Hong Kong Jitters | Yemen's Mysterious Island

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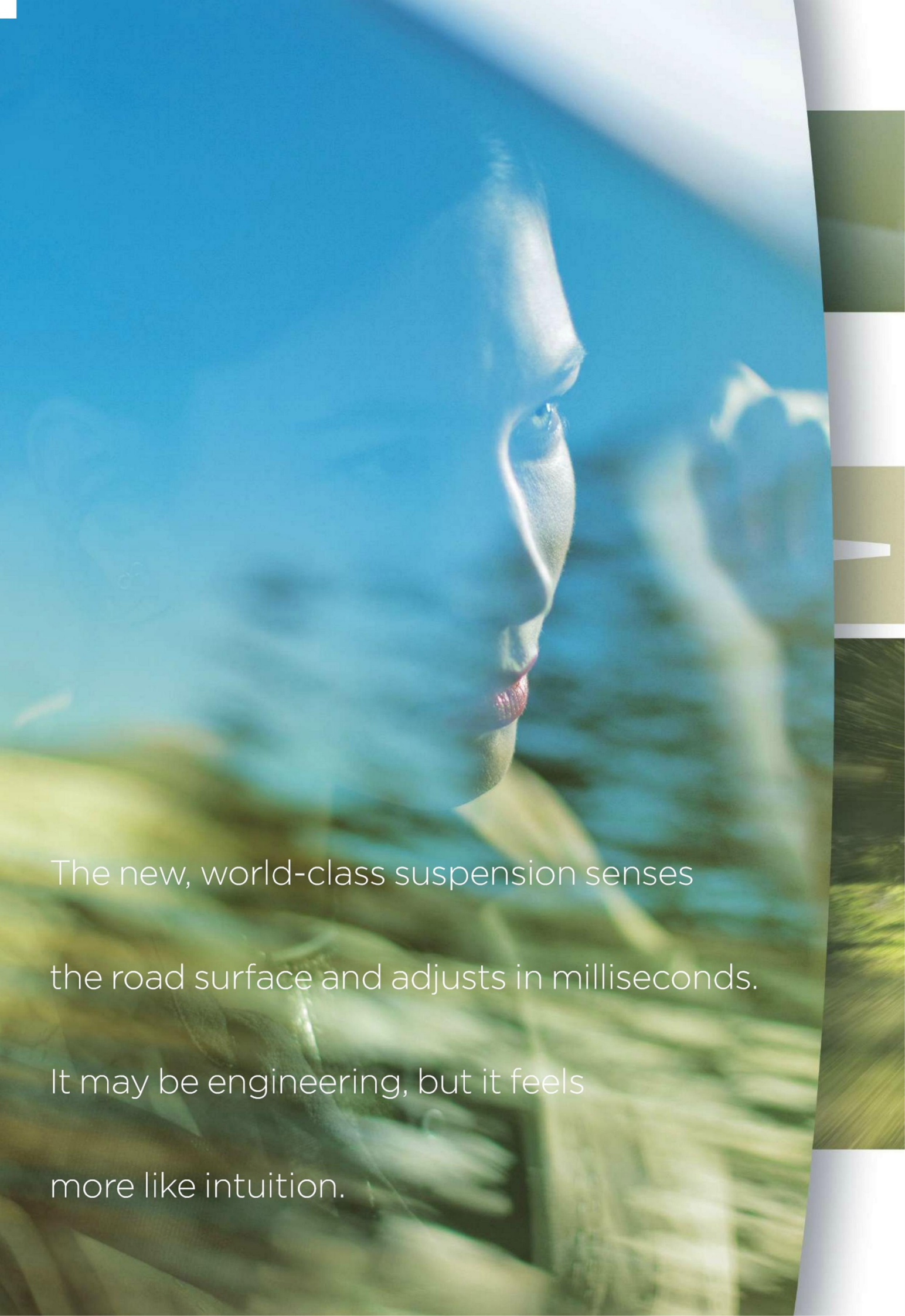
NATIONAL GEOGRAPHIC

Solar SUPER Storms

HOW THEY COULD IMPACT
OUR HIGH-TECH WORLD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From its perch on an abandoned farmhouse, this female owl glided off as if to hunt, then doubled back, nearly flying over the photographer's head.

SVEN ZAČEK

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- **Milford Sound** — SOUTH ISLAND, NEW ZEALAND
- **National Sculpture Garden** — WASHINGTON, DC
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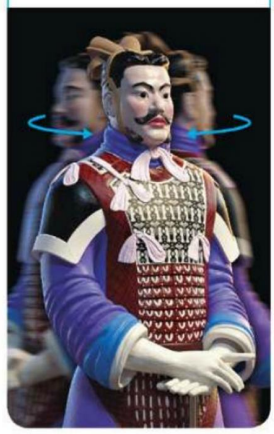

ART: PURE RENDERING GMBH

On the Cover
Recorded in ultraviolet light, a massive storm bursts from the sun.
Image by NASA Solar Dynamics Observatory

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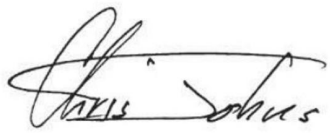
Our Man in China

Some of us plan ahead by setting aside money for a rainy day or—looking even more forward—for retirement. But China's first emperor, Qin Shi Huang Di, took the longest view of all. He ordered up an army of thousands of life-size terra-cotta warriors armed with bronze weapons to be buried near his tomb to protect him for all eternity.

Lou Mazzatenta, whose photographs illustrate this month's story on the latest finds from the extraordinary burial site near Xian, started at the magazine in 1961 as an intern in the illustrations department. Afterward, he took a job at the *Minneapolis Tribune,* served in the Army, then returned to this magazine for a 30-year-long career track that included jobs as illustrations editor, head of layout and design, and finally director of the control center (which kept track of the complexities of production). Still, Lou's real love was getting out in the field to photograph stories, which he somehow managed to do while wearing his other hats.

Lou's real love is getting out in the field.

Lou retired in 1994, but that's a technicality at best. "Terra-Cotta Warriors in Color" is his 13th story since that so-called retirement, and it also happens to be his third story on the same subject. You might say that Lou, who loves working in China, is our ambassador to the Republic of the Terra-Cotta Soldier. He regards these magnificent clay artifacts with respect and reverence, and the Chinese archaeologists, in turn, respect him. "I think I may be the only foreign photographer allowed right on the pit floor eye to eye with the warriors," he told me, and it wouldn't surprise me a bit if it turned out to be so.



ART: GRAFILU

Black-and-White Ruffed Lemur
(Varecia variegata)
Size: Head and body length, 43 - 57 cm (16.9 - 22.4 inches); tail, 60 - 65 cm (23.6 - 25.6 inches)
Weight: 3.1 - 3.6 kg (6.8 - 7.9 lbs)
Habitat: Remnant tracts of tropical moist lowland and montane forests
Surviving number: Unknown; populations declining

Photographed by Nick Garbutt

WILDLIFE AS CANON SEES IT

Unmistakable. With its long face, lavishly tufted ears and raucous calls, the black-and-white ruffed lemur is easy to pick out of a crowd. Ruffed lemurs are the largest and most frugivorous members of the lemur family, the latter trait making them especially effective pollinators and seed dispersers. They also distinguish themselves by being the only primates to build nests exclusively for birth and the first few days of rearing their young. Females carry their infants in their mouths and "park" them while they forage. But there's no mistaking the deadly dangers they encounter, from the wholesale destruction of the forest to hunting.

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What Dogs Tell Us

The Great Dane and Brussels griffon dogs have both been surgically altered by ear cropping followed by manipulation of the remaining cartilage of the earflaps to force them to stand up. This is not a genetically inherited trait. Ear cropping is a surgical procedure and causes great pain to the dog during recovery. Research shows there is no medical benefit of any kind to the dog, and it is performed only for cosmetic reasons and to adhere to outdated breed standards. The veterinary profession has spent many years educating clients regarding this and does not recommend the procedure.

A. WATERFIELD
Ottawa, Ontario

My Lakeland terrier, Stanley, immediately attacked the February edition, guarding against this intrusion upon his pack's home. I will now read "What Dogs Tell Us" through the puncture marks left by a terrier in defend mode.

PAUL SWEETING
Sedbergh, England

I would guess my Jack Russell terrier is mostly herder (for getting me and my wife out of the house twice a day) and part hunter (for getting lost among the deer and rabbits in the forest). But only a small part—he never brings anything back.

DALE HARBRON
Tadley, England

To characterize the village dogs of Togo as "no breed at all" smacks of the same old elitism that used to characterize the entire Southern Hemisphere as primitive.

MICHAEL MOSKOWITZ
New York, New York

Does the ability to shape the perfect dog outweigh the risk of canines dying in the process? Why can't humans leave canines as their "best friend" instead of trying to create their "perfect friend"?

