERLING R. JOHNSON
Palm Springs, California

I am a lifelong Seventh-day Adventist. I am a vegan with the occasional exception of an egg or two. I am over 50 years old and weigh within a pound or two of what I did the day I graduated from high school. I still enjoy aerobic activities and have very few gray hairs. All of these benefits I owe to God, who has blessed me and given me a knowledge of the simple ways to care well for my body.

WESLEY McDONALD
Shamokin, Pennsylvania
From our online forum
ngm.com/0511

War Letters

As I was reading your story, I realized from the inscription on the tombstone that Robert B. Madrid was the same marine who practically died in my arms. "Bat," as his friend Robert Wada knew him, died almost instantly from mortar fire. Platoon Sgt. Bill Rodgers and I reached him about the same time to see if there was anything we could do while calling for a medic. Being his squad leader, I, like Wada, have thought of him many times. I have been able to locate and talk with Robert Wada thanks to the author of the article, Andrew Carroll, Maggie Steber, the photographer, and NATIONAL GEOGRAPHIC.

JACK R. UNDERWOOD
College Grove, Tennessee

I have received the biggest surprise of my life. I got a message from a man in College Grove, Tennessee. When I reached him later, he said he saw the "War Letters" article and looked me up on the Web. He then told me he was Bat's squad leader and was with Bat during the attack on Hill 749. When Bat was hit, he quickly cradled him. He said God was merciful in taking Bat without any suffering. We had a great but tearful conversation. It gave me a very emotional moment of consolation.

ROBERT WADA
Fullerton, California

It is easy to forget that the men and women who fight the wars around the world are just ordinary people who are sent for their leaders' ideas of right and wrong. To be able to read the soldiers' thoughts while they are on duty is vitally important to keeping a perspective.

MARTIN BISCOMBE
St. Day, Cornwall

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I have met Gloria Caldas (pages 78-9). We live in the same city and share the same grief. My son was killed in Afghanistan on November 24, 2004. The pain is still fresh. I keep waiting for him to call, but know that he will not. In one of his last letters he stated how cool it was to be part of Afghanistan's first real election. This is what he chose to do, and I know that he is waiting for us in heaven. I only wish he were here.

JANE FLEISCHER
San Antonio, Texas

From our online forum
ngm.com/0511

Inside Nepal's Revolution

Having trekked in Nepal and enjoyed the company and welcome provided by these kind people, it deeply concerns me that they are now caught in a savage dispute between a corrupt government and a rebel movement, both using brutality to further their ends. Neither the government nor the rebels seem to promote the best interests of the people they claim to represent. What can be done to assist the Nepalis?

TIM HARPER
West Cross, Swansea

Many human rights groups work in Nepal, including Amnesty International, Informal Sector Service Centre, and International Nepal Solidarity Network. Links to these websites and others can be found at ngm.com/0511/feature3/learn.html.

ZipUSA: Maurice, Louisiana

I found it ironic that your ZipUSA flew directly in the stomach of the cover article. Of the universal "Secrets of Living Longer," the turducken obviously didn't make the cut. Then again, what the Cajuns of Maurice lack in longevity, they easily make up for in *joie de vivre!*

FOLWELL DUNBAR
New Orleans, Louisiana

Merci beaucoup for a great article on Maurice! Following two devastating hurricanes and the negativity in the news about Louisiana, it couldn't have come at a better time. It was nice to finally read something positive about Louisiana. Even with the speed trap, Maurice is a great little town.

JAMIE PRIMEAUX
Abbeville, Louisiana

Do It Yourself

Eating unprocessed foods of any kind is a step forward for most people, but telling your largely Western audience to start eating more tofu and a low-fat, plant-based diet is tantamount to propaganda. I ate this type of diet for over ten years and suffered from chronic insomnia, acid reflux, elevated triglycerides, mood swings, weight gain, and allergies.

GARY DEMPSTER
Carpinteria, California

Thank you so much for encouraging people to adopt a vegetarian diet. Since I've stopped eating animal products, my energy level has increased, my cholesterol level has decreased, and, most important, I have not had a breast cancer relapse in the 12 years since my mastectomy! I'm also proud to say that my food choices do not cause animal suffering or widespread environmental degradation.

ELAINE SLOAN
New York, New York

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Be a National Geographic Photographer Take your best shot—and send it to NATIONAL GEOGRAPHIC. This new section, Your Shot, will feature editors' selections from the first 5,000 photographs submitted electronically each month by GEOGRAPHIC readers. A new theme will be announced for each month's entries; the first, for photos to be published in the June 2006 issue, is "Where I Live." For guidelines, submission forms, and other information, go to *ngm.com/yourshot*.

Sit, Stay "He wouldn't stand still," says photographer Brenda Brown, who grabbed this jowls-in-motion portrait of a bulldog named Angus—while Photo Camp instructor Susanna Frohman tried to catch Brown in action—during a pet-blessing ceremony at the National Shrine of Saint Francis of Assisi in San Francisco's North Beach neighborhood. Brown, now 20, participated in National Geographic's Photo Camp last summer. "There were a lot of animals there," she says, "but I really liked his face."

As I write this, I feel truly blessed. After 42 years making pictures and writing about them, I love it more today than when I began. This love is nurtured by the people who enter and become part of my life through my work, something I fully realized last May when my son, Scott, died in Minnesota at age 45 from melanoma while I was living and working at a Hutterite colony in central Montana.

I knew Scott was going to die that day because of a phone call from my daughter Terri, who was with him. His condition had worsened so suddenly that it was impossible for me to get to Minnesota in time. I spoke to Scott by telephone several hours before he passed away, surrounded and comforted by his wife and children, his mother, his sisters, and loving relatives. In Montana I was surrounded and comforted by what has become over the years a kind of second family to me: Darius and Annie Walter, their children, grandchildren, and other members of the Surprise Creek Colony I first photographed and wrote about in 1969.

Bill Allard began photographing for NATIONAL GEOGRAPHIC in 1964. His story about the Hutterites will appear in the June 2006 issue.

Scott died on a Saturday afternoon, the day before 25-year-old Billy Walter, youngest of Darius and Annie's boys, was to marry Karen Hofer. There was a swirl of activity at the colony, and I decided to continue working. My alternative would have been to grieve in whiskey and solitude at the Sundown, a mom-and-pop motel out on Highway 87, where I'd moved when my room at the colony was needed for relatives arriving for the wedding. I didn't want that.

I made a picture that afternoon of five-year-old Carolyn Walter. She is wearing her new shoes and a very cool pair of sunglasses, and she smiles at me while parading among the adults gathered outside the Walters' house. Carolyn's face shines; it almost seems to glow, and it captures my heart. Whenever I look at that picture I am aware that as I photographed this jewel of a child, one of my own was departing this world, and my life. To look at Carolyn's picture reminds me of the heartbreaking sadness of my loss that day. But I also see in it the joy and promise of human renewal that will continue to shine in the days and years to come.

As I write this, I feel truly blessed.

Photo Gallery See more of Allard's work at **ngm.com/0502/feature3**.

www.toyota.co.jp/en

"Environmentally friendly" meets "fun to drive" in the Toyota Prius, the world's best-selling hybrid vehicle. The Prius is just one example of how Toyota brings "opposites" into harmony for a sustainable future.
What can we harmonize today?
TOYOTA

Kaihalulu Beach, Hawaii Sea foam washes a rocky lava wall on eastern Maui. The sands are tinted cinnamon by the erosion of cinder cliffs surrounding the area.

PHOTO: VIRGINIA BEAHAN AND LAURA McPHEE

West Atlantic, Bahamas A maze of yellow and blue scales flashes at the base of the tail of a reef-dwelling queen angelfish.

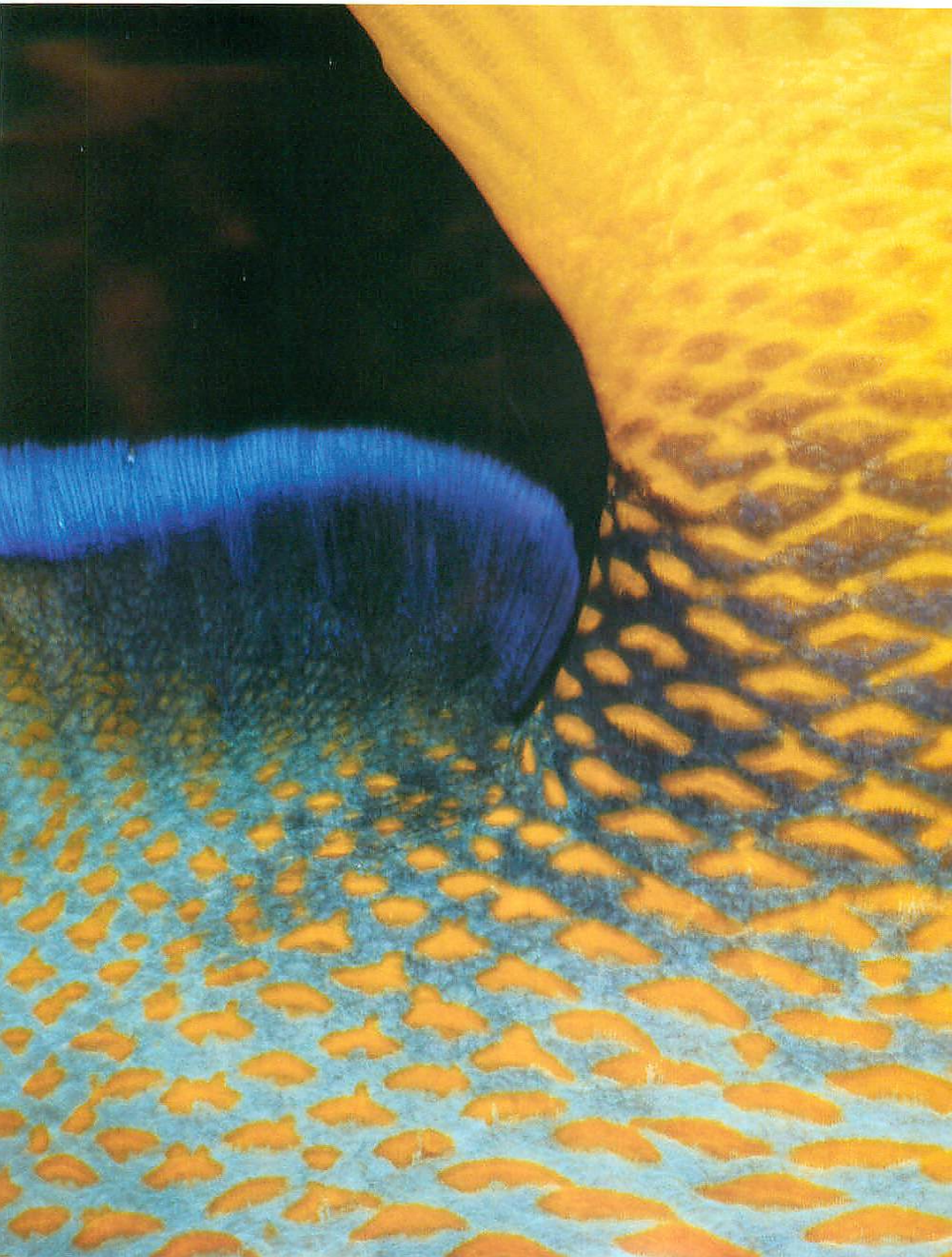
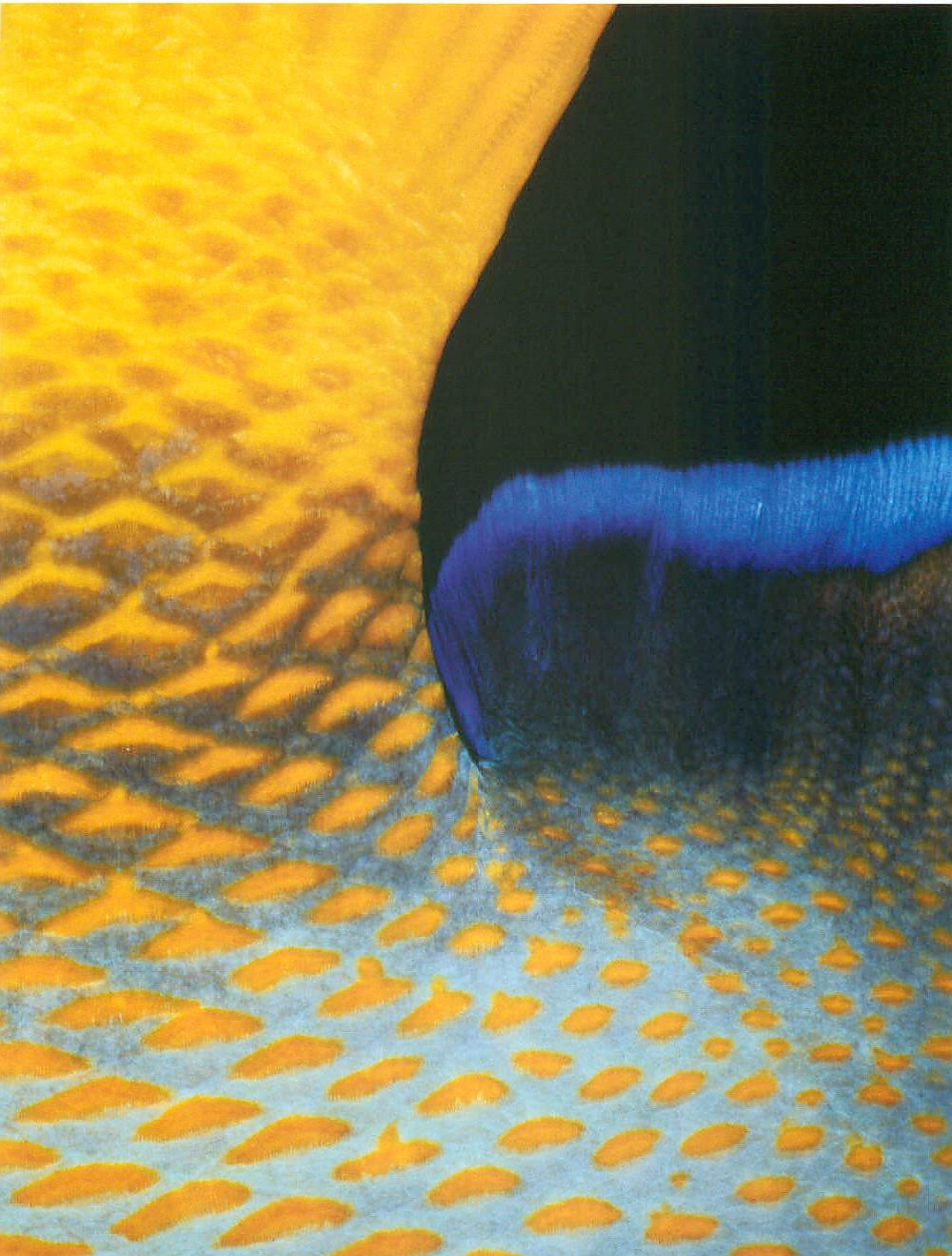


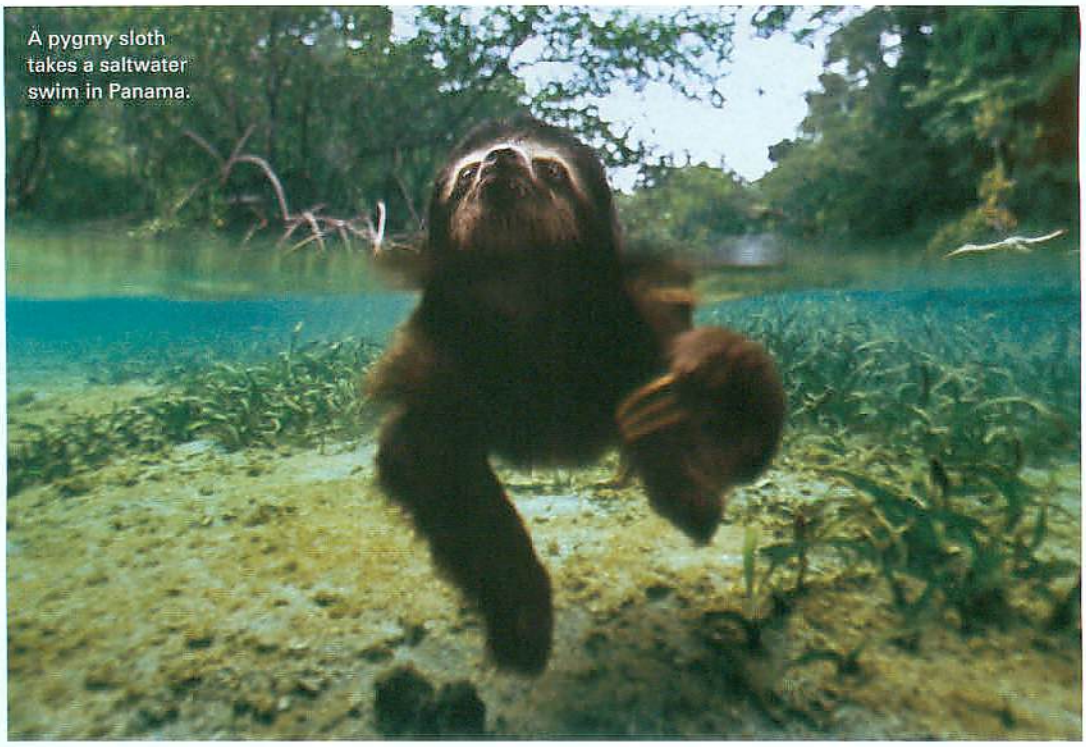
PHOTO: JEFF ROTMAN, NATURE PICTURE LIBRARY



Ahraura, India Beneath bright saris, shining silver jewelry and red painted toes decorate the feet of women in this northern Indian town.

↖ **Decorate Your Desktop** with this and other images in Fun Stuff at **ngm.com/0603.**

PHOTO: SARAH LEEN



A pygmy sloth takes a saltwater swim in Panama.

NG GRANTEE **New Sloth** This pygmy three-toed sloth, a recently discovered species, was photographed by Expeditions Council grantee Bill Hatcher on Isla Escudo de Veraguas off Panama. Pygmies weigh six and a half pounds—about 40 percent less than mainland sloths in Panama—and sport a hoodlike hank of hair. Hatcher's shot captured a first: Scientists had believed sloths swam only in fresh water. "This one was in salt water just offshore in the mangroves," he says. —*John L. Eliot*

Coming & Going

The great bustard has returned to Great Britain. Among the heaviest of flying birds, it became extinct there in 1832. With males sporting a seven-foot wingspan and a weight of 40 pounds, the bustard's British demise was in part due to popularity as a game trophy and at the dinner table. British conservationists hoping to reestablish the bird's population launched the Great Bustard Project in 2003. They brought chicks from Russia, where, along with Spain, Portugal, and Hungary, about 40,000 wild bustards still live. Last summer 33 birds were released in Britain. Now more than 20 survive in the wild.

Scientists are surprised by a new species of worm found in the waters off Sweden's coast. Researchers discovered the creature feasting on the bones of a dead minke whale they'd sunk in the North Sea. They named the species *Osedax mucofloris,* Latin for "bone-eating mucus flower." Similar *Osedax* worms had been found previously only in Pacific depths. The find underscores the importance of whale fall to ocean floor ecosystems worldwide.

A new species of bird has been discovered in the Philippines. Dark brown plumage contrasting dramatically with its bright red beak and legs marks the Calayan rail, which is named for the remote island it inhabits. Researchers estimate that a population of 100 to 200 pairs of the low-flying birds live in the forests they have studied so far. But the long-term survival of the Calayan rail is threatened by clearing of its habitat, as well as by roads and human settlements, which may introduce predators such as cats and rats.

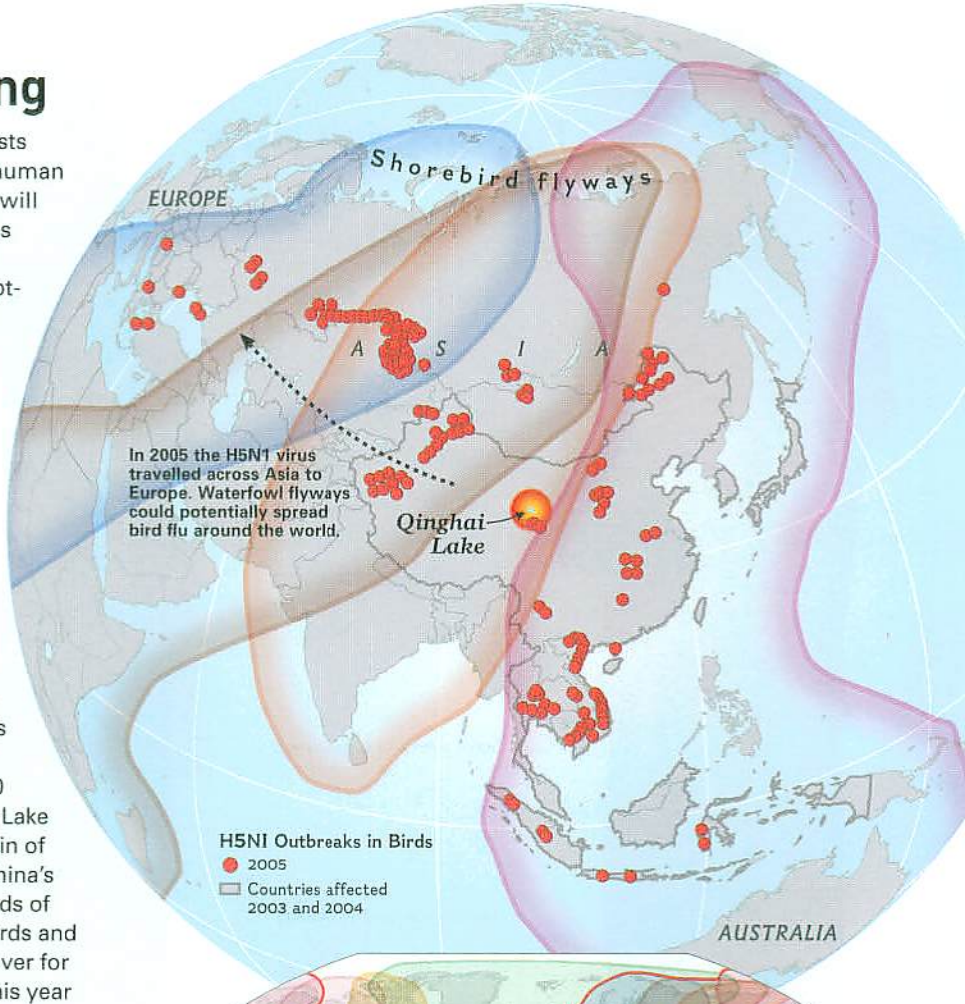
PHOTO: BILL HATCHER

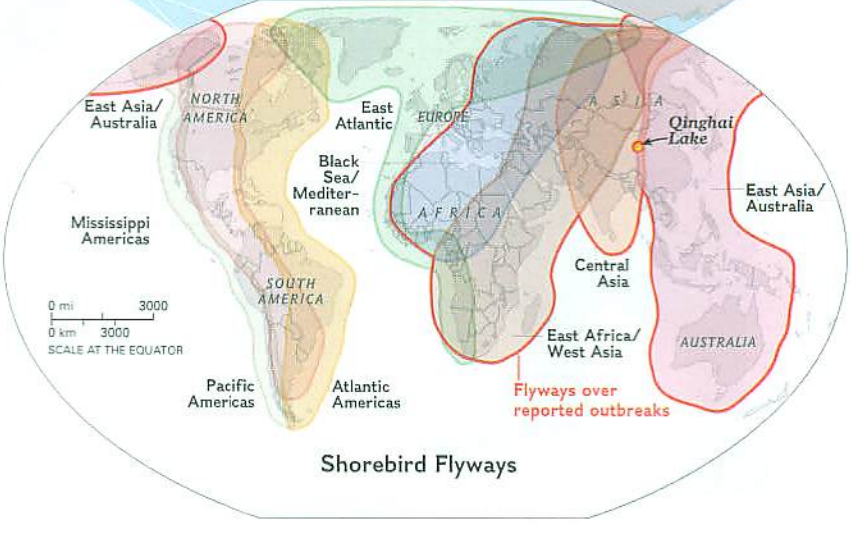
Bird Flu Takes Wing

Though most scientists agree that a deadly human influenza pandemic will occur, nobody knows when or how it will arrive. A highly adaptable strain of avian flu known as H5N1 seems a possible source. Most human cases of H5N1 have so far been limited to those in close contact with infected domestic fowl such as chickens and ducks. But wild birds are also affected by the virus and could be vehicles for its expansion.

In 2005 some 6,000 wild birds at Qinghai Lake died of the H5N1 strain of avian flu. The lake, China's largest, hosts hundreds of thousands of waterbirds and is an important stopover for migratory species. This year authorities are monitoring birds in the area for signs of new infection.

Qinghai sits at a crossroads of avian flyways through Asia, Europe, and the rest of the world. As the spring 2006 migration season approaches, will wild birds there—and elsewhere in affected areas in Asia and Europe—help spread the flu around the globe?
—Margaret G. Zackowitz





The Next Killer Flu Hear more about this deadly disease in a special multimedia show at **ngm.com/0510.**

SOURCES: FOOD AND AGRICULTURE ORGANIZATION, UNITED NATIONS; RODNEY WEST, INTERNATIONAL WADER STUDY GROUP; WORLD ORGANISATION FOR ANIMAL HEALTH. NGM MAPS

Drivers for Hire

	Golan Sarwar	Donovan Palmer
Age	20 years	49 years
Weight	101 lb	150 lb
Earnings each day	$2.65	$90
Days worked each week	6	5
Hours worked each day	10	12
Calories burned each day	3,292	1,824
Miles traveled each day	30	120

GOLAN SARWAR
Cycle rickshaw driver
Dhaka, Bangladesh

DONOVAN PALMER
Cab driver
New York City, United States

PHOTOS: DAVID H. WELLS, AURORA (LEFT); ROBERT CLARK

Vents on the facade of "the gherkin" draw fresh air into the London building.

London's Green Giant Nicknamed "the gherkin" for its pickle profile, this distinctive London skyscraper (above and below) is one of a new crop of buildings designed to reside in better harmony with Mother Nature than previous generations of office towers. The 41-story structure's glass facade and open floor plans allow sunlight to penetrate deep into its interior, reducing the building's reliance on electric lighting. And its curved shape helps direct wind into a natural ventilation system, which minimizes the need for air-conditioning. These and other green features may trim the building's total energy consumption to about half that of a comparable conventional structure. Meanwhile, the gherkin's architect, Norman Foster, has turned his attention to New York City, where his firm is using recycled steel to build Hearst Corporation's new 46-story eco-friendly headquarters, scheduled for completion this summer. *—Peter Gwin*

How "Green" Is Your Home? Find out in an interactive game at **ngm.com/greenhouse.**

Coming attractions in the green-building movement:

- **Bank of America Tower** Now under construction, the Manhattan skyscraper will capture and reuse rain and wastewater.
- **Beijing Olympics** Organizers say all new venues for the 2008 Summer Games will incorporate green design.
- **Guadalajara stadium** The Mexican city's new soccer arena will be built within a hill. Outside, its grass-covered slopes will serve as a public park.

PHOTOS: NICK WOOD

Glycyrrhizic acid, a medicinal compound in licorice, is 50 times sweeter than sugar.

Licorice Power One of the world's oldest known medicines, the root of the licorice plant (above) has been prescribed since antiquity. Historians such as Pliny the Elder describe its use in treating colds and asthma and healing wounds. Herbalists in China and India add licorice to their compounds, and it's in over-the-counter remedies for sore throats. Now scientists worldwide are testing its potential. One team found that glycyrrhizic acid, a compound in licorice, kills cells infected with the virus that causes Kaposi's sarcoma, a cancer. It also inhibits the growth of the SARS virus and has been tested with success against Japanese encephalitis, chronic hepatitis, and HIV. —*A. R. Williams*

Often fruit-flavored, red licorice candy contains no actual licorice.

What's New?

Nine avoidable risk factors cause more than one-third of cancer deaths worldwide. The risk factors considered in a study by the Harvard School of Public Health are obesity and overweight, low fruit and vegetable intake, physical inactivity, smoking, alcohol consumption, unsafe sex, urban air pollution, indoor smoke from coal, and contaminated injections given in health-care settings. Approximately 2.5 million annual cancer deaths would be prevented through environmental and lifestyle changes.

Born to lie? Compared with generally honest people, chronic liars, cheaters, and malingerers average 22 percent more white matter in the prefrontal cortex of their brains and 14.2 percent less gray matter, or neurons, a recent study by the University of Southern California found. White matter, the brain's networking material, connects neurons much the way telephone wire connects phones; it also ties the prefrontal cortex to the body's limbic system, which controls emotion. That's why pathological liars can tell such whoppers without showing any nervousness. "It could well be that some people are born with a genetic predisposition to lie," says Adrian Raine, co-author of the study.

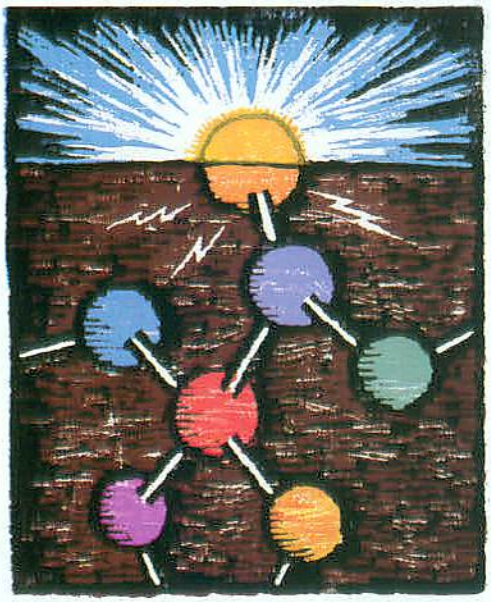
PHOTOS: DORLING KINDERSLEY LIMITED, LONDON/CORBIS (TOP); JIM ZUCKERMAN, CORBIS

The Origin of Life... Through Chemistry

The emergence of life on Earth is on a short list of the biggest unknowns in science. Did life begin in a small, warm pond at the edge of a primordial sea, as Charles Darwin speculated? Or deep beneath that sea, around one of the burbling hydrothermal vents first seen in the 1970s? And never mind the where: What was it, this initial germ of life? Was it a cell? A replicating molecule?

One of the most intriguing theories says that the answer to the mystery is right inside us. Biologist Harold Morowitz of George Mason University argues that our metabolism—the chemical reactions that allow cells to turn energy and atoms into biologically useful molecules—provides a long fossil record of Earth life. Morowitz and collaborator Eric Smith of the Santa Fe Institute believe that a central set of chemical reactions has been in place since life's earliest moments about four billion years ago. These reactions involve just 11 small carbon molecules, such as citric and acetic acids, very ordinary stuff that would have been abundant on the young Earth.

Those 11 molecules could have played a role in other chemical reactions that led to the development of such biomolecules as amino acids, lipids, sugars, and eventually some kind of genetic molecule such as RNA. In other words, metabolism came first—before cells, before replication, before life as we commonly think of it.



This is probably not what opponents of the teaching of evolution want to hear, but it seems that a kind of molecular natural selection applies even to the world of geochemistry. Some types of molecular chains outcompeted other molecular chains for the planet's resources, and gradually they led to the kind of molecules that life depends upon—all this before the first living thing oozed forth. Many scientists say life wasn't a freak accident at all, but the likely outcome of the interaction of the molecules and minerals of the Earth. "Life is an elaboration of something very simple," says Smith. "It looks easy and inevitable."

Earth scientist Robert Hazen's new book, *Ge•ne•sis,* says that many theories about the origin of life involve the principle of "emergence." From simple beginnings, complexity can emerge. A classic example of emergence is in your brain. Individual neurons don't think, but collectively they produce the emergent phenomenon we call consciousness. Says Morowitz, "the unfolding of life involves many emergences."

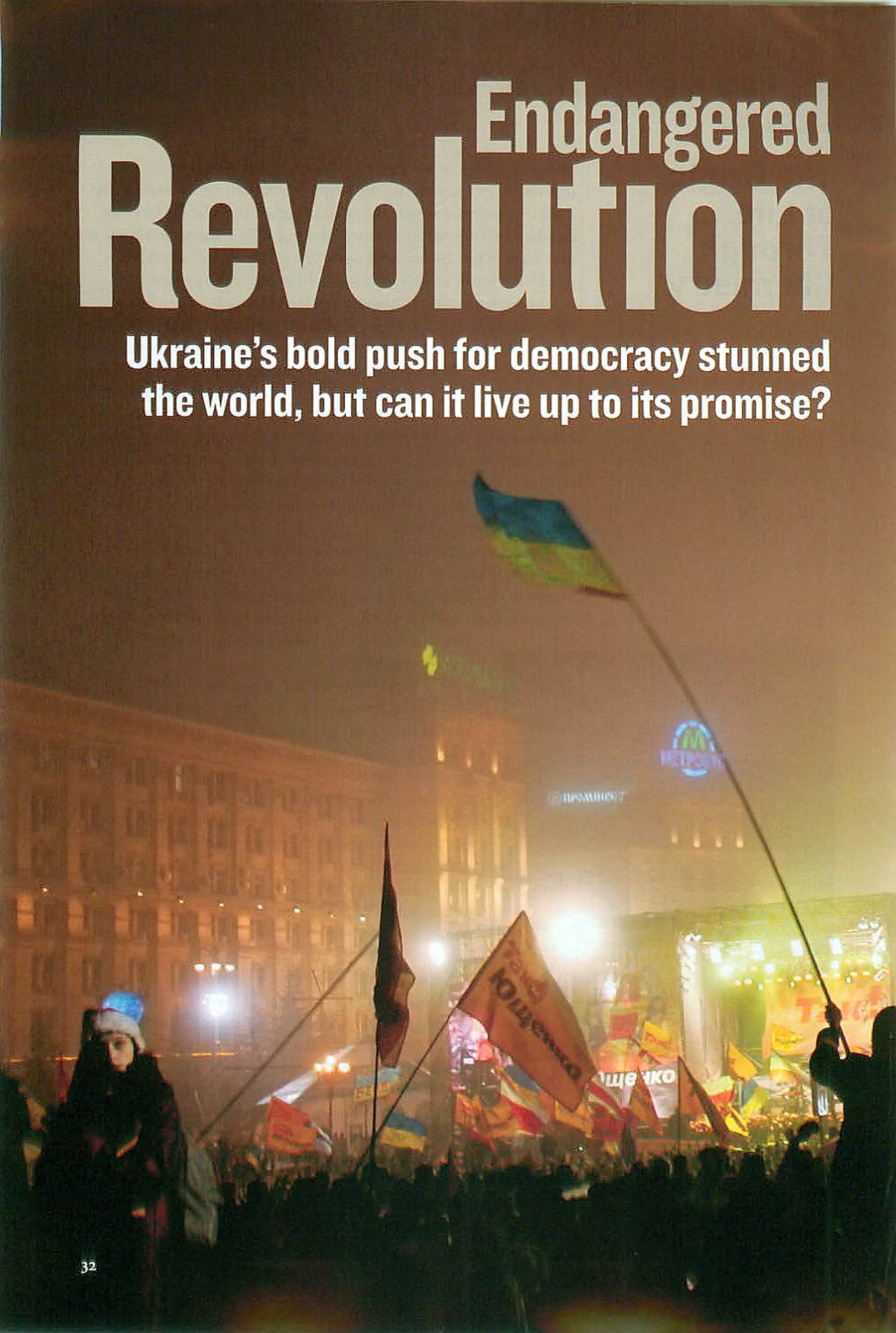
All of this is sure to be a matter of contentious debate for a long time. But ours would not be so interesting a world if its ultimate secrets were easily discovered. It took us four billion years to evolve to a point where we could even begin the search.

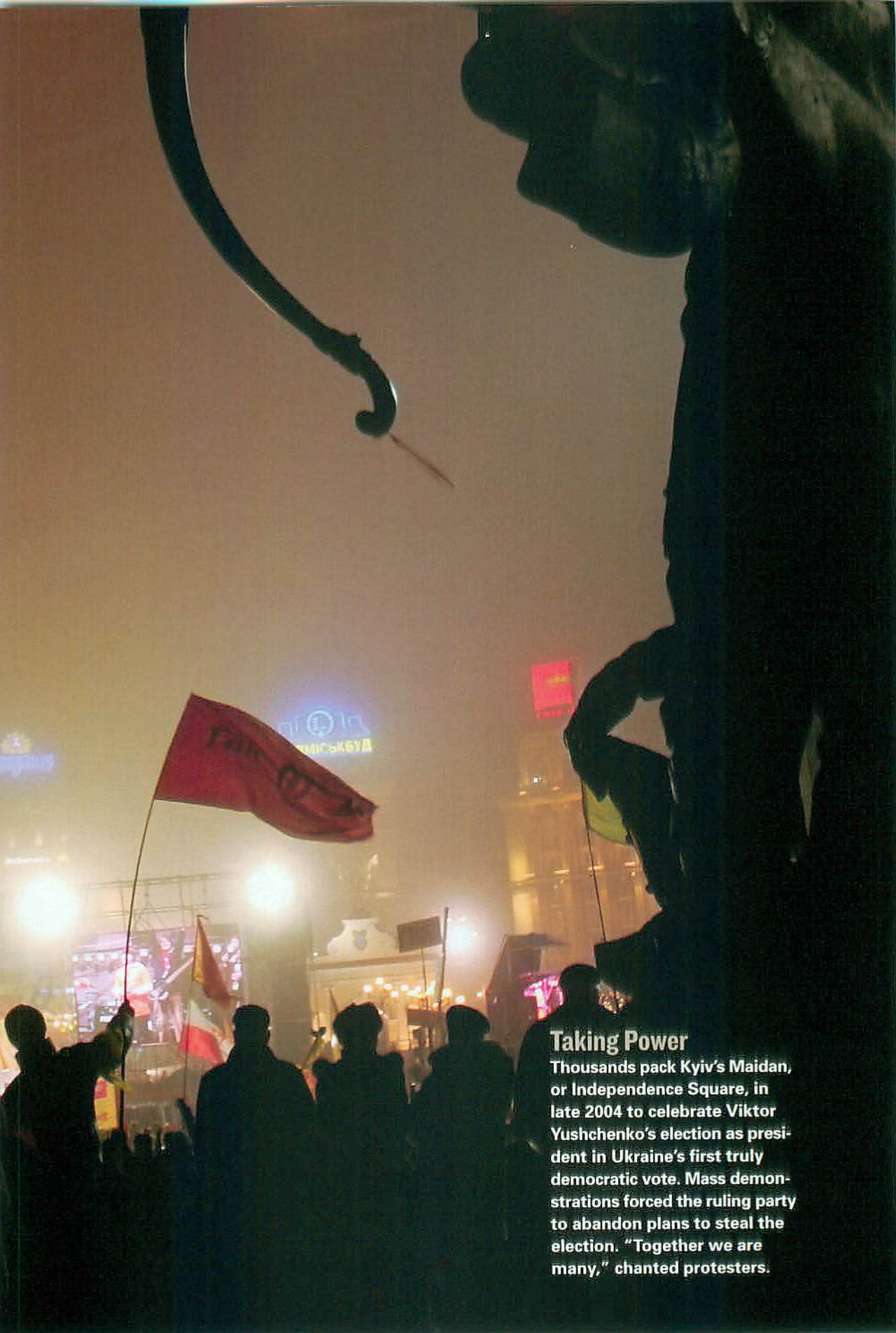
Joel Achenbach is a staff writer for the *Washington Post.*

ART: SAM HUNDLEY

Endangered Revolution

Ukraine's bold push for democracy stunned the world, but can it live up to its promise?





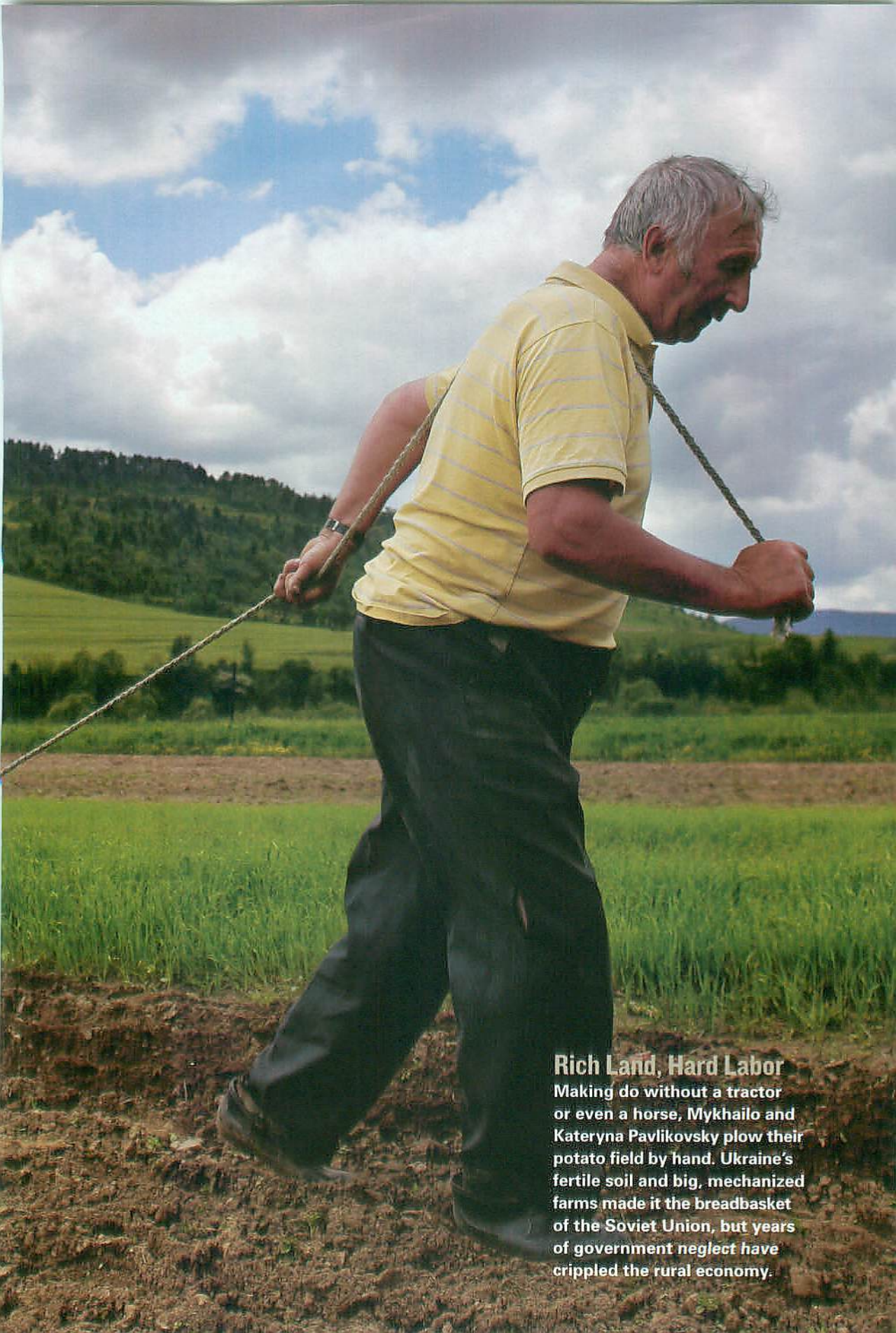
Taking Power

Thousands pack Kyiv's Maidan, or Independence Square, in late 2004 to celebrate Viktor Yushchenko's election as president in Ukraine's first truly democratic vote. Mass demonstrations forced the ruling party to abandon plans to steal the election. "Together we are many," chanted protesters.