SEM VERBEEK
Bradenton, Florida

Lost da Vinci

One of the pieces of evidence showing a possible rush to judgment in favor of da Vinci is: "Shaded areas showed distinctive left-handed strokes just like Leonardo's." Many artists turn a work sideways or completely upside down while doing such shading to make it easier to accurately shade with repeated strokes. If a right-handed artist turned the drawing over while making the strokes, might it not look like the strokes were made by a left-handed artist?

KEN GARY
San Diego, California

Correction

FEBRUARY 2012: KAZAKHSTAN
Page 87: Kazakhstan is roughly the size of western Europe, not the entire continental Europe.

FEEDBACK

Readers offered their thoughts on what our cover dog would tell us if she could talk.

GRAPHIC: LAWSON PARKER, NGM STAFF

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WRITE National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199. Include name, address, and daytime telephone. Letters may be edited for clarity and length.

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New technology usually starts out at astronomical prices and then comes down years later. We skipped that step to allow everyone the chance to experience this watch's brilliant fusion of technology and style. We originally priced the Stauer ***Compendium Hybrid*** at $395 based on the market for advanced sports watches... but then stopped ourselves. Since this is no ordinary economy, we decided to start at 92% off from day one. That means this new technological marvel can be yours for only $29!

Welcome a new Digital Revolution. With the release of the dynamic new ***Compendium***, those boxy, plastic wrist calculators of the past have been replaced by this luxurious LCD chronograph that is sophisticated enough for a formal evening out, but rugged and tough enough to feel at home in a cockpit, camping expedition or covert mission.

The watch's extraordinary dial seamlessly blends an analog watch face with a stylish digital display. Three superbright luminous hands keep time along the inner dial, while a trio of circular LCD windows track the hour, minutes and seconds. An eye-catching digital semi-circle animates in time with the second hand and shows the day of the week. The watch also features a rotating bezel, stopwatch and alarm functions and green, electro-luminescence backlight. The ***Compendium Hybrid*** secures with a rugged stainless steel band and is water-resistant to 3 ATMs.

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- Stop watch function
- Fits 6 3/4"–8 3/4" wrist

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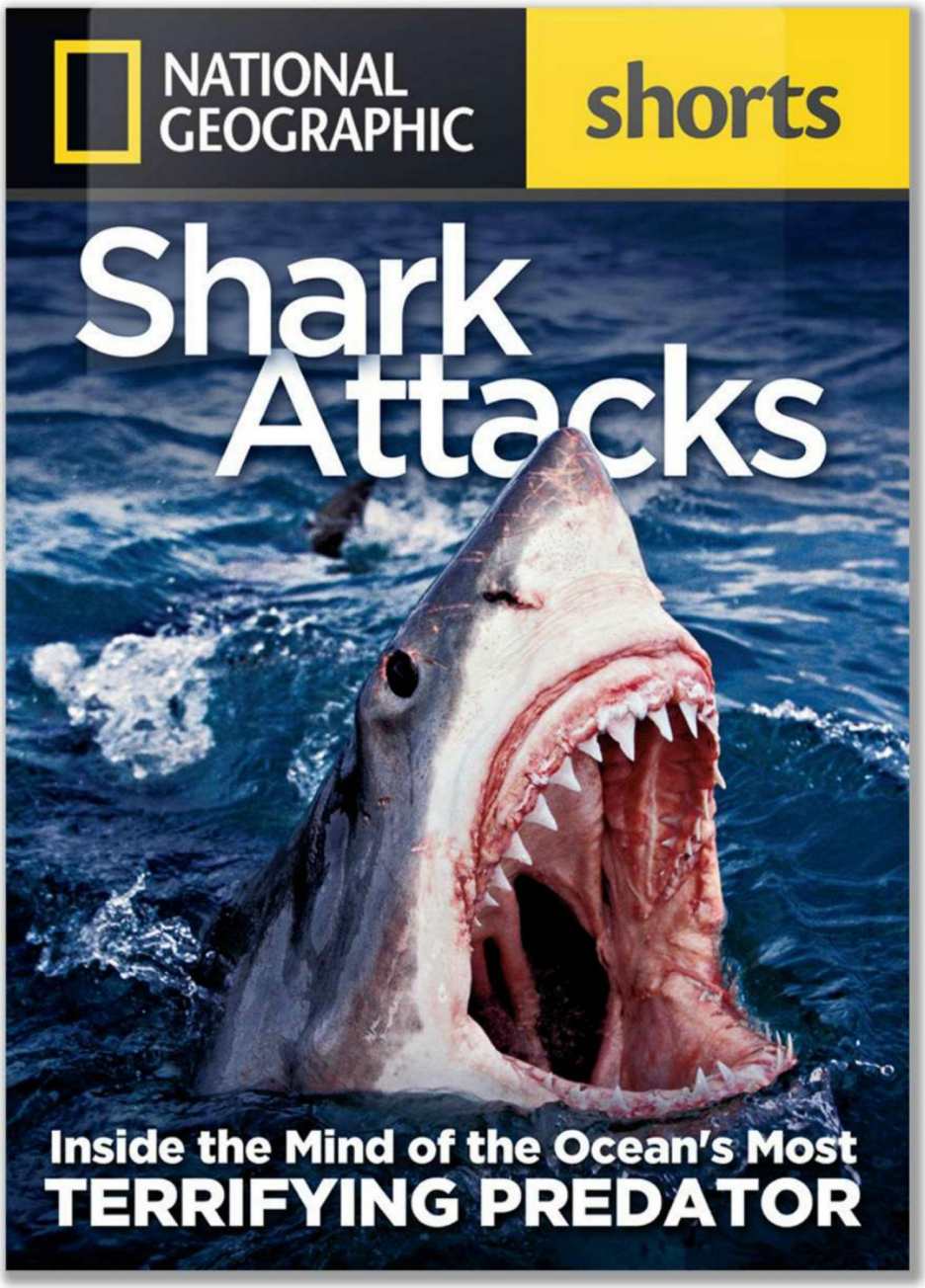

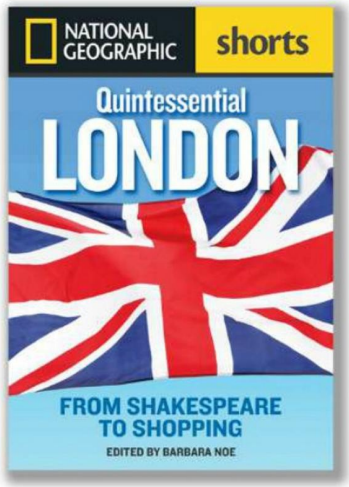

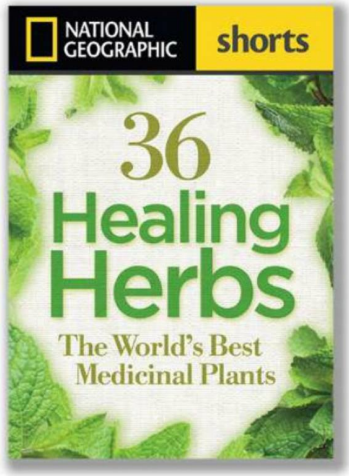

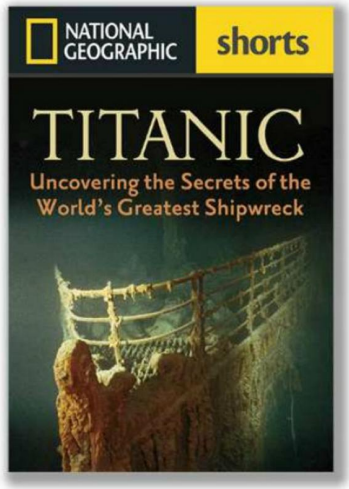

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THIS MONTH

Untamed Americas

Even the most seasoned traveler hasn't witnessed anything like this before. Find the true meaning of the great outdoors as we take a fresh look at wildlife within the Americas. From Alaska to Patagonia, high-tech cameras capture the amazing—and sometimes alarming—behavior of the animals that inhabit our forests, mountains, deserts, and coasts. Watch a puma on the prowl (above) in southern Chile, then touch down in Ecuador to zoom in on a tube-lipped nectar bat's remarkable tongue. Somewhere farther north there's a lizard that squirts blood from its eyes. Want to know if it's lurking in your backyard? Grab a spot on the couch and tune in.

For listings go to **natgeotv.com** and **natgeowild.com.**

NATIONAL GEOGRAPHIC CHANNEL

NAT GEO WILD

Sunrise illuminates the Andes in Chile's Torres del Paine National Park. Catch the view on *Untamed Americas* on the National Geographic Channel and Nat Geo WILD.

PHOTOS: JOHN SHIER, NGT

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William Saturno

A Maya mural appears in a doorway hacked out by looters in a Guatemalan rain forest.

A rare set of 1,200-year-old Maya murals offers a glimpse into an ancient mind-set.

Founded in 1888, the National Geographic Society has added to our knowledge of earth, sea, and sky by supporting more than 10,000 explorations and research projects. Readers' membership dues make this support possible.

MISSION *To document and preserve Maya paintings*

AT FIRST GLANCE THE MOUND IS nothing remarkable—just a pile of dirt and stone covered in trees and vegetation. It's in the Guatemalan forest on the outskirts of the Classic Maya site of Xultún, near another site I've been studying for the past decade. At some point, looters dug a hole into it, looking for a tomb. I told the student who found an eroded wall with faint glimpses of paint, "There used to be something here, but there's nothing now." Still, I was curious. So I excavated to the back wall, and I saw a beautiful portrait of a king. There he was in Technicolor, with blue feathers. I laughed. I mean, what are the chances?

It's rare to find ancient Maya murals, but I've had great luck over the years. I'd love for it to be due to some brilliance of mine, but it's just luck. I can't explain it. When we excavated the six-foot-wide room in this mound, we found paintings of several figures

PHOTO (COMPOSITE OF 31 IMAGES): TYRONE TURNER

Saturno excavates the Xultún mural room, scraping debris near the painting of Younger Brother Obsidian.

with the king. One is identified in glyphs as Younger Brother Obsidian. He's holding a stylus. An entire wall is covered in mathematical calculations.

My hunch is that this may have been a workspace or teaching space for scribes, artists, or scholars. They were working things out for later public consumption. This room gives us a rare glimpse of Maya thought processes. When my colleagues and I studied four columns of huge numbers, we realized these were calculations based on the Maya calendar and astronomy that projected 2.5 million days—some 7,000 years—into the future.

This was done in A.D. 813 or 814, 75 years before Xultún's final days. A lot of the Maya lowlands had already fallen silent. The collapse had begun. Trade routes and hubs of communication were all changing. At Xultún, folks were going about business as usual, but there was an undercurrent of anxiety. They wanted to tie events in their king's life to larger cosmic cycles. They wanted to show that the king would be OK.

It's important to understand that the ancient Maya predicted the world would continue. That was their point. They didn't predict the end of the world. There would be cycles, new beginnings—but never endings. That's what's going on in this room. The numbers on the walls are calculations of when the same cosmic events would happen in the future. The Maya were looking for a guarantee that nothing would change. We keep looking for endings. It's an entirely different mind-set.

I would never have identified this nondescript mound as special. But this discovery implies that special things are everywhere. *—William Saturno*

Watch a video of Saturno uncovering the murals in our iPad edition.

PHOTO: TYRONE TURNER. NGM MAPS

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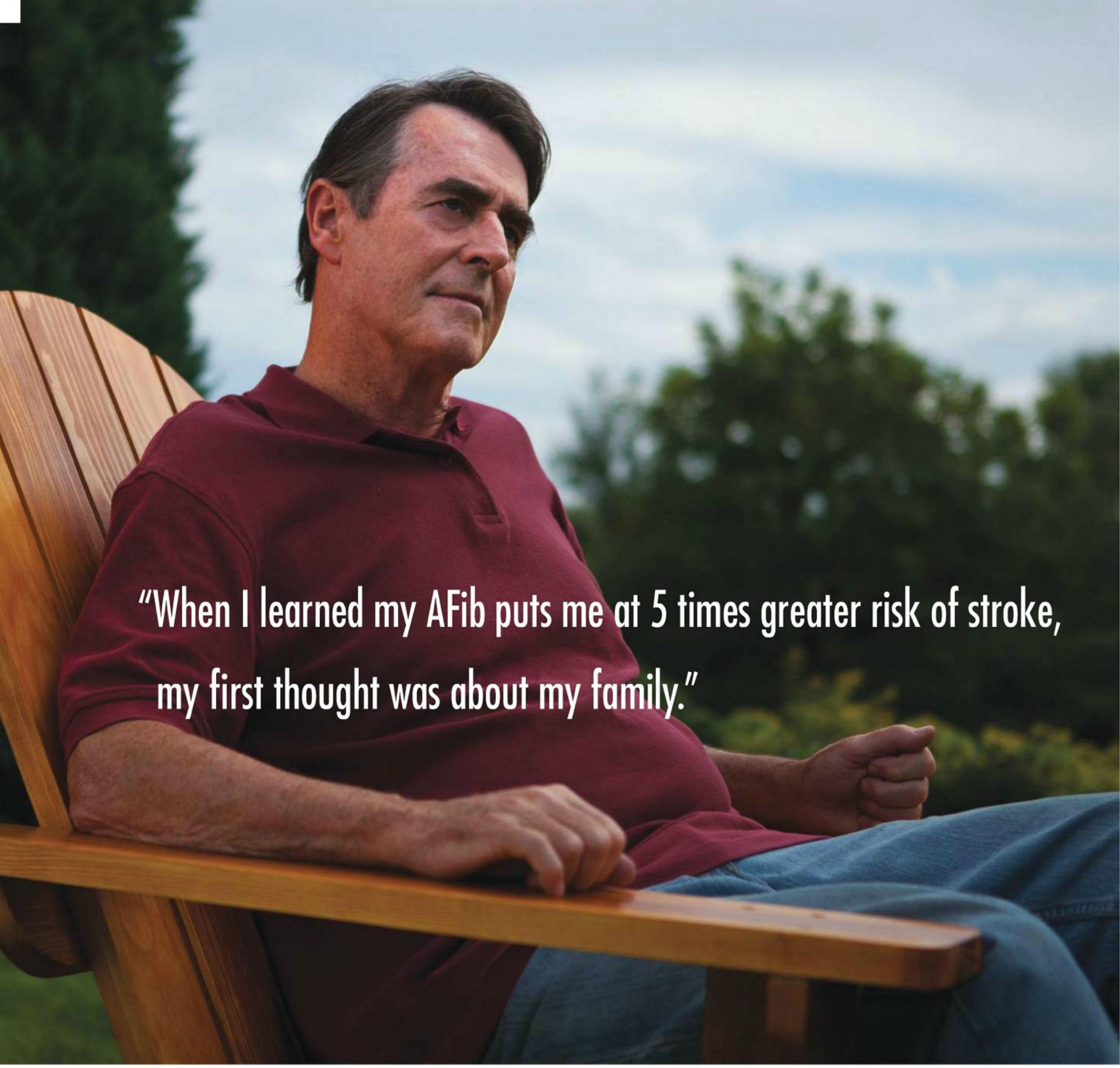

WHAT IS *PRADAXA*?

PRADAXA is a prescription blood-thinning medicine used to reduce the risk of stroke and blood clots in people with atrial fibrillation not caused by a heart valve problem.

IMPORTANT SAFETY INFORMATION ABOUT *PRADAXA*

PRADAXA can cause bleeding which can be serious and sometimes lead to death. Don't take PRADAXA if you currently have abnormal bleeding or if you have ever had an allergic reaction to it.

Your risk of bleeding with PRADAXA may be higher if you: are 75 years old or older, have kidney problems, have stomach or intestine bleeding that is recent or keeps coming back or you have a stomach ulcer, take other medicines that increase your risk of bleeding, like aspirin products, non-steroidal anti-inflammatory drugs (NSAIDs) and blood thinners, have kidney problems and take dronedarone (Multaq®) or ketoconazole tablets (Nizoral®).

Call your doctor or seek immediate medical care if you have any of the following signs or symptoms of bleeding: any unexpected, severe, or uncontrollable bleeding; or bleeding that lasts a long time, unusual or unexpected bruising, coughing up or vomiting blood; or vomit that looks like coffee grounds, pink or brown urine; red or black stools (looks like tar), unexpected pain, swelling, or joint pain, headaches and feeling dizzy or weak.

Boehringer Ingelheim

If you have an irregular heartbeat called atrial fibrillation, or AFib, not caused by a heart valve problem, **PRADAXA** can reduce your risk of stroke.

- In a clinical trial, PRADAXA 150 mg **reduced stroke risk 35% more** than warfarin.

Risk reduction was greatest when compared to patients on warfarin whose blood tests showed lower levels of control.

- **Unlike warfarin:**

No regular blood tests.

No dietary restrictions.

Ask your doctor about

Pradaxa®
dabigatran etexilate
CAPSULES

IMPORTANT SAFETY INFORMATION CONTINUED

It is important to tell your doctor about all medicines, vitamins and supplements you take. Some of your other medicines may affect the way PRADAXA works.

Take PRADAXA exactly as prescribed by your doctor. Don't stop taking PRADAXA without talking to your doctor as your risk of stroke may increase.

Tell your doctor if you are planning to have **any** surgery, or medical or dental procedure, because you may have to stop taking PRADAXA for a short time.

PRADAXA can cause indigestion, stomach upset or burning, and stomach pain.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

Please see more detailed Medication Guide on next page.