OLME

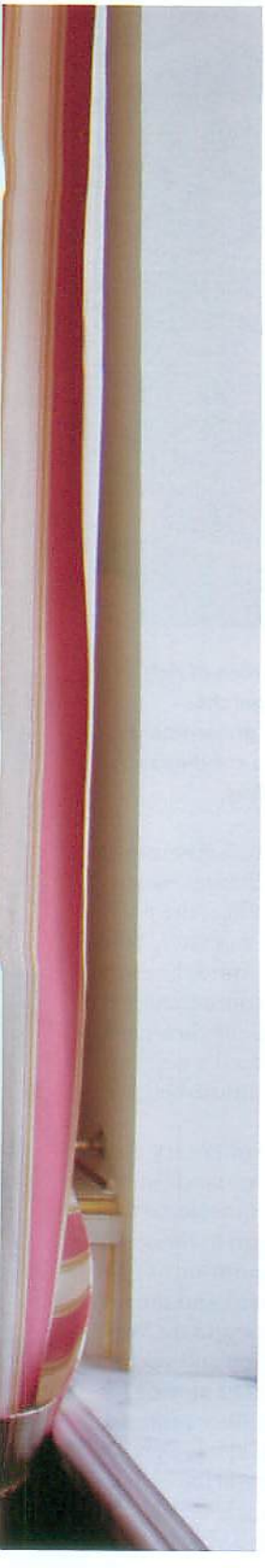
Free Spirits

A woman grabs a kiss from a Kyiv restaurateur at Arena, one of the city's hottest night spots. Kyiv's young and ambitious, most of whom are eager for Ukraine to join the European Union, helped spark the peaceful uprising that came to be called the Orange Revolution.



Rich Land, Hard Labor
Making do without a tractor or even a horse, Mykhailo and Kateryna Pavlikovsky plow their potato field by hand. Ukraine's fertile soil and big, mechanized farms made it the breadbasket of the Soviet Union, but years of government *neglect have* crippled the rural economy.

Unbowed
Scarred by dioxin poisoning during the bitter 2004 election campaign, President Viktor Yushchenko confronted tough challenges his first year in office: entrenched corruption, an anemic economy, and squabbling among allies who helped bring him to power.



BY ANDREW MEIER

PHOTOGRAPHS BY ANTHONY SUAU

When Viktor Yushchenko rises each dawn to begin the longest days of his life, he stares hard in the mirror. "The president doesn't recognize himself," an aide in his inner circle

confides. "For him, it's impossible to square the face in the glass with the man inside." For millions of his compatriots, however, Yushchenko's face—bloated, pockmarked, and deeply discolored—is a fitting symbol of their long-suffering land, scarred by the past yet surviving against all odds.

For years Yushchenko bided his time. Throughout the dark era of former President Leonid Kuchma, Ukraine, a nation of 46 million in a land larger than France, devolved into a fiefdom of regional clans and robber baron oligarchs. Reformers mounted feeble assaults on the halls of power, but the country was held captive by a criminal regime atop a foundering post-Soviet state. For Ukrainians who yearn to escape Russia's shadow and join the rest of Europe and the West, Yushchenko stood as the last great hope.

Then, almost on cue, came Yushchenko's brush with death. During the tense days leading up to the 2004 presidential election, then candidate Yushchenko fell gravely ill and had to be spirited out of the country for emergency treatment. Austrian doctors discovered the cause of his near-fatal sickness: dioxin poisoning. Yushchenko survived, but with a disfigured face that fueled outrage at the old regime, believed by many to have ordered Yushchenko's assassination. Instead of killing him, however, his rivals became unwitting handmaidens of his revolution.

A declaration echoed across Ukraine in the wake of Yushchenko's ascent: *Ya stoyav na Maidani!* It means "I stood on the Maidan," Independence Square in the heart of Kyiv. It also means, I was there, I stood up for freedom, I have a

Monuments to wealth, the homes of rich entrepreneurs and corrupt oligarchs—businessmen who profit from government connections—line an exclusive cul-de-sac south of Kyiv on the Dnipro River.

right to expect change. During those tense wintry weeks when the old regime tried to hijack the election and the future hung in the balance, Ukrainians young and old flooded the capital, setting up a tent city on the Maidan and taking over the Kreshchatyk, Kyiv's central avenue that doubles as Ukraine's main street. For weeks the world watched the standoff, wondering if civil war would erupt between western Ukraine, Yushchenko's stronghold, and the country's eastern half, home to most of Ukraine's eight million ethnic Russians. It didn't happen. Surrounded by riot troops, the protesters stood their ground in peace. Their only weapons were banners, T-shirts, scarves, and balloons, all the same orange color. The Orange Revolution was born.

In the end the courts sided with Yushchenko, and Ukraine entered an uncharted realm of promise. Soon after his inauguration the new president embarked on a world tour. Blazing through Western capitals, Yushchenko was hailed a hero, a Slavic Nelson Mandela from the old Soviet bloc. Suddenly the elite clubs of the West —NATO and the European Union—loomed on the horizon. Kyiv, meanwhile, was buoyant with hope. For months there was heady talk of a national revival. A land that had languished so long under the rule of license stood on the cusp of a spiritual cleansing. Many Ukrainians for the first time felt proud of being Ukrainian.

By last fall, however, Yushchenko's government had imploded. Corruption charges swirled in Kyiv. Just nine months in office, the president fired his popular prime minister, Yulia Tymoshenko, and her cabinet. Amid the ensuing burlesque of charges and countercharges, Ukrainians once again were shaking their heads over old troubles. And many faced a new fear: The Orange Revolution, still unfinished, was now endangered.

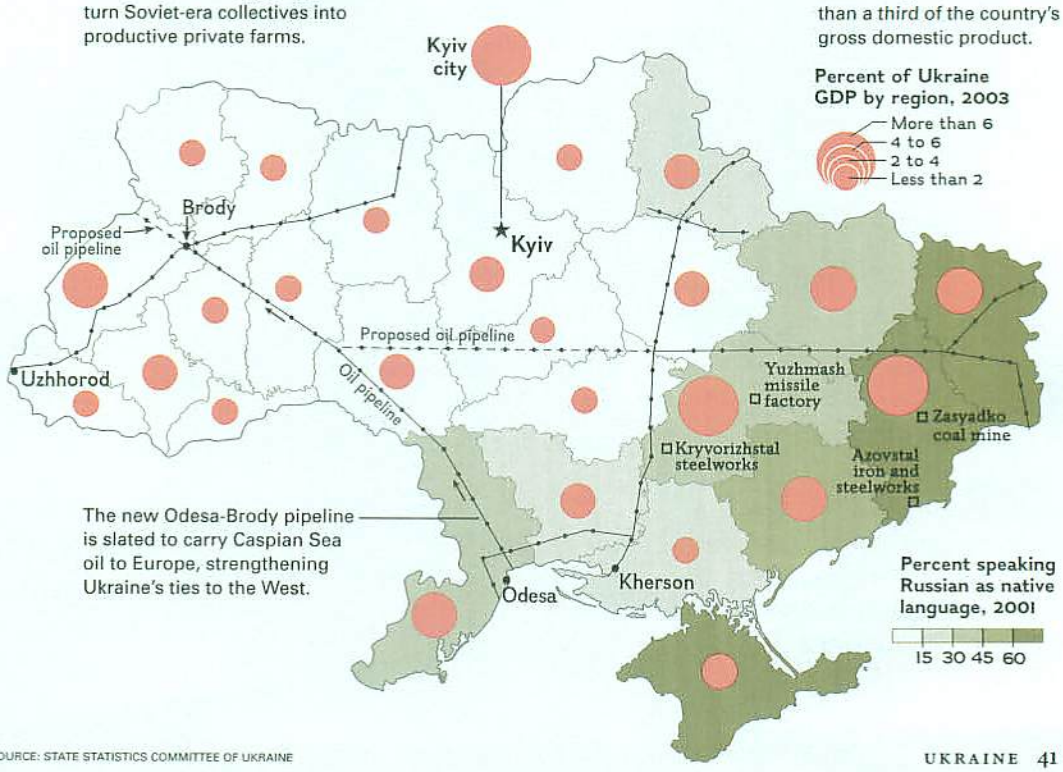
With the approach of parliamentary elections this spring, Ukraine again stands on the precipice. Will pro-reform forces overcome their infighting? Can Yushchenko, born in the east of Ukraine but driven by the aspirations of the west, bridge his nation's divisions and move it closer to integration with Europe and the West? Will efforts to weed out corruption and steer the economy toward a free market keep moving forward or stall? If progress made since protesters stormed the Maidan 15 months ago is a predictor, any push for lasting reform will have to surmount entrenched opposition.

Yushchenko was elected on a vow to clean

The Great Divide **Europe's second largest nation is torn between two worlds: In the industrial east and south of the country, most people speak Russian and favor close ties to Russia; in the agricultural west, most speak Ukrainian. This split translates into politics: In the 2004 presidential election, the west voted for Yushchenko, while the east and south voted for his Russia-backed opponent, Viktor Yanukovych.**

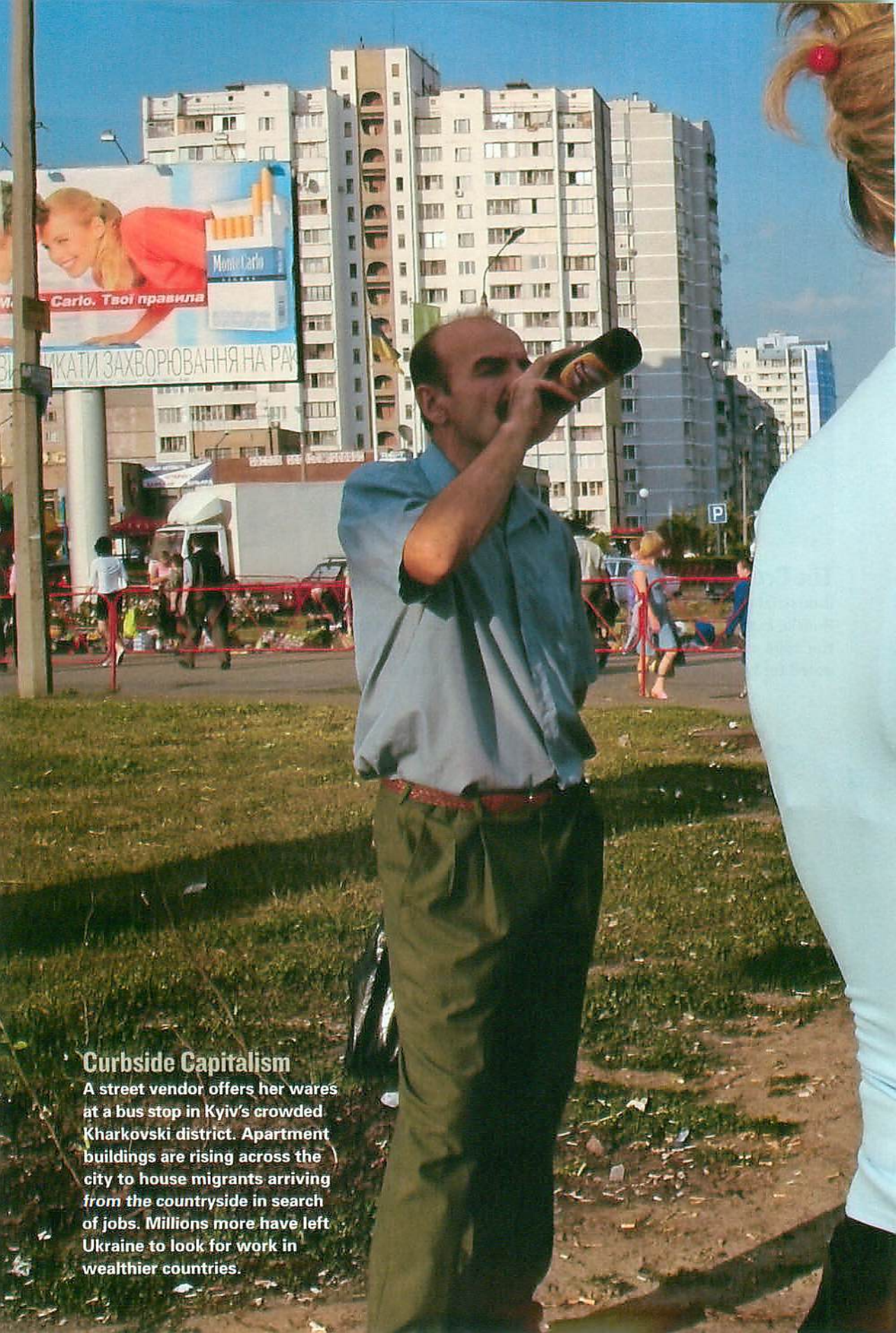
Farming dominates the poor, rural west, still struggling to turn Soviet-era collectives into productive private farms.

Factories and mines in five eastern regions create more than a third of the country's gross domestic product.



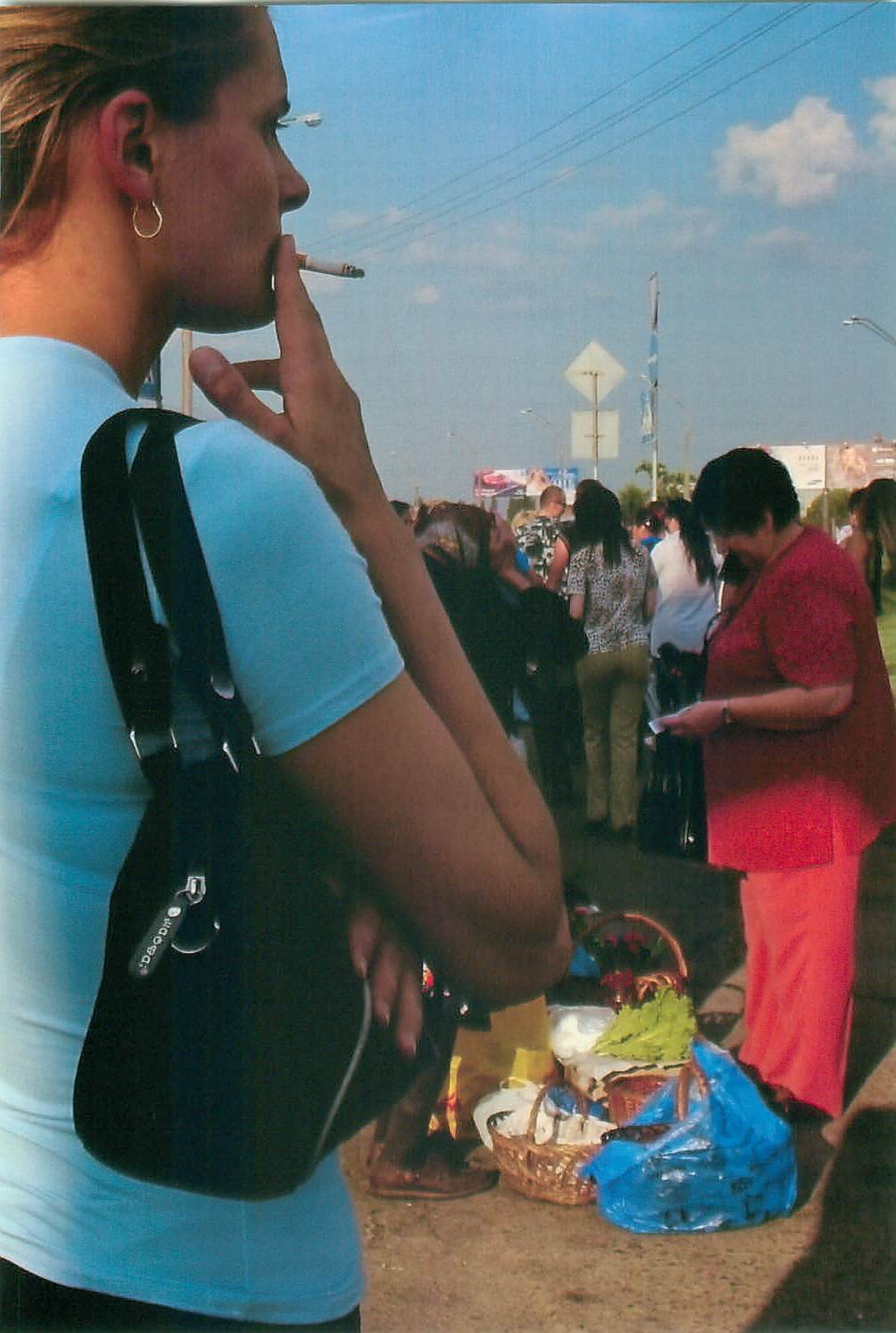
The new Odesa-Brody pipeline is slated to carry Caspian Sea oil to Europe, strengthening Ukraine's ties to the West.

SOURCE: STATE STATISTICS COMMITTEE OF UKRAINE



Curbside Capitalism

A street vendor offers her wares at a bus stop in Kyiv's crowded Kharkovski district. Apartment buildings are rising across the city to house migrants arriving from the countryside in search of jobs. Millions more have left Ukraine to look for work in wealthier countries.



house, and since his first weeks in office a war has raged across Ukraine, a campaign against corruption. At times the battle has threatened to spill blood; at times it has risked turning to farce. As I traveled the country the summer after Yushchenko took office, the corrupt powers that upheld the Kuchma regime were under fire in many of their old haunts. Indeed, in a corner of western Ukraine bordered by four countries —Poland, Slovakia, Hungary, and Romania— a foot soldier of the revolution had already won a battle against the regional boss.

Yuriy Rakhovsky heads up the Ministry of Internal Affairs office in Uzhhorod, a border city thick with traders and uncertain wares. Standing well over six feet tall, Rakhovsky is a dark coil of muscle and anxiety. When he speaks, in a bass staccato, jabbing the air with his forefinger, his muscles show beneath a dark blue suit. The suit is new, a concession to his recent promotion. Before the revolution Rakhovsky had worked as a detective. He had ambitions, of course, but becoming head honcho was not among them. Then he built a case against the man who had run Uzhhorod under Kuchma, Ivan Rizak. Now Rakhovsky is a very busy man.

AS CORRUPTION SPIRALED during the Kuchma years, Ukraine nearly achieved rogue state status.

On the day of my visit, I was kept waiting outside his office at police headquarters for four hours. When I was finally allowed in, Rakhovsky stood behind a broad desk at the far end of the long room, a cell phone pressed to an ear. Now and then he distractedly tapped a tank of tropical fish beside a bank of phones.

"A raid," he explained in short bursts of words. "Final preparations. A stolen truck. Hungarian contraband. Rounding up the whole gang." Unhooking a pair of cell phones from his belt, he placed them on the desk like a gunslinger unholstering his six-shooter at a poker table.

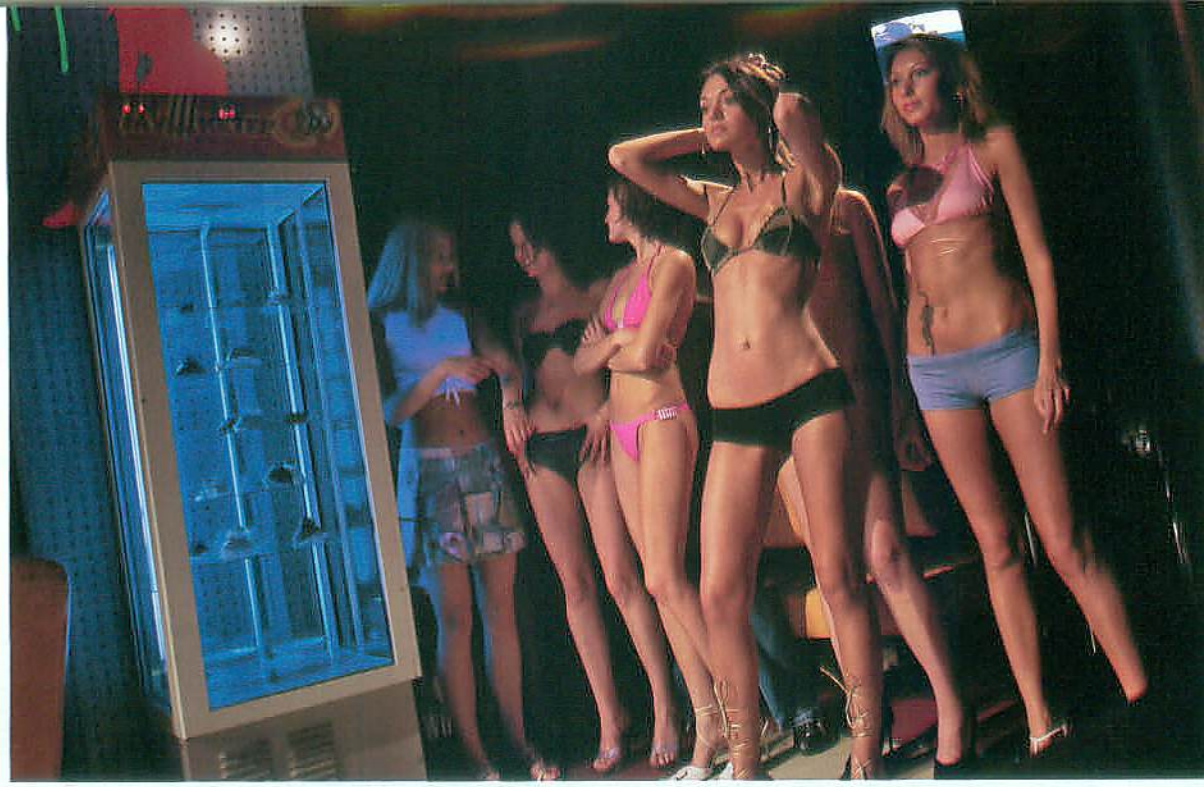
When I asked how he had snared a powerful figure like Rizak, Rakhovsky revealed a distaste for publicity. "That's a question for the governor," he said, chuckling at the thought of Rizak sitting in prison a few blocks away. The "governor," as Rizak was called, stood accused of half a dozen crimes, including graft and "leading a man to suicide." That man was 61-year-old Volodymyr Slyvka, dean of Uzhhorod National University and two-time laureate of the state prize for science. Rizak, it was alleged, had pressured the dean to force the 13,000 student body to vote for Kuchma's chosen successor, Viktor Yanukovych, an ex-prime minister from the east who had served time in Soviet jails for assault.

"The dean had terrible relations with Rizak," Rakhovsky explained. "Once he was out of the way, the governor replaced him with his own man, but the students still voted for Yushchenko."

How had the dean committed suicide? I asked. "That's the strange thing," Rakhovsky said. "No bullet, no rope. Just cuts—many, many knife cuts." According to press reports, Slyvka's wife found him in the bath, his veins cut and a kitchen knife in his chest.

Other Kuchma cronies felt the heat. His minister of transportation was found "prematurely deceased" in his dacha outside Kyiv. The former interior minister was discovered with two bullets in his head just hours before he was to have been questioned by police. Both deaths were ruled suicides, but many Ukrainians suspect the men were silenced by former associates with secrets to hide. "Suicide has become popular in our country," quipped Oleksandr Tkachenko, a Kyiv media executive. By the end of 2005, more than half a dozen key players in Kuchma's regime were in jail, exile, or graves. Dozens of lesser officials were charged in the anti-corruption drive.

Another top priority for the fledgling government has been resolving the case of Georgiy Gongadze, a 31-year-old investigative reporter whose headless corpse was discovered in 2000 in a shallow grave outside Kyiv. Gongadze had made a career raising the ire of the Kuchma regime. On secret recordings from Kuchma's office, a voice strikingly similar to the former president's tells an aide how best to get rid of the meddling journalist. Yet at the time of the 2004 presidential elections, police still had not



Long-legged beauties audition during a "talent search" at a club in Kyiv, a city popular with sex tourists. The hardships of Ukraine's post-Soviet market economy lead many women to sell their looks and their bodies.

apprehended Gongadze's killers. Worse still, his body remained unburied in a city morgue.

"Burying Gongadze is essential if we are ever to move forward," Yushchenko told a friend soon after taking office. A funeral would be a potent symbol of the new government's commitment to the rule of law. Last summer three men suspected of being the triggermen were charged with Gongadze's murder, but efforts to track down the kingpins who ordered the killing seemed to stall. As Ukraine marked the first anniversary of the Orange Revolution late last year, the investigation was still under way, and Gongadze's body was still unburied.

THE HEADLESS CORPSE of an uncompliant reporter, the poisoned face of a presidential rival—both are appalling emblems of the former government's disregard for the rule of law, the same disregard that landed Ukraine's economy in hock to criminals. As corruption spiraled during the Kuchma years, Ukraine nearly achieved rogue state status, its president rejected at NATO confabs and its Red Army surplus turning up in unlovely corners of the world. (Cargo planes were sold to cocaine wholesalers in Colombia, for instance.) At home, meanwhile, business disputes resembled gangland warfare. Police still find victims who were disposed of behind walls and under floorboards.

Yaroslav Rushchyshyn is a survivor of those dangerous days. A 38-year-old clothing manufacturer, he launched his company, Trottola, in 1994. He remembers well the fat bribe he had to pay an official to get an export quota. He also recalls how his competitors—those "with connections in Kyiv"—received shipments of Chinese-made suits virtually duty-free by declaring their value to be a ludicrous 17 cents apiece. "How could I compete?" Rushchyshyn exclaimed. An ardent supporter of the Orange Revolution, he is grateful to the new president for closing old loopholes.

From the outside, Rushchyshyn's factory reminded me of the grim textile mills that a hundred years ago lined the industrial Northeast corridor of America, sweatshops where women and children once toiled under cruel conditions. Inside, however, a new ventilation system pumped cool, filtered air to women tending sewing machines beneath fluorescent lights, their workstations adorned with orange pennants. "I care about their health," Rushchyshyn said, proudly displaying a certificate awarded by

a team of human rights inspectors from the European Union.

Ten countries—eight from the old Soviet bloc—were admitted to the EU in 2004, bringing higher wages and better benefits to their workers. As a result, "Ukraine became Europe's sewing machine," Rushchyshyn said. "We're selling cheap labor." Rushchyshyn employs 2,000 workers, most of whom average 120 dollars a month in wages, up from four dollars a month when he founded the company 12 years ago. Of the quarter million blouses, dresses, and trousers his employees produce each month, virtually every item is shipped out of Ukraine and sold to European consumers under English, French, and Swedish brand names. Rushchyshyn would prefer to make Ukrainian clothes for Ukrainians, "but that's a dream for tomorrow," he says. "The revolution has taught us to like things Ukrainian, but today there is no market in Ukraine, only in Europe. It doesn't make me happy, but that's the reality."

Another unhappy reality facing Ukraine is the outflow of its human capital. Millions of

Kneeling to pray, Orthodox Christians circle their church to mark the 30th day after Easter. Persecuted by the Soviets, both Ukraine's Orthodox and Catholic churches are reclaiming buildings, congregations, and souls.

Ukrainians—seven million was one estimate I was given, although no one keeps exact figures—have gone abroad in search of a living since the Soviet Union dissolved. One migrant, a nurse by training, reported earning far more money picking olives in Portugal than providing medical care in Ukraine. Such imbalances fuel the flight of workers to other countries. "We can't stop it," a government adviser admitted. "Too many families survive on the money sent home."

Like foreign workers the world over, Ukrainian migrants often fill menial jobs: farm laborer, dishwasher, housekeeper, child care provider. And like other economic refugees far from home, some fall prey to exploitation.

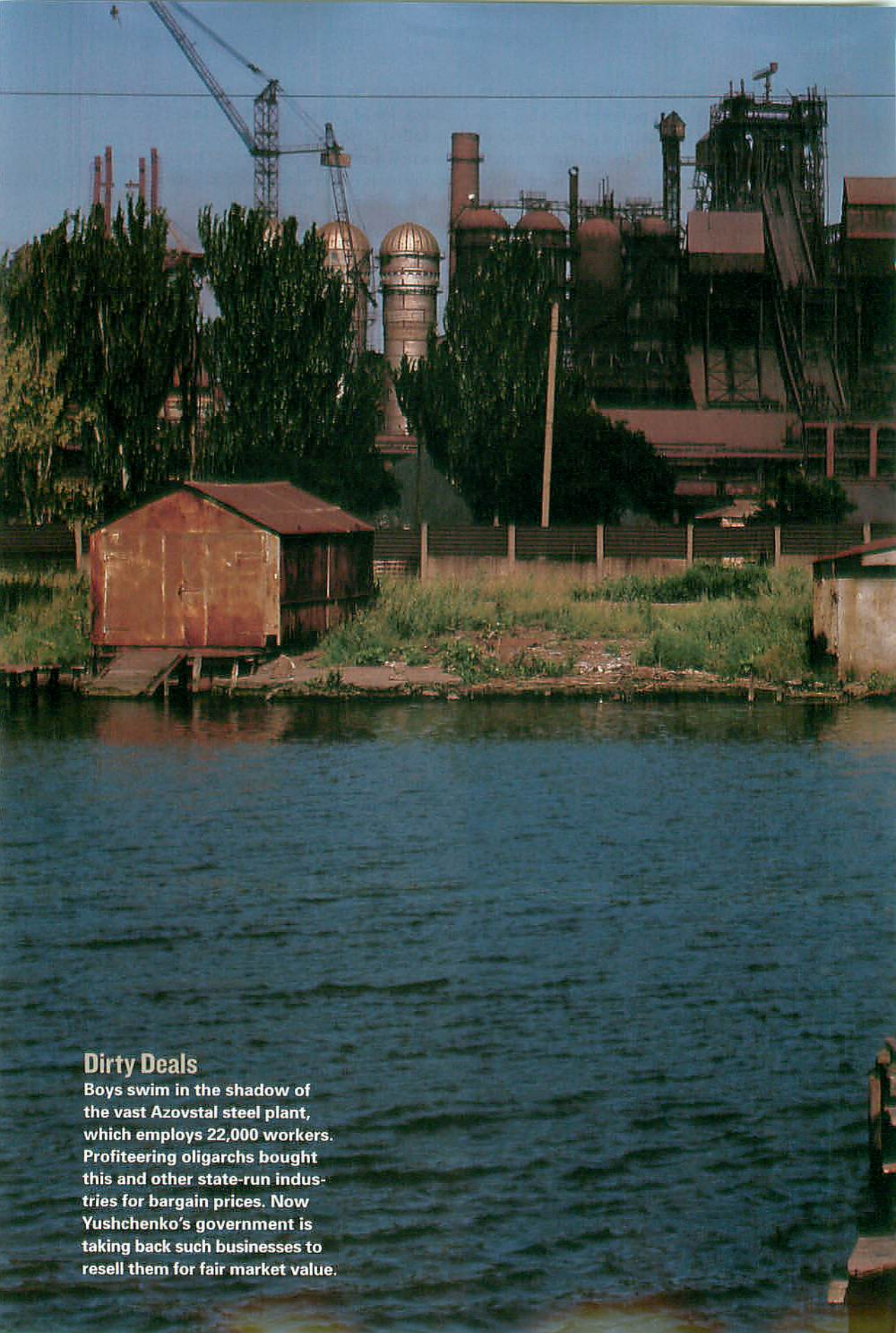
At the Kyiv office of the International Organization for Migration (IOM), Oksana Horbunova detailed case after case in which Ukrainian women were enticed overseas by promises of glamorous careers modeling and dancing, only to be ensnared in the sex industry. Other victims were forced to work in factories and on farms, even beg on the streets.

The IOM runs a rehabilitation center in Kyiv where psychiatrists, nurses, and social workers have ministered to more than 650 women and children over the past five years. Contrary to common notions, most victims were not naive farm girls with little education. The majority came from urban areas, and one in five had earned a university degree. The youngest victim was age 3, the oldest 62.

Stanching the outflow of its citizens is vital to Ukraine's future, and not just for humanitarian reasons. Ukraine suffers the lowest birthrate in Europe. With deaths outpacing births by a factor of two, the current population of 46 million is projected to drop by as much as 40 percent by 2050. Old plagues such as alcoholism and smoking, as well as new challenges such as drug-resistant tuberculosis, loom large.

But HIV/AIDS casts the darkest specter. In 1994 there were 223 registered cases of HIV in Ukraine. By 2003 the number exceeded 68,000. The actual number may be more than 600,000, surpassing prevalence rates in India, China, and the rest of Europe. By 2016 as many as 2.1 million Ukrainians will die of AIDS and AIDS-related disease. Beyond the human cost, the epidemic will tax the economy. By 2010, analysts fear, HIV/AIDS could consume half of the Ministry of Health's budget. The toll is certain to affect Ukraine's productivity, warns the World Bank, with economic growth rates declining by as much as one percent a year.

IF YUSHCHENKO is to get the economy off life support and revive it for the 21st century, he will need to rein in the small circle of oligarchs who grew preposterously rich during the great grab of the Kuchma era. Among these privileged few, 39-year-old Rinat Akhmetov—by most reckonings Ukraine's richest man—stands apart. The son of a coal miner, Akhmetov is spoken of with fear in Kyiv and reverence in his home region of the Donets Basin, or Donbas, in eastern Ukraine. He rules over System Capital Management (SCM),



Dirty Deals

Boys swim in the shadow of the vast Azovstal steel plant, which employs 22,000 workers. Profiteering oligarchs bought this and other state-run industries for bargain prices. Now Yushchenko's government is taking back such businesses to resell them for fair market value.

a vast conglomerate that includes holdings in heavy industries, power plants, media companies, breweries, a soccer team, and Ukraine's glitziest hotel, the Donbass Palace.

The Palace is a temple to the new times, a citadel of marble and smoked glass in the heart of Donetsk, capital of Ukraine's black-collar coal-mining region. One morning last summer, the Palace was abuzz with activity. Young businessmen and women in pinstripes and pantsuits rushed through its gilded foyer clutching briefcases, headed, it seemed, for urgent appointments with strategic investors. Lissome young Ukrainian women in Italian stilettos glided across the marble, floating toward the boutiques nearby. In a plush lounge, a fountain of molten chocolate gurgled beneath a chandelier, while a pianist in tails played ballads on a white baby grand. Everything about the Palace announced it as a rare crossroads of culture and business, efficiency and success.

The tableau, however, was a facade, a set for a TV commercial ordered up by Akhmetov, who just days before had been "invited" in for questioning by the police. The ad was part of a broader public relations strategy to improve the oligarch's image. Akhmetov was suddenly eager to embrace the revolution, the West, and Wall

Dying of AIDS, a prisoner lies in a clinic in Odesa. The disease's rapid spread, as well as alcoholism, poor health care, emigration, and low birthrates, are projected to shrink Ukraine's population 40 percent by 2050.

Street. When the ad aired across Ukraine and Europe, the letters SCM were emblazoned in revolutionary orange.

To true supporters of the revolution, Akhmetov is a poster boy for the rigged privatization deals that handed insiders control of many of Ukraine's fattest enterprises for a song. Just months before the 2004 election, Akhmetov and his erstwhile partner, Viktor Pinchuk—the son-in-law of then president Kuchma—won control of the massive Kryvorizhstal steelworks for a mere 800 million dollars. Foreign bidders had offered much more for the mill, one of the world's largest and most profitable. Within weeks of coming to power, Yushchenko's government announced its intention to resell the mill, this time for its market value. Last October the world's largest steel company, Mittal, purchased the plant for 4.8 billion dollars at an auction witnessed on television by millions of Ukrainians. That single transaction boosted foreign investment in Ukraine by 50 percent.

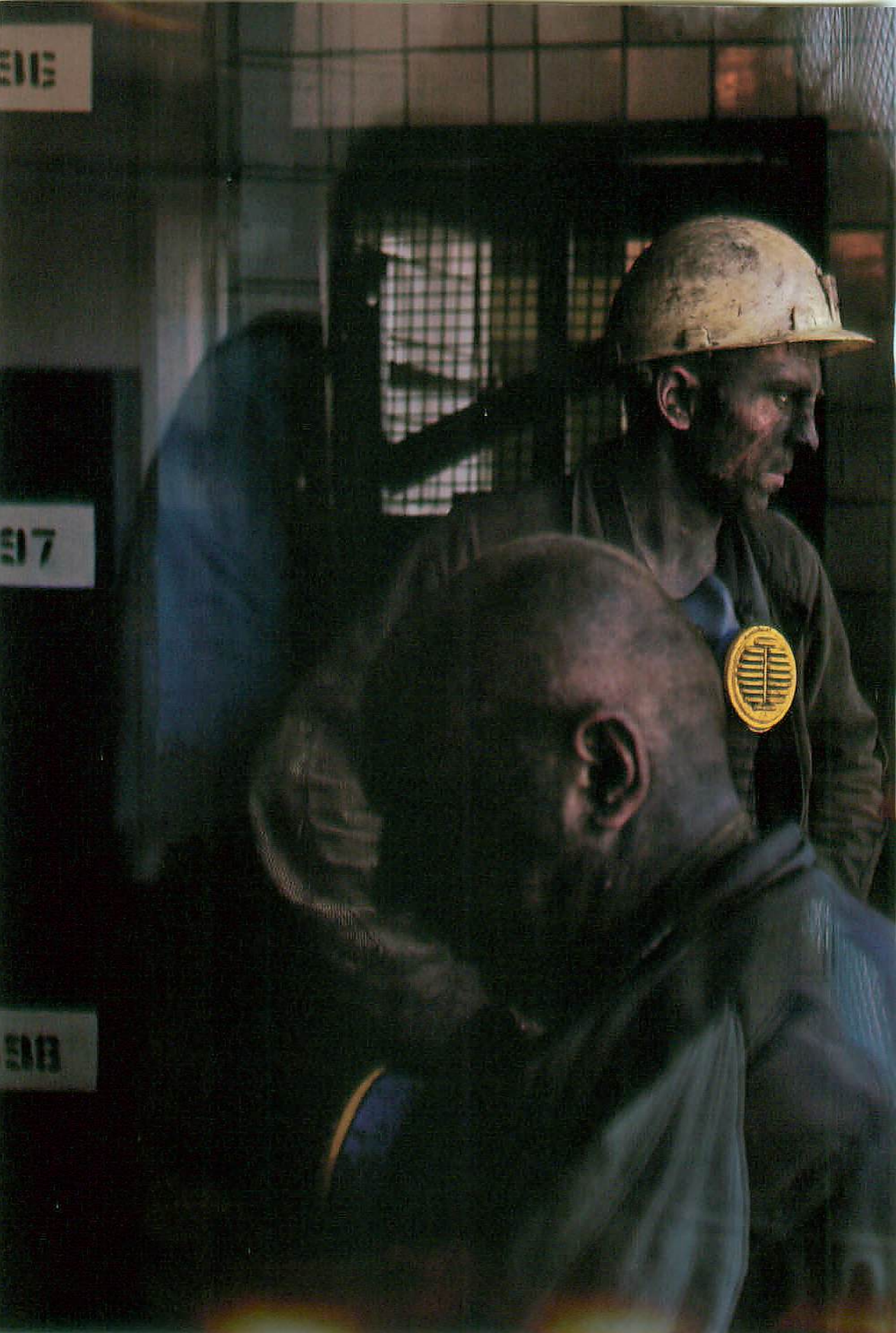
Akhmetov may have lost his biggest prize, but he also struck a deal with the new powers in Kyiv that allows him to retain control over much of his empire. And late last year he announced his intention to run for parliament in the upcoming election, a bid some think he could win.

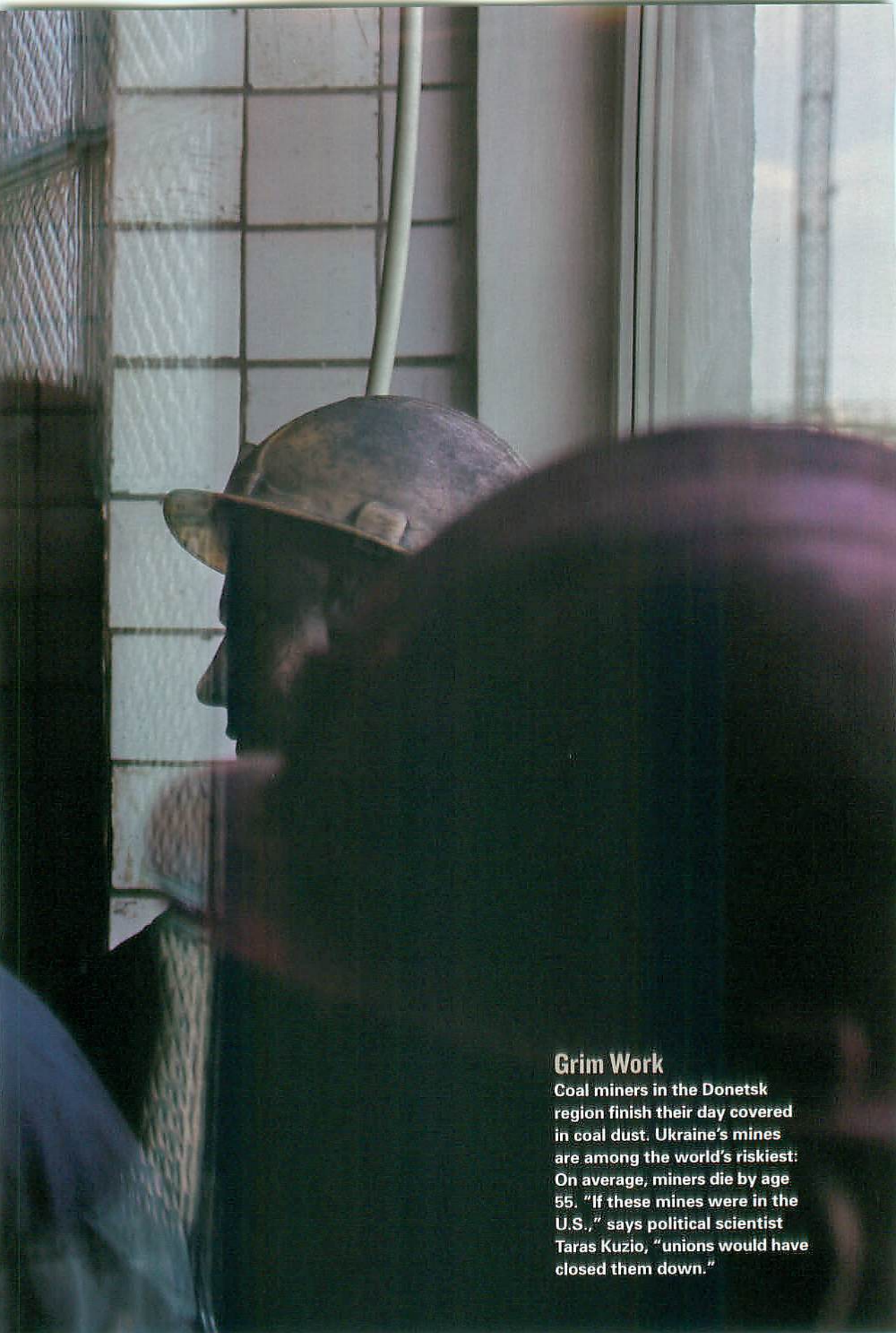
Always a proud and fiercely defiant region, Donetsk stands squarely behind its oligarch—and against Yushchenko and his westernizing agenda. At the Zasyadko coal mine, one of 114 active mines in the Donets Basin, I met 29-year-old Oleg, who has spent most of the past five years underground. His face was pallid, the rings circling his red eyes as dark as eyeliner. As a kid Oleg had no intention of following his father and grandfather into the mines. But, he says, he had no choice but to go "down there."

Ukraine's mines are among the most lethal in the world. More than 4,300 miners have died since the fall of the Soviet Union, after which state funding withered and safety along with it. Oleg knew the numbers well. He had nearly been among the dead in 2001 when a methane blast ripped through the Zasyadko mine, killing 55 of his fellow workers. "I was down there with them," he said. "Lucky, I guess."

Oleg had no interest in national politics and no faith in the new government. In a voice so soft I had to lean in to hear him, he said he wanted only to work and make what passes for a living in these parts.

"If the mine is in the government's hands, there's no order, only chaos," he said. After the miseries of the Kuchma era, it made little sense to believe the government, let alone fight for the survival of the revolution. He had no love for the oligarchs, but at least they kept the mines open. Like many in eastern Ukraine, Oleg had





Grim Work

Coal miners in the Donetsk region finish their day covered in coal dust. Ukraine's mines are among the world's riskiest: On average, miners die by age 55. "If these mines were in the U.S.," says political scientist Taras Kuzio, "unions would have closed them down."

staked his future on the discomfiting trade-off so prevalent across the former Soviet lands—stability for freedom.

Nostalgia for Soviet stability runs deep in the eastern city of Dnipropetrovsk, a belching swath of pipe factories and old missile plants cleft by the meandering Dnipro River. I spent two nights here in an aging brick and concrete apartment tower overlooking the Dnipro, a tired guest in the welcome clutches of Galina Mikhailovna Matsygailo. A robust widow of 68, Galina wore a blue cotton blouse dotted with white seashells, her gray hair pulled back tight. With her homemade vodka and *salo*—a Ukrainian staple that is nothing but pork fat—she nearly killed me with hospitality.

Galina had just retired from what she called her "capitalist career," part-time work in a travel agency run by an émigré. But it was her long career under communism that she recalled with pleasure and pride. For 18 years she had worked in state agriculture as an "incubator," hatching chickens, geese, and turkeys and flying them by helicopter to state farms across eastern Ukraine. Stocking the farms was hard work, but vital. They would incubate more than a million birds a season, she said. And today? I asked. "Not a single one. The system's destroyed."

Caught in the act, the principal of a mining school watches as police bag evidence—one of three $100 bills undercover officers gave her in return for unearned diplomas. Her sentence: three years in prison.

The 11th of each month is pension day, and it was then that I met Lidia Ivanovna Neskoromnaya, Galina's good friend who lives on the same floor. A state courier not much younger than the two women had delivered the pensions, and Lidia had rushed over, barefoot and wearing a sky blue apron, to collect her stack of hryvnias—thin banknotes she counted with care after wiping her hands of cooking grease. Lidia receives 371 hryvnias, Galina 415—about $74 and $83 respectively. Both also get the "Yushchenko bonus," three dollars added since the revolution as a hedge against inflation.

Lidia had worked 38 years at Yuzhmash, the missile factory on the outskirts of town that Kuchma had once run, back in the days when it employed 50,000 workers and churned out the SS-20s the Soviets aimed at the West. As the two women spoke of the past, their eyes grew moist. Lidia remembered the days when Yuzhmash had "orders from all across the U.S.S.R. and abroad." Galina recalled the barges that used to crowd the Dnipro, and the music that flowed from the tourist boats up to her narrow balcony.

The two friends chatted amiably until the talk turned to events in Kyiv. Their building has 84 apartments, but few of the residents had voted for Yushchenko. "Only three were willing to admit it," said Galina, who had cast one of the votes. As she spoke of her hopes for the revolution, Lidia tightened her round face and screwed up her eyes. She could not brook any talk of a new order. She had no illusions about Kuchma, for long ago she and her husband had worked beside him. ("Kuchma destroyed the factory," she said, "and then he destroyed the country.") But Lidia had no love for "the changes."

"You have to know the history," she said. "There are fault lines. Ukraine was never a unified country. The east has always been closer to Russia. We've always looked to Moscow, and the west to Europe."

UKRAINE'S CULTURAL SCHIZOPHRENIA has roots deep in its tortured past, which spans more than a thousand years of bloodshed, foreign domination, and internal divisions. In the tenth century Kyiv was at the center of the first Slavic state, Kyivan Rus, the birthplace of both Ukraine and Russia. Then came Tartar invaders from the east, followed by Polish and Lithuanian armies from the west. For part of the 18th century and all of the 19th, Ukraine was absorbed into the Russian Empire. The 20th century was the most brutal of all, with two famines that killed more than eight million Ukrainians, and two World Wars in which seven to eight million more died. By the 1950s Soviet power had broken the peasantry's back, Russified Ukrainian culture, and buried its ancient heritage. The Soviets' final

Making Do

Families picnic beside their Soviet-era cars near a river in Izyum. Ukrainians' living standards lag behind those of their counterparts elsewhere in eastern Europe. Yushchenko hopes to change this by attracting new foreign investment.

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insult was the Chornobyl nuclear disaster, whose death toll still mounts.

In geographic terms, Ukraine straddles the heart of Europe, but in every other register it remains torn between East and West. The westernmost part of the country became part of Soviet Ukraine only when the U.S.S.R. expanded in the wake of World War II. Differences in language (learning Russian was mandatory under the Soviets, but no longer), religion (western Ukraine is mostly Catholic while the east is largely Orthodox), and opportunity are legacies of history that will prove hard to overcome.

In the cobblestone heart of Lviv, I found myself surrounded by the spirits of dead empires. Lviv dates from the 13th century and was at various points in its misshapen history Austro-Hungarian, Polish, and German. The Nazi-Soviet deal known as the Molotov-Ribbentrop Pact handed it to the U.S.S.R. in 1939.

Lviv lies in the heart of the Orange Zone, home of Yushchenko's most devout electorate. Even after decades of Soviet repression, Lviv and the surrounding region remain largely and fervently Catholic. The villages that dot the rutted roads along the nearby Polish border are dominated by crosses. No matter how small, each village has at least two outsize churches.

UKRAINE AGAIN STANDS on the precipice. Will pro-reform forces unite? Can Yushchenko bridge his nation's divisions?

Stepan Kurpil and his wife, Natalya Balyuk, both newspaper editors, mirror the regional sensibility. She grew up in a Russian-speaking home, but she is proud to announce that their ten-year-old daughter, Yulia, learns German and English, "but not Russian."

Traversing the country for a month, I heard Ukrainians speak of their famous divide. Both west and east blame the other for the nation's failings. In a factory where Ukrainians now assemble Czech-made Skoda cars, the manager had made an absurd claim: "Only western Ukrainians could become European workers." Weeks later in Donetsk, a demure 24-year-old woman studying Japanese and English had declared with a straight face, "In western Ukraine people are just different—genetically." Her comment wasn't meant as a compliment.

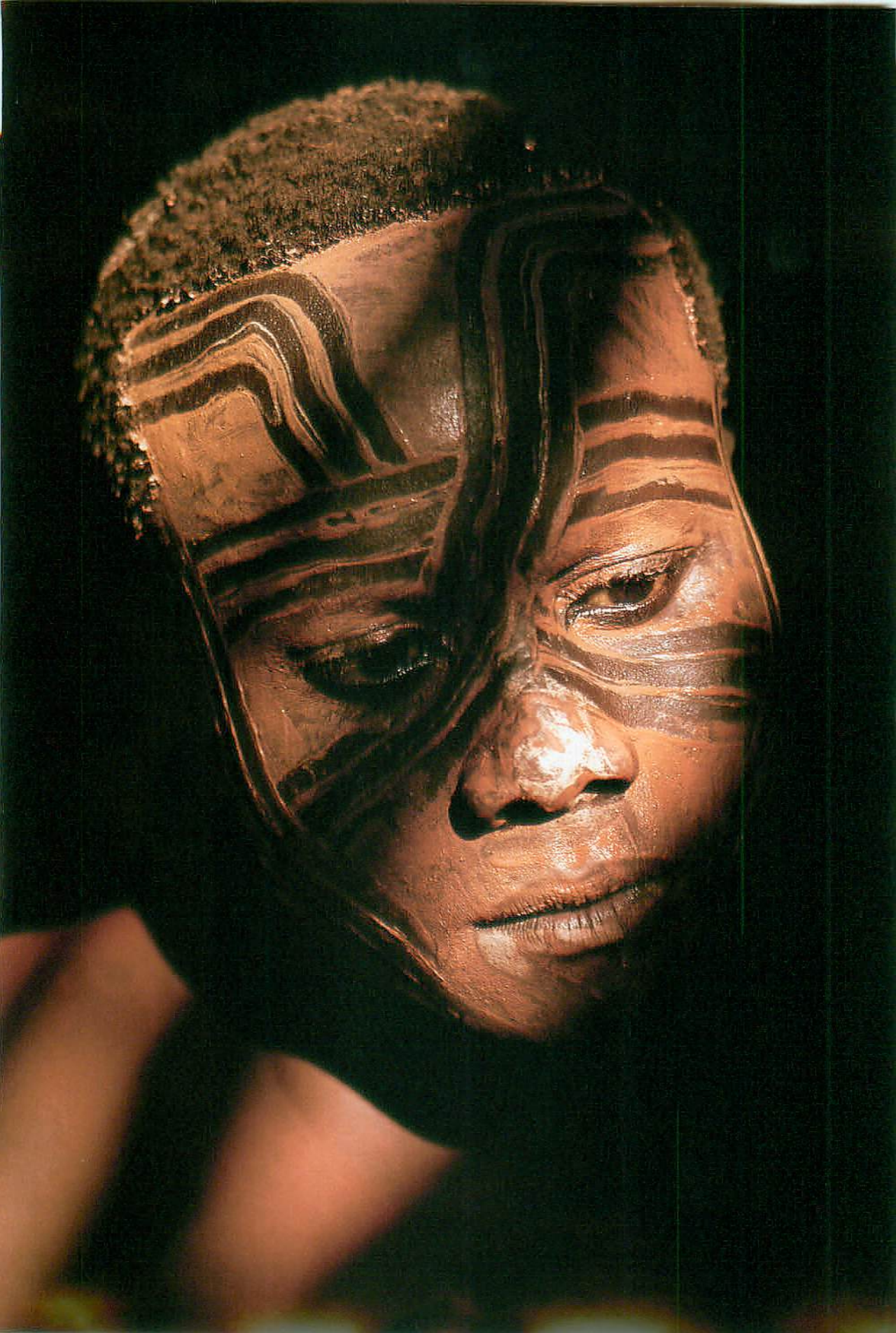
Yushchenko addresses the nation August 24, 2005, days before he fired his prime minister, at right, and her cabinet. Parliamentary elections this month will test whether voters still back Yushchenko's plan to reform Ukraine.

Yet in both the east and the west I also heard the same woes from men and women who, like so many of their compatriots, knew no luxuries but time. I heard them mourn the past and fear what lay ahead. On the night train to Odesa, I overheard two women wonder how their president looked. "Stronger," they agreed, whispering about his poisoned face. And in Kyiv I sat with one of Ukraine's first dissidents, Evhen Sverstjuk, who served 12 years in Soviet jails and exile. "We're facing an unknown," worried the philosopher, who at 77 still edits a small religious paper. "We're an independent country at last, but where are we going in this new century? What are we carrying with us? What lessons?"

Those questions, and many others, still linger. But so do the hopeful words of a young member of the revolutionary army who had joined in the protest on the Maidan, Independence Square. Like many young Ukrainians east and west, Andriy Shevtsiv enjoys a blissful distance from the Soviet past that still haunts Evhen Sverstjuk's generation. Only 19 years old, with hair that drapes his shoulder, Andriy seemed too young to help build a new democracy. But as we spoke—he groping for words in Russian, which he rarely speaks now—I felt the same mixture of relief, wonder, and fear that had flooded the country in the revolution's first triumphant hours.

"Every revolution gets exploited," Andriy said with unexpected wisdom. "But don't worry. The Maidan remains in our hearts." □

Great Expectations Has the Orange Revolution lived up to its promise? Share your opinion in our forum, then hear insights from photographer Anthony Suau in an interview at **ngm.com/0603.**



The genes of people today tell of our ancestors' trek out of Africa to the far corners of the globe.

THE GREATEST JOURNEY

MONGOLIA

BRAZIL

UNITED STATES

An Onge man (left) and others like him from the Andaman Islands off Myanmar carry some of the oldest genetic markers found outside Africa—evidence that *Homo sapiens,* or modern humans, headed east from Africa as long as 70,000 years ago. Fanning out across the continents, they gave rise to new faces and races.

BY JAMES SHREEVE

Everybody loves a good story, and when it's finished, this will be the greatest one ever told. It begins in Africa with a group of hunter-gatherers, perhaps just a few hundred strong. It ends some 200,000 years later with their six and a half billion descendants spread across the Earth, living in peace or at war, believing in a thousand different deities or none at all, their faces aglow in the light of campfires and computer screens.

In between is a sprawling saga of survival, movement, isolation, and conquest, most of it unfolding in the silence of prehistory. Who were those first modern people in Africa? What compelled a band of their descendants to leave their home continent as little as 50,000 years ago and expand into Eurasia? What routes did they take? Did they interbreed with earlier members of the human family along the way? When and how did humans first reach the Americas?

In sum: Where do we all come from? How did we get to where we are today?

For decades the only clues were the sparsely scattered bones and artifacts our ancestors left behind on their journeys. In the past 20 years, however, scientists have found a record of ancient human migrations in the DNA of living people. "Every drop of human blood contains a history book written in the language of our genes," says population geneticist Spencer Wells, a National Geographic explorer-in-residence.

The human genetic code, or genome, is 99.9 percent identical throughout the world. What's left is the DNA responsible for our individual differences—in eye color or disease risk, for example—as well as some that serves no apparent function at all. Once in an evolutionary blue moon, a random, harmless mutation can occur in one of these functionless stretches, which is then passed down to all of that person's descendants. Generations later, finding that same mutation, or marker, in two people's DNA indicates that they share the same ancestor. By comparing markers in many different populations, scientists can trace their ancestral connections.

In most of the genome, these minute changes are obscured by the genetic reshuffling that takes place each time a mother and father's DNA combine to make a child. Luckily a couple of regions preserve the telltale variations. One, called mitochondrial DNA (mtDNA), is passed down intact from mother to child. Similarly, most of the Y chromosome, which determines maleness, travels intact from father to son.

The accumulated mutations in your mtDNA and (for males) your Y chromosome are only two threads in a vast tapestry of people who have contributed to your genome. But by comparing the mtDNA and Y chromosomes of people from various populations, geneticists can get a rough idea of where and when those groups parted ways in the great migrations around the planet.

IN THE MID-1980S the late Allan Wilson and colleagues at the University of California, Berkeley, used mtDNA to pinpoint humanity's ancestral home. They compared mtDNA from women around the world and found that women of African descent showed twice as much diversity as their sisters. Since the telltale mutations seem to occur at a steady rate, modern humans must have lived in Africa twice as long as anywhere else. Scientists now calculate that all living humans are related to a single woman who lived roughly 150,000 years ago in Africa, a "mitochondrial Eve." She was not the only woman alive at the time, but if geneticists are right, all of humanity is linked to Eve through an unbroken chain of mothers.

Mitochondrial Eve was soon joined by "Y chromosome Adam," an analogous father of us all, also from Africa. Increasingly refined DNA studies have confirmed this opening chapter of our story over and over: All the variously shaped and shaded people of Earth trace their ancestry to African hunter-gatherers.

PRECEDING PAGES: RAGHUBIR SINGH (FAR LEFT); DAVID EDWARDS, JOEL SARTORE, AND NATIONAL GEOGRAPHIC PHOTOGRAPHER MICHAEL NICHOLS (LEFT TO RIGHT)

What accounts for the ancient wanderlust? Perhaps some kind of neurological mutation led to spoken language and made our ancestors fully modern, setting a small band on course to colonize the world.

Looking more closely at DNA markers in Africa, scientists may have found traces of those founders. Ancestral DNA markers turn up most often among the San people of southern Africa and the Biaka Pygmies of central Africa, as well as in some East African tribes. The San and two of the East African tribes also speak languages that feature a repertoire of unique sounds, including clicks. Perhaps these far-flung people pay witness to an expansion of our earliest ancestors within Africa, like the fading ripples from a pebble dropped in a pond.

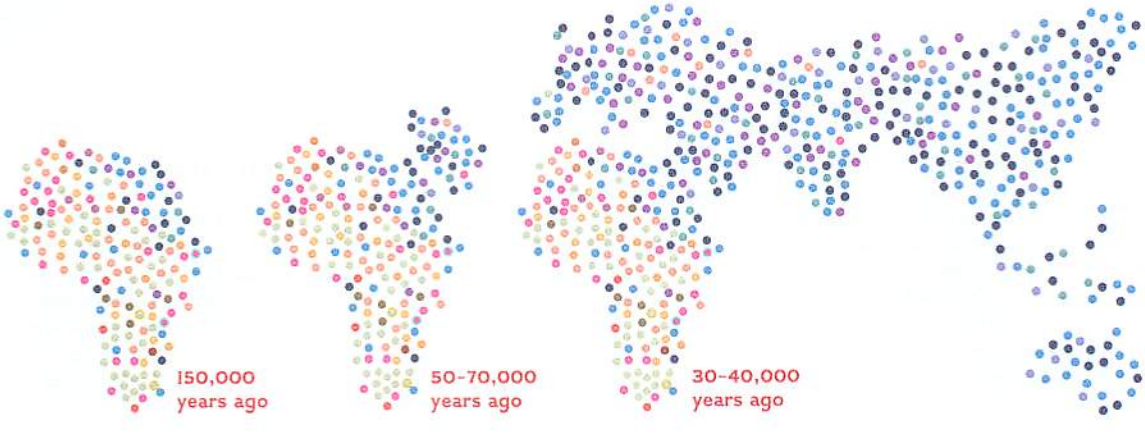
WHAT SEEMS VIRTUALLY CERTAIN now is that at a remarkably recent date—probably between 50,000 and 70,000 years ago—one small wavelet from Africa lapped up onto the shores of western Asia. All non-Africans share markers carried by those first emigrants, who may have numbered just a thousand people.

Some archaeologists think the migration out of Africa marked a revolution in behavior that also included more sophisticated tools, wider social networks, and the first art and body ornaments. Perhaps some kind of neurological mutation had led to spoken language and made our ancestors fully modern, setting a small band of them on course to colonize the world. But other scientists see finely wrought tools and other traces of modern behavior scattered around Africa long before those first steps outside the continent. "It's not a 'revolution' if it took 200,000 years," says Alison Brooks of George Washington University.

Whatever tools and cognitive skills the emigrants packed with them, two paths lay open into Asia. One led up the Nile Valley, across the Sinai Peninsula, and north into the Levant. But another also beckoned. Seventy thousand years ago the Earth was entering the last ice age, and sea levels were sinking as water was locked up in glaciers. At its narrowest, the mouth of the Red Sea between the Horn of Africa and Arabia would have been only a few miles wide. Using

Diverse From the Start

The diversity of genetic markers is greatest in Africa (multicolored dots in map), indicating it was the earliest home of modern humans. Only a handful of people, carrying a few of the markers, walked out of Africa (center) and, over tens of thousands of years, seeded other lands (right). "The genetic makeup of the rest of the world is a subset of what's in Africa," says Yale geneticist Kenneth Kidd.



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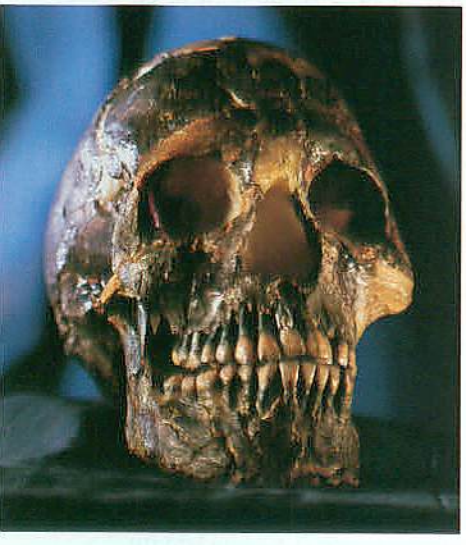
What Genes and Fossils Tell Us



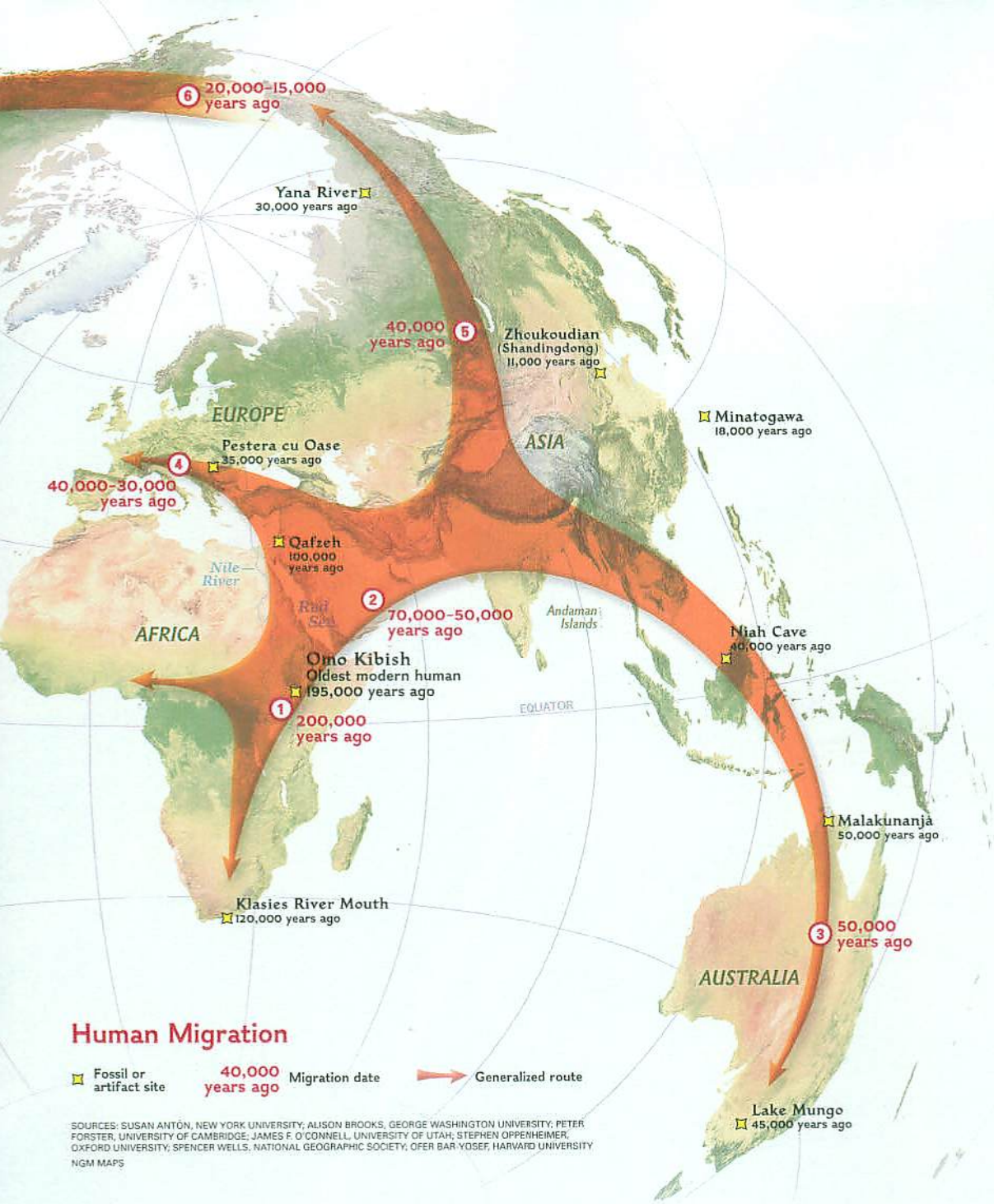
Scientists have long held that modern humans originated in Africa because that's where they've found the oldest bones. Geneticists have come to the same conclusion by looking at Africa's vast genetic diversity, which could only have arisen as DNA mutated over millennia. There's less consensus about the routes our ancestors took in their journey out of Africa and around the planet. Early migrations stalled but left behind evidence such as a human skull (above) from 92,000 years ago at Qafzeh, Israel. Those people may have taken a northern route through the Nile Valley into the Middle East. But other emigrants who left Africa tens of thousands of years later could also have taken a different route: across the southern end of the Red Sea. Scientists say these more recent wanderers gave rise to the 5.5 billion humans living outside Africa today. "I think the broad human prehistoric framework is in place," says geneticist Peter Forster of the McDonald Institute for Archaeological Research in Cambridge, England, "and we are now fitting in the details."

① African Cradle
Most paleoanthropologists and geneticists agree that modern humans arose some 200,000 years ago in Africa. The earliest modern human fossils were found in Omo Kibish, Ethiopia. Sites in Israel hold the earliest evidence of modern humans outside Africa, but that group went no farther, dying out about 90,000 years ago.

② Out of Africa
Genetic data show that a small group of modern humans left Africa for good 70,000 to 50,000 years ago and eventually replaced all earlier types of humans, such as Neandertals. All non-Africans are the descendants of these travelers, who may have migrated around the top of the Red Sea or across its narrow southern opening.

③ The First Australians
Discoveries at two ancient sites—artifacts from Malakunanja and fossils from Lake Mungo—indicate that modern humans followed a coastal route along southern Asia and reached Australia nearly 50,000 years ago. Their descendants, Australian Aborigines, remained genetically isolated on that island continent until recently.

PHOTO BY KENNETH GARRETT



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NGM MAPS

4 Early Europeans

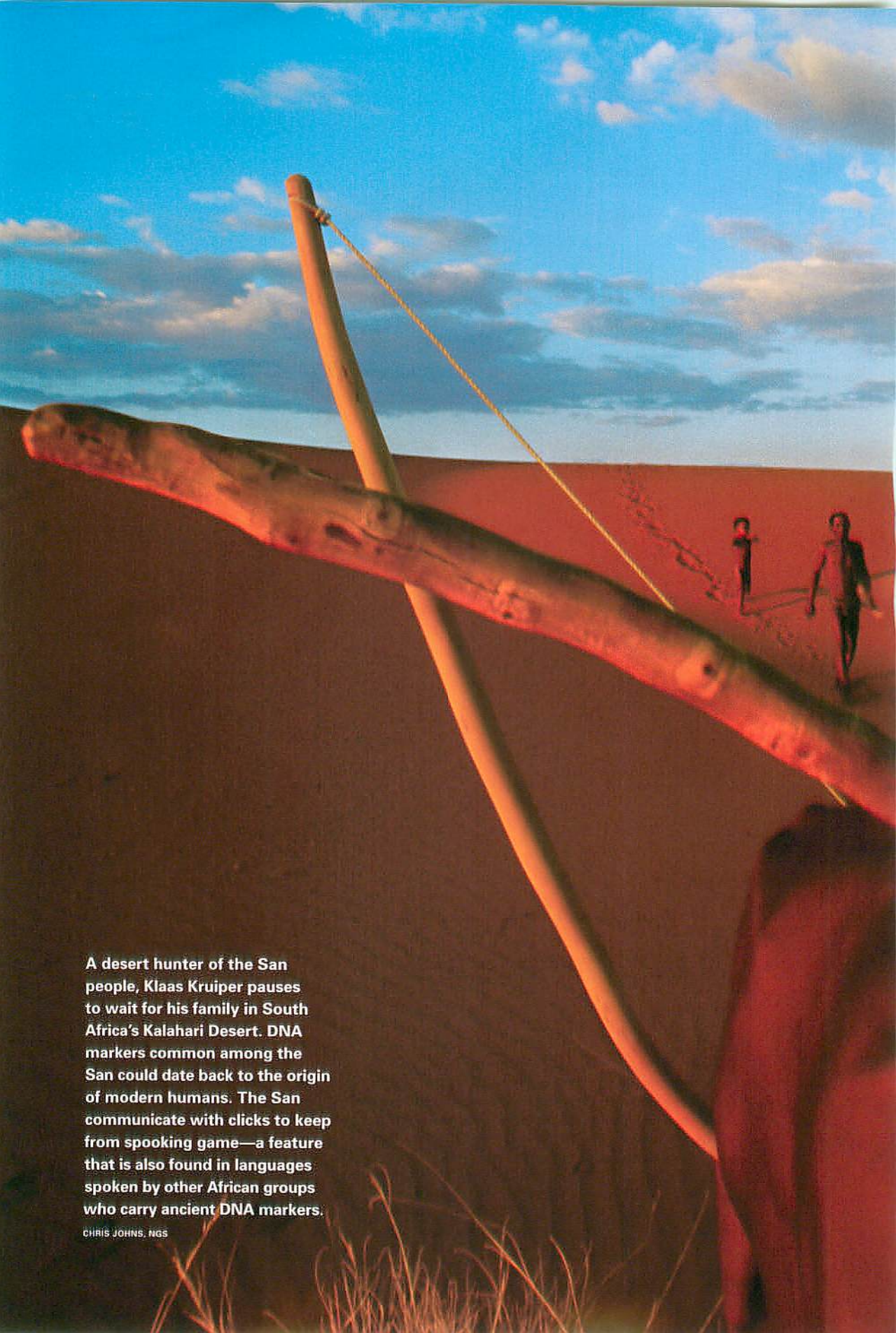
Paleoanthropologists long thought that the peopling of Europe followed a route from North Africa through the Levant. But genetic data show that the DNA of today's western Eurasians resembles that of people in India. It's possible that an inland migration from Asia seeded Europe between 40,000 and 30,000 years ago.

5 Populating Asia

Around 40,000 years ago, humans pushed into Central Asia and arrived on the grassy steppes north of the Himalaya. At the same time, they traveled through Southeast Asia and China, eventually reaching Japan and Siberia. Genetic clues indicate that humans in northern Asia eventually migrated to the Americas.

6 Into the New World

Exactly when the first people arrived in the Americas is still hotly debated. Genetic evidence suggests it was between 20,000 and 15,000 years ago, when sea levels were low and land connected Siberia to Alaska. Ice sheets would have covered the interior of North America, forcing the new arrivals to travel down the west coast.



A desert hunter of the San people, Klaas Kruiper pauses to wait for his family in South Africa's Kalahari Desert. DNA markers common among the San could date back to the origin of modern humans. The San communicate with clicks to keep from spooking game—a feature that is also found in languages spoken by other African groups who carry ancient DNA markers.

CHRIS JOHNS, NGS

primitive watercraft, modern humans could have crossed over while barely getting their feet wet.

Once in Asia, genetic evidence suggests, the population split. One group stalled temporarily in the Middle East, while the other followed the coast around the Arabian Peninsula, India, and beyond. Each generation may have pushed just a couple of miles farther.

"The movement was probably imperceptible," says Spencer Wells, who heads the National Geographic Society's Genographic Project, a global effort to refine the picture of early migrations (see page 70). "It was less of a journey and probably more like walking a little farther down the beach to get away from the crowd."

Over the millennia, a few steps a year and a few hops by boat added up. The wanderers had reached southeastern Australia by 45,000 years ago, when a man was buried at a site called Lake Mungo. Artifact-bearing soil layers beneath the burial could be as old as 50,000 years—the earliest evidence of modern humans far from Africa.

No physical trace of these people has been found along the 8,000 miles from Africa to Australia—all may have vanished as the sea rose after the Ice Age. But a genetic trace endures. A few indigenous groups on the Andaman Islands near Myanmar, in Malaysia, and in Papua New Guinea—as well as almost all Australian Aborigines—carry signs of an ancient mitochondrial lineage, a trail of genetic bread crumbs dropped by the early migrants.

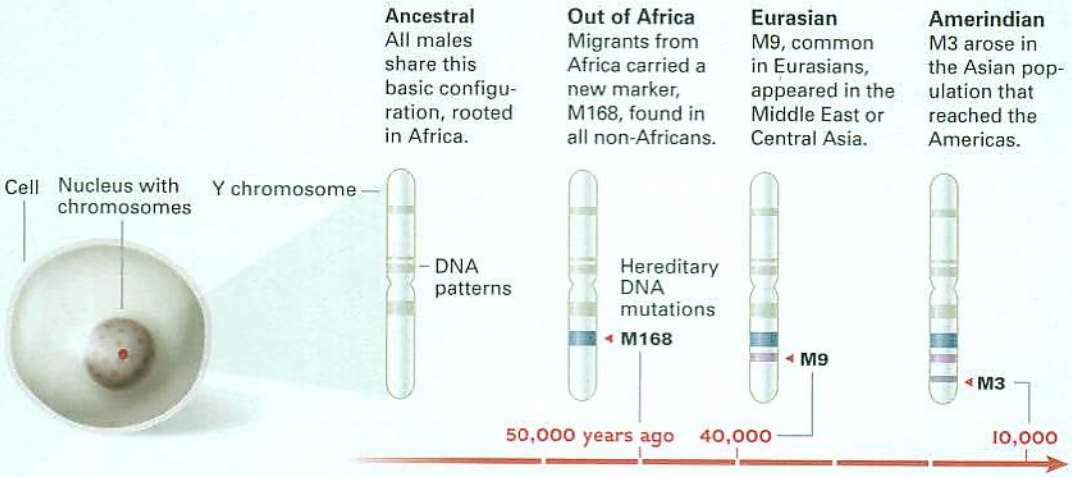
People in the rest of Asia and Europe share different but equally ancient mtDNA and Y-chromosome lineages, marking them as descendants of the other, stalled branch of the African exodus. At first, rough terrain and the Ice Age climate blocked further progress. Europe, moreover, was a stronghold of the Neandertals, descendants of a much earlier migration of pre-modern humans out of Africa.

Finally, perhaps 40,000 years ago, modern humans advanced into the Neandertals' territory. Overlapping layers of Neandertal and early modern human artifacts at a cave in France suggest that the two kinds of humans could have met. How these two peoples—the destined parvenu and the doomed caretaker of a continent—would have interacted is a potent mystery. Did they eye each other with wonder or in fear? Did they fight, socialize, or dismiss each other as alien beings?

All we know is that as modern humans and distinctly more sophisticated toolmaking spread into Europe, the once ubiquitous Neandertals were squeezed into ever shrinking pockets of habitation that eventually petered out completely. On current evidence, the two groups interbred rarely, if at all. Neither mtDNA from Neandertal fossils nor modern human DNA bears any trace of an ancient mingling of the bloodlines.

History on a Chromosome

Genetic mutations act as markers, tracing a journey through time. The earliest known mutation to spread outside Africa is M168, which arose some 50,000 years ago. This graphic shows the Y chromosome of a Native American man with various mutations including M168, proving his African ancestry.



NGM ART

DNA studies have confirmed this opening chapter of our story over and over: All the variously shaped and shaded people of Earth trace their ancestry to African hunter-gatherers, some 150,000 years ago.

About the same time as modern humans pushed into Europe, some of the same group that had paused in the Middle East spread east into Central Asia. Following herds of game, skirting mountain ranges and deserts, they reached southern Siberia as early as 40,000 years ago. As populations diverged and became isolated, their genetic lineages likewise branched and rebranched. But the isolation was rarely if ever complete. "People have always met other people, found them attractive, and had children," says molecular anthropologist Theodore Schurr of the University of Pennsylvania.

Schurr's specialty is the peopling of the Americas—one of the last and most contentious chapters in the human story. The subject seems to attract fantastic theories (Native Americans are the descendants of the ancient Israelites or the lost civilization of Atlantis) as well as ones tinged with a political agenda. The "Caucasoid" features of a 9,500-year-old skull from Washington State called Kennewick Man, for instance, have been hailed as proof that the first Americans came from northern Europe.

In fact most scientists agree that today's Native Americans descend from ancient Asians who crossed from Siberia to Alaska in the last ice age, when low sea level would have exposed a land bridge between the continents. But there's plenty of debate about when they came and where they originated in Asia.

For decades the first Americans were thought to have arrived around 13,000 years ago as the Ice Age eased, opening a path through the ice covering Canada. But a few archaeologists claimed to have evidence for an earlier arrival, and two early sites withstood repeated criticism: the Meadowcroft Shelter in Pennsylvania, now believed to be about 16,000 years old, and Monte Verde in southern Chile, more than 14,000 years old.

The DNA of living Native Americans can help settle some of the disputes. Most carry markers that link them unequivocally to Asia. The same markers cluster in people who today inhabit the Altay region of southern Siberia, suggesting it was the starting point for a journey across the land bridge. So far, the genetic evidence doesn't show whether North and South America were populated in a single, early migration or two or three distinct waves, and it suggests only a rough range of dates, between 20,000 and 15,000 years ago.

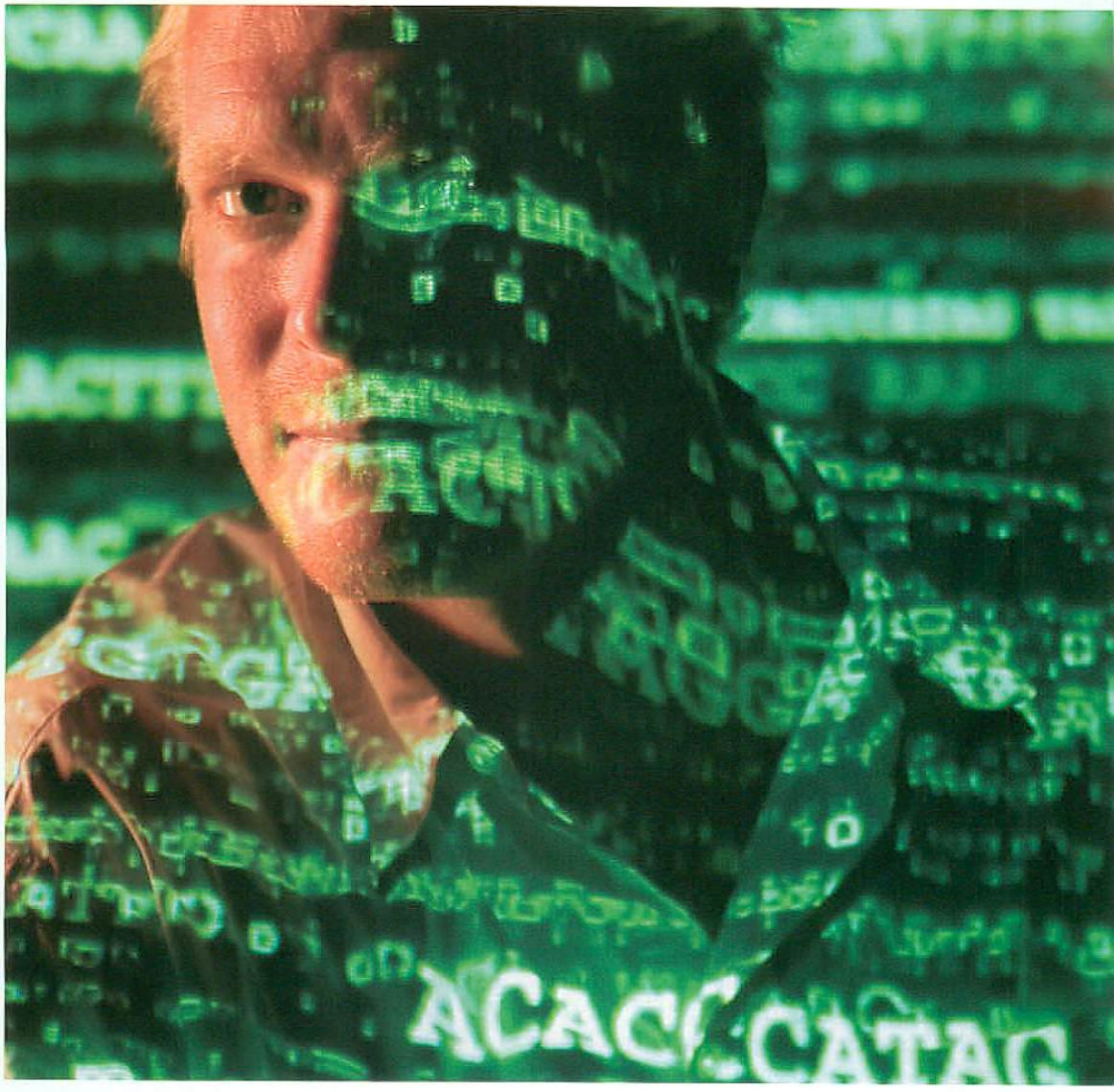
Even the youngest of those dates is older than the opening of an inland route through the Canadian ice. So how did the first Americans get here? They probably traveled along the coast: perhaps a few hundred people hopping from one pocket of land and sustenance to the next, between a frigid ocean and a looming wall of ice. "A coastal route would have been the easiest way in," says Wells. "But it still would have been a hell of a trip."