Pradaxa®
dabigatran etexilate
CAPSULES

For more information or help paying for your medication, call 1-877-PRADAXA or visit pradaxa.com.

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Pradaxa®
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CAPSULES 150 mg

MEDICATION GUIDE

PRADAXA (pra dax' a)
(dabigatran etexilate mesylate)
capsules

Read this Medication Guide before you start taking PRADAXA and each time you get a refill. There may be new information. This Medication Guide does not take the place of talking with your doctor about your medical condition or your treatment.

What is the most important information I should know about PRADAXA?

- PRADAXA can cause bleeding which can be serious, and sometimes lead to death. This is because PRADAXA is a blood thinner medicine that lowers the chance of blood clots forming in your body.
- **You may have a higher risk of bleeding if you take PRADAXA and:**
  - are over 75 years old
  - have kidney problems
  - have stomach or intestine bleeding that is recent or keeps coming back, or you have a stomach ulcer
  - take other medicines that increase your risk of bleeding, including:
    - aspirin or aspirin containing products
    - long-term (chronic) use of non-steroidal anti-inflammatory drugs (NSAIDs)
    - warfarin sodium (Coumadin®, Jantoven®)
    - a medicine that contains heparin
    - clopidogrel (Plavix®)
    - prasugrel (Effient®)
  - have certain kidney problems and also take the medicines dronedarone (Multaq®) or ketoconazole tablets (Nizoral®).

    Tell your doctor if you take any of these medicines. Ask your doctor or pharmacist if you are not sure if your medicine is one listed above.
- PRADAXA can increase your risk of bleeding because it lessens the ability of your blood to clot. While you take PRADAXA:
  - you may bruise more easily
  - it may take longer for any bleeding to stop.

Call your doctor or get medical help right away if you have any of these signs or symptoms of bleeding:

- unexpected bleeding or bleeding that lasts a long time, such as:
  - unusual bleeding from the gums
  - nose bleeds that happen often
  - menstrual bleeding or vaginal bleeding that is heavier than normal
- bleeding that is severe or you cannot control
- pink or brown urine
- red or black stools (looks like tar)
- bruises that happen without a known cause or get larger
- cough up blood or blood clots
- vomit blood or your vomit looks like "coffee grounds"
- unexpected pain, swelling, or joint pain
- headaches, feeling dizzy or weak

Take PRADAXA exactly as prescribed. Do not stop taking PRADAXA without first talking to the doctor who prescribes it for you. Stopping PRADAXA may increase your risk of a stroke.

PRADAXA may need to be stopped, if possible, for one or more days before any surgery, or medical or dental procedure. If you need to stop taking PRADAXA for **any reason**, talk to the doctor who prescribed PRADAXA for you to find out when you should stop taking it. Your doctor will tell you when to start taking PRADAXA again after your surgery or procedure.

See "What are the possible side effects of PRADAXA?" for more information about side effects.

What is PRADAXA?

PRADAXA is a prescription medicine used to reduce the risk of stroke and blood clots in people who have a medical condition called atrial fibrillation. With atrial fibrillation, part of the heart does not beat the way it should. This can lead to blood clots forming and increase your risk of a stroke. PRADAXA is a blood thinner medicine that lowers the chance of blood clots forming in your body.

It is not known if PRADAXA is safe and works in children.

Who should not take PRADAXA?

Do not take PRADAXA if you:

- currently have certain types of abnormal bleeding. Talk to your doctor, before taking PRADAXA if you currently have unusual bleeding.
- have had a serious allergic reaction to PRADAXA. Ask your doctor if you are not sure.

What should I tell my doctor before taking PRADAXA?

Before you take PRADAXA, tell your doctor if you:

- have kidney problems
- have ever had bleeding problems
- have ever had stomach ulcers
- have any other medical condition

- are pregnant or plan to become pregnant. It is not known if PRADAXA will harm your unborn baby.
- are breastfeeding or plan to breastfeed. It is not known if PRADAXA passes into your breast milk.

Tell all of your doctors and dentists that you are taking PRADAXA. They should talk to the doctor who prescribed PRADAXA for you, before you have **any** surgery, or medical or dental procedure.

Tell your doctor about all the medicines you take, including prescription and non-prescription medicines, vitamins, and herbal supplements. Some of your other medicines may affect the way PRADAXA works. Certain medicines may increase your risk of bleeding. See "**What is the most important information I should know about PRADAXA**?"

Especially tell your doctor if you take:
- rifampin (Rifater, Rifamate, Rimactane, Rifadin)

Know the medicines you take. Keep a list of them and show it to your doctor and pharmacist when you get a new medicine.

How should I take PRADAXA?
- **Take PRADAXA exactly as prescribed by your doctor.**
- Do not take PRADAXA more often than your doctor tells you to.
- You can take PRADAXA with or without food.
- **PRADAXA comes in a bottle or in a blister package.**
- **Only open 1 bottle of PRADAXA at a time. Finish your opened bottle of PRADAXA before opening a new bottle.**
- **After opening a bottle of PRADAXA, use within 4 months. See "How should I store PRADAXA?"**
- **When it is time for you to take a dose of PRADAXA, only remove your prescribed dose of PRADAXA from your open bottle or blister package.**
- **Tightly close your bottle of PRADAXA right away after you take your dose.**
- Swallow PRADAXA capsules whole. Do not break, chew, or empty the pellets from the capsule.
- If you miss a dose of PRADAXA, take it as soon as you remember. If your next dose is less than 6 hours away, skip the missed dose. Do not take two doses of PRADAXA at the same time.
- Your doctor will decide how long you should take PRADAXA. **Do not stop taking PRADAXA without first talking with your doctor. Stopping PRADAXA may increase your risk of stroke.**
- Do not run out of PRADAXA. Refill your prescription before you run out. If you plan to have surgery, or a medical or a dental procedure, tell your doctor and dentist that you are taking PRADAXA. You may have to stop taking PRADAXA for a short time. See "What is the most important information I should know about PRADAXA?"
- If you take too much PRADAXA, go to the nearest hospital emergency room or call your doctor.
- Call your healthcare provider right away if you fall or injure yourself, especially if you hit your head. Your healthcare provider may need to check you.

What are the possible side effects of PRADAXA?
PRADAXA can cause serious side effects.
- See "What is the most important information I should know about PRADAXA?"
- Allergic Reactions. In some people, PRADAXA can cause symptoms of an allergic reaction, including hives, rash, and itching. Tell your doctor or get medical help right away if you get any of the following symptoms of a serious allergic reaction with PRADAXA:
  - chest pain or chest tightness
  - swelling of your face or tongue
  - trouble breathing or wheezing
  - feeling dizzy or faint

Common side effects of PRADAXA include:
- indigestion, upset stomach, or burning
- stomach pain

Tell your doctor if you have any side effect that bothers you or that does not go away.

These are not all of the possible side effects of PRADAXA. For more information, ask your doctor or pharmacist.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

How should I store PRADAXA?
- Store PRADAXA at room temperature between 59°F to 86°F (15°C to 30°C). After opening the bottle, use PRADAXA within 4 months. Safely throw away any unused PRADAXA after 4 months.
- **Keep PRADAXA in the original bottle or blister package to keep it dry (protect the capsules from moisture). Do not put PRADAXA in pill boxes or pill organizers.**
- **Tightly close your bottle of PRADAXA right away after you take your dose.**

Keep PRADAXA and all medicines out of the reach of children.

General information about PRADAXA
Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide. Do not use PRADAXA for a condition for which it was not prescribed. Do not give your PRADAXA to other people, even if they have the same symptoms. It may harm them.

This Medication Guide summarizes the most important information about PRADAXA. If you would like more information, talk with your doctor. You can ask your pharmacist or doctor for information about PRADAXA that is written for health professionals.

For more information, go to www.PRADAXA.com or call 1-800-542-6257 or (TTY) 1-800-459-9906.

What are the ingredients in PRADAXA?

Active ingredient: dabigatran etexilate mesylate

Inactive ingredients: acacia, dimethicone, hypromellose, hydroxypropyl cellulose, talc, and tartaric acid. The capsule shell is composed of carrageenan, FD&C Blue No. 2 (150 mg strength only), FD&C Yellow No. 6, hypromellose, potassium chloride, titanium dioxide, and black edible ink.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

Distributed by:
Boehringer Ingelheim Pharmaceuticals, Inc.
Ridgefield, CT 06877 USA

Revised: January 2012

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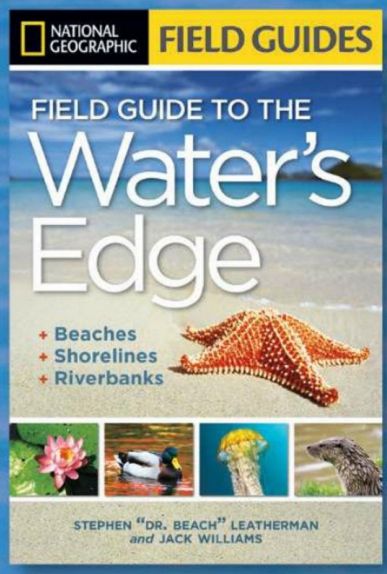
TAKE A WATER BREAK



Co-written by Stephen "Dr. Beach" Leatherman, creator of the famous annual Top 10 Beaches

Summer just isn't official without an aquatic adventure. This is your essential guide to understanding the fascinating plants, animals, shells, and other curiosities to be found along the water's edge in oceans, lakes, rivers, marshes, ponds, and streams. It also features North America's 20 all-time top beaches, 10 top rivers, and 5 top Great Lake destinations.