Beyond the glaciers lay immense herds of bison, mammoths, and other animals on a continent innocent of other intelligent predators. Pushed by population growth or pulled by the lure of game, people spread to the tip of South America in as little as a thousand years.

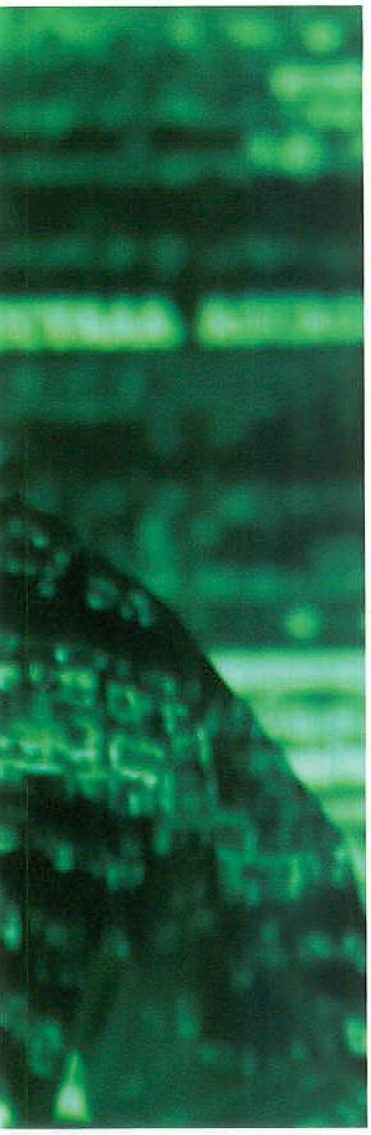
The genes of today's Native Americans are helping to bring their ancestors' saga to life. But much of the story can only be imagined, says Jody Hey, a population geneticist at Rutgers University. "You can't tell it with the richness of what must have happened."

With the settling of the Americas, modern humans had conquered most of the planet. When European explorers set sail 700 years ago, the lands they "discovered" were already full of people. The encounters were often wary or violent, but they were the reunions of a close-knit family.

Perhaps the most wonderful of the stories hidden in our genes is that, when unraveled, the tangled knot of our global genetic diversity today leads us all back to a recent yesterday, together in Africa. □



READING SECRETS OF THE BLOOD



"The story of our ancestors is written in the simple DNA code of A, C, G, and T," says Spencer Wells, head of the National Geographic Society's Genographic Project. It will analyze DNA from hundreds of thousands of people to map how prehistoric humans populated the planet.

BY JAMES SHREEVE

In 1675 a bloody conflict broke out in New England between English colonists and the Wampanoag Indians. Led by their chief, Metacomet—known to the English as King Philip—the Wampanoag gathered other tribes to their side, but were ultimately no match for the firepower of the English. King Philip's War ended a year later, with Philip's severed head displayed on a pole in Plymouth and virtually all of his people killed or forced into servitude. For the next 300 years, their descendants lived and died on the fringes of society while modern New England rose up around them.

On a warm late summer evening last year, a few dozen people from today's Wampanoag Nation gathered in the American Legion Hall in Seekonk, Massachusetts. Except for a few Native Pride baseball caps and some Indian jewelry, they looked like a cross section of working-class America—white, black, and brown, some young, some elderly—the kind of folk you might see at Fenway Park on a Sunday afternoon. But this wasn't a casual get-together. These members of the Seaconke-Wampanoag Tribe had come to give their blood to the Genographic Project, a global inquiry into humanity's deep collective past that could also shine a light on their own history.

Launched by the National Geographic Society with major support from the IBM Corporation and the Waitt Family Foundation, the project hopes to use genetic information gleaned from a thousand indigenous populations around the world to enhance our understanding of humanity's ancient migrations around the planet (see page 60). Conceived and directed by National Geographic Explorer-in-Residence Spencer Wells, it is among the most ambitious and potentially most informative projects the Society has ever undertaken. It may also prove to be one of the more controversial.

THE SEACONKE-WAMPANOAG were the first U.S. group to participate. As more people trickled into the Legion Hall, University of Pennsylvania molecular anthropologist Theodore Schurr and a colleague set up a makeshift blood collection station. Schurr is coordinating Genographic research in North America, and over the project's five-year scope, he and his team intend to analyze DNA from up to a hundred indigenous groups. The resulting flood of data could help resolve long-standing debates about how, when, and from where the Americas were first populated.

Other investigators will try to pin down details of migrations across the rest of the globe. But the project's success depends on the willingness of indigenous groups here and abroad to volunteer. More than a dozen have already signed up, from the Caucasus Mountains to Laos, and hundreds more will be needed. "If this works for us, we're hoping other tribes will jump in and give their DNA too," says Seaconke-Wampanoag Chief George Silver Wolf Jennings.

In the early 1990s the pioneering population geneticist Luca Cavalli-Sforza of Stanford University and his colleagues conceived

PHOTO BY NATIONAL GEOGRAPHIC PHOTOGRAPHER MARK THIESSEN

A World of Unanswered Questions

While science has traced the outlines of human migrations, key questions remain, some of which appear below. The Genographic Project hopes to answer many of them with help from geneticists at 11 centers worldwide, who will draw DNA from blood and cheek swabs of living people and extract it from fossils. By comparing lineages, they hope to piece together the scattered puzzle of the human journey.

Sub-Saharan Africa

Fundamental riddles in the land where the human story began

At the National Health Laboratory Service in Johannesburg, South Africa, Himla Soodyall will try to find out which African populations harbor the most ancient genetic lineages and map patterns of diversity within sub-Saharan Africa. She'll also explore the impact of migrations into Africa.

North Africa/Middle East

Did Alexander the Great and the Romans leave a genetic trail?

Pierre A. Zalloua of the American University of Beirut Medical Center will explore the genetic legacy of ancient armies and empires. He will also try to identify the earliest inhabitants of the Sahara.

South Asia

The complicated branches of India's genetic tree

At Madurai Kamaraj University in Tamil Nadu, India, Ramasamy Pitchappan will try to understand what role the Indian caste system has had in determining genetic patterns, and if there was an influx of Indo-European language speakers from Central Asia 3,500 years ago.

East/Southeast Asia

Hopping islands and continents, and maybe the largest ocean

Li Jin of Fudan University in Shanghai, China, asks: When did people first reach Taiwan and Japan? What led to the north-south genetic divide among native populations in East Asia? Did ancient seafarers cross the Pacific from Asia to South America, and if so, where did they embark?

Australasia/Pacific Ocean

Following migratory tracks into the vast down under

John Mitchell of La Trobe University in Melbourne, Australia, wants to learn when and how the first modern humans reached Australia and Papua New Guinea—an event now generally thought to predate the arrival of the first modern humans in Europe. Also, how did the ancestors of the Maori reach New Zealand?

North Eurasia

Staging ground for migrations to Europe and the Americas

Elena Balanovska of the Research Centre for Medical Genetics in Moscow, Russia, will study the enigma of the Caucasus Mountains: Were they a bridge or a barrier between Europe and Asia? What is the link between the high degrees of linguistic and genetic diversity in the region? She will also search for clues about who first settled Siberia and which groups continued on to the Americas.

Central/Western Europe

The legacy of hunter-gatherers, farmers, and empires

At two institutes—France's Institut Pasteur in Paris and the United Kingdom's Wellcome Trust Sanger Institute in Cambridge—Lluis Quintana-Murci and Chris Tyler-Smith are examining mitochondrial DNA and the Y chromosome, respectively, for traces of ancient European hunter-gatherers and early farmers. They will also study whether great European empires have left detectable genetic marks. And are the Basque people as distinct from their neighbors as their unique language suggests?

North America

How Native Asians became the Native Americans of today

Theodore Schurr at the University of Pennsylvania in Philadelphia will weigh in on controversial questions: When did people first reach the New World, and what routes did they follow from Asia?

South America

The end of the road for wanderers from Asia

At Brazil's Universidade Federal de Minas Gerais, Fabricio R. Santos is asking: When did people first arrive in South America, and are their descendants still alive today? Did the indigenous people of the Andes originate in the Amazon?

Ancient DNA

If fossil genes could speak, what might they tell us?

A lab run by Alan Cooper of the Australian Centre for Ancient DNA will study human remains. DNA from old teeth and bones could show when the genetic markers seen today first appeared and help scientists test their picture of ancient migrations.

the Human Genome Diversity Project (HGDP) with similar goals in mind. But the plan ran into heated opposition. Some indigenous groups bridled at the notion that their DNA might be used to tell a story of their origins in conflict with their own traditional beliefs. Others balked at volunteering what they perceived might be patentable medical information and getting nothing in return. Still others found the project's intention to create self-propagating cell lines from their blood disturbing, even sacrilegious. Amid the misunderstanding and protest, the HGDP never received the funding it needed.

In a field lab in Chad, Jason Blue-Smith of the Genographic Project transfers DNA into tubes for transport. "Anthropologists often refer to this region as the crossroads of Africa," says Blue-Smith. "Genetic information from indigenous groups here will offer a first glimpse into what could be some of our species' oldest stories."

Wells and his colleagues are taking pains to distinguish their effort from the HGDP. The Genographic Project will produce no cell lines or medically relevant data. It will also provide something tangible to indigenous groups, at the same time attracting new participants and gleaning some extra scientific data. For a fee, anyone can submit a cheek swab of DNA by mail, then learn about their own "deep ancestry." Proceeds will support research and go to educational and cultural preservation projects for indigenous groups.

So far, more than 100,000 cheek-swab kits have been sold, bringing in over 2.2 million dollars. The kits only reveal a small fraction of a person's full genetic ancestry, and some critics think the program raises unrealistic expectations. They also warn that distributing the money fairly will not be easy.

Wells has failed to win over some doubters. "The project inherently conflicts with indigenous interests," says Debra Harry of the Indigenous Peoples Council on Biocolonialism, an advocacy group that has called for a boycott of the National Geographic Society, IBM, and Gateway Computers, the source of funding for the Waitt Foundation. "The fundamental question the project is asking is 'Where do we come from?' That's not a question that is of interest to us as indigenous people. We already know where we came from."

"If people feel strongly, they don't have to participate," says Wells. "But we find that most people are excited to learn that they carry a record of their ancestry in their blood." Michael Tender Heart Markley, chairperson of the Seaconke-Wampanoag, agrees. "Because the project uses our genetics to track our path, it is really us, the Seaconke-Wampanoag Tribe, telling our own story."

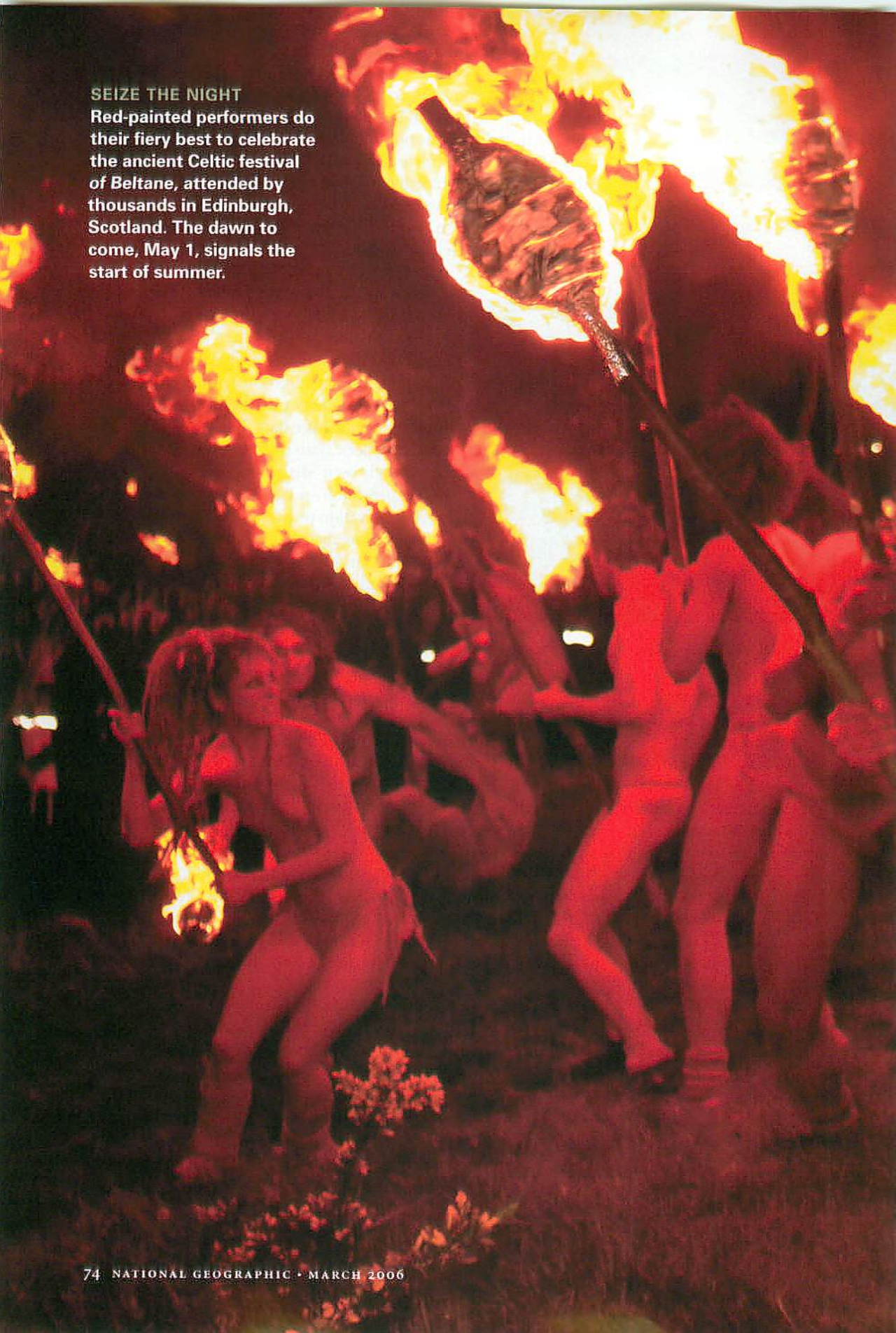
THE TRIBE'S DNA is unlikely to yield any simple truths, at least in the short term. Native American groups like the Seaconke-Wampanoag have European and African as well as Native American ancestry. And as Theodore Schurr explains to those donating blood, the initial results won't reveal a person's full heritage. They could point back to Metacomet's people—or to ancestors from another continent. A fuller picture will emerge only after the project analyzes each person's full set of chromosomes and compares them with the Genographic Project's growing lode of DNA from other groups.

Says Chief Jennings: "I just hope these guys aren't gonna tell us we're all Swedish." □

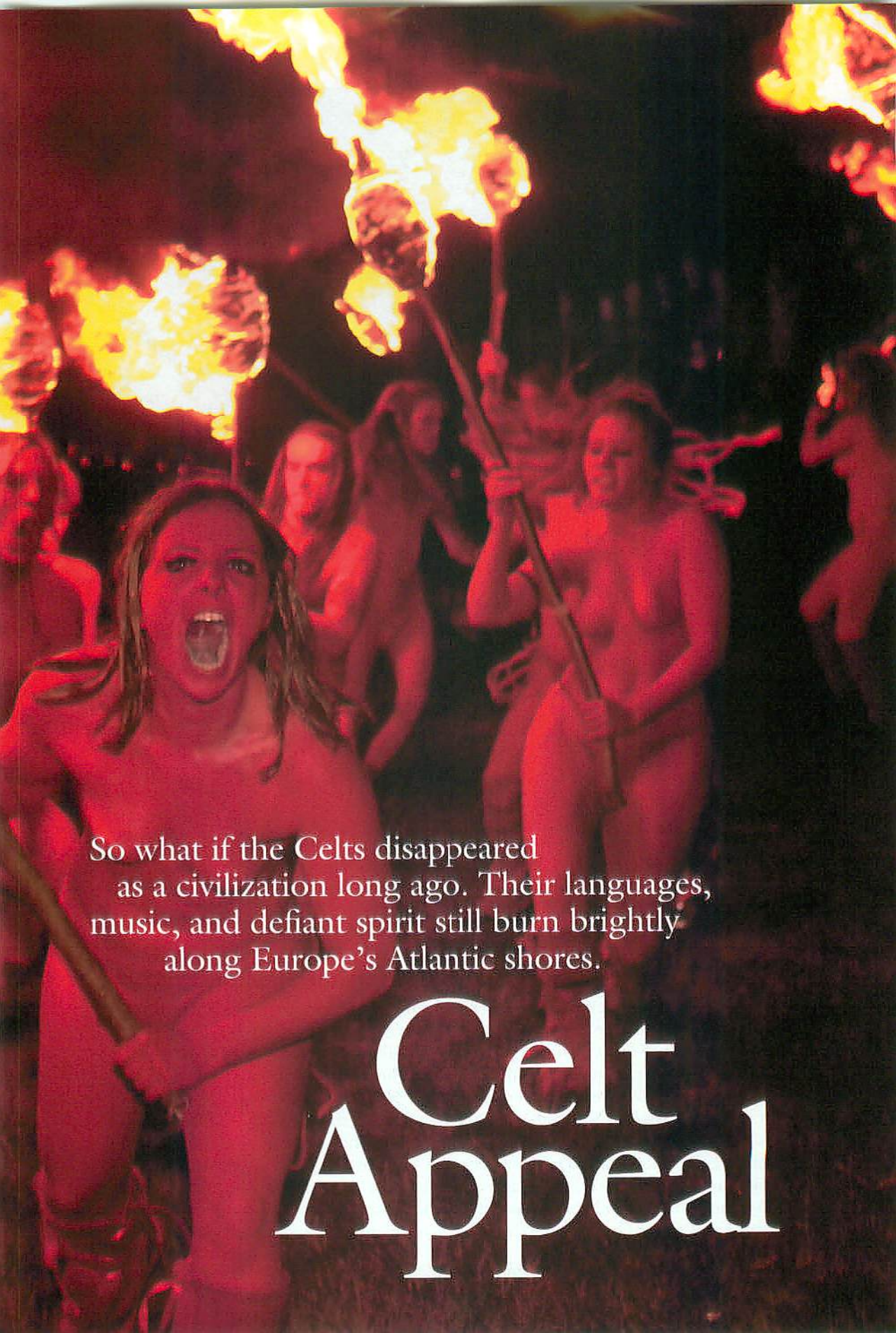
Family tree Are you curious about your ancestral connections? Tell us in our forum and learn about genetic mysteries yet to be unraveled in a video interview with Spencer Wells at **ngm.com/0603**.

SOCIETY PARTNERSHIP
This project is co-sponsored by your Society.

PHOTO BY DAVID EVANS

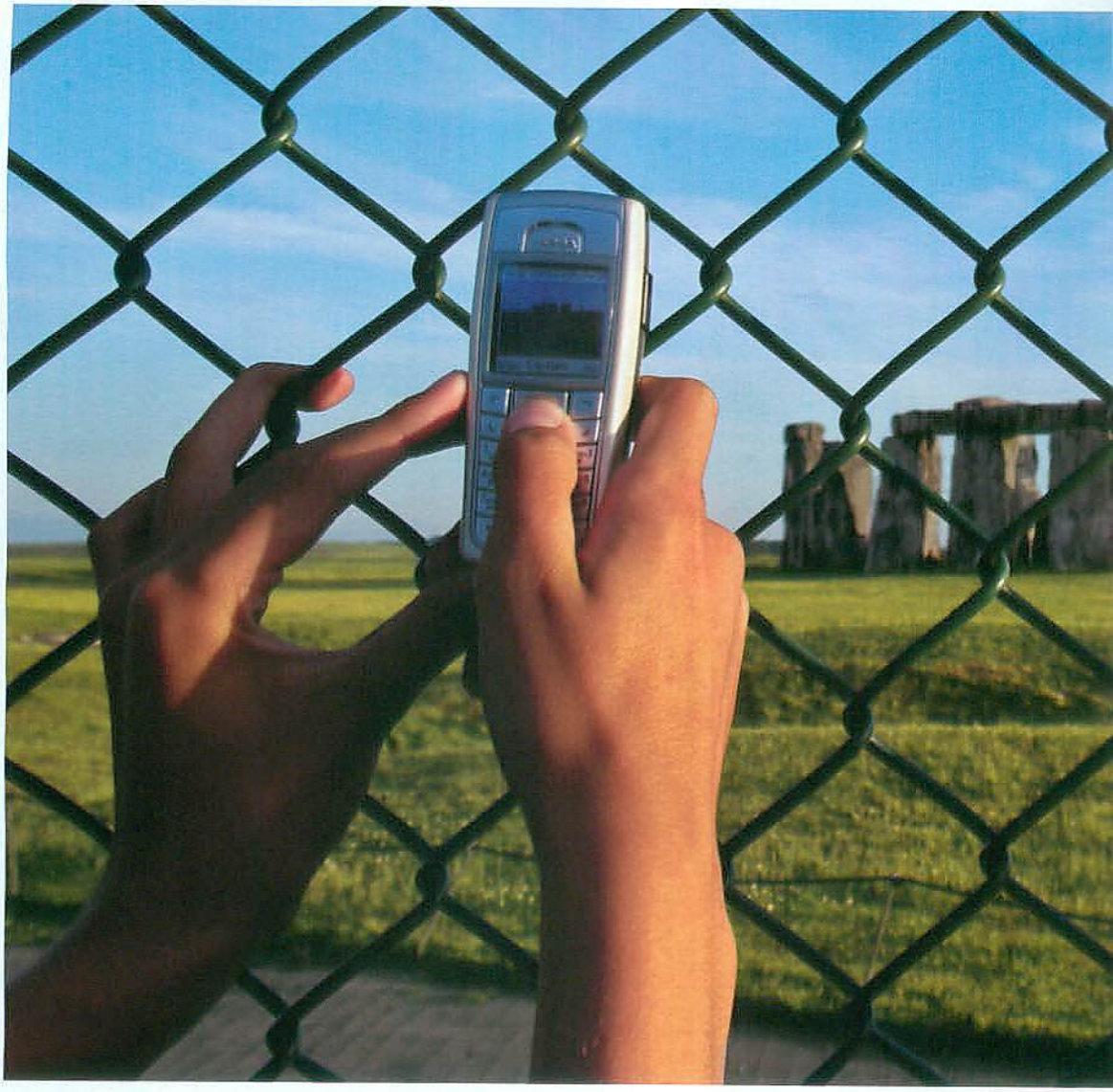


SEIZE THE NIGHT
Red-painted performers do their fiery best to celebrate the ancient Celtic festival *of Beltane*, attended by thousands in Edinburgh, Scotland. The dawn to come, May 1, signals the start of summer.



So what if the Celts disappeared as a civilization long ago. Their languages, music, and defiant spirit still burn brightly along Europe's Atlantic shores.

Celt Appeal



by Tom O'Neill NATIONAL GEOGRAPHIC SENIOR WRITER

photographs by Jim Richardson

Finding a Celt in 21st-century Europe isn't that difficult, though you may need a few ferry tickets, a good pair of boots, and a sharp set of ears before your search is done. Go as far west as you can, right up to the cliffs and coves of the Atlantic—it doesn't matter if it's France or England or Ireland or the outer islands of Scotland—and turn around. Odds are you'll see rocks, plenty of them, piled up in fences, shaped into houses, or lying like bare knuckles in scruffy fields. Probably it's raining. Your search is getting warm. To get warmer still, find a place like the Cross Inn on the windy, moor-covered Isle of Lewis in Scotland's Outer Hebrides. If you're lucky, you might hear a bagpipe or fiddle playing, and if you're luckier still, you might tune in to an unfamiliar sound: Celts talking.

The conversation might go:

"Hullo, Norman, how's your mother?"

"Great, she's visiting her grandchildren and planting flowers in the garden."

Except the speech is rhythmic and guttural, a back-of-the-throat performance, nothing like the rounded slip and slide of English. If there were sound balloons above their heads, they'd

VISIONS OF STONEHENGE **Irresistible to tourists with camera phones, pre-Celtic Stonehenge in England has also drawn Celtic revivalists for over a century. For their rituals many model themselves on ancient Druids.**

look like this: *"Hallo, a Thormoid. Ciamar a tha do mhàthair?"*

"Gu dòigheil. Tha i a' coimhead air a h-oghaichean agus a' cur flùraichean anns a' ghàrradh."

The Sunday mates in the Cross Inn are speaking Scottish Gaelic. To them it's no big deal; it's the first language they learned at home. But to me, an American long intoxicated by Irish roots and curious whether an even wider and deeper kinship might exist, that of a Celtic identity, I felt as if I had stumbled upon a secret society. There was something thrilling, even subversive, about hearing an ancient Celtic language in the land of Shakespeare, where neither the Queen nor the Prime Minister would have the foggiest clue what these locals on Lewis were talking about.

When the men caught me listening, they switched to English. "It's rude, that's what we were taught, to speak our language in front of strangers," said Norman Campbell, a novelist and poet who publishes in Scottish Gaelic. I bought a round, and the men opened up, telling me how in their parents' time teachers would take a belt

The Celtic Fringe

Once spread across the breadth of Europe, Celtic culture, created by a loose-knit group of aristocratic warrior tribes, had shrunk to the edges of the continent by the late Middle Ages. Monuments to the glory days, like the 3,500-year-old, ocean-defended fort of Dun Aengus in the Aran Islands of Ireland, fell into ruin. But in isolation and poverty, Celtic society survived. Language anchors the current resurgence of Celtic identity: Some 2.5 million people claim to speak a Celtic language.

to students overheard speaking the native tongue. Now it's different, they said, and the government is promoting the language. More drinks, and Norman's brother Alasdair drops by and starts singing. The tune is "Gealach Abachaidh an Eòrna," or "The Moon that Ripens the Barley." It sounds sad, I remarked. "Well," Alasdair said, "that moon is huge, very yellow, and it breaks your heart."

Ah, the clues are adding up for identifying a Celt: the ancient language, an easily retrieved sense of historical grievance, a resort to song, and this bittersweet sentimentality. Less clear is how a fringe culture like the Celts managed to survive, even flourish, in a rapidly assimilating world. A brief detour into history begins to tell the tale.

Most of us are unaware that Celts once dominated the breadth of Europe from the Black Sea to the Atlantic—and for a long time. An early form of Welsh was spoken in Britain 1,500 years before Old English took root. The Celtic languages still spoken in Europe hark back to the Late Bronze Age (1200-800 B.C.) and a civilization of aristocratic warrior tribes. The word "Celtic" comes from the Greek *Keltoi,* first appearing in the sixth century B.C. to describe "barbarians" living inland from the Mediterranean Sea. Little suggests these people united or called themselves Celts. Yet there is no denying that these far-flung peoples spoke closely related languages and shared beliefs, styles of art and weaponry, and tribal societies. Trade, principally by water, connected them. Calling them Celts makes sense, if only to separate them from what they weren't: Roman or Greek.

All this categorizing might easily have become an arid academic debate about a lost people. Beginning in the second century B.C. Roman legions vanquished Celtic armies across Europe. Only the peoples of northern Britain and Ireland remained unconquered. In the fifth century A.D. the Anglo-Saxons invaded Celtic lands, followed by the Vikings, storming the coasts in their long warships, the Normans, who attacked from France, and finally the colonizing armies of the English and French crowns. From these wars of resistance came many Celtic heroes and martyrs such as the legendary King Arthur, the Irish High King Brian Boru, and Scotland's William Wallace, known as Braveheart.

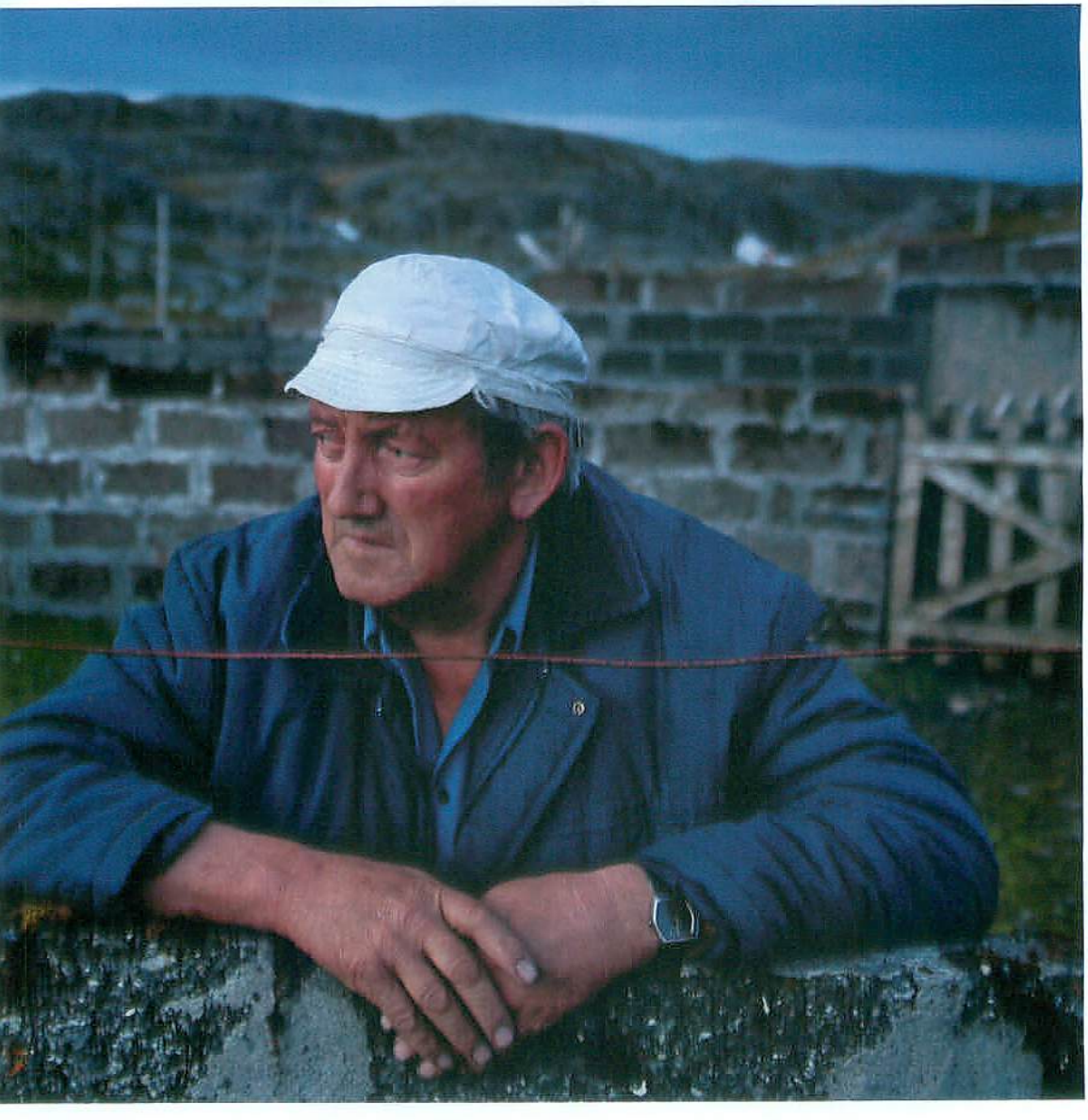
By the end of the Middle Ages, Celtic culture was headed toward extinction, its remnants pushed to the very western edge of Europe. "No one else wanted to live where the Celts did," a Breton man said. "Those places were poor and remote, and no one spoke their languages."

LOYAL TO THE MOTHER TONGUE
Bannatyne MacLeod speaks the old language of Scottish Gaelic to his family and neighbors on Harris, in Scotland's Outer Hebrides. As everyday speech, the Celtic languages are most widely heard along the farthest western edges of the Celtic realm.

Being ostracized to no-man's-land did not spare the Celts from further depredations. The English and French banned or restricted their languages, their instruments and music, their names, their right to own property, and in the case of the kilt-wearing Scottish Highland clans, even their clothing. It's a bit miraculous Celtic civilization survived in any form. By clinging to the fringes, geographically and culturally, Celts refused to vanish.

Now, in one of those delectable backward flips of history, Celts and all things Celtic suddenly seem omnipresent. "Europe's beautiful losers," as one British writer called them, are commanding attention as one of the new century's seductive identities: free-spirited, rebellious, poetic, nature-worshipping, magical, self-sufficient.

I first saw Fred Morrison onstage at the Festival Interceltique in Brittany, wearing a plaid kilt and a polka-dot tie, all sweaty and solemn as he played Breton and Irish tunes on his bagpipes. Morrison ("the Jimi Hendrix of pipers!" a fan raved) is from the island of South Uist in Scotland's Outer Hebrides. When we met in a café late one morning, he had traded his kilt for blue jeans and looked like an off-hours traveling salesman with two attaché-size



WEATHER-BEATEN **The tangled coat of a Shetland pony stands up to the wind on the Scottish**

island of South Uist. Like most Celtic areas, the land here is generous only in rock and bog.

cases in hand. Inside were bagpipes. He said he'd learned the pipes from his father and in 1972, at 18, had headed to Amsterdam to play in the streets. Soon he hooked up with some Irish musicians and freed his style. "I learned to become a rebel musically," Morrison said. He went on to play for pathbreaking Scottish bands like Capercaillie and Clan Alba, and worked on the soundtrack for the movie *Rob Roy.*

For Morrison, like most modern-day Celts, the past became liberating; it was not some sacred, hands-off heirloom but a scuffed-up plaything, the more loved the more it's used. "I would never turn my back on tradition," Morrison said. "But I came to see that tradition can come with this straight face, allowing almost no freedom for improvisation. I decided it was cooler to break the rules." At that he set off to rehearse with a "killer bouzouki player," that being someone extremely handy with a mandolin-like instrument from the Balkans—sure to sound Celtic when Morrison is done accompanying it.

A similar sleight of hand is happening throughout the Celtic realm, from Scotland to Galicia in northern Spain, where anything goes and the definition of a Celt is as elusive and shifting as the coastal weather. There are "blood Celts," the several million people who were raised and still live in the surviving Celtic language territories. Then there is the growing tribe of "Celts of the spirit," who feel touched by the history, myths, and artistic expressions of beautiful losers. "Celtic of any sort," observed J. R. R. Tolkien, is "a magic bag, into which anything may be put, and out of which almost anything may come."

Out of that magic bag drips water, the element that linked the Celtic lands in the past and now most often serves to separate them, for better or worse. Chugging across the Little Minch, the ferry remains the most practical way to reach Lewis and Harris, the northernmost of the Outer Hebrides. One Saturday night I caught the weekend's last sailing from the Island of Skye, the waves seemingly in sync with the churning vowels and consonants of the Gaelic onboard announcements. Ferries don't run on Sundays, a stone-quiet day when an austere form of Presbyterianism keeps shops shuttered and people inside their homes.

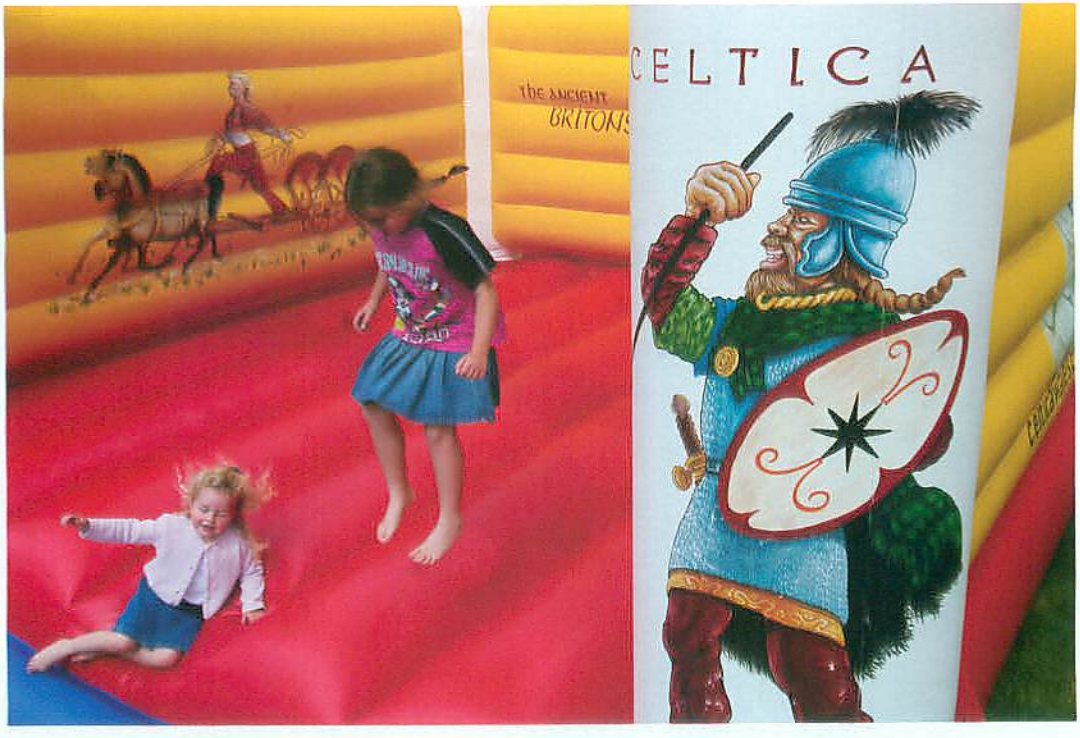
Driving down Lewis's empty roads, past stretches of gloomy bogland, through villages lined with houses the color of wet sand, I discovered a forgiven bustle of activity in the parking lot of the Free Church of Scotland in Barvas. A service in Scottish Gaelic was about to begin.

Lewis attracted me because of its isolation and because of its sounds. Many of its 18,500 inhabitants still speak Gaelic as an everyday language, a rare pocket considering that less than one percent of Scotland's population, or only about 30,000 people, are believed to be fluent in the language. An even rarer phenomenon awaited inside the bare-walled church: the singing of psalms in the local language, a musical form as unique and starkly sensual as the chanting of Tibetan monks.

Several dozen parishioners, mostly older folks, took their places on the hard pews, the gents in dark suits, the ladies a bit more daring in summer hats sprouting ribbons and bows. A well-freckled woman on my right shyly passed me a sweet. In a tradition going back to preliterate days, a precentor stood up and began singing solo, to imprint melody and words with the congregation. Soon everyone joined in. The voices didn't lift in ecstatic joy but keened and moaned. The singing conjured up worlds of lament and forbearance, a requiem for an island drifting away from its roots.

"Europe's beautiful losers," as one British writer called them, are commanding attention as one of the new century's seductive identities.

Services in English are outdrawing the Gaelic sessions, the minister said afterward. Other islanders told me they were worried that the toll of emigration—everyone had tales of relatives past and present leaving—and the decline of crofting, the family practice of raising crops and livestock on small plots, would finally bury the language. But the most pressing problem, it seems, is that for the younger generation, a whiff of country bumpkin rises off the ancient words.



CELTOMANIA Celts sell—from music festivals to sacred-site tours. But theme parks may be a stretch. Celtica, located in Machynlleth, Wales, is closing after ten up-and-down years.

While I was interviewing Christina Morrison, 83, in her home, her middle-aged daughter interrupted from the kitchen. "It's not cool to speak Gaelic. The fancy people in town look down on us." The old woman nodded and admitted that even her grandchildren are a tough sell. "I give them ten pence if they answer in Gaelic."

Learning Gaelic does have economic benefits. In a cafeteria in Stornoway, the only town on the island, I met a dozen college-age islanders who through Comunn na Gàidhlig, a government-funded agency promoting Gaelic, worked at summer jobs using their bilingual skills. They were interning at places like the BBC radio station, which broadcasts 65 hours of Gaelic programming a week, and the local arts council. Most hoped to make a career out of teaching Gaelic, and all vowed to raise Gaelic-speaking children. "But amongst ourselves, we mostly speak English," confessed one young woman, Jayne Macleod. "Anymore, Gaelic is the language of schools and old people."

When I rode the ferry back to Skye, I noticed that the shipboard announcements were only in English. Christina should have been aboard with her change purse.

During the Celtic glory days of old, water routes converged on Ireland. From its shores came merchants, missionaries, soldiers of fortune, musicians, and in 1607, the last of the Gaelic aristocracy, including my ancestors, the Uí (Gaelic for "descendant of") Néill, who were fleeing English troops. Befitting this busy, water-coursed past, the ferry I took to Ireland was no slow boat to a rustic past but a high-speed catamaran rushing to a cosmopolitan future. For most of the passengers, crossing the North Channel from Stranraer, Scotland, to Belfast, capital of Northern Ireland, Celtic no doubt meant Celtic Tiger, a brand name of success given to the booming economy of the Republic of Ireland. Irish in both the north and south are gloating that—finally—they've caught up with England and the rest of Western Europe, embracing the one-size-fits-all notion of modern prosperity.