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NATIONAL GEOGRAPHIC

Inspire Future Generations

Grace Cleere included National Geographic in her estate plans.

A communications expert for the government, Grace Cleere recently named National Geographic as a beneficiary in her will. "I included a bequest intention to National Geographic because I believe in everything the organization represents," says Cleere. "If we don't understand our world, we are bound to mistreat it. And if we are not curious about all living things on our planet, we are bound to lose them through thoughtlessness and indifference. National Geographic shines a spotlight on the critical issues of the day and proposes innovative solutions that are grounded in science. I feel good about my legacy knowing that National Geographic will leverage my gift so it can have the greatest impact."

It is easy to include National Geographic in your will. For more information about how to include National Geographic in your estate plans, or to let us know that you have already done so, please contact the Office of Estate Planning.

TO MAKE YOUR BEQUEST

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Minimum age 45. Payments begin at age 65.

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Photo: Adam Buchanan

VISIONS

Djibouti
Stamped into parched desert territory near the Somali border, patches of artificial grass provide tiny oases for teeing off at Golf Club de la Douda. Annual rainfall in the African republic averages around just six inches.

PHOTO: MATTHIEU PALEY

United Kingdom
A "sea pool" constructed along a stretch of rocky coast invites refreshing dips in the Cornish village of Mousehole. Such pools, filled by seawater at high tide, were popular in the U.K. during the 1930s. Today some 30 of them remain in use.

PHOTO: TESSA BUNNEY

Italy
Sawtooth peaks in the Dolomites, part of the eastern Alps, give way to a bucolic field—a resting spot for hikers and, at times, grazing cattle. The towering pinnacles of Grosse Fermeda (front) and Sass Rigais (rear) rise more than 9,000 feet.

PHOTO: KEVIN KUNSTADT

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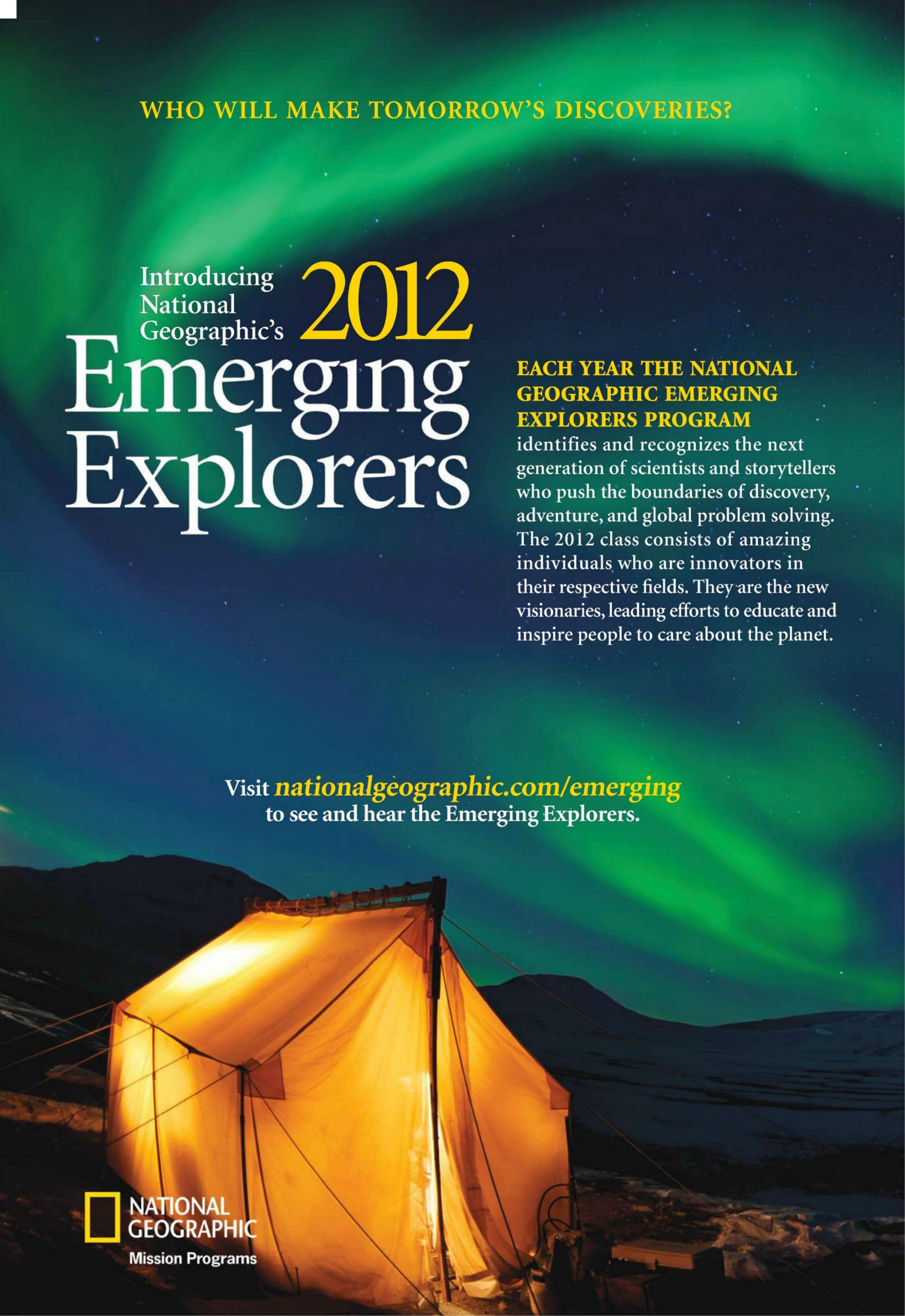

WHO WILL MAKE TOMORROW'S DISCOVERIES?
Introducing National Geographic's 2012 Emerging Explorers
EACH YEAR THE NATIONAL GEOGRAPHIC EMERGING EXPLORERS PROGRAM identifies and recognizes the next generation of scientists and storytellers who push the boundaries of discovery, adventure, and global problem solving. The 2012 class consists of amazing individuals who are innovators in their respective fields. They are the new visionaries, leading efforts to educate and inspire people to care about the planet.
Visit nationalgeographic.com/emerging to see and hear the Emerging Explorers.
NATIONAL GEOGRAPHIC
Mission Programs

Cyborg Anthropologist Amber Case explores how humanity's new relationship with information via computers and mobile software is changing the way we think, interact, and understand our world.

Photo: Kris Krüg

Digital Storyteller and Zoologist Lucy Cooke champions the unloved yet endangered animals of the world through quirky videos, blogs, and documentaries, reaching a new, wider audience with conservation messages.

Photo: Kira Ivanoff/NGS

Behavioral Ecologist Iain Couzin reveals principles of collective behavior that improve understanding of how groups of people, animals, and cells can accomplish together what they cannot individually.

Photo: Simon Garnier

Underwater Archaeologist Guillermo de Anda dives into Mexico's caves, discovering ancient human bones and a road to the underworld that reveal new insights about Maya rituals and culture.

Photo: Guillermo Pruneda

Chemist Yu-Guo Guo invents nanotechnology that could reshape the feasibility of electric vehicles, creating batteries that are smaller, more powerful, and less expensive.

Photo: Jin-Song Hu

Conservationist Osvel Hinojosa Huerta leads efforts to restore the Colorado River Delta, renew river flow to the sea, and re-create crucial wetlands so wildlife and local economies can flourish again.

Photo: Cheryl Zook/NGS

Pilot and Educator Barrington Irving inspires youth to excel academically and pursue their dreams through dynamic skill-building educational programs and his own history-making flight.

Photo: Jon Ross

Photo: Sandesh Kádur/NGS

Conservation Biologist Krithi K. Karanth conducts interdisciplinary research to better understand ecological and social dimensions of conservation.

Photo: Kris Krüg/PopTech

Crisis Mapper Patrick Meier applies new lifesaving technology to humanitarian and human rights crises worldwide, making response and relief faster, more targeted, and effective.