Poet Gearóid Mac Lochlainn, like a true Celt, resists the homogenizing forces of the time. He speaks and writes in the Irish language, which in parts of his native Belfast still comes across as fighting words. "Here the language itself is viewed as a taunt just by the fact that it's still spoken, that

MISCHIEF-MAKER Long banished from Cornwall for inciting rowdiness, the fertility horse figure

Penglaz swirls once again through Penzance at the revival of Golowan, the feast of St. John.

it's survived," said Mac Lochlainn, a thin, jeans-and-T-shirt guy with close-cropped hair.

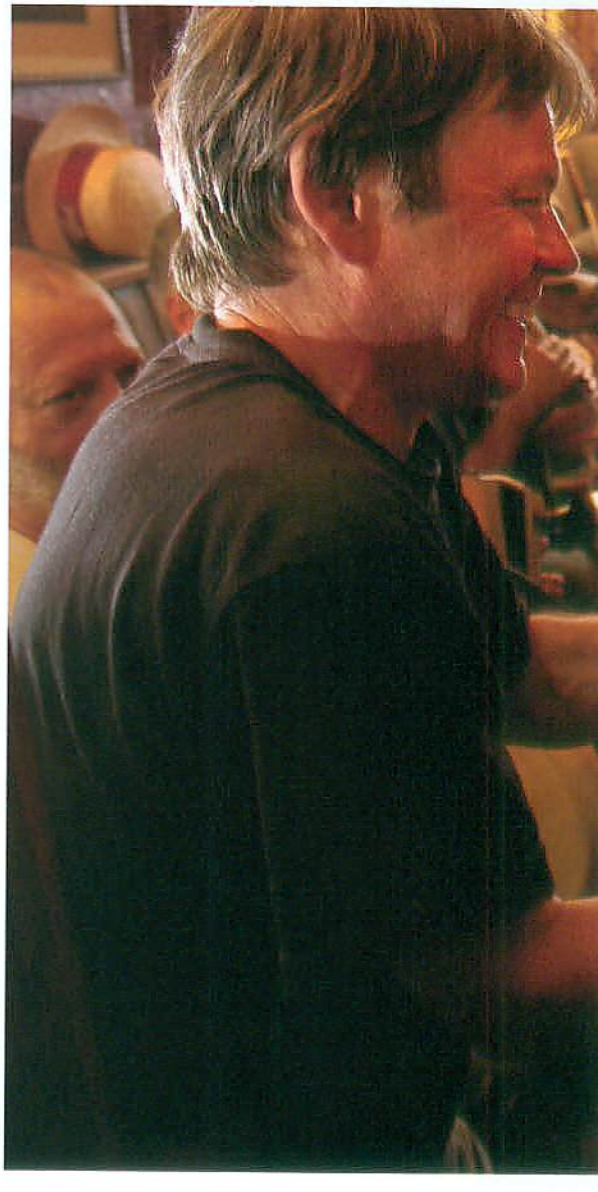
Mac Lochlainn talked to me on safe ground, inside the Cultúrlann, a steepled red-brick church converted to an Irish-language center in the working-class Catholic neighborhood of Falls Road. He did not learn Irish from the cradle. He picked up threads of it from a Christian Brothers school and from family friends and visitors from the Gaeltacht, the areas in the republic, mostly on the western fringe, where Irish hangs on as a community language. His poems often marvel at the dissonance of sounds between the majority and minority languages, as when he flirts with an Irish-speaking woman whose "puckety-pocking words" show up his "sluppity-slip-slapping" drunken talk in English.

As Mac Lochlainn spun his past, people kept stopping by our table to say hello. He had caused a sensation with his book *Stream of Tongues (Sruth Teangacha)*—Irish poems side-by-side with their English translations. One called "Poet's Choice" laid out his fever dream: "I want to speak, rant, rave / untie tongue till it blooms and bleeds / in seven shades of street rhythms." But it wasn't the printed page that caused the stir; tucked into the back of the book was a CD of Mac Lochlainn rapping his poetry to music. It was a mesmerizing performance. Admirers who turn out for his appearances probably think he shares turf with Eminem, but Mac Lochlainn points to a deeper influence, that of the Celtic bards. He likens his poems to *sean nós,* the traditional style of unaccompanied singing. "When I read my work, it's like a séance," he said. "I feel like I'm a vessel for past voices."

Soon he was off, a busy man, writing and recording a new book and preparing for performances in Liverpool, Slovenia, the Czech Republic. "It seems like everyone wants to be a Celt," he said. I dropped the bard off near his flat, somewhere in a tough-looking neighborhood of brick apartment blocks, a Celtic tiger on the loose.

Voyagers long knew the Celtic lands by their native names: Scotland was Alba; the Isle of Man, Ellan Vannin; Ireland, Éireann; Cornwall, Kernow; and Wales, Cymru. "KUM-ree, KUM-ree," I softly chanted aboard the *Jonathan Swift,* a ferry across the Irish Sea to the island of Anglesey in northern Wales.

As a nod toward their native languages, most modern Celtic lands put up bilingual town names. And as a nod toward independence, Celtic vandals just as regularly scratch out the English and French names, creating the sight of tourists standing befuddled beside their cars in



BRITTANY, 3 A.M. A night of draining pints and playing fiddles and flutes refuses to end at the Galway Inn, an Irish pub in Lorient, long a Celtic stronghold in France. "The Irish and Bretons have a lot in common," says émigré publican Padraig Larkin. "Music brings out our Celtic roots."

places like northwestern Ireland and the western tip of Cornwall, a useless English-language map hanging from their hands. Memorizing a few pronunciation rules is almost mandatory in Wales. Try asking for directions to Machynlleth and Llanfairfechan.

Except for a few regions in Ireland, the Welsh stand apart in retaining their old unaccompanied, un-anglicized place-names, particularly in the north and west. Here is the best defended outpost of Celtic speech: Nearly 600,000 people, roughly a fifth of the population, can speak Welsh, the beneficiaries of a nationalist movement that has used language as a rallying cry since the 1960s. The old language bubbles up in schools, pubs, grocery stores, and on television. The English name for Wales comes from the Anglo-Saxon word *wealas*, meaning foreigners, a description many Welsh today would turn on its head and apply to the English themselves.

Besides language, what gives the Celtic Welsh a chest-pounding feel of home is heroic history —and Wales is thick with it: walled towns, roofless churches, spiral-engraved standing stones, holy wells, crumbling hill forts, all proclaiming a past age of Celtic dominance.

The history that stirs the hottest passions among Welsh Celts belongs to medieval times,

when Welsh leaders resisted the ultimately successful invasions of the English kings. Those heroic days seemed as fresh as an open wound to David Petersen as he drove me through the Towy River Valley in southwestern Wales. I had met the ponytailed Petersen before at the Festival Interceltique, the pan-Celtic music event in Lorient, Brittany, where he headed the Welsh delegation. When I heard him call the Union Jack a "butcher's apron," I knew I'd found a Celtic troublemaker.

Petersen, a Celtic commentator and sculptor, wanted to show me one of the latest patriotic monuments to the Welsh cause. He was in a pugnacious mood, befitting the son of a former heavyweight champ. Jabbing his finger right and left as we sped through the mellow valley, Petersen bloodied the English face on the landscape. He angrily corrected a few anglicized names of towns; pointed out the ruins of Welsh castles while ignoring the bulkier, fixed-up English ones; and, slowing down beside a modest piece of pastureland, complained that no marker identified this ground as the site of the glorious Battle of Coed Llathen. Here, in 1257, Welsh troops crushed the invading English army of King Henry III. "A new map of this area has left the battlefield out," Petersen said in disbelief. "The effing nerve of the authorities to tell us that this has no historical value."

Wheeling into a car park in the center of Llandovery, an old market town, Petersen reached the point of his harangue: On a rise, sharing space with the broken walls of a castle, stood a warrior's statue. Helmet, spear, flowing cloak, shield, and broadsword—the costume of war gleamed in stainless steel. But where there should have been a face and a body inside the medieval uniform, empty space stared out.

The 16-foot-high statue represents Llywelyn ap Gruffydd Fychan, a "brave nobody," Petersen said. When English troops stormed the area in 1401, looking for the army of Welsh rebel Owain Glyndŵr, the local Lord Llywelyn led the enemy in the wrong direction, buying time for Glyndŵr to escape. As punishment for his subterfuge, Llywelyn was executed in the town square. "The English took his stomach out and cooked it in front of him," Petersen said. The empty cloak symbolizes the horrific form of death.

Petersen knows the full story behind the raising of the statue on the 600th anniversary of Llywelyn's execution. His sons Toby and Gideon designed and built the locally commissioned monument. Back at the car we found a £30 ($50) parking ticket on the windshield. Petersen snatched it up, cursed the authorities, and vowed to fight the ticket. He had no choice: A Ghost of Wales Past was looking over his shoulder.

When I reached Cornwall at the southernmost tip of England by car—alas, no ferry—I drove from St. Just to St. Ives to St. Agnes to St. Austell. People joke that there aren't enough seats in heaven for all the Celtic saints. Wherever you are in Celtic lands, every day is a holy day. For the first week or so of September alone, I counted feast days for saints named Macanisius, Ultan, Rhuddlad, Disibod, Kieran, and Finian. The saints' names date to the time between the fifth and eighth centuries when Celtic Christian missionaries, most from Ireland, scattered along the Atlantic coast and beyond to establish monastic centers. The monks often located their sanctuaries at pre-Christian ceremonial sites, acknowledging their sacred significance.

"Celtic of any sort," observed J.R.R. Tolkien, is "a magic bag, into which anything may be put, and out of which almost anything may come."

This entwining of pagan and early Christian traditions today exerts a magnetic pull at the religious sites, luring pilgrims, tourists, spiritual groupies, and mystic seekers. Something about Cornwall, its woolly wet weather, its abundance of prehistoric sites, and its ties to the legend of King Arthur (local Arthurians locate his castle at Tintagel), draws the more mystical and pagan of the pilgrims.

One day while looking around the Iron Age village site of Carn Euny, I met Cheryl Straffon,

HOLY PLACE At monastic ruins in Ireland's Aran Islands, Dara Molloy, an ex-Catholic priest, marries the Yoshidas. The Japanese couple came for the atmospheric Celtic ceremony.

a Cornish goddess worshipper. I first noticed her at the head of a group of American women coming out of an underground chamber. The early Celts may have used such subterranean rooms, called *fogous* in Cornwall, as ritual sites. "That room has great acoustics," I overheard Straffon saying. "Chanting sounds good in there."

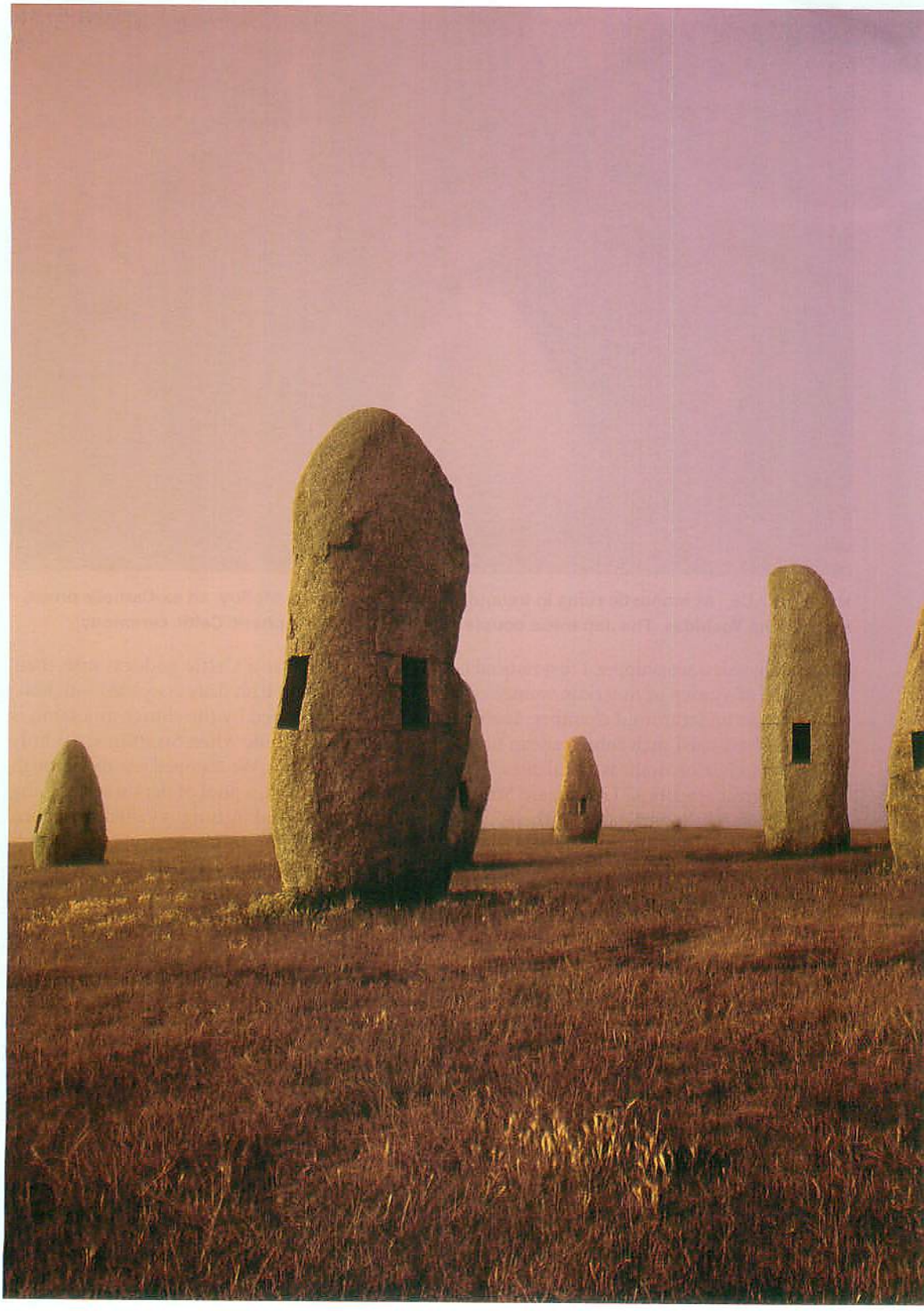
Straffon is editor of a newsletter called *Meyn Mamvro* about sacred sites in Cornwall. Middle-aged with a mop of graying blond hair, she has been intensely drawn to the Cornish landscape since she was a schoolgirl here. "It's as if I had been born with memories of these places," she said. "It is not a cold remote past here. It's a warm immediate past."

To commune with that past, Straffon observes the pre-Christian Celtic calendar, conducting rituals on the season-turning feast days of Imbolc (February 1, to mark the lactation of ewes), Beltane (May 1, when flocks and herds were moved to summer pastures), Lughnasa (August 1, for the first harvest), and Samhain (October 31-November 1, when the world of the dead was believed to briefly open, inspiring the modern Halloween).

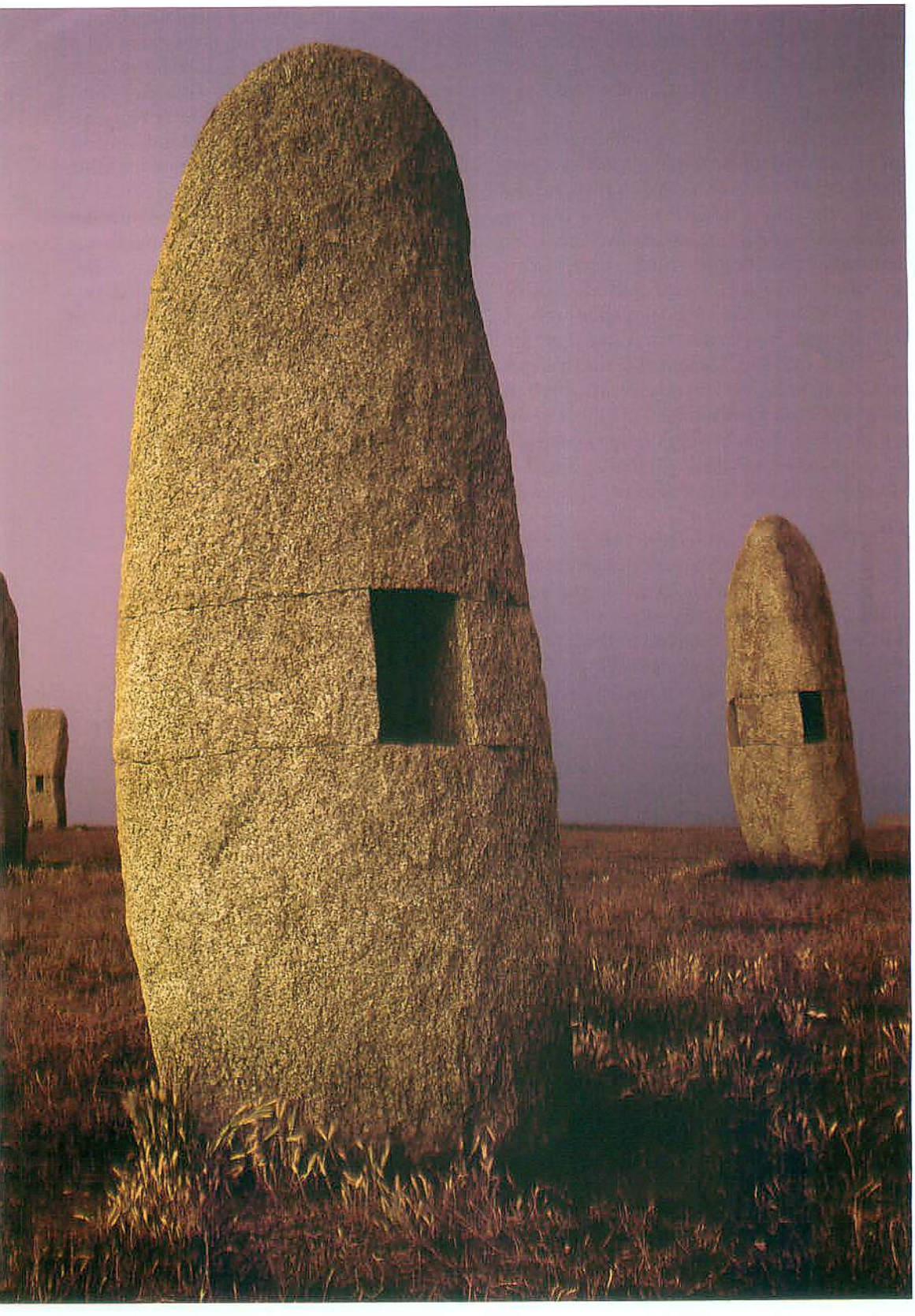
On each of these days Straffon and her fellow celebrants invite a Celtic goddess into their midst. Brigid, an Irish deity associated with healing, later absorbed by the church as a saint, is invoked on Imbolc when Straffon visits holy wells like Madron. We tramped one day through woods to the well, a pool of dark water seeping out of the ground. A fungus called stinkhorn gave off a piercing sour smell, and on the surrounding moss-furred trees, shreds of cloth and paper hung like ornaments off every branch. These were offerings, or "clouties," representing body parts that petitioners, Christians as well as pagans, wished to have healed.

When conducting a ritual here, Straffon said she and her friends decorate the well with candles and call in Brigid using Gaelic chants, just the way she imagines people did for centuries. "This gives us a sense of connecting with our ancestors who lived here," she said. "It allows us to relate to the land and give it thanks."

Pagans don't delight everyone in Cornwall. Some members of a local church have stripped the clouties at well sites, Straffon said, and a fundamentalist Christian farmer knocked down a standing stone on his land. But as we sloshed through mud back to the road and rain began



SPAIN'S CLAIM **A postmodern array of standing stones, with portals facing the sea, rises from a**



sculpture park at A Coruña in Galicia, a Spanish region touting its Celtic roots.

to fall, Straffon remarked that, judging by the number of visitors from afar seeking out the local sacred sites, Celts must be everywhere. "I believe if you feel Celtic," she said, "you become Celtic."

In many ways the so-called Celtic spirituality has become as popular and marketable as Celtic music. People are embracing it for its aura of seeking the divine in nature and for treating women as the spiritual equals of men. They come to meditate and conduct rituals at early Celtic Christian centers like Iona in Scotland, Glastonbury in England, and Glendalough in Ireland. On Inishmore in Ireland's Aran Islands, I attended a "Celtic wedding." Dara Molloy, who had quit the Catholic priesthood ten years earlier to protest the prohibition against female clergy, read the vows inside the ruins of a 12th-century church—but only after he had led the American couple to a fertility stone and holy well to pray.

The overnight ferry to Brittany across the English Channel probably follows a route similar to the one taken by Guénolé, a Celtic saint who sailed to "Little Britain" from England in the late fifth century to found a monastery. Driving through rolling farm country (finally, fertile, stone-free fields!), I stopped outside the village of Collorec, at a small fieldstone chapel named after the saint. A farmer was in the doorway, like Father Time himself, with a scythe on his shoulder, having just cut the grass around the building.

"When I was young, people would come to pray for the rains to stop," said Marcel Quéré, laying down his scythe and unlocking the chapel door to give me a look. "When a person died, someone would come ring the bell." Inside the dim interior I saw sculpted dragons swallowing the ends of the crossbeams and carved human heads where the walls met the ceiling. Tolerating these pagan symbols were sad-eyed wooden statues of the Virgin Mary and St. Guénolé.

One Sunday afternoon, a hundred or so people, almost all of them white-haired, gathered for Guénolé's pardon, or feast day. They sat on benches outside the chapel in the shade of pine trees. A mischievous breeze kept blowing the cross off the makeshift altar and onto the grass, until Father Pierre Mahé, smiling through his white beard, laid it flat on the table. Following custom, the priest, who serves 22 churches in four parishes, said the outdoor Mass in French, but the worshippers sang hymns in Breton, now spoken almost exclusively by the elderly. When Mass ended, two men carried the statue of St. Guénolé out of the chapel, hoisted him on their shoulders, and

UNVANQUISHED Outfitted with kilt and shield and carrying the Scottish flag, a patriot climbs the hill at Glenfinnan, where in 1745 Gaelic-speaking Highlanders joined an uprising against the British king. The rebels lost, but now generations later, the underdog Celts insist their time has come again.

led everyone on a slow procession down the lane, past stone farmhouses, circling around to return the saint to the chapel.

For the rest of the afternoon, the congregants held a dance at a nearby crossroads. Mostly the women danced, twirling and stepping in the crisp syncopation of Breton dance, while a pair of accordion players and someone on the bodhran, an Irish drum, made music under a hot sun. The men bowled in a grassy patch beside the road, tossing unpainted wooden balls at rows of pins. The priest, having replaced his vestments with blue jeans, stayed and drank beer. No one appeared in any hurry to leave.

I suspected that the Scots, the Irish, the Welsh, and the Cornish, the blood Celts among them anyway, would all feel at home here with these Bretons. There were no costumes or causes on display, nothing done to impress an outsider. The past danced into the present, and everyone, with a nod toward St. Guénolé, could feel thankful that on this day the world did not feel strange or hostile. It felt Celtic. □

Celtic Rising Listen to Scotsman Fred Morrison play his pipes, and hear Irishman Gearóid Mac Lochlainn of Belfast read—and rap—his poetry in Irish Gaelic at **ngm.com/0603**.

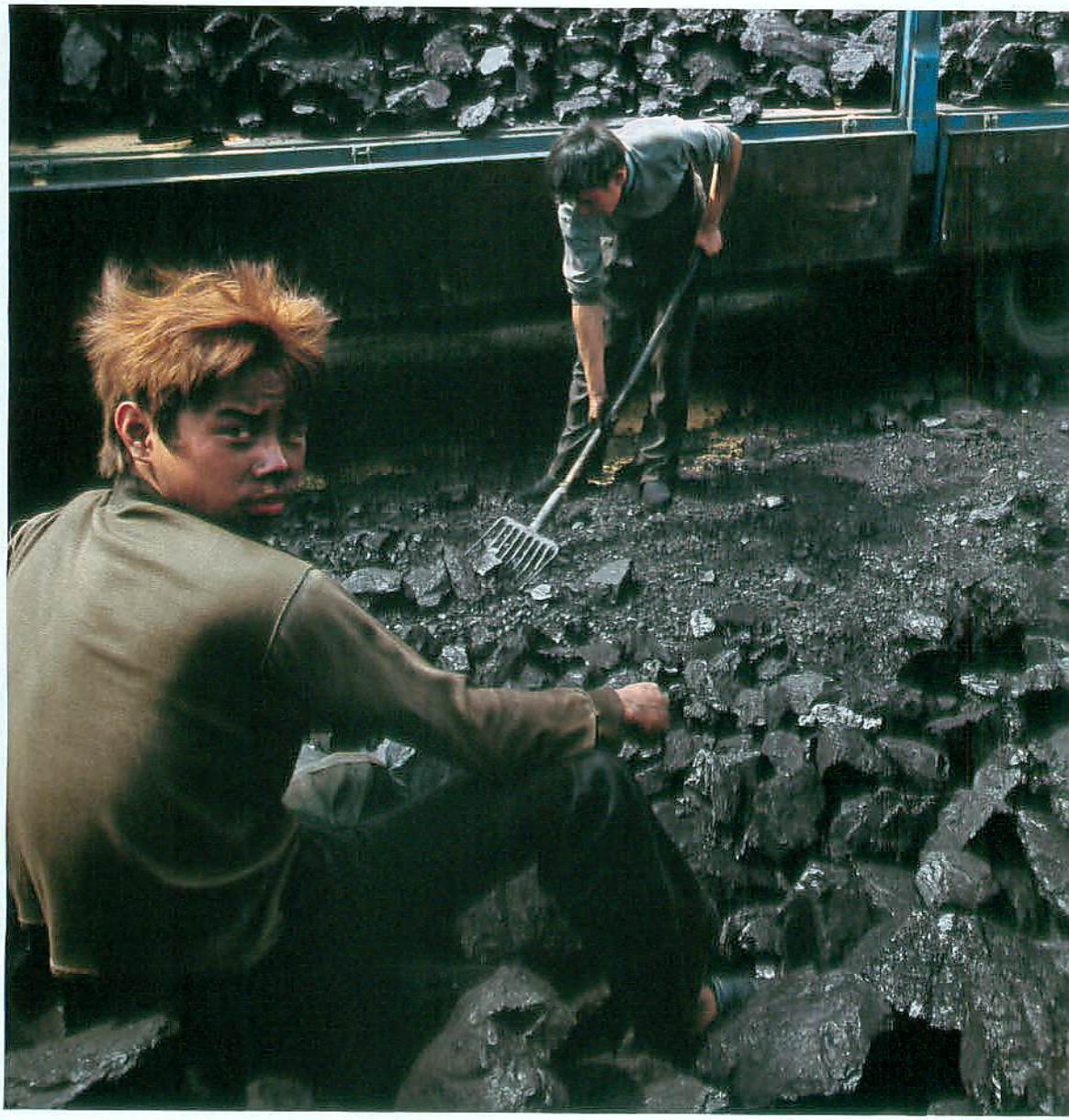
The High Cost of Cheap COAL

Coal is king again. Oil supplies are tight and natural gas prices are spiking, but coal could light our houses and power our factories for centuries. The price of this energy abundance could be high, however, as two stories on the following pages show. **The Coal Paradox** surveys the threat to global climate that legions of new coal-burning power plants would pose—a threat that new technologies could blunt. **When Mountains Move** describes a different hurt, for which there is no cure: landscapes and communities ravaged by our hunger for cheap coal.

RAW POWER | Utah's Hunter plant burns 14,000 tons of coal daily, generating enough electricity for a small city. Steam wafts from 600-foot stacks along with tens of thousands of tons of climate-warming CO_2 a day.

LESTER LEFKOWITZ, CORBIS

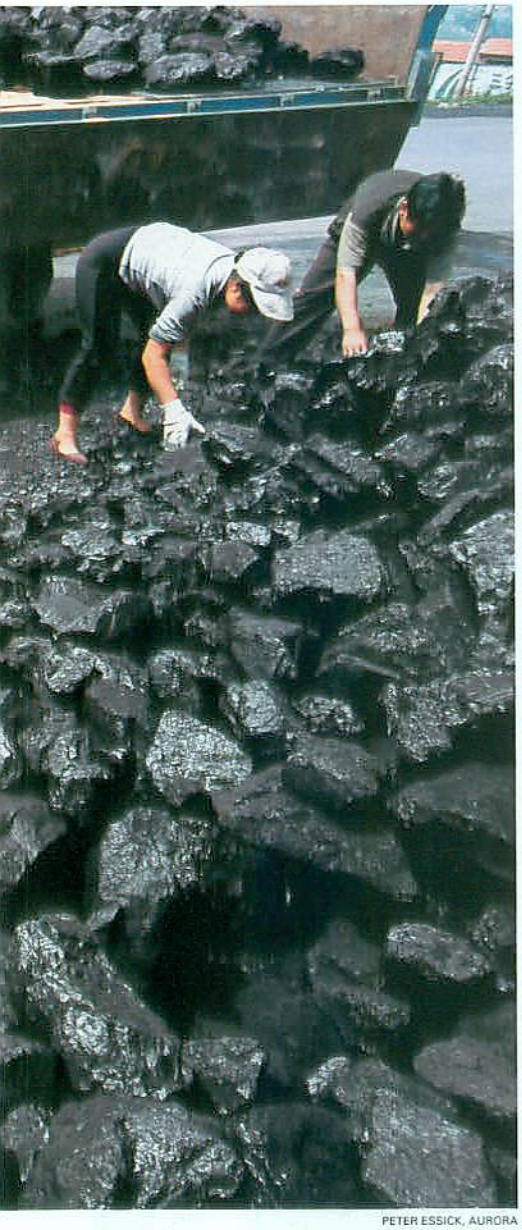
By Tim Appenzeller
NATIONAL GEOGRAPHIC SENIOR EDITOR



FUEL OF THE FUTURE | Workers loading coal in Shanxi Province, China, help feed the country's vast appetite for the fuel. Burned in homes, factories, and power plants, coal provides 65 percent of China's energy. Consumption —already the world's highest—could more than double in 20 years.

The Coal Paradox

We can't live without it. But can we survive with it?



PETER ESSICK, AURORA

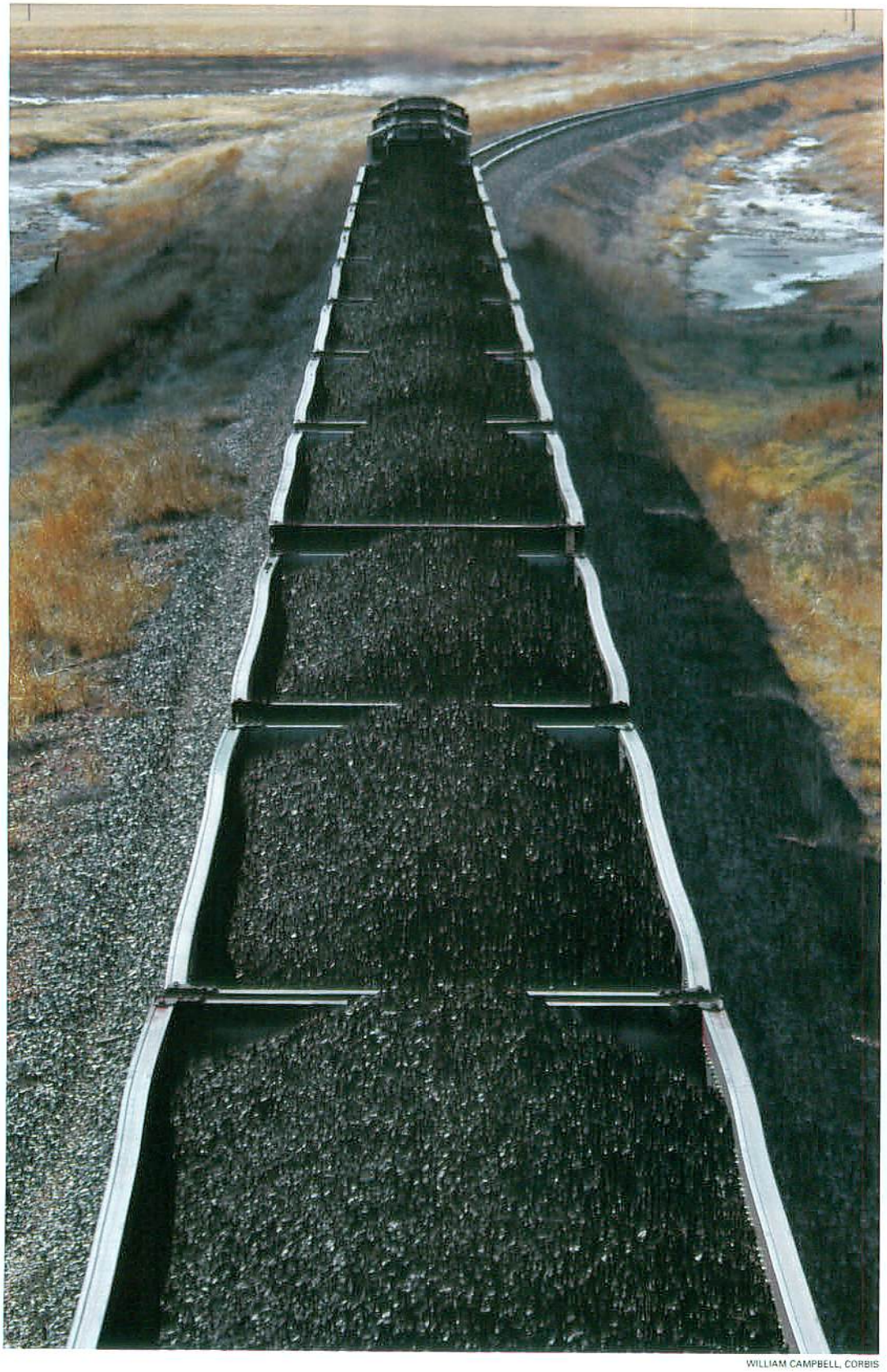
ON A SCORCHING AUGUST DAY IN southwestern Indiana, the giant Gibson generating station is running flat out. Its five 180-foot-high boilers are gulping 25 tons of coal each minute, sending thousand-degree steam blasting through turbines that churn out more than 3,000 megawatts of electric power, 50 percent more than Hoover Dam. The plant's cooling system is struggling to keep up, and in the control room warnings chirp as the exhaust temperature rises.

But there's no backing off on a day like this, with air conditioners humming across the Midwest and electricity demand close to record levels. Gibson, one of the biggest power plants in the country, is a mainstay of the region's electricity supply, pumping enough power into the grid for three million people. Stepping from the sweltering plant into the air-conditioned offices, Angeline Protogere of Cinergy, the Cincinnati-based utility that owns Gibson, says gratefully, "This is why we're making all that power."

Next time you turn up the AC or pop in a DVD, spare a thought for places like Gibson and for the grimy fuel it devours at the rate of three 100-car trainloads a day. Coal-burning power plants like this one supply the United States with half its electricity. They also emit a stew of damaging substances, including sulfur dioxide—a major cause of acid rain—and mercury. And they gush as much climate-warming carbon dioxide as America's cars, trucks, buses, and planes combined.

Here and there, in small demonstration projects, engineers are exploring technologies that could turn coal into power without these environmental costs. Yet unless utilities start building such plants soon—and lots of them—the future is likely to hold many more traditional stations like Gibson.

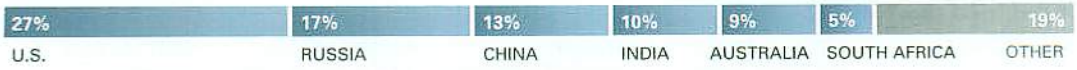
Last summer's voracious electricity use was just a preview. Americans' taste for bigger houses, along with population growth in the West and air-conditioning-dependent Southeast, will help



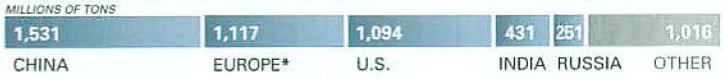
WILLIAM CAMPBELL, CORBIS

When you turn up the AC, think of Gibson and the grimy fuel it devours at the rate of three 100-car trainloads a day.

WHO HAS COAL? The world has more than a trillion tons of readily available coal. The U.S. has the largest share, but other energy-hungry countries, such as China and India, are richly endowed as well.



WHO USES COAL NOW? Global coal consumption is roughly five billion tons a year, with China burning the most. Western Europe has cut coal use by 36 percent since 1990 by using available natural gas from the North Sea and Russia.



WHO WILL USE IT TOMORROW? China's coal needs will more than double by 2025 to satisfy factories and consumers. The country also plans to convert coal to liquid motor fuels. Worldwide, consumption will rise by 56 percent.

**Excluding Russia*

push up the U.S. appetite for power by a third over the next 20 years, according to the Department of Energy. And in the developing world, especially China, electricity needs will rise even faster as factories burgeon and hundreds of millions of people buy their first refrigerators and TVs. Much of that demand is likely to be met with coal.

For the past 15 years U.S. utilities needing to add power have mainly built plants that burn natural gas, a relatively clean fuel. But a near tripling of natural gas prices in the past seven years has idled many gas-fired plants and put a damper on new construction. Neither nuclear energy nor alternative sources such as wind and solar seem likely to meet the demand for electricity.

Meanwhile, more than a quarter trillion tons of coal lie underfoot, from the Appalachians through the Illinois Basin to the Rocky Mountains —enough to last 250 years at today's consumption rate. You hear it again and again: The U.S. is the Saudi Arabia of coal. About 40 coal-burning power plants are now being designed or built in the U.S. China, also rich in coal, could build several hundred by 2025.

Mining enough coal to satisfy this growing appetite will take a toll on lands and communities (see following story, page 104). Of all fossil fuels, coal puts out the most carbon dioxide per unit of energy, so burning it poses a further threat to global climate, already warming alarmingly. With much government prodding, coal-burning utilities have cut pollutants such as sulfur dioxide and nitrogen oxides by installing equipment like the building-size scrubbers and catalytic units crowded behind the Gibson plant. But the carbon dioxide that drives global warming simply goes up the stacks—nearly two billion tons of it each year from U.S. coal plants. Within the next two decades that amount could rise by a third.

There's no easy way to capture all the carbon dioxide from a traditional coal-burning station. "Right now, if you took a plant and slapped a carbon-capture device on it, you'd lose 25 percent of the energy," says Julio Friedmann, who

SUPPLY AND DEMAND | A coal train rumbling across Montana is a mile and a half long yet carries barely a day's fuel for a large power plant. The U.S. burns more than a billion tons of coal a year but has the world's richest deposits (above), enough to last 250 years.

SOURCE: ENERGY INFORMATION ADMINISTRATION, DOE. NGM ART

U.S. ELECTRICITY GENERATION

U.S. POWER PLANT CO_2 EMISSIONS

WHAT'S IN COAL SMOKE?

SULFUR DIOXIDE
The sulfur in coal forms this gas, which gives rise to acid rain when it reacts with water in clouds. Many plants control sulfur emissions by burning low-sulfur coal and passing the exhaust through scrubbers, which capture sulfur dioxide.

NITROGEN OXIDES
The heat of power-plant burners turns nitrogen from the air into nitrogen oxides, which can contribute to acid rain and ground-level ozone. Pollution controls on many plants limit nitrogen oxide emissions.

MERCURY
The traces of mercury in coal escape in power-plant exhaust. Falling hundreds of miles away in rain or snow, the mercury builds up in fish, making some species unsafe for children and pregnant women to eat.

CARBON DIOXIDE
Coal produces more CO_2 per energy unit than any other fossil fuel. CO_2 is a greenhouse gas, affecting climate by trapping heat that would otherwise escape to space. Power plants today release all their CO_2 into the atmosphere.

PARTICULATES
Particles from coal-burning plants can harm people who have heart and breathing disorders. Soot and ash are captured before they go up the stacks, but finer particles can form later, from oxides of sulfur and nitrogen.

studies carbon dioxide management at Lawrence Livermore National Laboratory. But a new kind of power station could change that.

A hundred miles up the Wabash River from the Gibson plant is a small power station that looks nothing like Gibson's mammoth boilers and steam turbines. This one resembles an oil refinery, all tanks and silvery tubes. Instead of burning coal, the Wabash River plant chemically transforms it in a process called coal gasification.

The Wabash plant mixes coal or petroleum coke, a coal-like residue from oil refineries, with water and pure oxygen and pumps it into a tall tank, where a fiery reaction turns the mixture into a flammable gas. Other equipment removes sulfur and other contaminants from the syngas, as it's called, before it's burned in a gas turbine to produce electricity.

Cleaning the unburned syngas is cheaper and more effective than trying to sieve pollutants from power plant exhaust, as the scrubbers at a plant like Gibson do. "This has been called the cleanest coal-fired power plant in the world," says Steven Vick, general manager of the Wabash facility. "We're pretty proud of that distinction."

The syngas can even be processed to strip out the carbon dioxide. The Wabash plant doesn't take this step, but future plants could. Coal gasification, Vick says, "is a technology that's set up for total CO_2 removal." The carbon dioxide could be pumped deep underground into depleted oil fields, old coal seams, or fluid-filled rock, sealed away from the atmosphere. And as a bonus, taking carbon dioxide out of the syngas can leave pure hydrogen, which could fuel a new generation of nonpolluting cars as well as generate electric power.

The Wabash plant and a similar one near Tampa, Florida, were built or refurbished with government money in the mid-1990s to demonstrate that gasification is a viable electricity source. Projects in North Dakota, Canada, the North Sea, and elsewhere have tested the other parts of the equation: capturing carbon dioxide and sequestering it underground. Researchers say they need to know more about how buried carbon dioxide behaves to be sure it won't leak back out—a potential threat to climate or even people. But Friedmann says, "For a first cut, we have enough information to say, 'It's a no-brainer. We know how to do this.'"

Yet that's no guarantee utilities will embrace the gasification technology. "The fact that it's proved in Indiana and Florida doesn't mean

SOURCE: ENERGY INFORMATION ADMINISTRATION, DOE. NGM ART

MITCH EPSTEIN

A CLEANER WAY | A North Dakota chemical plant transforms coal to a gas while stripping out carbon dioxide and piping it underground to an oil field in Canada; only steam escapes. This plant sells the gas, but clean power plants of the future could make coal gas, then burn it to generate electricity.

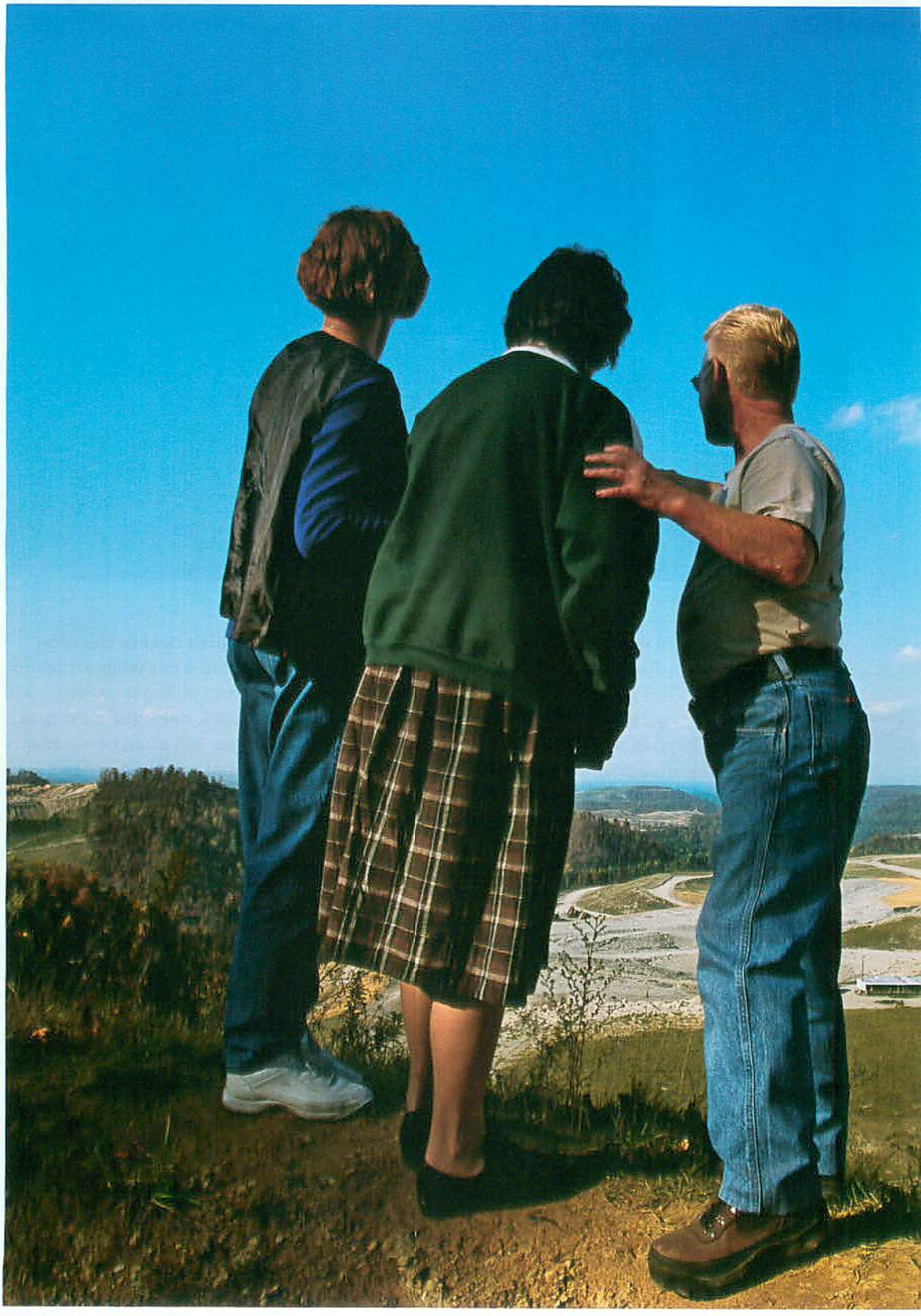
executives are going to make a billion-dollar bet on it," says William Rosenberg of Harvard's Kennedy School of Government. The two gasification power plants in the U.S. are half the size of most commercial generating stations and have proved less reliable than traditional plants. The technology also costs as much as 20 percent more. Most important, there's little incentive for a company to take on the extra risk and expense of cleaner technology: For now U.S. utilities are free to emit as much carbon dioxide as they like.

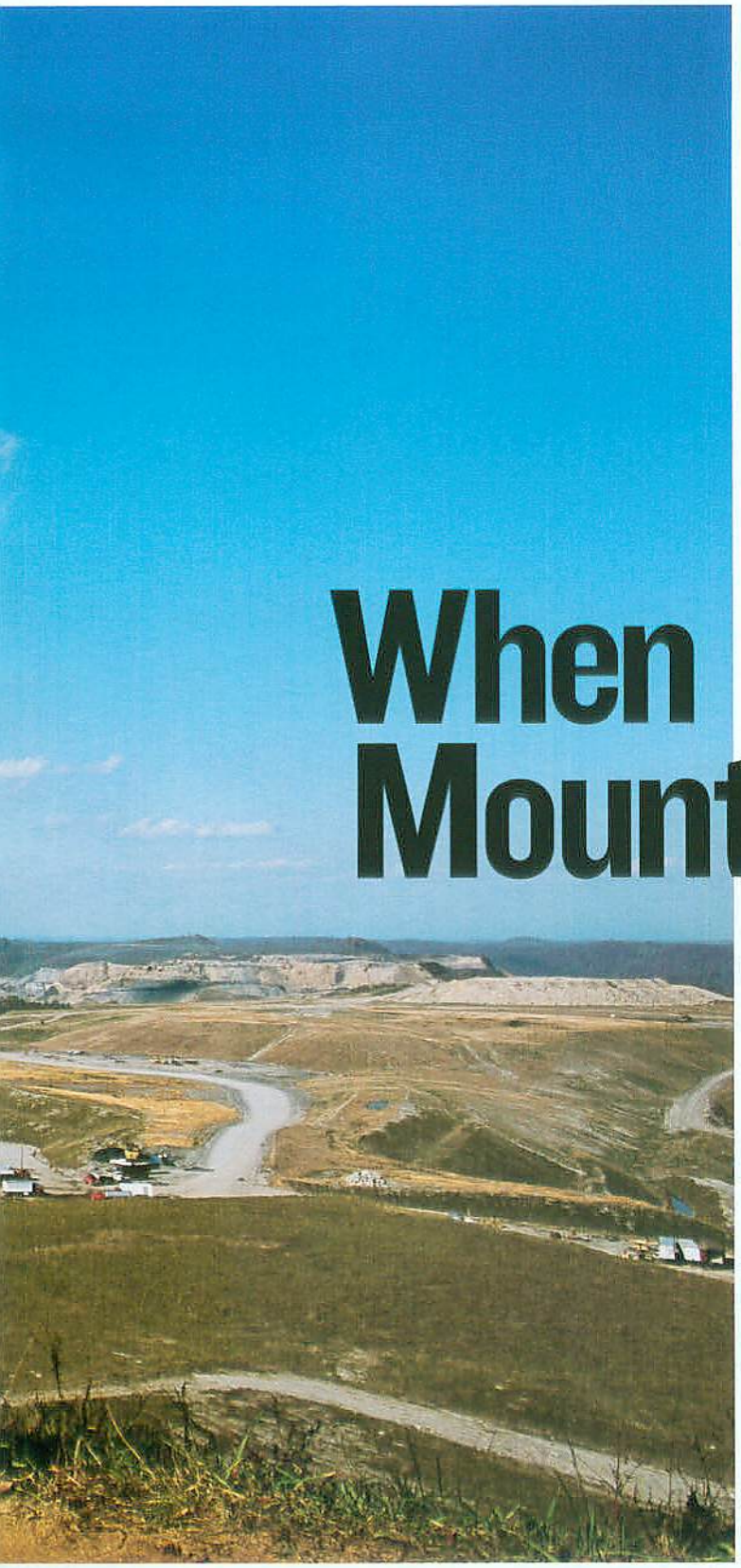
Cinergy CEO James Rogers, the man in charge of Gibson and eight other carbon-spewing plants, says he expects that to change. "I do believe we'll have regulation of carbon in this country," he says, and he wants his company to be ready. "The sooner we get to work, the better. I believe it's very important that we develop the ability to do carbon sequestration." Rogers says he intends to build a commercial-scale gasification power plant, able to capture its carbon dioxide, and several other companies have announced similar plans.

The energy bill passed last July by the U.S. Congress offers help in the form of loan guarantees and tax credits for gasification projects. "This should jump-start things," says Rosenberg, who advocated these measures in testimony to Congress. The experience of building and running the first few plants should lower costs and improve reliability. And sooner or later, says Rogers, new environmental laws that put a price on carbon dioxide emissions will make clean technology look far more attractive. "If the cost of carbon is 30 bucks a ton, it's amazing the kinds of technologies that will evolve to allow you to produce more electricity with less emissions."

If he's right, we may one day be able to cool our houses without turning up the thermostat on the entire planet. □

↖ **Insatiable Appetite** Can the Earth sustain our growing coal consumption? Is the government pushing hard enough for cleaner coal technologies? Share your thoughts in our forum at **ngm.com/0603.**





The High Cost of Cheap **COAL**

When Mountains Move

Big mining companies hit pay dirt by scalping mountaintops in the billion-dollar coalfields of southern West Virginia. But residents pay a high price in noise, air, and water pollution. From his family cemetery, Larry Gibson and his visitors look down on the mines created when a coal company blew the top off Kayford Mountain, near Whitesville. Another company wants the 50-acre plot Gibson kinfolk have owned for two centuries. But Larry, now an environmental evangelist, vows "this land will never be for sale."

MINE-MADE BADLANDS | One of the largest strip mines in West Virginia, Hobet 21 sprawls across almost 12,000 acres. Forests edging these mountaintop mines often block the view of them from the ground, though nearby households, right, suffer from the proximity.

By John G. Mitchell
Photographs by Melissa Farlow

COAL BROUGHT PEOPLE TO MARFORK hollow in the Appalachian Mountains of southern West Virginia. And it was coal, or rather a different way of mining it, that finally drove the people away. The last to leave was Judy Bonds.

A coal miner's daughter whose roots here go back nine generations, Bonds packed up her family and fled when she could no longer tolerate the blasting that rattled her windows, the coal soot that she suspected was clotting her grandson's lungs, and the blackwater spills that bellied-up fish in a nearby stream. Retreating to the town of Rock Creek, a few miles downstream, Bonds joined Coal River Mountain Watch, a citizens group determined to oppose surface-mining abuses.

In the years since Bonds moved, coal companies have turned to an even more aggressive mining process known as mountaintop removal. After clear-cutting a peak's forest, miners shatter its rock with high explosives. Then they scoop up the rubble in giant draglines and dump the overburden, as they call it, into a conveniently located hollow, or valley. The method was first tested in Kentucky and West Virginia in the late 1970s and has since spread to parts of Tennessee and Virginia.

"What the coal companies are doing to us and our mountains," said Bonds when she and I first met years ago, "is the best kept dirty little secret in America."

Now the secret is out. Coal companies have obliterated the summits of scores of mountains scattered throughout Appalachia, and more and more folks like Judy Bonds are decrying the environmental and social fallout of what some refer to as strip mining on steroids.

Not only is mountain topping less labor intensive than underground mining, it is also more efficient and profitable than the older form of surface mining, in which the operator stripped away the horizontal contours of a mountainside as one might peel an apple. So fast has the practice spread that there's no accurate accounting of

FAMILY TIES | It took a legal battle for the Millers and Caudills to keep the "homeplace," inherited property now used for family gatherings. A county court granted a coal company petition to take the land to expand Hobet 21, but the state supreme court overturned that ruling. Still, Lucille Miller, far right, worries, "Eventually, we'll be in a bowl surrounded by mining."

"What the coal companies are doing to us and our mountains is the best kept dirty little secret in America."

the area affected, but surface mining in general has impacted more than 400,000 acres in this four-state Appalachian region (map, page 113), including more than 1,200 miles of streambeds. If the practice continues until 2012, it will have squashed a piece of the American earth larger than the state of Rhode Island.

In the years since high-tech earthmoving machinery made mountain topping increasingly attractive to the energy industry, more and more of West Virginia's total production of coal—some 154 million tons in 2004—has come from its decapitated highlands. Relative to Western coal (Wyoming is the nation's top coal producer), second ranked West Virginia's low-sulfur bituminous burns with a cleaner, hotter efficiency in the electric power plants of America. And taxes from bituminous coal help fuel a large part of the state's economy.

But some West Virginians have been paying a hurtful price for their state's good fortune—and the coal industry's cost-cutting efficiency. In 1948 some 125,000 men worked in the mines of West Virginia. By 2005 there were fewer than 19,000, and most of these were employed in underground mines. Nowadays, it just doesn't take many hands to wrestle coal off the top of a mountain.

Consider, for example, the Big Coal River community of Sylvester, where fewer than 20 of its 195 longtime residents are employed in mining or related services. And consider Sylvester resident Pauline Canterberry. She lives in a small house just a quarter mile down State Route 3 from a coal-washing plant operated by the Elk Run Coal Company, a subsidiary of Massey Energy, West Virginia's premier producer. Canterberry has been waging a decade-long battle with Massey and state and federal regulators over the volume of coal dust wafting from the Elk Run facility and sifting under the sills of Sylvester's homes. She has personal reasons for being concerned about the quality of the air. Her father, Ernest Spangler, died in 1957 from silicosis. His job had been putting out mine fires with buckets of pulverized rock dust. Then in 1991 her husband, John D. Canterberry, died of black lung disease after years of working in underground mines.

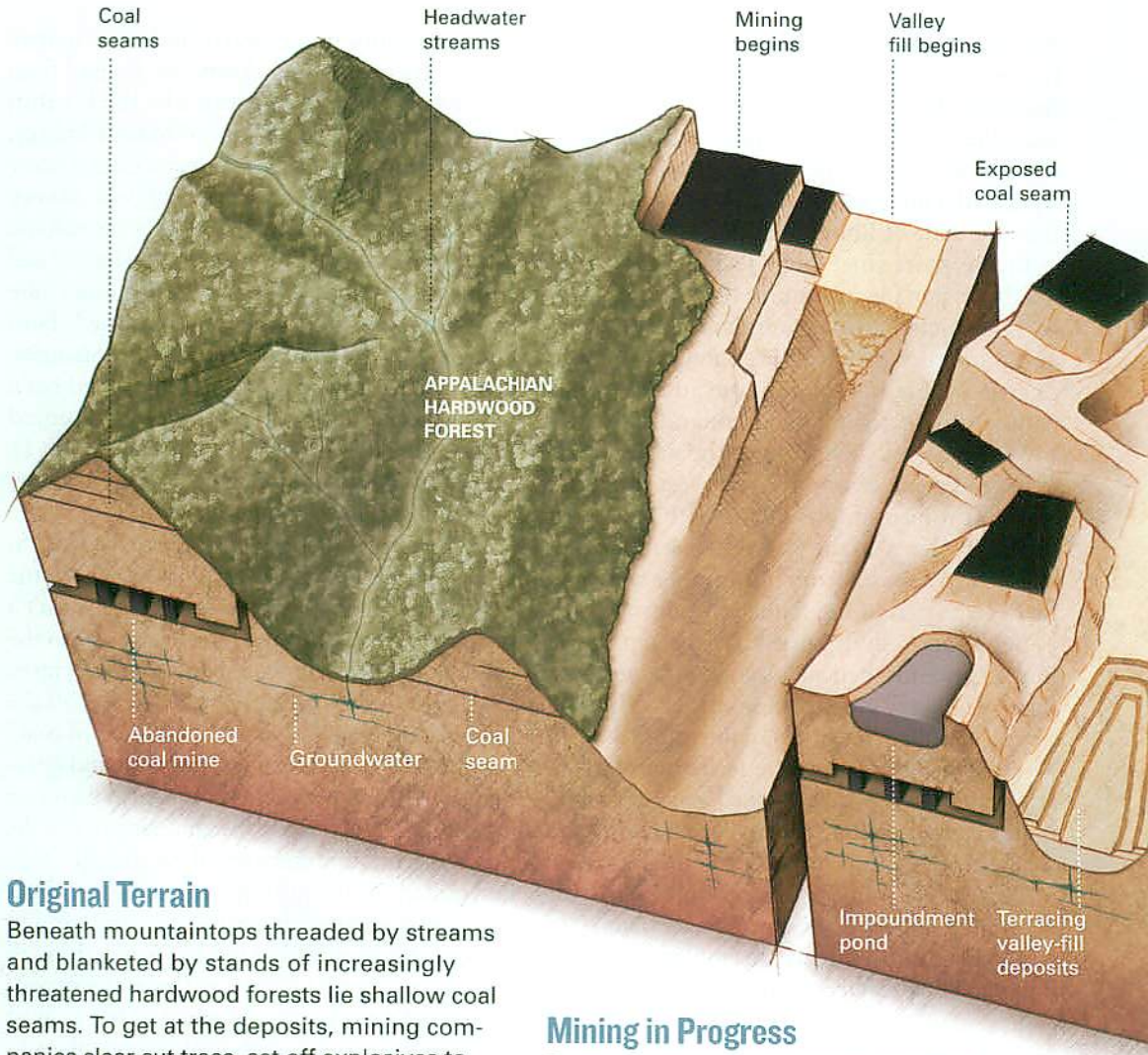
"When I was young, Sylvester was the place to be," Canterberry said. "Everyone wanted a home here because the town was so clean. It wasn't a company town. But then Massey came into the valley, and it's been downhill ever since—in more ways than one. Now they'll take 300 feet off the top of a mountain just to get at a few feet of coal."

After a long succession of petitions and hearings, 150 Sylvester residents prevailed in their case against Elk Run, forcing the company to pay the litigants economic damages of nearly half a million dollars and requiring it to maintain a dust-trapping dome over its processing plant and to limit the number of coal trucks passing through town to an average of 20 a day. Despite these concessions, Canterberry and some of her activist neighbors are worried about Massey's plans to expand its Elk Run operations. (Massey representatives did not return repeated phone calls requesting information on its record at Sylvester.)

Several years ago the director of the state's Division of Mining and Reclamation issued a memorandum showing that for the years 2000 and 2001 Massey incurred 500 violations, more than twice the number accumulated by the state's next three largest producers combined. Sixty-two of those violations, most involving excessive coal dust emissions, were attributed to the Elk Run Coal Company at Sylvester.

NOT FIT TO DRINK | Kenneth Stroud blames the toxic soup flowing from the tap in his home in Rawl for maladies affecting his sons and him. Stroud and some 350 other area residents are suing Massey Energy, claiming that by storing coal sludge in old mine shafts it fouled well water, a charge the company denies. Not far from Rawl, tainted water (top) flowing down a slope above Pigeon Creek is blamed on seepage from a coal refuse impoundment owned by Arch, an allegation also denied.

Moving Mountains



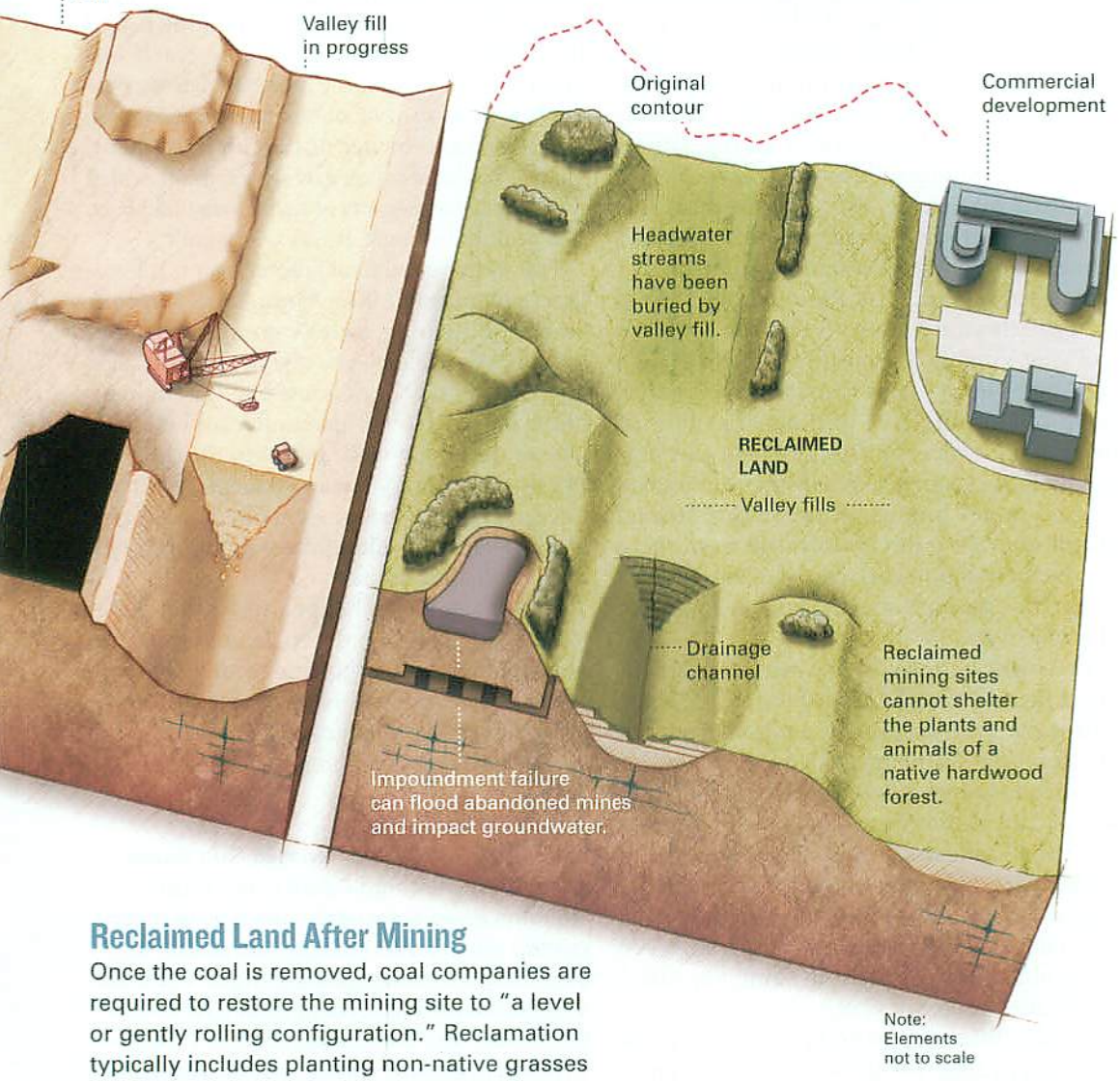
Original Terrain

Beneath mountaintops threaded by streams and blanketed by stands of increasingly threatened hardwood forests lie shallow coal seams. To get at the deposits, mining companies clear-cut trees, set off explosives to loosen soil and rock, and discard topsoil in nearby valleys. The result: a loss of habitat for a number of species, including migratory birds like the cerulean warbler.

Mining in Progress

To expose coal seams, giant draglines—cranelike machines measuring up to 20 stories high—remove the overburden of rock and dirt, lifting a hundred tons or more in a single bite. If the coal needs to be washed to remove impurities, impoundment ponds store the resulting toxic sludge and wastewater. The threat of a collapsed impoundment or valley fill is a concern to many living below.

Terraced to retard erosion, valley fill rises like a dam at the edge of a reclaimed West Virginia mining site. Mountaintop mining has grown to account for a quarter of the state's annual 154-million-ton coal production.



Reclaimed Land After Mining

Once the coal is removed, coal companies are required to restore the mining site to "a level or gently rolling configuration." Reclamation typically includes planting non-native grasses and scattered stands of quick-growing trees. In a few cases companies have gotten variance permits to build a factory, a prison, golf courses, and even an FBI facility.

ART BY JUAN VELASCO, NGM GRAPHICS

"Now the coal companies will take 300 feet off the top of a mountain just to get at a few feet of coal."

I GREW UP BEHOLDEN to West Virginia bituminous coal. My parents' house in Cincinnati was heated by it until they switched to oil in 1945. The coal came down the Ohio River by barge, and every wintry month or so a dump truck would deliver a big pile beside our garage. I remember helping my father cart it to the furnace inside, and the grating screech of his shovel on the cellar floor. And I remember the trail of black soot and the coal dust on my shoes. I was grateful for the warmth the coal gave us, but I hated it too because it was dirty. This was before public health and clean-air regulations obliged the mining industry to wash coal and, in Appalachia at least, dispose of the dust, dirt, and wastewater in impoundments, often perched precariously on the sides of the mountains.

There are some 500 of these impoundments in Appalachia today, more than half in Kentucky and West Virginia. Variously referred to as slurry ponds, sludge lagoons, or waste basins, they impound hundreds of billions of gallons of toxic black water and sticky black goo, byproducts of cleaning coal, mostly from underground mines but also from surface mines. Mountain folk residing downhill from these ponds worry about what a flood of loose sludge might do—and has already done in a number of tragic cases.

In Logan County in the winter of 1972, following two straight days of torrential rain, a coal-waste structure built by a subsidiary of the Pittston Coal Company collapsed and spilled 130 million gallons into Buffalo Creek. The flood scooped up tons of debris and scores of homes as it swept downstream. Survivors recalled seeing houses bob by, atilt in the swift current, the doomed families huddled at their windows. The final count was 125 dead, 1,000 injured, 4,000 made homeless. The Pittston Company called the disaster an "act of God."

In neighboring Kentucky on an October morning in 2000, the bottom of a waste pond near the town of Inez collapsed, pouring 250 million gallons of slurry—25 times the amount of oil spilled in the *Exxon Valdez* disaster—into an inactive underground mine shaft. From there, the slurry surged to the mine's two exits and flooded two creeks hell-bent for the Tug Fork of the Big Sandy and the Ohio River beyond. Miraculously, there was no loss of human life, though 20 miles of stream valley would be declared an aquatic dead zone, water systems in ten counties would have to be shut down, and the black slick would eventually reach out toward the riverfront in Cincinnati. Lawyers for the Martin County Coal Company, a Massey subsidiary and owner of the impoundment, blamed the accident on excessive rainfall, which was simply another way of saying what had been said at Buffalo Creek. It was God's fault.

Fear of impoundment failures haunts the collective memory of West Virginians. "I'm convinced something awful's going to happen again," Freda Williams was saying the day I called on her at her tidy brick house beside a tributary of the Big Coal River, just south of Whitesville. One of the largest waste basins in the state, the Brushy Fork slurry lagoon, owned by Massey Energy, impounds some eight billion gallons of blackwater sludge about three miles upstream from Williams's home.

"What's going to happen to all that water if the dam breaks or the basin collapses into an abandoned underground mine?" By some accounts, should the Brushy Fork impoundment ever fail, a wave of sludge 25 feet high could roll over Whitesville in no time flat.

RESHAPING THE LAND | Twisted Gun public golf course in Mingo County (top right) smooths away scars left by the kind of mountaintop mining that still goes on beside it. Searching for native ginseng (right) is a West Virginia tradition with diminishing returns. While deer and overharvesting have taken a toll on the plant, whose root is prized as a medicinal, mining destroys the forests where ginseng grows.

CAT

CLEAN SWEEP | Workers for JMAC Leasing use nothing more than shovels and brooms to remove dirt and rock from coal at Joe's Branch mine. "The cleaner we keep it, the more we get for it," says Gordon Justice, who took over the site after a large, highly mechanized firm left. "I get $50 a ton and up, depending on the quality." But it's hard to find the workers he needs. "Mountaintop removal is just easier work," he says.

Should the Brushy Fork impoundment fail, a wave of sludge 25 feet high could roll over Whitesville in no time flat.

Two other Massey waste impoundments pucker the slopes of the Big Coal Valley. The one at Sundial looms directly above the Marsh Fork Elementary School, with an enrollment of 240 children, from kindergarten through fifth grade. Though Stephanie Timmermeyer, chief of the state's Department of Environmental Protection, has claimed that the Massey facility poses no threat to the schoolchildren, the agency's own rating system lists the dam as a Class C facility, meaning its failure could reasonably be expected to cause loss of human life.

BESIDES THE RAW SCARS of the mines themselves, the most startling features of coal country are not necessarily those blackwater basins but the mountain-topped valley fills that have buried hollows and headwater streams under millions of tons of broken rock. Critics fear some fills could eventually come tumbling down in landslides of unpredictable proportions. As one Kentucky attorney likes to put it: "A valley fill is a time bomb waiting to happen."

One of West Virginia's biggest time bombs reaches more than two miles down what used to be, when it was flowing free, the Connelly Branch of Mud River in Lincoln County. The fill represents part of a mountaintop the Arch Coal Company unhinged to create the 12,000-acre Hobet 21 mine, one of the largest surface mines in West Virginia. But Hobet 21, now owned by Magnum Coal, has another distinction: For several years it's been home to "Big John," an earthmoving machine with a 20-story dragline and a bucket scoop that swallows over 100 tons of soil and rock in a single bite.

Up the Mud River a short way, a tributary known as Laurel Branch flows sweet and clear beside a weathered white-frame farmhouse. The front porch overlooks a garden of corn and potatoes. From the porch in the spring you can hear the vernal murmur of the creek, though not when the farmhouse is crowded, as it was at the time of my visit, with kin of the Caudill-Miller clan gathered at a place that has been in the family for a hundred years. Leon and Lucille Miller preside as host and hostess for these occasions. She is one of the surviving heirs of John and Lydia Caudill, who inherited 75 acres abutting the Mud and built this farmhouse in 1920. Lucille was raised here, along with nine siblings. But now, for all the copious country food and Caudill hospitality, an explicable uneasiness lingered at the edge of the festivities. Moving to expand its Hobet 21 operation, Arch Coal had informed the Millers that it was looking to do with Laurel Branch what it had done to the Connelly. And Arch wanted the Caudill homeplace out of the way.

"They want it all," Leon Miller told me, "the house and everything. And we're saying, 'No.'"

Since that particular May reunion a few years ago, I have been following the ups and downs of the Millers' struggle to stop Arch Coal from burying Laurel Branch and the ancestral home under the shadow of Hobet 21. Arch did succeed in buying out some of the Caudill heirs, thereby acquiring a two-thirds interest in the 75 acres. But when Lucille Miller and six of the heirs continued to say "no," Arch's Ark Land Company filed a lawsuit in Lincoln County Circuit Court arguing that the holdouts should be forced to sell their interests because coal mining was "the highest and best use of the property" and because the cost of protecting the nearby Miller-Caudill land from mining waste would be prohibitive for Arch. Besides, the company's attorneys said, the heirs did not live at the farm but used

FIGHTING BACK | Attorney Brian Glasser briefs residents of Sylvester on their suit against Elk Run Coal Company. For three years local "dust busters" wiped outdoor surfaces, saving the dust spewed by a coal-processing plant. A court ordered the company to maintain dust-control equipment and pay $473,000 in damages for reduced property values. Residents in Switzer were not so lucky: Heavy rains washed valley fill onto a roadway (left).

it only on weekends and other occasions. The circuit court ruled in the company's favor and ordered the property sold at auction. Arch got it. The Millers appealed to the state supreme court and won a reversal of the lower court's ruling. The farmhouse still stands, and the Laurel still murmurs, at least for now.

While Millers and Caudills rallied round their embattled homeplace, a larger but not unrelated issue was unfolding in federal courts and among the agencies responsible for regulating coal mining under the Clean Water Act and the Surface Mining Control and Reclamation Act of 1977 (SMCRA). Under "Smackra," as the act is known, environmentalists contend that the U.S. Office of Surface Mining should enforce a buffer-zone rule prohibiting, in all but the most exceptional cases, any mining activity within one hundred feet of a stream. Under the Clean Water Act, the Army Corps of Engineers was supposed to regulate the actual filling of the streambed itself. Perceiving a lack of enforcement on both counts, opponents of mountaintop mining in West Virginia have been in and out of court for the past five years, occasionally winning a legal round only to have it set aside on appeal by attorneys for various agencies and the coal industry.

In or out of the courtroom, the argument often boils down to differing opinions as to what constitutes a regulated stream in Appalachia, how vital its uppermost reaches might be to the ecological health of the downstream watershed, and finally the degree to which valley fill might contribute to flooding in a peak storm event.

The defenders of valley fills argue that most of these structures affect intermittent streams only and therefore do not fall within the reach of the Army Engineers and the Clean Water Act. William Raney, president of the West Virginia Coal Association, believes many fill areas are simply "dry hollows" for most of the year, implying that they serve little ecological function.

But that's not the way Ben Stout, a biology professor at Wheeling Jesuit University, sees it. According to Stout, aquatic insects in seep springs

GIVING UP | The stress of living next door to the Hobet 21 mine proved too much for Lorene Caudill, packing to move from the house she and her husband, Therman, built along the Mud River in 1966. "There was so much dust," she says. "The blasts came in the morning and evening. They rattled dishes like an earthquake." A mine company guard now lives in their former home.

A TOWN CREMATED | The community of Dehue, where miners' homes were owned by their employer, Dingess-Rum Land Company, was razed to make room for a new processing facility in a state dominated by King Coal.

at the top of a watershed feed larger life-forms by shredding leaf litter and sending the nutrient-rich particles downstream. "These insects provide the link between a forest and a river," Stout says. "Bury their habitat and you lose the link."

The issue of flooding also evokes conflicting views. Raney sees no connection between mountaintop mining and floods. "Science doesn't bear that out," he told me during an interview in his Charleston office. "What causes flooding is too much water falling in too short a time."

Yet a study by federal regulators, obtained by the *Charleston Gazette* through the Freedom of Information Act, predicted that one valley fill at the Hobet 21 mine could increase peak runoff flow by as much as 42 percent. Vivian Stockman, a project coordinator with the Ohio Valley Environmental Coalition in Huntington, contends that 12 West Virginians have died since 2001 because of floods related to mountaintop mining. "Old-timers will tell you property that has been in their families for generations never flooded severely until mining began upstream," Stockman says. "It's common sense. Denuded landscapes don't hold water the way forests do."

It was not the intent of Smackra, of course, to allow coal companies to walk away from their surface mines and leave them denuded. Stripped mountainsides, the law declared, must be restored to their "approximate original contour" and stabilized with grasses and shrubs, and, if possible, trees. But putting the entire top of a topped-off mountain back together again was an altogether different—and more expensive—matter. So mountaintop mines were given a

"They've stripped off hundreds of thousands of acres but put less than one percent of it into productive use."

blanket exemption from this requirement with the understanding that, in lieu of contoured restoration, the resulting plateau would be put to some beneficial public use. Coal boosters claimed the sites would create West Virginia's own Field of Dreams, seeding housing, schools, recreational facilities, and jobs galore. In most cases it didn't work out that way. The most common "use" turned out to be pastureland (in a region ill-suited for livestock production) or what the industry and its regulators like to identify as fish and wildlife habitat.

"The coal companies have stripped off hundreds of thousands of acres," says Joe Lovett, an attorney for the Appalachian Center for the Economy and the Environment, "but they're putting less than one percent of it into productive use."

Yet the industry should get some credit for what it's managed to accomplish in post-mining land use over the years. It's provided a number of West Virginia counties with the flat, buildable space to accommodate two high schools, two "premier" golf courses, a regional jail, a county airport, a 985-acre complex for the Federal Bureau of Investigation near Clarksburg, an aquaculture facility, and a hardwood-flooring plant in Mingo County that now employs 250 workers.

"Economically, we were dying on the vine," said Mike Whitt, executive director of the Mingo County Redevelopment Authority, as we toured the 40-million-dollar flooring plant, financed by grants from federal, state, and local governments and by private investors. "So we got OPM —other people's money—to get the job done. Without the infrastructure to create jobs, you're out of the game."

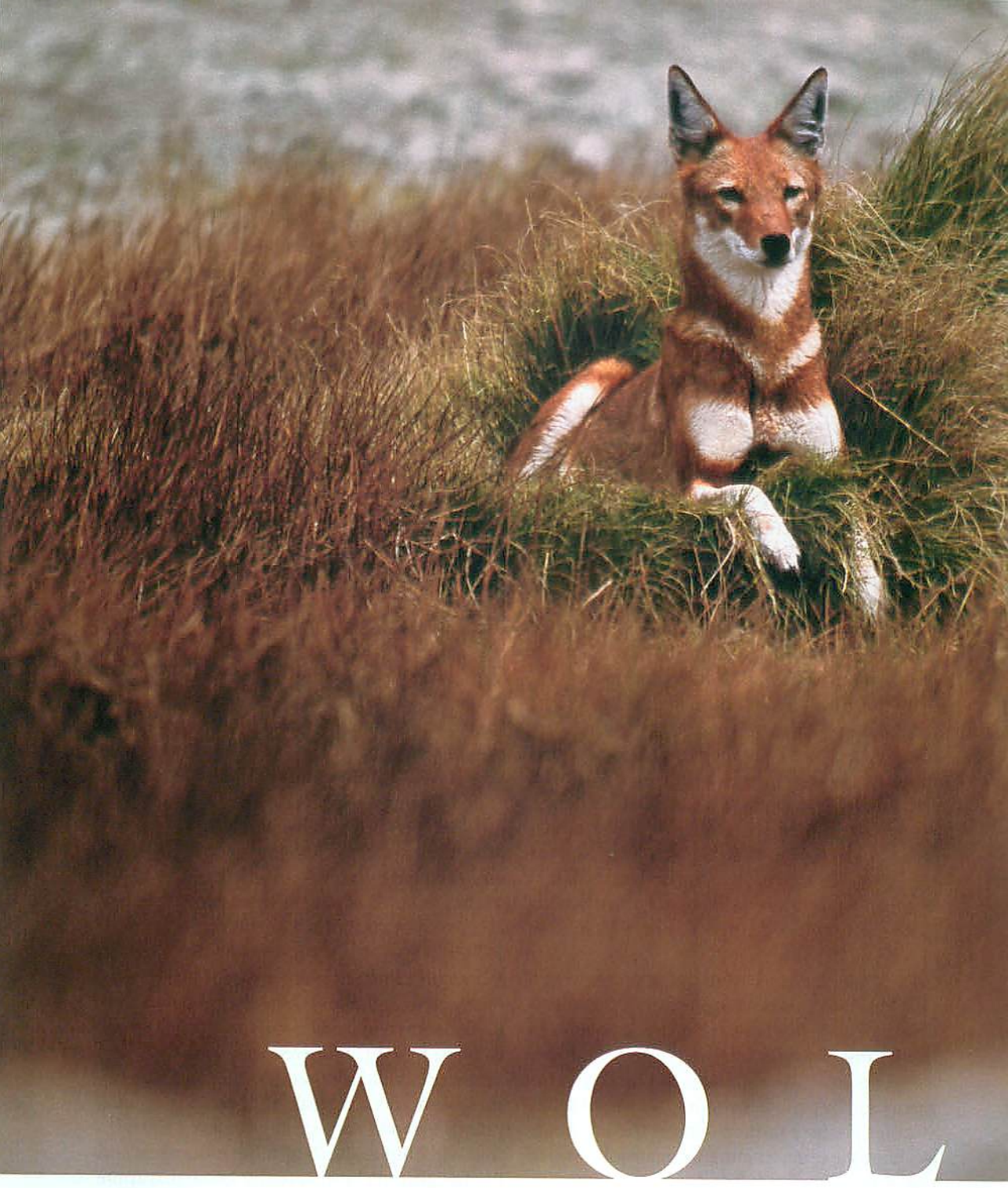
One emerging idea to help keep this underemployed region in the game is commercial forestry—restoring the land not as pasture or golf course or school but as a reincarnation of what used to be here in the rich diversity of the Appalachian forest. Arch Coal, with test plantings already established east of Whitesville, reports it's eager to pursue this option. "Our intent," says Arch's Larry Emerson, "is not just to approximate what was there before mining but, for the long range, establish a commercial forest."

Some foresters are not convinced that Arch is willing to go far enough in its romance with reforestation. James Burger, a professor of forestry at Virginia Tech University and a zealous proponent of turning topless mountains into productive forests, has found in his studies that weathered brown sandstone soils—making up a mountaintop's uppermost layer and therefore the first to be dumped and lost in a valley fill—would be better set aside and used, without compaction, as top dressing for any reforestation. But Arch's forestry consultant argues this would raise substantially the per-acre cost of reclamation.

A few environmentalists, such as Joe Lovett of the Appalachian Center, hail Burger's crusade for reforestation as the next best thing to stopping mountaintop mining altogether. Others view it as a cop-out exercise in wishful thinking. "I understand what makes up that forest, and it's not just trees," says Judy Bonds of Coal River Mountain Watch. "I'm talking about the herbs and the plants that evolved here in this forest over thousands of years. Re-create *that* forest? You couldn't do it in 1,500 years."

Standing in the doorway of the Mountain Watch office on the main street of Whitesville, I listened to Judy Bonds reminisce about the way it was 50 years ago when she was a child. "I used to swim in the Coal River then," she said, "but now it's so full of silt that the water barely comes up to your knees. It breaks my heart. I look at my grandson, and I see that he's the last generation that will hunt and fish in these mountains and dig for ginseng, and actually know mayapple when he sees it. These mountains are in our soul. And you know what? That's what they're stealing from us. They're stealing our soul." □

↖ **Disappearing Landscapes** What's the future of this region, and how can residents resist the mining companies? Voice your opinion in our forum, then view Web-exclusive images at **ngm.com/0603**.