Photo: Louise Bray/BBC

Archaeologist Sarah Parcak revolutionizes the field of archaeology, using infrared satellite imagery to reveal hidden cities, roads, and pyramids buried for centuries below Egypt's landscape.

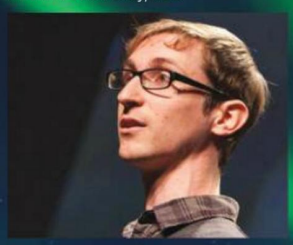


Photo: Kris Krüg/PopTech

Data Scientist Jake Porway connects pro bono data scientists with social change organizations to solve pressing problems, using data collection, management, and analysis in the service of humanity.

Photo: Darren Moore

Guerrilla Geographer Daniel Raven-Ellison challenges children and adults to explore and connect with the world around them in creative new ways, inspired by his films, books, website, and walks.

Photo: Scott DeGraw/NGS

Archaeologist Jeffrey Rose raises questions about early humans' timing and route out of Africa and makes the process of scientific discovery more accessible, exciting, and immediate to the public.

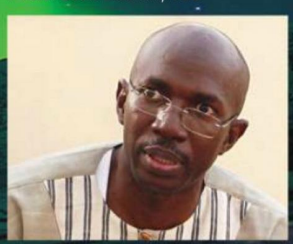


Photo: Tom Burrell

Engineer Ibrahim Togola transforms prospects for western Africa's remote rural areas through renewable energy projects, innovative economic development, environmental protection, and advocacy.

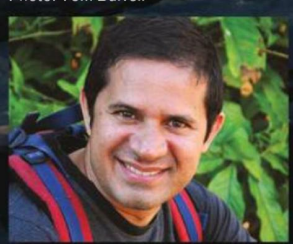
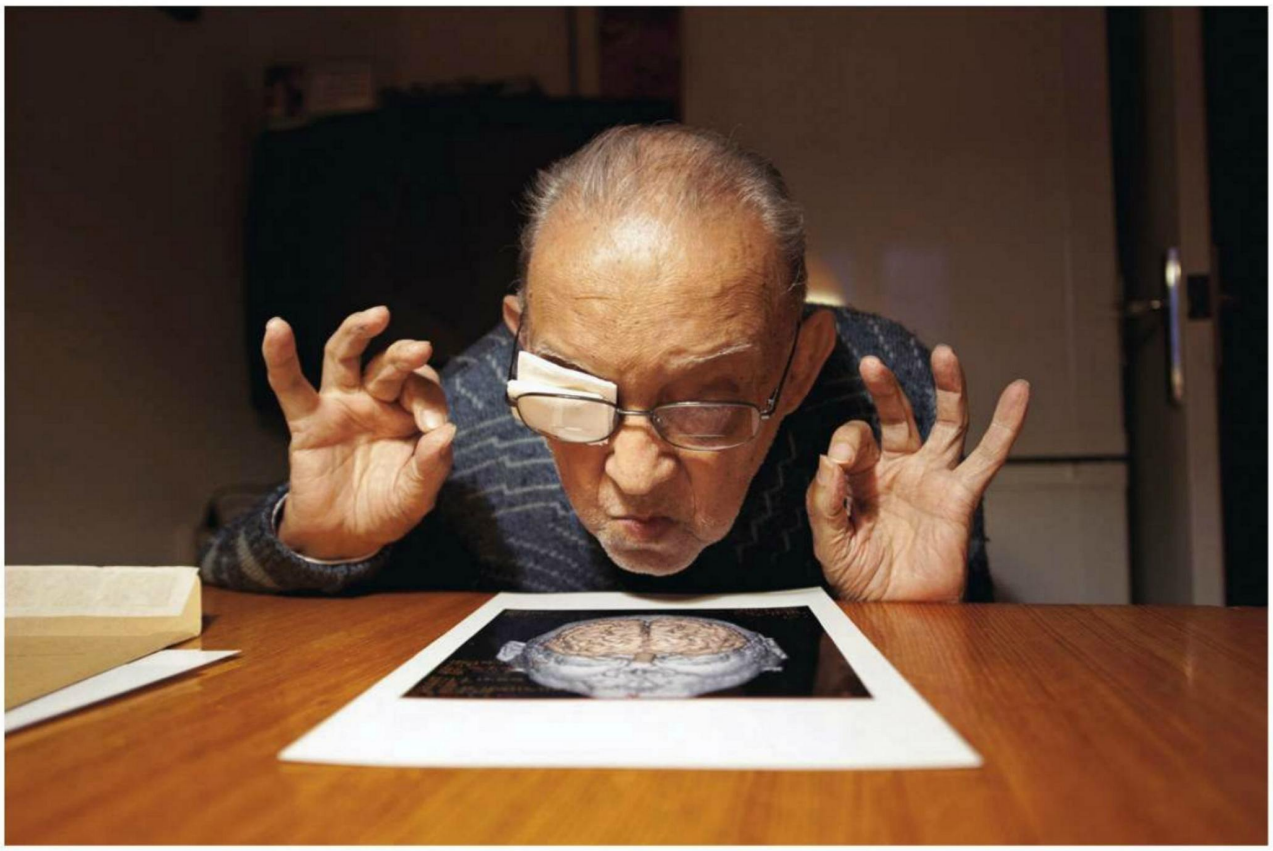


Photo: Yamila Lomba

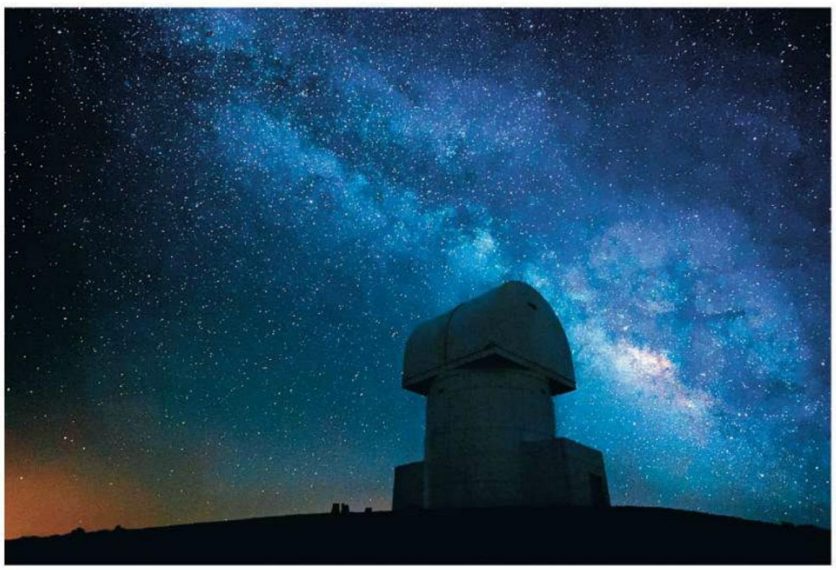
Archaeologist Daniel Torres Etayo combs land and sea, exploring archaeological sites and shipwrecks to shed new light on Cuba's history, ancient aboriginal culture, and unsolved mysteries.

This section features photographs chosen by our editors and one chosen by our readers via online voting. For more information, go to *ngm.com/yourshot.*



EDITORS' CHOICE **Dolors Bas** Anglès, Spain

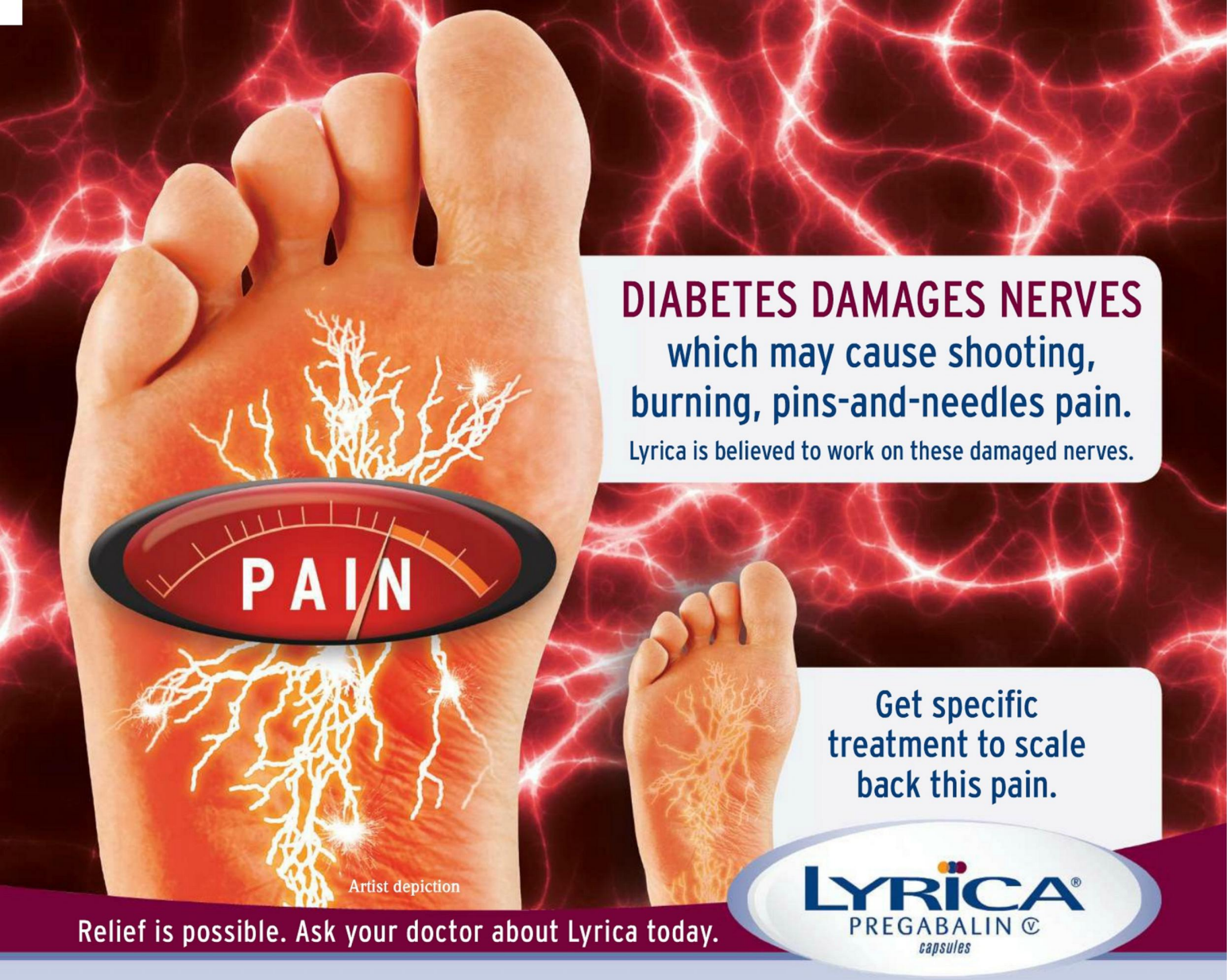
Capturing the essence of Paco, her friend for 40 years (and a fellow artist), was a cherished goal for Bas. A longtime sculptor who now has vision problems, Paco—here at his home in Girona—delights at "being able to see inside himself" via a scan that was taken of his brain.



READERS' CHOICE

Harry Katzjaeger
Villach, Austria

"The deeper the silence, the higher the inspiration," says Katzjaeger, 55, whose interest in Greece took hold in childhood. He drank strong coffee to combat the cold while taking long exposures of the night sky above Helmos Observatory in northern Peloponnesus.



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*Individual results may vary. †Those who have had a drug or alcohol problem are more likely to misuse Lyrica.

Prescription Lyrica is not for everyone. Tell your doctor right away about any serious allergic reaction that causes swelling of the face, mouth, lips, gums, tongue, throat or neck or any trouble breathing or that affects your skin. Lyrica may cause suicidal thoughts or actions in a very small number of people. Call your doctor right away if you have new or worsening depression, suicidal thoughts or actions, or unusual changes in mood or behavior. Lyrica may cause swelling of your hands, legs and feet. Some of the most common side effects of Lyrica are dizziness and sleepiness. Do not drive or work with machines until you know how Lyrica affects you. Other common side effects are blurry vision, weight gain, trouble concentrating, dry mouth, and feeling "high." Also, tell your doctor right away about muscle pain along with feeling sick and feverish, or any changes in your eyesight including blurry vision or any skin sores if you have diabetes. You may have a higher chance of swelling, hives or gaining weight if you are also taking certain diabetes or high blood pressure medicines. Do not drink alcohol while taking Lyrica. You may have more dizziness and sleepiness if you take Lyrica with alcohol, narcotic pain medicines, or medicines for anxiety. If you have had a drug or alcohol problem, you may be more likely to misuse Lyrica. Tell your doctor if you are planning to father a child. Talk with your doctor before you stop taking Lyrica or any other prescription medication.

Please see Important Risk Information for Lyrica on the following page.

To learn more visit www.lyrica.com or call toll-free 1-888-9-LYRICA (1-888-959-7422).

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

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IMPORTANT FACTS

LYRICA® PREGABALIN capsules (LEER-i-kah)

IMPORTANT SAFETY INFORMATION ABOUT LYRICA

LYRICA may cause serious, even life threatening, allergic reactions. Stop taking LYRICA and call your doctor right away if you have any signs of a serious allergic reaction:
- Swelling of your face, mouth, lips, gums, tongue, throat or neck
- Have any trouble breathing
- Rash, hives (raised bumps) or blisters

Like other antiepileptic drugs, LYRICA may cause suicidal thoughts or actions in a very small number of people, about 1 in 500.
Call your doctor right away if you have any symptoms, especially if they are new, worse or worry you, including:
- New or worsening depression
- Suicidal thoughts or actions
- Unusual changes in mood or behavior

Do not stop LYRICA without first talking with your doctor.

LYRICA may cause swelling of your hands, legs and feet.
This swelling can be a serious problem with people with heart problems.

LYRICA may cause dizziness or sleepiness.
Do not drive a car, work with machines, or do other dangerous things until you know how LYRICA affects you. Ask your doctor when it is okay to do these things.

ABOUT LYRICA

LYRICA is a prescription medicine used in adults 18 years and older to treat:
- Pain from damaged nerves that happens with diabetes or that follows healing of shingles
- Partial seizures when taken together with other seizure medicines
- Fibromyalgia (pain all over your body)

Who should NOT take LYRICA:
- Anyone who is allergic to anything in LYRICA

BEFORE STARTING LYRICA

Tell your doctor about all your medical conditions, including if you:
- Have had depression, mood problems or suicidal thoughts or behavior
- Have or had kidney problems or dialysis
- Have heart problems, including heart failure
- Have a bleeding problem or a low blood platelet count
- Have abused prescription medicines, street drugs or alcohol in the past
- Have ever had swelling of your face, mouth, tongue, lips, gums, neck, or throat (angioedema)
- Plan to father a child. It is not known if problems seen in animal studies can happen in humans.
- Are pregnant, plan to become pregnant or are breastfeeding. It is not known if LYRICA will harm your unborn baby. You and your doctor should decide whether you should take LYRICA or breast-feed, but not both.

Tell your doctor about all your medicines. Include over-the-counter medicines, vitamins, and herbal supplements.
LYRICA and other medicines may affect each other causing side effects. Especially tell your doctor if you take:
- Angiotensin converting enzyme (ACE) inhibitors. You may have a higher chance for swelling and hives.

BEFORE STARTING LYRICA, continued

- Avandia® (rosiglitazone)*, Avandamet® (rosiglitazone and metformin)* or Actos® (pioglitazone)** for diabetes. You may have a higher chance of weight gain or swelling of your hands or feet.
- Narcotic pain medicines (such as oxycodone), tranquilizers or medicines for anxiety (such as lorazepam). You may have a higher chance for dizziness and sleepiness.
- Any medicines that make you sleepy

POSSIBLE SIDE EFFECTS OF LYRICA

LYRICA may cause serious side effects, including:
- See "Important Safety Information About LYRICA."
- Muscle problems, pain, soreness or weakness along with feeling sick and fever
- Eyesight problems including blurry vision
- Weight gain. Weight gain may affect control of diabetes and can be serious for people with heart problems.
- Feeling "high"

If you have any of these symptoms, tell your doctor right away.

The most common side effects of LYRICA are:
- Dizziness
- Blurry vision
- Weight gain
- Sleepiness
- Trouble concentrating
- Swelling of hands and feet
- Dry mouth

If you have diabetes, you should pay extra attention to your skin while taking LYRICA and tell your doctor of any sores or skin problems.

HOW TO TAKE LYRICA

Do:
- Take LYRICA exactly as your doctor tells you. Your doctor will tell you how much to take and when to take it. Take LYRICA at the same times each day.
- Take LYRICA with or without food.

Don't:
- Drive a car or use machines if you feel dizzy or sleepy while taking LYRICA.
- Drink alcohol or use other medicines that make you sleepy while taking LYRICA.
- Change the dose or stop LYRICA suddenly. You may have headaches, nausea, diarrhea, or trouble sleeping if you stop taking LYRICA suddenly.
- Start any new medicines without first talking to your doctor.

NEED MORE INFORMATION?

- Ask your doctor or pharmacist. This is only a brief summary of important information.
- Go to **www.lyrica.com** or call **1-866-459-7422 (1-866-4LYRICA).**

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NOW

Incense in Peril

With its spicy aroma and biblical presence alongside myrrh and gold, frankincense evokes the ancient and the exotic. Long procured for use in fragrances, rituals, and medical remedies, the tree resin now faces hazards that threaten to halve yields in the next 15 years, say Ethiopian and Dutch researchers.