WOL
OF

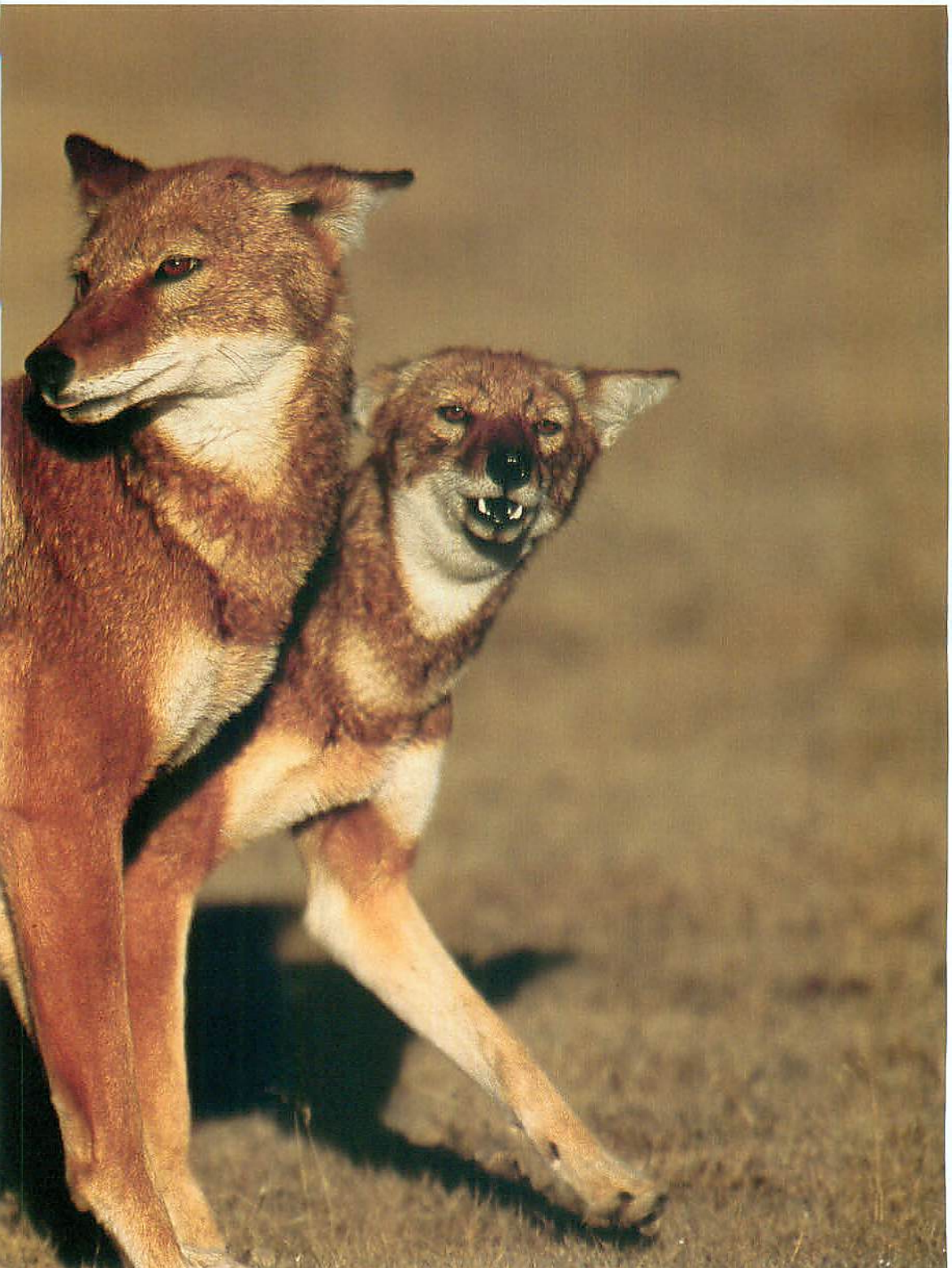
VES

Roughly 100,000 years ago during the last ice age, wolves migrated from Eurasia to the highlands of what is now Ethiopia. As the glaciers retreated, the wolves held their ground. Now, hobbled and hemmed in by people, Africa's only wolf species is on the run—with nowhere to go.

ETHIOPIA

Last of Their Kind

Sniffing, snapping, yipping, whimpering—wolves greet each other in a morning ritual that strengthens the solidarity of their pack while reinforcing its pecking order. Afterward they will leave the youngsters behind and set out to patrol their territory and hunt. External threats, including a rabies outbreak, have pushed the wolves close to extinction. Roughly 600 remain.



BY VIRGINIA MORELL
PHOTOGRAPHS BY ANUP SHAH

Mornings on the high Sanetti Plateau of Ethiopia's Bale Mountains break cold and spare, the sun's first rays stirring not warmth, but an icy, cutting wind. I pull my neck gaiter over my chin, stomp my feet on the frozen grass, and tell myself again that this is Africa. Then, on a rocky outcrop some 20 feet away, a wolf appears. She throws back her head and yips—five quick, sharp calls that summon four other wolves, all males. They paw and stretch and lick each other's muzzles, tails wagging.

They are red, these wolves, with black-and-white tails, and white blazes on their chests. The fur on their throats is white too, and sweeps in a curve toward their eyes, giving them the look of laughing clowns. But it's the sassy hue of their coats that catches your eye. We're the top dogs here, their color proclaims. And they are. For these are Ethiopian wolves: the only species of wolf found in Africa.

Six pups come tumbling from beneath a rock, and their mother—the

In the Bale Mountains, wolves patrol a habitat that's disappearing: Farming and grazing are gradually using up the land.

female that had called the pack together—greets them, letting them nurse for a moment. But mornings for the Ethiopian wolf are for patrolling, and the mother and her companions are ready to go. They leave the pups to the care of a younger female and set off at a brisk trot, loping over the icy grass and silvery *Helichrysum* shrubs in a classic wolf beeline.

One glances at us—wildlife biologist Deborah Randall and me—giving us an "Aren't you coming?" look. Randall shoulders her pack and spotting scope. And we're off: running with the wolves in Africa, pursuing a leftover ice age species in a chilly remnant of Africa's ice age world.

THE ETHIOPIAN WOLVES had their beginning here some 100,000 years ago during a global ice age when glaciers covered the peaks and plateaus of the Bale Mountains. A small number of gray-wolflike ancestors ventured into this wintry land from Eurasia. They never made it farther into Africa, for beyond Ethiopia's mountain massif lay only desert. As isolated as if they lived on an island, those wolves evolved into the separate—and rare—species we're trailing.

Researchers estimate that about 600 *Canis simensis* are scattered

throughout the highlands of the country (as their common name implies, they are found only in Ethiopia). The largest concentration—about 350 animals—lives in Bale Mountains National Park. Their minuscule population gives them the distinction of being one of the world's most endangered canids, and they are on the endangered list of the International Union for Conservation of Nature and Natural Resources.

Here at 13,000-plus feet they share their habitat with Oromo farmers and herders, who often graze their cattle and horses inside the park. It's not unusual to see wolves hunting rodents among the browsing livestock, and the Oromo (who tolerate the wolves because they seldom kill domestic animals) have named them for this trait: *jedalla farda,* or horse's jackal. The wolves are thus accustomed to seeing people every day, and many packs like this one are used to being trailed by Randall and researchers from the Ethiopian Wolf Conservation Programme (EWCP), a joint project of Oxford University and the Ethiopian government. For Randall, they also offer the chance to collect the data for her doctoral study on the wolves' genetics.

That data became easier to collect after late 2003, when a rabies epidemic swept through the wolves in the Web Valley below the Sanetti Plateau, decimating five packs and killing all their newborn pups. During the epidemic EWCP biologists vaccinated some of the Sanetti wolves, hoping

Prowling like a cat, a wolf prepares to snag its prey—usually giant mole rats or other rodents. Large prey is scarce across the wolves' range (map), so they don't need to hunt in packs. Unlike most canids, they usually hunt and eat alone.

MAP SOURCE: JORGELINA MARINO AND CLAUDIO SILLERO, ETHIOPIAN WOLF CONSERVATION PROGRAMME
NGM MAPS

to form a barricade against the disease. To keep track of the vaccinated wolves, the researchers clipped colored tags into the tops of their ears and outfitted some with radio collars.

"We really don't know them as individuals," Randall says as we stomp over the frozen ground. "But now that they're tagged, we can see who sleeps together, patrols together, and hangs out at the den together. Remember that young female who's babysitting the pups at the den? She's at the age where it's time for her to move out and find her own pack. Now we'll find out where she goes, what pack she moves into, and if she has pups of her own."

The wolves we're following, now reddish specks in the distance, are trotting toward a rocky bluff about a mile away. Then the rocks give way to a grassy saddle, and the wolves make their way along the rocky shore of a bright blue pond, their images rippling on the water's surface. Two ducks lift into the air, but the pack ignores them and continues on to a high meadow that's dotted with giant lobelia—spiky, eight-foot-tall plants that tower over the windswept grasses. Here the wolves stop to circle and pee, and Randall maps the spot on her handheld GPS.

"This is one of their boundary points," she whispers. "The territory on the other side of this ridge belongs to the Batu pack," named for a nearby mountain peak. Our pack, the Quarry pack, trots along some invisible line of demarcation. With their ears pricked forward and noses down to catch a scent, they're keenly alert to any sign of their rivals.

But the Batu wolves have apparently decided to patrol elsewhere, and the Quarry pack moves on; there won't be any rumbles or chases this morning. "They'd be a lot more agitated if there were other wolves around," says Randall. "The pack with the most wolves usually wins the border fights, and right now Batu is bigger than Quarry."

When Ethiopian wolves aren't patrolling, they're usually hunting, and the Quarry pack has now split up in search of breakfast. Unlike other wolf species, which typically hunt in groups, Ethiopian wolves are solitary hunters. They prey on the fat, bunny-size giant mole rats and grass rats that live in abundance on the high plains and meadows. From a boulder on the ridge we've climbed, Randall scans the meadow below and spots one of the males, now busy stalking rodents. "Let's follow him," she says.

But first she sweeps the far plains and hills with her binoculars, picking out the other hunting Quarry wolves and searching for, well, anything unusual. That's the other thing she does now on her morning patrols. She counts the living and looks for the dead.

LIKE MANY RARE, ISOLATED SPECIES, the Ethiopian wolf could vanish for any number of reasons: shrinking habitat, mating with domestic dogs, shooting. Yet the most immediate threat they face is disease, in particular disease introduced by dogs. The latest outbreak of rabies, like several others in the past, probably started when a rabid dog entered the park with its owner and a herd of cattle. "There's a lot of social chasing and biting and licking among the packs," Randall says. "So if one wolf is infected with rabies, it can easily spread the disease to several others."

Keeping an eye—and paw—on ten-week-old pups, an adult wolf is one of several in the pack who help rear the young. Once grown, males stay with their birth pack for life, but females leave to seek out mates. Some female wolves have been mating with aggressive domestic dogs, creating hybrids—and headaches for conservationists seeking to maintain the wolves' genetic integrity.

The strong sociability of the Ethiopian wolf actually puzzled researchers when they launched their first major studies here in the late 1980s. Since Ethiopian wolves generally hunt alone, "it didn't make sense," Randall says. "Why live in a pack if you're not going to hunt and eat together? Why help raise the offspring of somebody else?"

An answer came after researchers inventoried the rodents available to each pack in their small, two-to-three-square mile territories: It was largely a matter of ensuring the size of their range. "They live together so they can defend an area with enough rodents so that everybody can eat and feed the pups," says Randall. That's why the morning patrols are so important to the wolves. They are, in essence, guarding their grocery store.

Breakfast doesn't come easy, judging from the number of failed stalks and leaps the male we're watching has made. He's chosen an area favored by the giant mole rat, a hefty rodent with eyes protruding from the top of its head like two periscopes. The rat feeds by making short, sudden lunges from its burrow to grab fresh grasses and plants. And it's in those few brief moments when the rat is at the surface that the wolf must act.

"The wolf's hearing is very acute," Randall says, as the male cocks his head from side to side, listening to the rustling of rodents below ground. "I'm sure they can hear the rats getting ready to surface."

Suddenly, a mole rat pops up and begins its busy back-and-forth shuttle. The wolf folds his tall frame into a crouch and crawls forward, his tail swishing like a cat's. He holds still for another second, then makes a quick dash and leaps into the air. When he comes down, his front paws slam the mole rat's burrow and he shoves his snout deep into the earth, biting dirt and grass—but not rat. Once again, he's missed his meal.

Randall laughs. "It takes the young ones a while to get the hang of this."

The handsome profile of Canis simensis *undoubtedly assisted conservationists in making it a flagship species of Ethiopia. That might help preserve its habitat and protect the area's endemic birds and rodents that lack the wolf's charisma.*

RANDALL HAS ANOTHER PACK to check on that afternoon, one called Garba Guracha. It was in their territory that she found the dead wolf. Randall doesn't know if the wolf was from the Garba Guracha pack or another one nearby, and now she or another researcher checks up on the Garba Guracha wolves daily. "Some of them look sick," she says. Still, the dominant female is lactating, a sign that there are pups.

Over the next few days we return to Garba Guracha several times but never do find the den. We revisit Quarry pack, too, and spend time at Batu pack's den, watching their pups fight over old rat bones and sticks and bounce over the frosty grass to tackle their babysitter. No more dead wolves turn up, and at the researchers' camp the mood begins to lighten.

Then, early one afternoon, an EWCP team member arrives with a plastic bag. Inside lies the limp body of one of the Batu pups. "Well, if there's one thing I've learned, it's how to do a field postmortem," Randall says.

"I doubt if rabies killed this pup," she says, spreading a blue plastic sheet on the ground and arranging her tools. "If it was rabies, its mother would already be dead." Randall slips on a pair of rubber gloves and pulls the small carcass—a male—from the bag. He's surprisingly plump, his dark, puppy fur thick and fluffy. Randall gives him a few gentle strokes, then lays him on the tarp. "He's so little," she says. She lifts his upper lip to show his bright white, perfect puppy teeth and sighs, "Ah, well."

Running With Wolves See more images in an online-only gallery. Then give the packs' pups the run of your desktop as wallpaper at **ngm.com/0603**.

And then she picks up a scalpel and neatly slices him from his neck to his genitals. Inside, she cuts through the sternum with scissors and exposes his lungs. She snips tissue samples from every major organ. All the samples will be dispatched to labs for analysis.

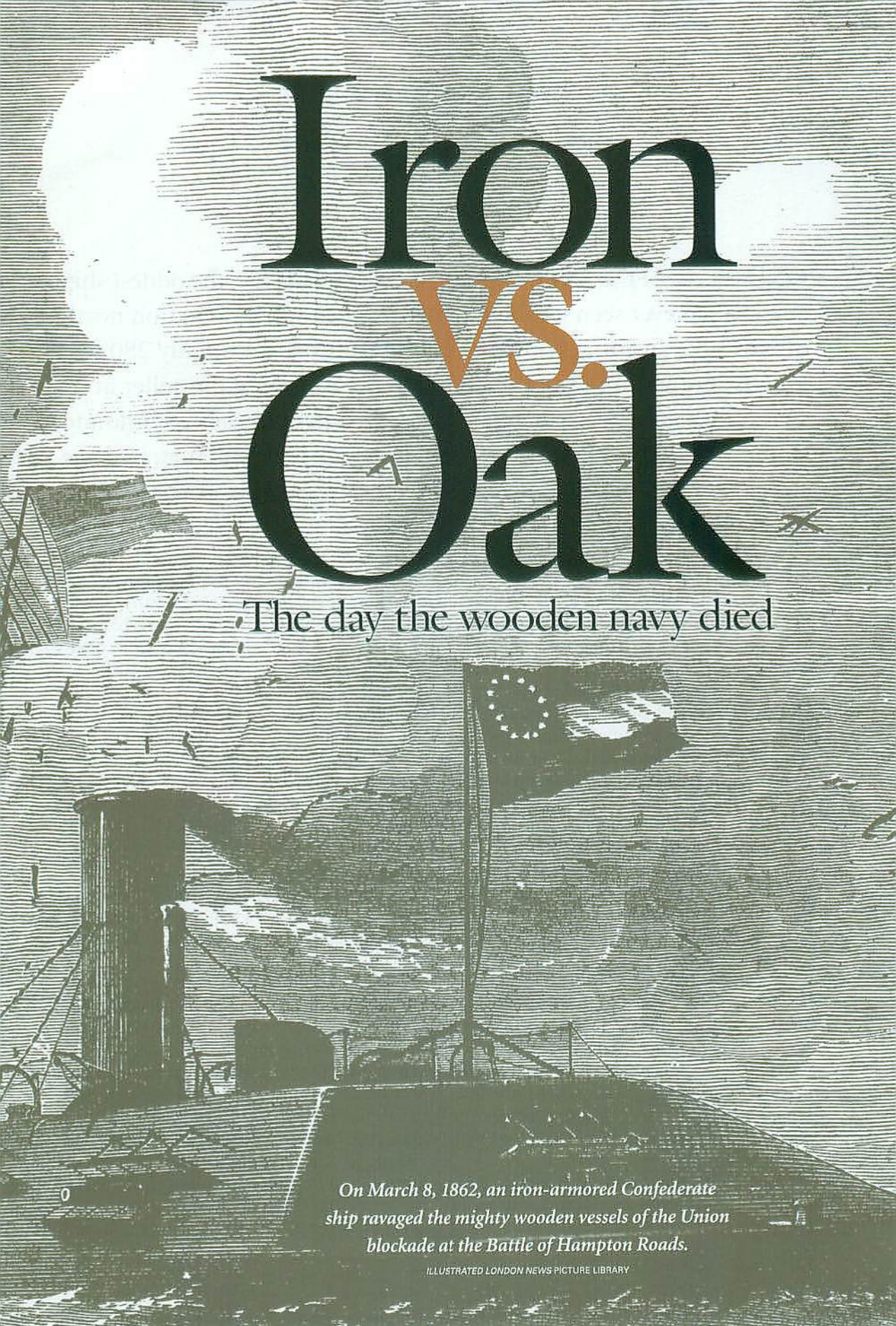
"Well, mom was feeding him," Randall says. "His intestines are full of rat hair. He might have died from worms or maybe canine distemper," a disease brought by domestic dogs into the park. When she's done, Randall packs up her tool kit and washes off the plastic sheet. There are a few thick tufts of puppy fur in the grass, and then they blow away on the wind.

ON THE SANETTI PLATEAU there's another pack the researchers named the BBC pack after the documentary crew that once spent a season filming them. The BBC wolves were living in the hills just beyond the meadow where the EWCP team was camped. This pack also had pups, and one day the adults moved the pups into a new den. They must have liked the new den, which was even closer to our camp, because that night as the stars came out the wolves sat on the ridge, yipping and howling. "It's like they're bragging, 'We're here! We're here!'" one of the scientists said.

It was a sound we all hoped would never be silenced in the Bale Mountains. It was the sound of Ethiopian wolves claiming their territory. □

Iron vs. Oak

The day the wooden navy died



On March 8, 1862, an iron-armored Confederate ship ravaged the mighty wooden vessels of the Union blockade at the Battle of Hampton Roads.

ILLUSTRATED LONDON NEWS PICTURE LIBRARY

By Joel K. Bourne, Jr.
NATIONAL GEOGRAPHIC SENIOR WRITER
Photographs by Ira Block

ON A PEACEFUL SATURDAY in early March 1862, the oddest ship anyone had ever seen lumbered into the great watery junction north of Norfolk, Virginia, known as Hampton Roads. Roughly 280 feet long from the iron ram at its prow to the thudding propeller at its stern, the black leviathan carried neither masts nor sails common to ships of the day, only a large smokestack, some pennants, and the starred banner of the Confederacy. It looked, according to one Union sailor, "like the roof of a very big barn."

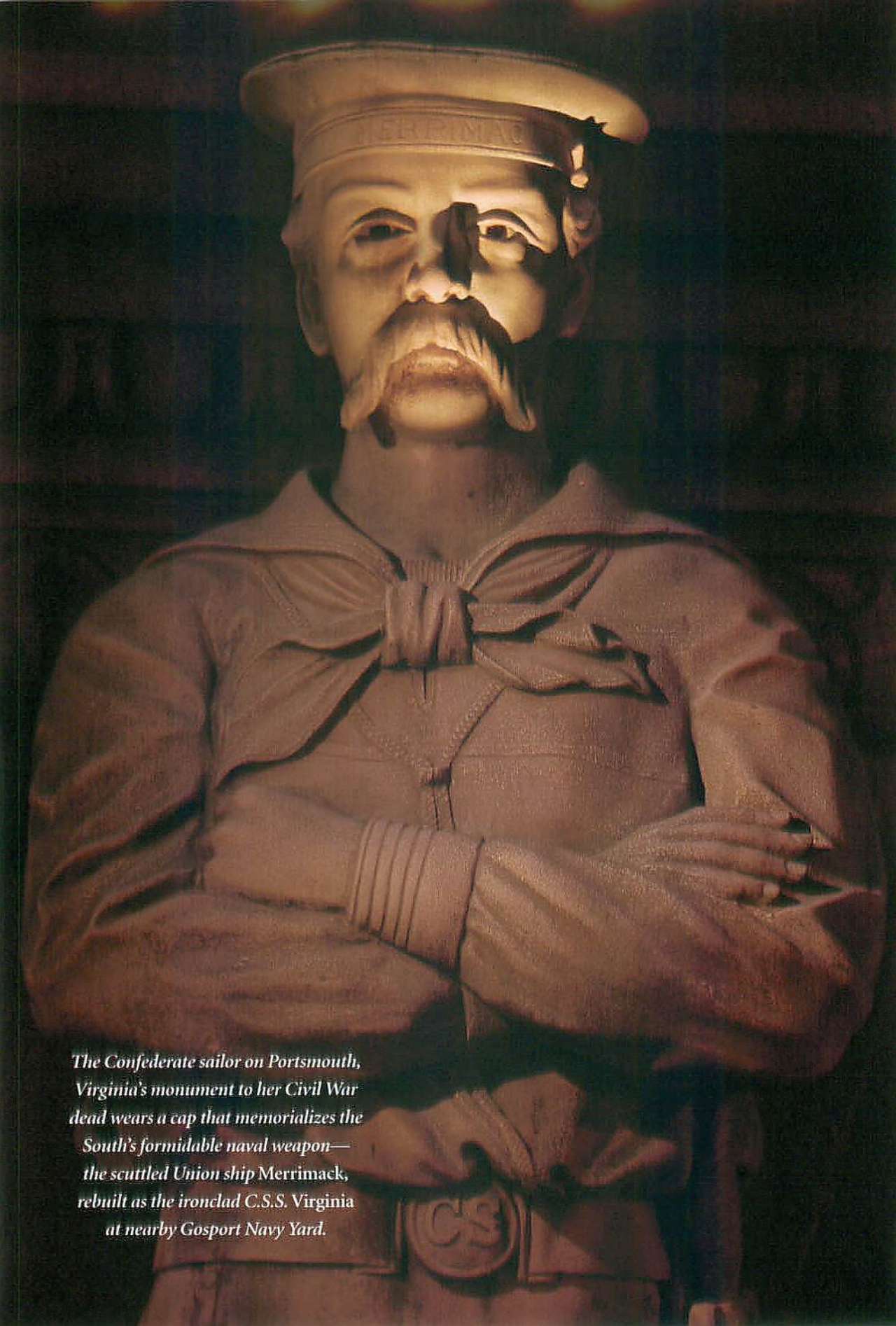
As the vessel steamed west to where the James River empties into the Roads, two powerful Union warships blockading the river cleared their decks for action. With their tall masts, clouds of sail, and gun decks bristling with cannon, wooden men-of-war like the U.S.S. *Congress* and U.S.S. *Cumberland* had ruled the seas for centuries. Lt. Joseph Smith, the young captain of the *Congress,* confidently steeled his men for the coming fight: "My hearties, you see before you the great southern bugaboo, got up to fright us out of our wits. Stand to your guns, and let me assure you that one good broadside from our gallant frigate and she is ours!"

The great southern bugaboo, otherwise known as the C.S.S. *Virginia,* plowed onward, one sailor recalled, like "the horrid creature of a nightmare." When the enemy ship came within a few hundred yards, Smith unleashed a broadside from more than 20 cannon that would have devastated almost any other vessel afloat—only to watch the shot and shells bounce off the *Virginia* as if they were marbles. Smith looked on in horror as the iron beast ran four large cannon out its gunports and fired, instantly turning his trim ship into a slaughterhouse. The nightmare that was the Battle of Hampton Roads had begun.

Anyone who muddled through eighth grade history class will likely remember the Battle of Hampton Roads as the battle of the *Monitor* and *Merrimack,* the first clash between ironclad warships. But that famous engagement took place on the second day of the battle. On the first, the South won a furious arms race to get an ironclad to Hampton Roads, proving in deadly fashion the superiority of iron over oak.

Originally a wooden Union frigate, the *Merrimack* (often misspelled *Merrimac*) was burned and scuttled near Norfolk at the outbreak of the Civil War to keep it from falling into Confederate hands. Southern shipwrights raised and recycled the vessel's hull and machinery into a formidable engine of war, the ironclad C.S.S. *Virginia.* To counter the threat to its wooden fleet, the Union commissioned its own ironclad, the U.S.S. *Monitor.* Outfitted with the world's first rotating gun turret, the *Monitor* was a technological marvel—despite looking, as one skeptic put it, like a "tin can on a shingle."

The two vastly different ships were riding a wave of technological change sweeping through the world's naval powers, ushering in steam engines, large rifled cannon, and ships armored in iron plate. But the battle was more than a test of technology. Control of the Roads was critical to Lincoln's blockade of southern ports and Union plans to attack the Confederate capital at Richmond. The duel was witnessed by tens of thousands of troops on ships and on shore, including military observers from Europe. In addition to breaking the blockade, Southern leaders



The Confederate sailor on Portsmouth, Virginia's monument to her Civil War dead wears a cap that memorializes the South's formidable naval weapon—the scuttled Union ship Merrimack, *rebuilt as the ironclad C.S.S.* Virginia *at nearby Gosport Navy Yard.*

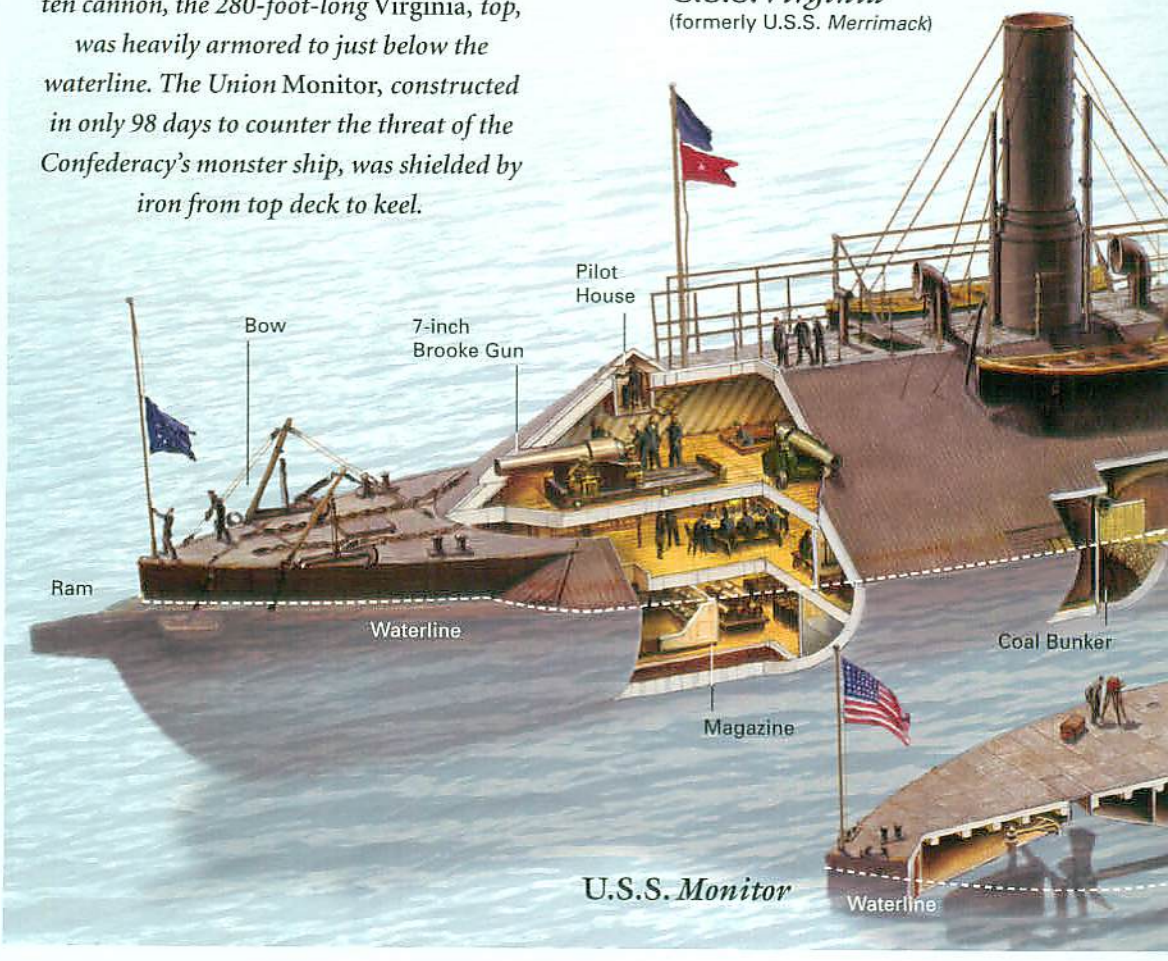
hoped a victory would sway France and England to weigh in on the side of the Confederacy.

Pacing the deck of the *Virginia,* Flag Officer Franklin Buchanan knew how high the stakes were and how great the risks. A volatile Marylander who had "gone South," "Old Buck" had spent nearly 50 years in the Navy's world of wooden ships and iron men, including a stint as the first superintendent of the U.S. Naval Academy. Yet on the morning of March 8, he boldly steered an experimental vessel on her maiden voyage straight into the maw of some of the best ships in the U.S. Navy. That morning he asked chief engineer Ashton Ramsay how well his engines were braced. "I am going to ram the *Cumberland,*" he informed Ramsay. "I'm told she has the new rifled guns, the only ones in their whole fleet we have cause to fear."

Aboard the *Cumberland,* Lt. George Morris saw the devastation inflicted on the *Congress* and knew his turn was next. His ship was a favorite among the federal fleet, an old frigate that had been cut down to create a fast-sailing corvette of 24 guns. Without wind she was a sitting duck, but Morris was confident that his larger cannon —particularly the new rifled pivot gun at the stern—would crush the *Virginia*'s iron shield. His forward guns roared, scoring direct hits, yet the deadly shells ricocheted off the ironclad, exploding harmlessly in the air.

The *Virginia* steamed on toward the *Cumberland,* firing as she came. The first strike smashed the starboard rail, killing or maiming nine marines. The next shot exploded among the 16 men of the forward gun crew, killing all but two. Shot after shot mowed down the *Cumberland*'s men, leaving a trail of body parts and blood. The dead were hauled to the port side; the wounded

Driven by steam engines, outfitted with ten cannon, the 280-foot-long Virginia, *top, was heavily armored to just below the waterline. The Union* Monitor, *constructed in only 98 days to counter the threat of the Confederacy's monster ship, was shielded by iron from top deck to keel.*

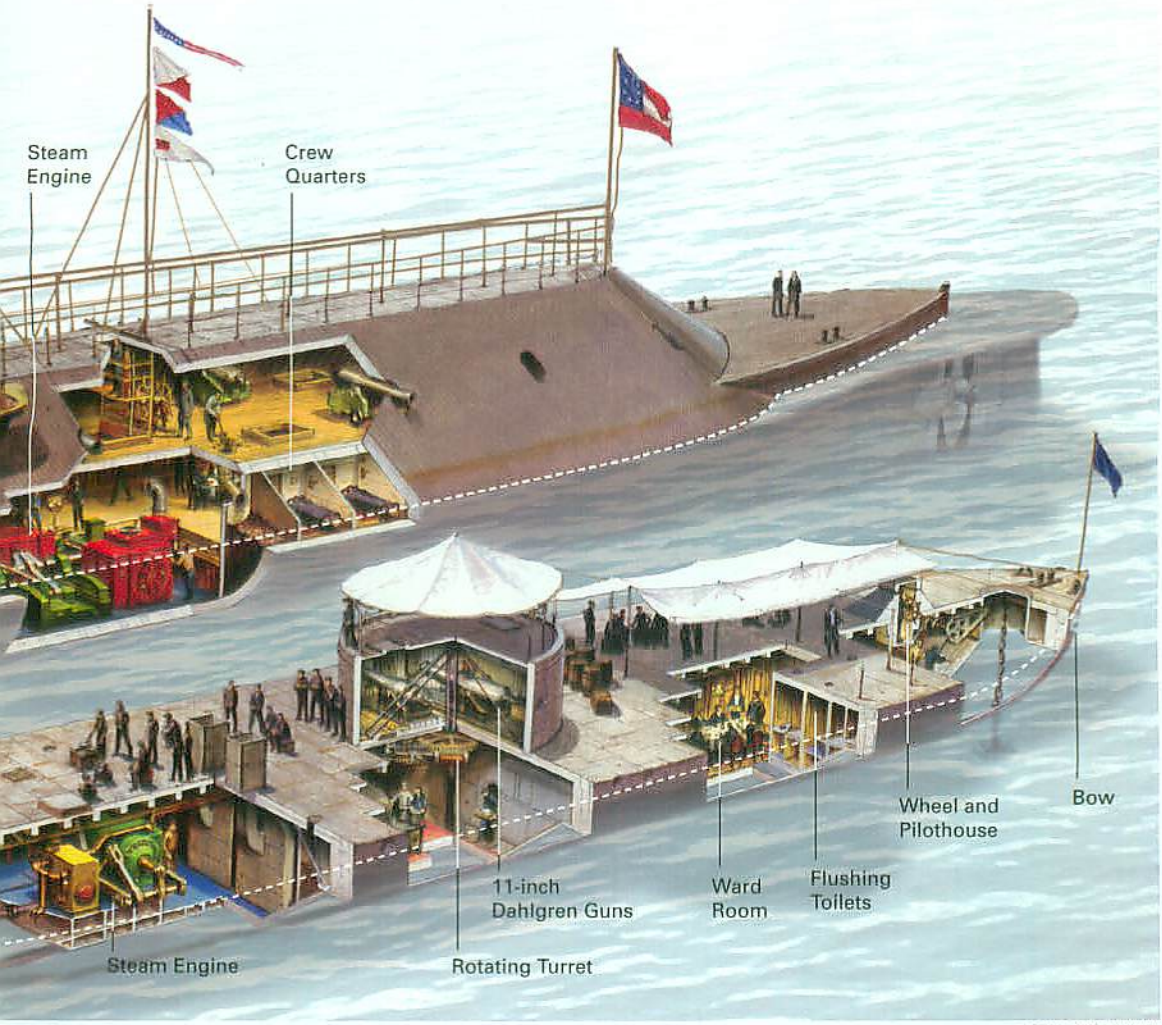


carried below. As each gunner fell, another stepped up to take his place.

Making a steady approach, Buchanan blasted the *Cumberland* for 15 minutes, then plowed his iron monster straight into the wooden ship. Sailors on both vessels felt a terrific crash as iron ram hit solid oak, punching a hole at the waterline some said was big enough for a horse and cart to pass through. The ram worked almost too well. The *Cumberland* began sinking so fast it threatened to take the ironclad down with it. At the last moment the ram wrenched off, freeing the *Virginia* from its victim.

Buchanan hailed the sinking ship, demanding its surrender. A defiant Morris yelled back, "No, damn you! I will never surrender!" The *Virginia* now lay parallel to the sinking *Cumberland* and fewer than a hundred yards away. The *Cumberland*'s crew, some in water to their knees, took their revenge, pouring round after round into the ironclad at close range. Gunners aboard the ironclad, their bodies black with powder and streaked with sweat, returned fire with devastating effect. "The way was slippery with blood, and the mutilated humanity was a sight too awful for description," recalled acting master William Pritchard Randall, who ordered the last shot fired from the *Cumberland*. Of the 376 men on board, 121 were dead or missing and perhaps another 80 or more were wounded.

"The normal practice at that time was to fight until you had 10 percent casualties; then you could honorably surrender," says Craig Symonds, professor emeritus of history at the U.S. Naval Academy. "The 55 percent casualty rate on the *Cumberland* was phenomenal. Some of that was because the wounded were carried below, but the numbers show how heroically they fought."

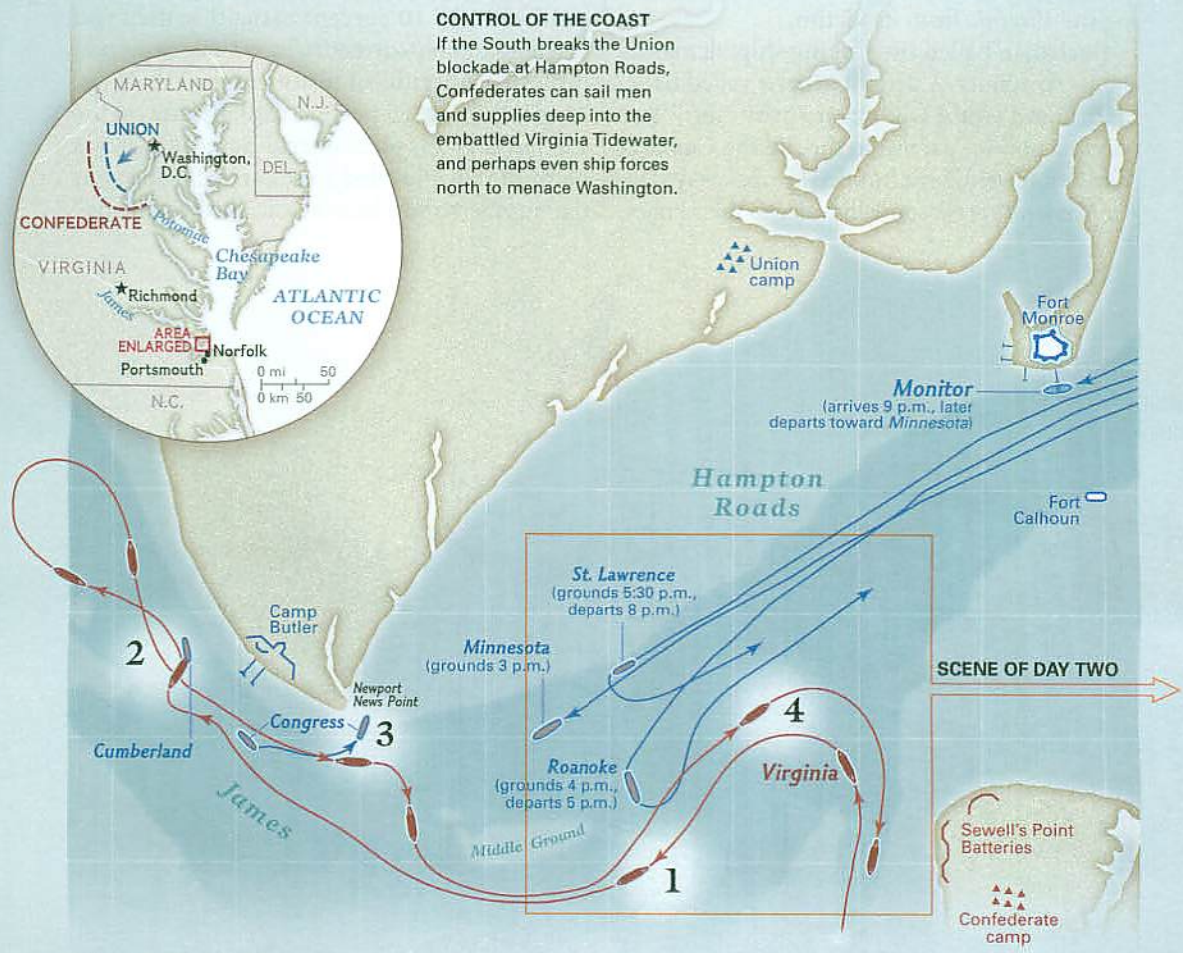


ART BY JAMES GURNEY

The Battle of Hampton Roads

Day One: Ironclad's rampage redefines naval power

Sheathed in iron armor, the Confederate ship *Virginia* enters Hampton Roads for the first time. Slow and unwieldy, she obliterates two of the most powerful wooden vessels in the Union Navy within hours—though they carry more experienced crew, and between them seven times her guns. Based on Union and Confederate eyewitness accounts of the battle, specifications of the fighting ships, and the expertise of naval historians, the maps below reconstruct two days of Civil War devastation and deadlock in unprecedented detail.



CONTROL OF THE COAST
If the South breaks the Union blockade at Hampton Roads, Confederates can sail men and supplies deep into the embattled Virginia Tidewater, and perhaps even ship forces north to menace Washington.

March 8, 1862

1 1:30 TO 2:30 P.M.
Virginia steams across the Roads, straight at the *Cumberland* and *Congress* at the mouth of the James.

2 3 P.M.
Virginia rams *Cumberland,* undeterred by the wooden ship s cannon fire, which continues as she sinks.

3 4 TO 5:30 P.M.
From 200 yards away *Virginia*'s barrages kill a quarter of *Congress*'s crew, leaving her a flaming wreck.

4 6 TO 8 P.M.
Darkness and a receding tide force *Virginia* to break off her assault on the Union fleet and anchor for the night.

THE TOLL OF BATTLE

U.S.S. *Cumberland* 121 dead

Cost to build (19th c.): $481,000

U.S.S. *Congress* 120

$353,000

C.S.S. *Virginia* 2

$173,000

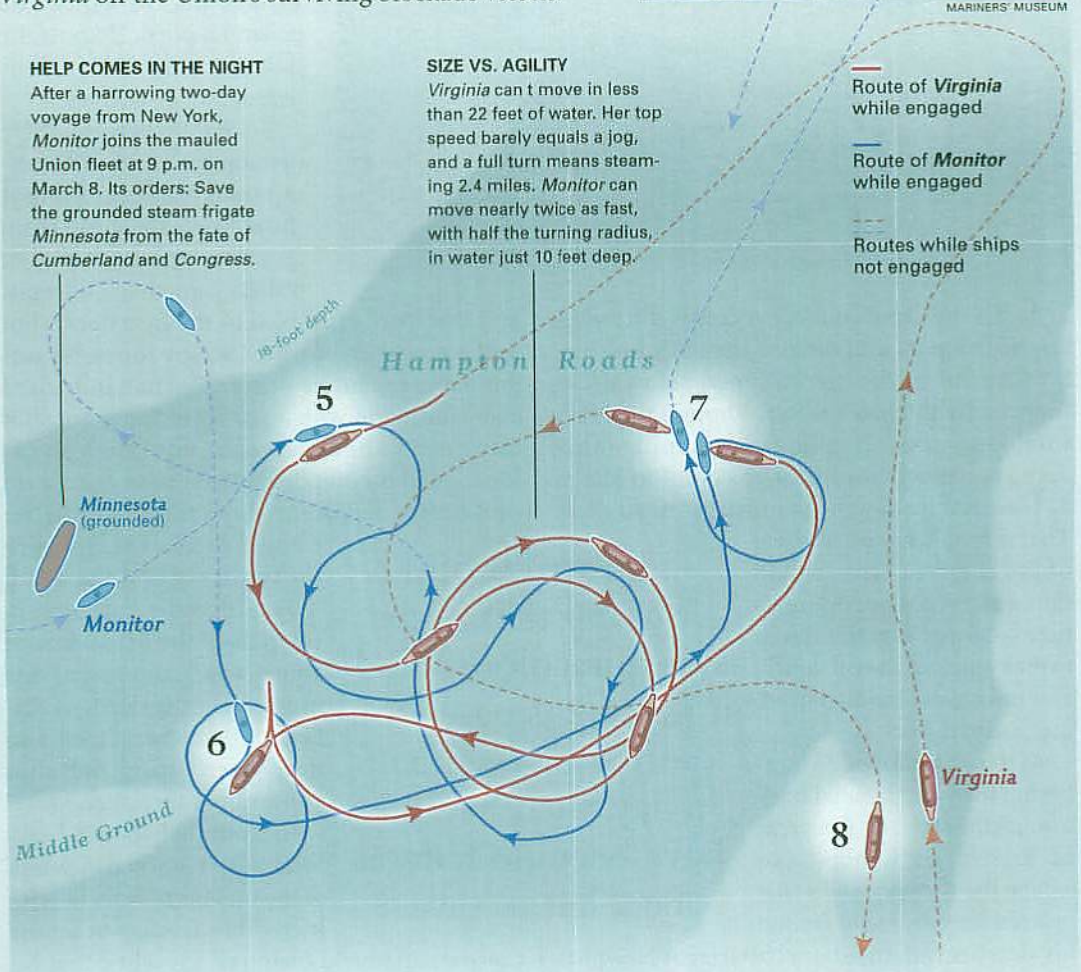
Day Two: The monsters brawl

Gunports belching smoke and flame, engines devouring tons of coal an hour, the first ironclad warships to meet in battle circle like prizefighters, pummeling each other with shot and shell. Nimbler *Monitor* (right, foreground) darts and weaves, fending massive *Virginia* off the Union's surviving blockade vessels.

MARINERS' MUSEUM

HELP COMES IN THE NIGHT
After a harrowing two-day voyage from New York, *Monitor* joins the mauled Union fleet at 9 p.m. on March 8. Its orders: Save the grounded steam frigate *Minnesota* from the fate of *Cumberland* and *Congress*.

SIZE VS. AGILITY
Virginia can t move in less than 22 feet of water. Her top speed barely equals a jog, and a full turn means steaming 2.4 miles. *Monitor* can move nearly twice as fast, with half the turning radius, in water just 10 feet deep.



March 9, 1862

5 AROUND 8 A.M.
Virginia enters the Roads to destroy *Minnesota*. *Monitor* intervenes, beginning the first battle between ironclads.

6 BEFORE 11 A.M.
Virginia runs aground. As her engines strain to move her off the shoal, *Monitor* circles, firing at will.

7 11 A.M. TO NOON
Virginia rams *Monitor* to no effect. *Monitor* targets *Virginia*'s rudder, but misses; Union commander wounded.

8 NOON TO 1 P.M.
Monitor moves out of range to reestablish command. A falling tide compels *Virginia* to withdraw.

U.S.S. *Minnesota* 5

$894,000

U.S.S. *Monitor* 0

$275,000

EACH GRID SQUARE REPRESENTS ONE SQUARE MILE.
HISTORICAL BOUNDARIES AND SHORELINE SHOWN.
RESEARCH: ROBERT E. PRATT, CARTOGRAPHER, NG MAPS.
CONSULTANTS: COLAN RATLIFF AND DANA WEGNER, NAVAL SURFACE WARFARE CENTER, CARDEROCK DIVISION, MARYLAND; JOHN V. QUARSTEIN, VIRGINIA WAR MUSEUM, NEWPORT NEWS; MARK HAYES, NAVAL HISTORICAL CENTER
NATIONAL GEOGRAPHIC MAGAZINE MAPS

NAVAL HISTORICAL CENTER

At last the *Cumberland,* her colors still flying, lurched to port and sank to the river bottom, the screams of the men trapped below decks silenced by the black water. Though the Navy would use wooden sailing vessels for another decade or two, many historians point to March 8, 1862, as the day the wooden warship died. That same afternoon, the fate of the U.S.S. *Congress* would signal an even more ominous turn—away from the traditional rules of naval battle and toward no-holds-barred, mechanized war.

As the *Virginia* made a lumbering turn and headed back toward the stricken *Congress,* Lt. Joseph Smith, hoping to escape the *Cumberland*'s fate, ordered a nearby tug to ground his ship beneath the shore batteries at Newport News Point. But even there the *Congress* was still within reach of the *Virginia*'s merciless nine-inch-diameter guns. Flying splinters ripped from the ship's wooden walls killed more than shot or shells, some men impaled by wood fragments as thick as their wrists. Within half an hour nearly a quarter of the crew were dead or wounded, including Lieutenant Smith, who was decapitated by a shell fragment. The ship raised the white flag.

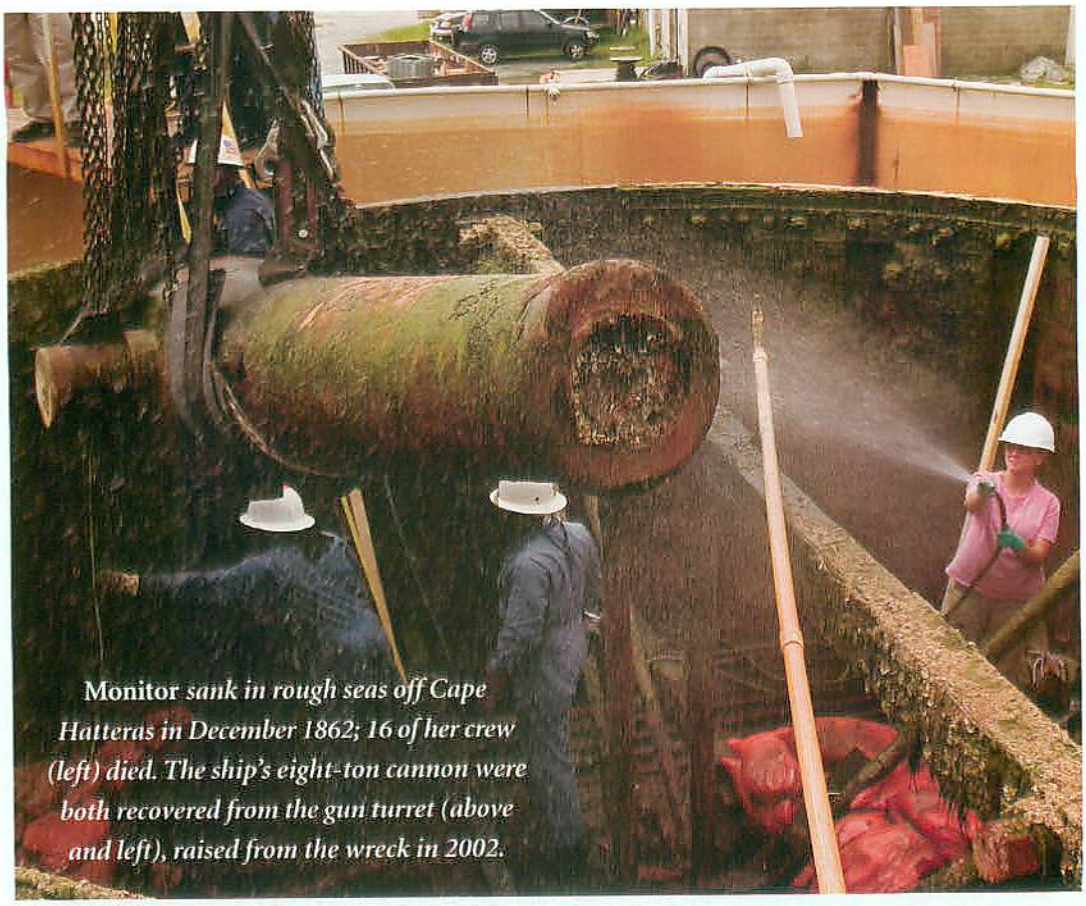
The water around the *Congress* was too shallow for the *Virginia* to approach, so Buchanan sent two small Confederate vessels to claim his prize. They were met by withering fire from Union soldiers on shore under the command of Gen. Joseph Mansfield. One of Mansfield's officers reportedly complained that the ship had surrendered and the rebels had a right to take her, to which the general replied, "I know the damned ship has surrendered, but we haven't!"

Buchanan was livid. He demanded a rifle and without thinking began firing at the soldiers on shore from atop the *Virginia.* A hail of bullets came back in reply, and Old Buck crumbled to the iron deck, shot in the groin. Calling for Catesby Jones, his unflappable executive officer, Buchanan turned over command with an order to "plug hot shot into her and don't leave her until she's afire!" Jones quickly complied, blasting the vessel with shot heated red in the ship's furnace until the *Congress* was a funeral pyre for the living and the dead.

> The arrival of the *Monitor* that night was miraculous. Had it missed its date with destiny by even half a day, there would have been no federal fleet left to save.

For decades afterward, veterans of the battle argued about who committed the more dastardly deed, Mansfield or Buchanan. "Here's an iron vessel firing hot shot at a stranded wooden vessel with wounded aboard," says Symonds. "It's a total violation of the traditional rules of war." Incredibly, Buchanan set the *Congress* aflame knowing all the while that his own brother, also a naval officer, was aboard the doomed ship.

At the start of the battle, three Union warships had rushed in pursuit of the *Virginia.* To the dismay of the men aboard, all three ships ran aground on a sandbar. Two of them eventually managed to break free and scurry back to Fort Monroe, a massive stone fortress that guards the entrance to the Chesapeake Bay. But the third, the U.S.S. *Minnesota,* remained hard aground. Jones was now keen to destroy her as well, but with the



Monitor *sank in rough seas off Cape Hatteras in December 1862; 16 of her crew (left) died. The ship's eight-ton cannon were both recovered from the gun turret (above and left), raised from the wreck in 2002.*

tide draining from the Roads, his pilots refused to approach closer than a mile. Jones pounded the Union vessel until it was too dark to sight his guns, then ordered the *Virginia* back to her moorings. He would return at dawn to finish off the hapless *Minnesota.*

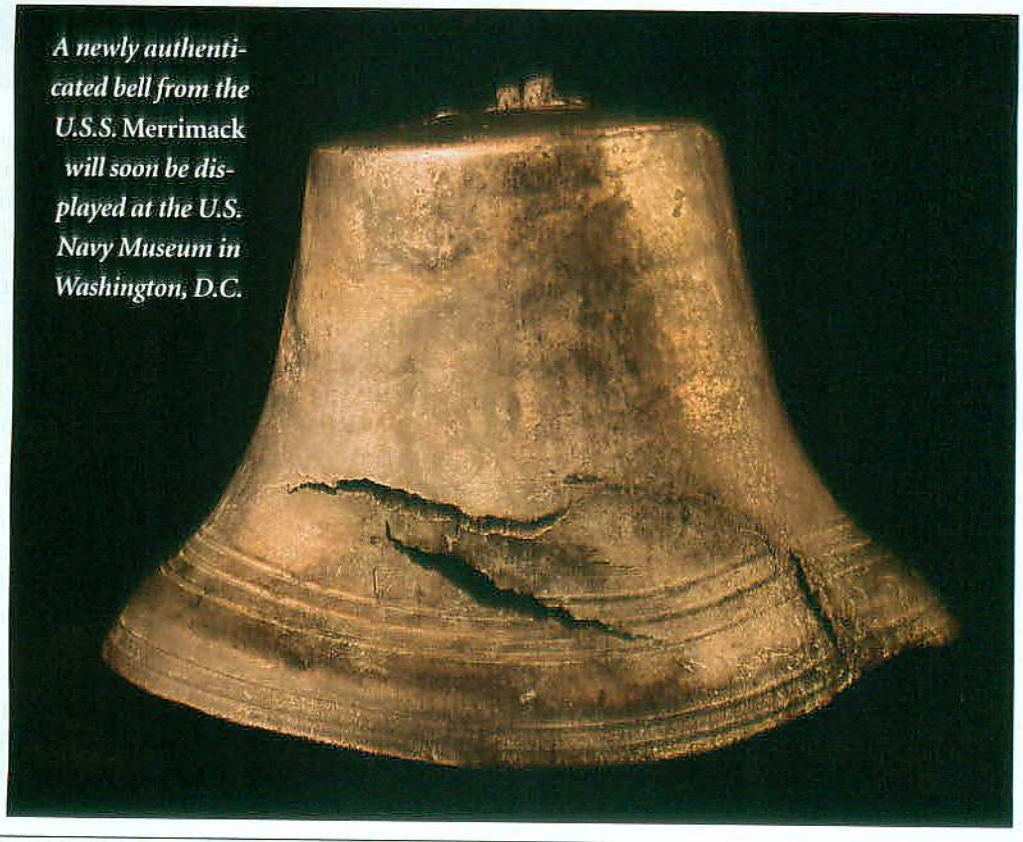
ON A HOT SUMMER DAY, Civil War historian John Quarstein, who has written extensively on the battle, threaded his black Mercedes convertible down a dead-end street to the industrial waterfront of Newport News. The nation's newest aircraft carrier, the U.S.S. *George H. W. Bush,* loomed above the Northrop Grumman shipyard nearby. The theatrical Quarstein, who is not above a hearty "Huzzah!" now and then, swept a cane toward the oily waters where the battle had raged. "The whole pathos of a nation divided, brother against brother, is right here," he said. "To sink two warships in two hours time, 10 guns against 70, is just amazing. Lincoln saw it as the greatest calamity since Bull Run."

In fact, the *Virginia* had handed the U.S. Navy the worst defeat it would suffer until Japan attacked Pearl Harbor 80 years later. Panic seized the North. No less a figure than Edwin Stanton, Lincoln's secretary of war, feared the rebel ironclad would steam up the Potomac River and lay waste to Washington. But that night, as the *Virginia*'s crewmen readied their ship, another odd vessel quietly steamed into the Roads and tied up to the stranded *Minnesota.* The arrival of the U.S.S. *Monitor* that night was nothing short of miraculous. Built in barely more than three months by an irascible inventor named John Ericsson, the flat, iron vessel nearly sank off the New Jersey coast as it was being towed south. Had the *Monitor* missed its date with destiny by even half a day, there would have been no federal fleet left to save at Hampton Roads.

When Catesby Jones steered the *Virginia* toward the *Minnesota* the next morning, Lt. John Worden, the slight, soft-spoken captain of the *Monitor,* steamed out to confront him. For the next four hours the two mechanical monsters went toe-to-toe, at times firing virtually

Found: The *Merrimack*'s Lost Bell

James Brennan, a young history enthusiast from Nuangola, Pennsylvania, was only 14 when he began investigating a mysterious bronze bell owned by family friends Adrian and Dori Pearsall. Though emblazoned with the name "Merrimac," the bell's history was sketchy. Two other bells said to be from the ship already resided in museums, but those bells were smaller and neither was cast with the famous name. Undeterred, Brennan wrote experts in the U.S. and England. They later confirmed that the Pearsalls' bell closely resembled those from Civil War vessels. Brennan then traced its ownership through several collectors to "Apache Jack" Nixon, a veteran of the Indian Wars and Buffalo Bill Cody's Wild West show. Nixon belonged to a Philadelphia veterans' post where the bell—likely a souvenir brought home by a Union soldier—was once displayed. The veterans claimed the bell was hit by a shell from the *Monitor,* but the dent was more likely made when the bronze was softened by high heat. Brennan thinks the damage occurred when the original *Merrimack* was torched to keep it out of rebel hands. His seven-year odyssey paid off last summer when Mark Wertheimer, head curator for the Naval Historical Center in Washington, D.C., deemed the artifact an authentic watch bell from the *Merrimack.* Kim Nielsen, director of the U.S. Navy Museum, said the bell is "one of the greatest naval icons of all time." The Pearsalls donated it to the museum, where it will soon be on display.



A newly authenticated bell from the U.S.S. Merrimack *will soon be displayed at the U.S. Navy Museum in Washington, D.C.*

barrel to barrel. The *Virginia* even rammed the *Monitor,* to no avail. Neither could gain an advantage until at last a Confederate gunner scored a direct hit on the *Monitor*'s pilothouse, blinding Worden. Blood streaming down his face, Worden turned the ship over to Samuel Dana Greene, his 22-year-old executive officer. Worden's charge to Greene was straightforward: "Save the *Minnesota*—if you can."

Jones, seeing the *Monitor* retreat into shoal water where he could not follow, believed she had given up the fight, and he turned his attention back to the *Minnesota.* But once again the tides and his pilots thwarted him, keeping him a mile from his target. The *Virginia* was leaking at the bow and had burned so much coal that it had risen more than a foot, exposing its vulnerable hull above the waterline. Conferring with his officers, Jones reluctantly left the *Minnesota* and headed back to Norfolk for repairs.

After assessing damage to the *Monitor* and finding her sound, Greene returned to the fray, only to find the *Virginia* steaming for home. Lieutenant Worden was seriously injured, and the crew hadn't slept in nearly three days. Greene's orders were explicit: Protect the *Minnesota.* He headed back to the stricken ship, believing the *Virginia* in full retreat.

Civil War buffs still argue about who won the battle. Most historians call it a draw. The two ironclads never fought again, and neither survived the year.

Civil War buffs still argue about who won the Battle of Hampton Roads. Most historians call it a draw, although Symonds qualifies the term. "The battle was certainly a draw in the tactical sense, but in the strategic sense it was a clear Union victory. The *Monitor* neutralized the offensive potential of the *Virginia,* which allowed the Union Navy to remain in Hampton Roads."

The two ironclads never fought again, and neither survived the year. Two months after the standoff, Union troops retook Norfolk, and Catesby Jones himself lit the powder train that blew up the *Virginia* to keep her out of enemy hands. Seven months later the *Monitor,* never built for rough seas, sank in a storm off Cape Hatteras, taking 16 men down with her.

More than 140 years later I stood atop makeshift scaffolding and stared down the barrel of history—two barrels to be exact. The turret of the *Monitor,* the first rotating gun turret in the world, sat upside down in a steel tank on the back lot of the Mariner's Museum in Newport News, Virginia. Recovered from the wreck site in 2002 through the combined efforts of the U.S. Navy and the National Oceanic and Atmospheric Administration (NOAA), the turret will soon be the centerpiece of a 30-million-dollar exhibit scheduled to open next year.

The importance of the 120-ton artifact hit home for NOAA historian Jeff Johnston the moment it entered its former battleground. "When we brought the recovery barge carrying the turret back into the Roads, Fort Monroe gave us a 21-gun salute," says Johnston. The honor was for the remains of two Union sailors found inside the turret, but the salute could as well have been for all the men who fought and died on those fateful days in March 1862. The barge then headed past Sewell's Point—a former mooring of the *Virginia* near what is now home base to half the U.S. Navy's aircraft carriers—toward the great shipyard that still builds the most advanced warships in the world, and finally to a dock in Newport News, a few hundred yards from where the men of the *Cumberland* went down fighting for their ship and the future of the nation.

The smoke of battle has long cleared, but legacies of the great conflict can still be seen in this old Navy town. Walk the decks of the U.S.S. *Wisconsin,* a World War II-era battleship now anchored at the Hampton Roads Naval Museum on the Norfolk waterfront, and see the sloped armor and rotating turrets—innovations evolved from the early ironclads.

More importantly, perhaps, the battle changed the nature of naval warfare itself. No longer would sailors fight in the grand tradition of Admiral Lord Nelson, blasting away at each other from unprotected decks in full view of their enemy. As one officer who fought aboard the *Monitor* noted ruefully, "There isn't danger enough to give us glory." □

Photo Gallery View a rendering of the sunken U.S.S. *Cumberland* and other Web-exclusive images plus related links at **ngm.com/0603**.

Longtime grande dame of Houston's elite, Lynn Wyatt reigns over River Oaks, neighborhood of choice for the charity-ball crowd.

Survival of the Richest

In Houston's glitziest neighborhood, the competition to be top socialite is on.

BY MIMI SWARTZ
PHOTOGRAPHS BY MICHAEL O'BRIEN

There are those who assert that Lynn Wyatt's sale of her River Oaks mansion and her move to a smaller mansion nearby means nothing to the life and times of Houston. Wyatt is now a woman of a certain age, but she looks great: She's still a blonde, still appears at charity galas, and is still featured in the pages of *Vogue* and *W.* She's also the woman who for decades gave Houston its international social cachet, an extremely valuable donation to a city that, despite being the country's fourth largest, still smarts at the slightest suggestion of hickdom. During the height of the oil boom in the 1970s and early '80s, the Wyatt mansion was a party house for the likes of Princess Grace, Bill Blass, Mick Jagger—and a temple of envy for those who weren't invited. Hence any hint that she might be withdrawing from the spotlight fills Houstonians with an odd mixture of fascination and dread. "Lynn Wyatt is NOT stepping aside," insists Franci Crane, a well-placed observer of River Oaks manners and mores. "If anyone tried to take her on, they would be insane."

Yet this improbable madness is currently the talk of Houston's showiest neighborhood. Oil and natural gas businesses may be thriving again, and local construction companies may be profiting handsomely from the war in Iraq, but the real concern among a certain crowd—young, female, and rich—is who will succeed La Lynn if and when she decides to abdicate. "It's an aggressive she-wolf campaign," says a friend who knows her way around the River Oaks Country Club.

To understand the importance of this particular

Always a standout, Becca Cason Thrash models a python-skin jacket at La Griglia, an A-list River Oaks restaurant. "Houston has the best-dressed women in the world," says Thrash, who was called "a card-carrying young Turk" of the Houston social scene by *Vogue* magazine. In a town renowned for bold statements, Thrash holds her own: At one legendary party with a Venetian theme, she installed a gondola in her indoor pool.

Starting small paid off for Susan Criner, who opened a nightclub in an inner-city neighborhood, then used it as a springboard to start booking top entertainers for local events. Though Houston is largely dependent on the boom-or-bust oil and gas industries, Criner's clients have deep enough pockets to weather its ups and downs—and to throw weddings where flowers alone may cost $150,000. In Houston, she says, "the high end is staying high."

Well-bred and well-wed: Courtney Sarofim, seated—daughter of former mayor Bob Lanier and his wife, Elyse, standing—is married to the son of a billionaire money manager. "The young swells," Elyse calls the new generation.

narrative, you have to understand the folkways of River Oaks. This pine-shaded, mansion-filled dreamscape of folly and ambition is both the geographic and mythical heart of Houston. Long an enclave of Houston's wealthiest residents, River Oaks, as opposed to, say, Philadelphia's Main Line or Manhattan's Upper East Side, tends to be more welcoming, less obsessed with pedigree, and more open to grand gestures and exhibition. The people who bought the Wyatts' mansion, for instance, immediately doubled its size, a move any male dog would understand. As Houston's ebullient former first lady, Elyse Lanier, told me: "I'm not moving out of 77019. It took me a long time to get here, and I'm not leaving." Once a friend told Lanier that by removing a fence in the yard behind her peach-colored mansion, she had made the house visible from the River Oaks golf course.

"Everyone can see you," he pointed out.

"Exactly," she said.

Here, more is always more. Yes, there are fine old families who keep their names out of the social columns and live (comparatively) modestly. Everyone pays lip service to admiring them. But they aren't really operating in the local tradition, like that of Silver Dollar Jim West, an eccentric millionaire who liked to toss coins from his chauffeur-driven limo, or Joanne Herring Davis, the widow of a natural gas king, who in the 1960s convinced a local Boy Scout troop to dress as Nubian slaves for one of her parties. The disastrous oil bust of the late '80s chastened the place considerably, but today River Oaks is back with a vengeance. The estates once occupied by oil tycoons and their couture queens have been taken over by a new generation of energy executives and investment bankers (the "new new money") who are reinterpreting the old crowd's flair.

Wyatt's staying power as reigning socialite is due largely to her ability to create an image that evokes both old and new money. She didn't come from enormous wealth—few in River Oaks did—but she got a boost from the self-made oil and gas fortune of her husband, Oscar (recently indicted in the UN oil-for-food scandal). Unlike many women who came of age during Texas' early struggle for social legitimacy, she knew how to look rich and restrained at the same time. Amid the voluminous silks and gargantuan jewels, there she would be, in a spare, gray Geoffrey Beene gown, wearing only one pin that just happened to be studded with many, many, many tastefully tiny diamonds. Her whiskey-and-cigarettes voice belied her behavior, which, in public at least, was beyond reproach.

The rules Wyatt created were as simple as

"I was a gladiator for 20 years," says Franci Crane, recalling her days as a litigator with a prestigious law firm. Crane served as co-counsel for several insurance companies in a lawsuit over the 1989 *Exxon Valdez* oil spill, in which Exxon Corporation won a 780-million-dollar settlement. She now devotes her time to volunteer work, mostly in the arts.

they were largely unachievable: 1) marry unlimited wealth, 2) exhibit impeccable taste, 3) keep your accent but never sound dumb, and finally, 4) be nice, even if you don't feel like it. She knew that display wasn't a bad thing, you just had to be careful about what you showed off.

Wyatt's life was novel for its time, but her successors—the Ladies Who Would Be Lynn—must adapt to a different era. Some have chosen to play the game a bit more sedately. Courtney Sarofim, the daughter of Elyse Lanier, wasn't above party-girl behavior in her youth, but now she's the respectable mother of a three-year-old, drives an SUV, dines with her extended family on Sunday nights, and supports local charities. "The model used to be you went to Europe," Elyse Lanier says. "Now these young women are active in family foundations."

After Hurricane Katrina, Amanda Brock, in purple, and her husband, Robert, went to the Astrodome to help. They invited the Barnes family, who were airlifted off a New Orleans rooftop, to stay at their second home on a nearby ranch.

Becca Cason Thrash, a more traditional exhibitionista, has built on Wyatt's passion for fashion and spectacle. Once a publicist for Tootsies, a pricey River Oaks boutique, she married an heir to a natural gas storage business and now has a glass-ceilinged kitchen with a party room above, attends couture shows in France, and has made friends with Fergie and the Shrivers. Becca's fetes are organized with far more precision than the Iraqi invasion: The chic are fussed over, the overweight are not permitted, and at least one person usually falls into her gigantic indoor pool, accidentally on purpose.

The presence of George and Barbara Bush in Houston has politicized the competition. The Bushes are too studiously sedate to live in River Oaks (they chose a more nondescript neighborhood), but their friends aren't. Nancy Kinder, whose husband, Richard, escaped Enron long before its fall, was one of George W.'s chief Texas fund-raisers during his re-election campaign and now has a regular table at La Griglia, the River Oaks lunch spot of choice. Maria Bush, the new wife of the President's younger brother Neil, is suddenly a regular in River Oaks circles, as is her coterie of once obscure girlfriends.

And unlike in Wyatt's heyday, Houston now has its working rich like everyplace else. The wife of one scion is running a prestigious art gallery, another oversees a nonprofit organization covering the Houston arts scene. And Susan Criner, a talent booker for society parties and corporate bashes, has managed to become one of River Oaks' most well-liked hostesses—despite the absence of the obligatory billion, a signal change if ever there was one.

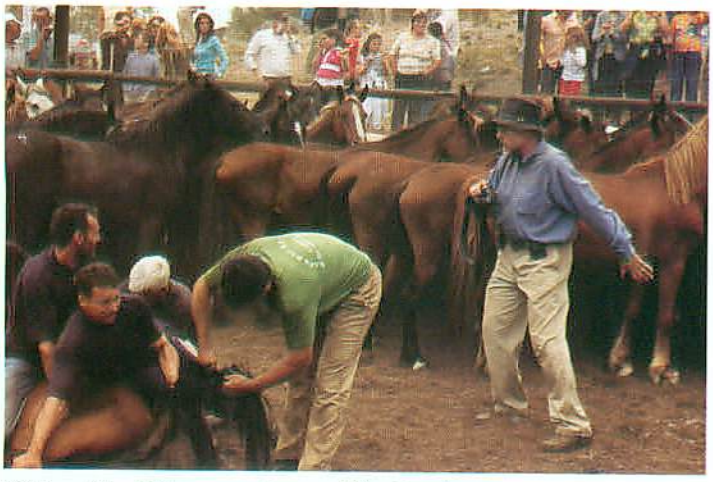
And so, Lynn Wyatt's River Oaks is a more worldly place, well-stocked with smart women who know from Birkin bags and Blahniks. Still, I'm grateful for the last vestiges of excessive excess. Perfect taste, after all, isn't everything. □

Nominate your favorite zip code for coverage in the magazine at **ngm.com/0603**.

The Svarts family board the *Orotava*—not the *Steuben*—in 1939.

UPDATE **Steuben Revisited** "I yelled to my wife, and she thought I'd had a heart attack," says John Svarts, 70, of Wodonga, Australia. Svarts was flipping through the February 2005 issue when he saw the photo (left) of a mother and child reportedly boarding the German refugee ship *Steuben* hours before it was sunk by a Soviet submarine in 1945. The caption read, "Their fate remains unknown." But Svarts knew their fate. The girl in the picture is his sister, Ena, now 68; their mother, Ellen, passed away in the 1990s. The family has another photo (above) including John and his father, Erik. The image the magazine ran, he explained, actually showed the family boarding the ship *Orotava* in Pärnu, Estonia, in 1939, when German Estonians were brought west by the Nazis. Such images were used as German propaganda. NATIONAL GEOGRAPHIC acquired the picture from a German historian, and two *Steuben* survivors who reviewed it did not doubt its authenticity. The caption was wrong, but the ending is happy.

PHOTOS: SVARTS FAMILY (TOP); OSTSEE-ARCHIV HEINZ SCHÖN



Mixing with wild horses and even wilder Spaniards who tackle them, Jim Richardson joins the action at a festival in the Celtic enclave of Galicia.

ON ASSIGNMENT

It's in His Blood

All those nights of hoisting a camera at music-soaked pubs and parades reminded photographer Jim Richardson that he is truly a Celt. His pedigree is solid: Richardson's ancestors go back to at least the 1500s in Cornwall, a Celtic stronghold in southwestern England. Growing up in Kansas, however, he was told by his mother that "we came from fine English stock." If she were still alive, he says, "I'd tell her to ditch the English stuff. We're Celts—and that's much more fun."

Contributors

Andrew Meier
The biggest challenge writer Andrew Meier faced in Ukraine was tracking down the story's main character: President Viktor Yushchenko. A bit of fresh tar gave him a clue. Meier saw that the potholes of Donetsk had been repaired, a tip-off that Yushchenko was making a trip there to address the opposition. Faced with a hostile crowd of thousands, the president talked nonstop for six hours in a stifling auditorium. "He basically wore out his enemies," says Meier. "It was an incredible scene."

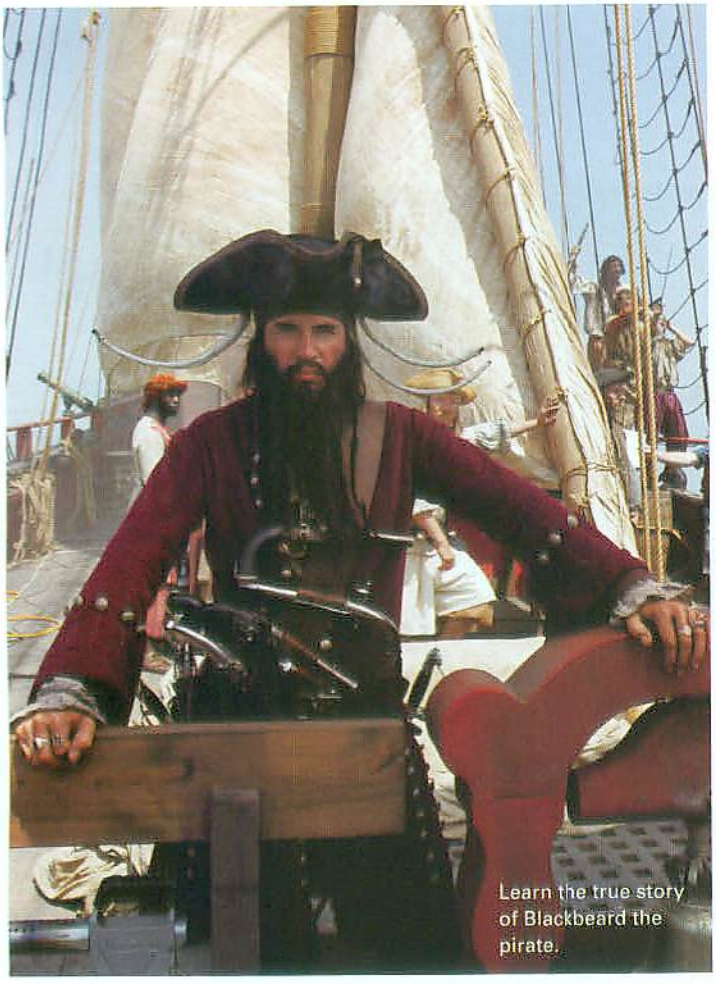
James Shreeve
For his story on the human journey, writer James Shreeve joined Wampanoag Indians who had gathered in Seekonk, Massachusetts, to donate blood for a genetic study. While they were waiting their turn, one person took out a guitar, others burst into song, and an elderly couple started dancing. "These are people united not just by a genetic legacy, but more so by generations of support for each other through hard times," says Shreeve. "Love and intimacy vibrated in that room."

Mimi Swartz
A longtime Houstonian and an executive editor at *Texas Monthly*, Mimi Swartz loves writing about her hometown. "People here are accessible," she says. "And there is always someone doing something outrageous, fascinating, silly. It's a never ending circus." She sees her story on the glitterati of Houston's River Oaks neighborhood as a natural fit for NATIONAL GEOGRAPHIC: "It's cultural anthropology. This is a tribe, with its own particular rites and rituals."

John Mitchell
A native of Cincinnati, Ohio, writer John Mitchell saw a lot of coal long before he did his story on mountaintop removal mining. "I remember looking down at the Ohio River and seeing coal barges—sometimes fleets of them—heading downstream," Mitchell recalls. "Until we switched to oil, my family relied on West Virginia coal to heat the house. Then, all that coal came from underground mines. But as I prowled the topless mountains of the Mountain State, I saw how much more harmful surface mining is—not only to the land, but also to the people who live there."

Anup Shah
When photographer Anup Shah first picked up a camera at age 13, he loved taking pictures of animals from odd angles. "People laughed at me because they weren't used to seeing things so differently," says Shah, a native of Nairobi, Kenya. "But I stuck with it." Now 36, Shah has shot seven natural history stories for NATIONAL GEOGRAPHIC, including this month's feature on Ethiopian wolves. "I try to let the animals relax and accept me. I try to let them speak."

PHOTOS CLOCKWISE FROM TOP: MARITA PRIETO DEL RÍO; REBECCA HALE, NGS; MARK THIESSEN, NGS; JACQUELINE MIA FOSTER, CONTACT PRESS



Learn the true story of Blackbeard the pirate.

Blackbeard

Sunday, March 12 at 8 p.m. ET/9 p.m. PT
One of history's most legendary and feared pirates, Blackbeard, along with his crew of cutthroats, terrorized the shores of colonial America. Was the sea captain a charming rebel or a murderous thief? National Geographic Channel presents the true story of Capt. Edward Teach. Witness a reenactment of his week-long siege of Charleston, South Carolina, and follow his retreat up the coast to the waters off Ocracoke Island, where he was finally cornered and killed.

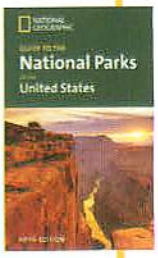
EXPLORER

Sundays at 8 p.m. ET/PT National Geographic Channel's award-winning documentary series covers the world and all that's in it. View never-before-seen footage revealing how Hurricane Rita punished New Orleans, Louisiana, last September. And watch as *Explorer* investigates the hidden culture of prisoners in *Surviving Maximum Security.*

NG Books

National Parks

The fifth and latest edition of the best-selling *National Geographic Guide to the National Parks of the United States* features updated information for all 58 national parks. With new maps, more than 350 photos, and a fresh design, this guide offers campground and hotel suggestions, itineraries, excursion ideas, and more ($25).



Making America

Author Alan Axelrod tackles American history in *1001 Events That Made America: A Patriot's Handbook.* This beautifully illustrated chronology of key events begins with the land's earliest inhabitants and ends in the present day. Covering events and people from the Civil War to the civil rights movement, from George Washington to George W. Bush, Axelrod reveals who and what shaped the United States into the country it is today ($19.95). Both books are available this month at bookstores.

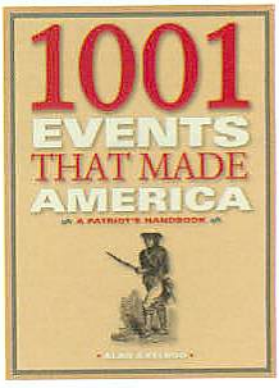


PHOTO: JACQUES MORELL

FLASHBACK

Puck of the Irish A visitor to the Puck Fair in Killorglin, Ireland, kicks a ball during a carnival game in 1956. "After he did not hit the first time," the photographer noted, "he bullied the boy who owns the game to put the ball at the right angle from where he was sure to hit." To launch the annual Puck Fair—which may stem from the ancient Celtic harvest festival called Lughnasa—locals capture a wild male goat, or "Puck," from the hills outside town and crown him king of the three-day event. The animal watches over the festivities from a cage atop an elevated platform and is released back to the wild on the fair's final day. Killorglin's fair royalty includes a queen as well, but she is no old goat: County Kerry schoolgirls compete in an essay contest to win the coveted title "Queen of Puck." *—Margaret G. Zackowitz*

Flashback Archive All the photos plus e-greetings, in Fun Stuff at **ngm.com/0603**.

PHOTO: INGE MORATH, MAGNUM PHOTOS

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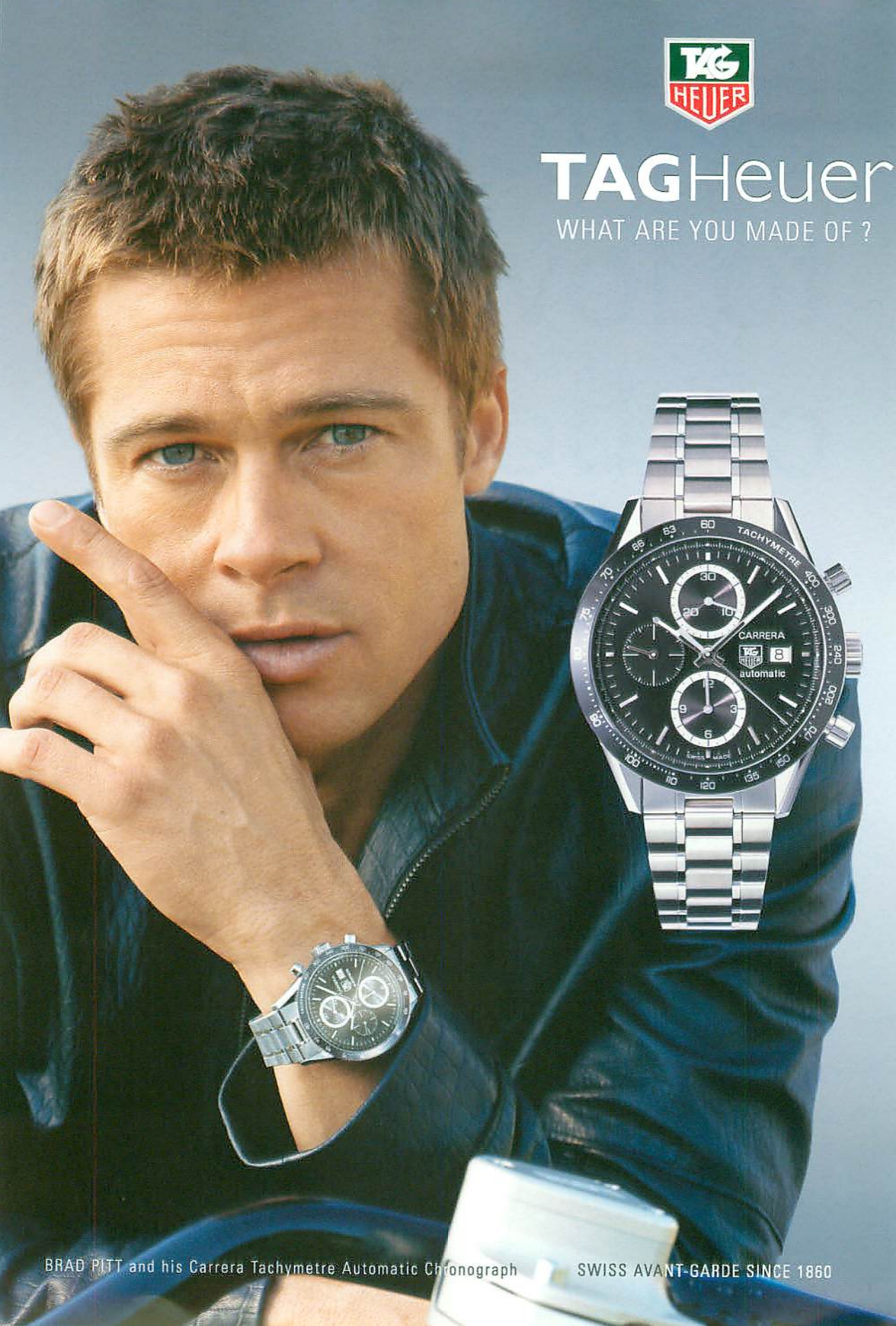
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