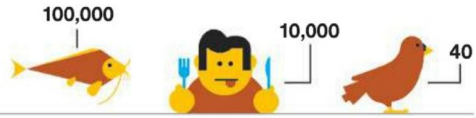
Their study, involving wild *Boswellia papyrifera* trees in Ethiopia, found high mortality in adult plants and few new ones replacing them. Beetle infestations, fire, and animal grazing all contribute to the problem. Tapping the trees itself wasn't key to the population issue but likely reduces tree health, notes co-author Frans Bongers of Wageningen University. Still, he says, tapping selectively and protecting areas for young trees would help preserve this gift of wise men. *—Luna Shyr*

Frankincense oozes from trees of the *Boswellia* genus (far left) when their bark is cut. The dried resin burns aromatically.

PHOTO: MARK THIESSEN, NGM STAFF
GRAPHIC: MATTHEW TWOMBLY, NGM STAFF

NOW

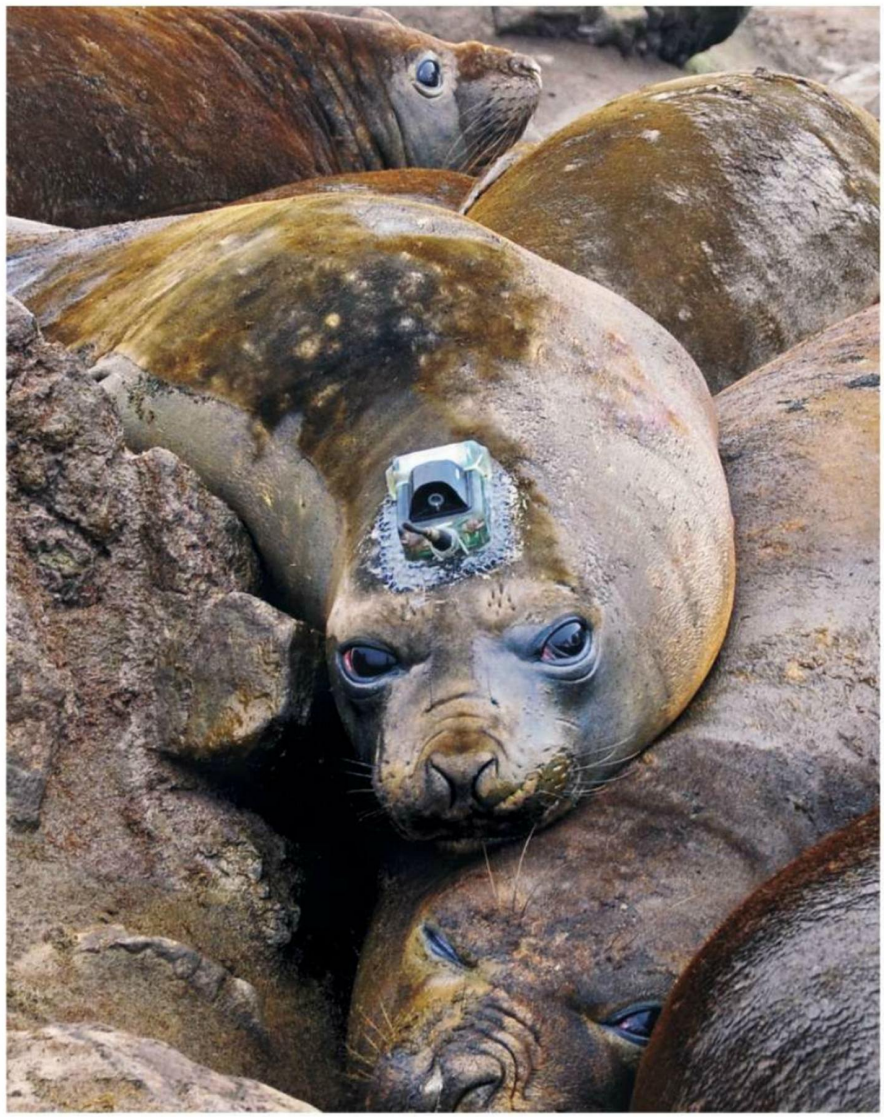
A catfish's **taste buds** cover its whole body. Both a human's and pigeon's considerably fewer taste receptors are concentrated on the tongue.

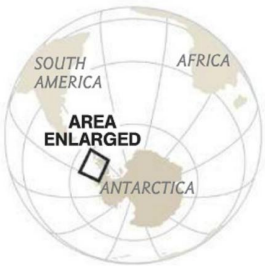


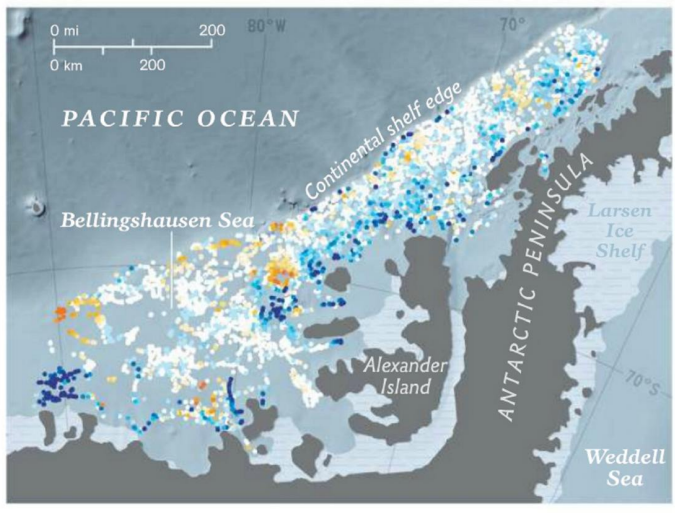
Mapmaker Seals

Elephant seals—which dive as deep as 6,500 feet—go to the bottom of Antarctica's continental shelf to forage, noticed ecologist Dan Costa. The odd part is that they often dipped below where the seafloor should have been according to sparse ship data. And so a study of the sea mammal's habits—200,000 dives of 56 temporarily tagged seals (right)—got passed to oceanographer Laurie Padman and ended up solving a cartographic conundrum: how to accurately measure the depth of an ocean under ship-stymieing Antarctic ice.

Another advantage? Salinity and temperature data showed where warm, salty water was moving in relation to ice shelves. The next step is a suite of tags and animals to reveal details of a changing southern ocean. *—Johnna Rizzo*







Difference between seal dive and known bathymetry (in feet)

Greater than 1,000 (shallower than expected)

0

Greater than 1,000 (deeper than expected)

Data from elephant seals reveal deeper seafloor close to shore and improve bathymetry mapping along the continental shelf edge as well as in deep troughs that cut across the shelf.

PHOTO: DAN COSTA. MAPS: JEROME N. COOKSON, NGM STAFF; THEODORE A. SICKLEY. SOURCES: LAURIE PADMAN, EARTH & SPACE RESEARCH; DAN COSTA AND KIM GOETZ, UC SANTA CRUZ; RTOPO; USGS. GRAPHIC: KISS ME I'M POLISH

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Life in a Fishbowl

Whether swimming inside a simple glass bowl or darting around a huge, elaborate aquarium, pet fish tend to draw a crowd. They're quiet, curious, sometimes even comical. Could their surroundings be affecting how they act?

Yes indeed, says Case Western Reserve University biologist Ronald Oldfield, whose new study indicates that behavior is influenced by tank size and decor. Using juveniles of the common tropical aquarium fish Midas cichlid (pictured), Oldfield found that fish in a small, typical home tank nipped and charged at one another. The attacks subsided in a hundred-gallon tank filled with plants and alcoves.

In tight, unfurnished environments, explains Oldfield, aggression becomes cost-effective because the fish have nothing else to do. However, in spacious accommodations with multiple objects to break up lines of vision, the fish put their energy toward exploring instead of tussling with their tank mates.

As for America's 12.6 million fish owners, Oldfield hopes his findings inspire new thoughts on their finned friends' homes. After all, why should the term "personal space" apply only to humans? *—Catherine Zuckerman*

PHOTO: DAVID LITTSCHWAGER

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NEXT

CITY SOLUTION **BIKE SHARING** | In the global push toward urban modernization, one low-tech concept is riding high: sharing bicycles. Young programs in London, Boston, and Washington, D.C., are expanding; New York City and Chicago plan large-scale launches this year, joining 200-plus bike-share systems worldwide. It's all part of a decades-long evolution from free—and theft-prone—borrowing schemes to automated systems that track payment, parking, and bike distribution.

Why the pedaling renaissance? Bikes are cheap (as little as one pound—about $1.50—for a half hour in London), green, and good exercise, says University College London's Oliver O'Brien, who studies usage data. And as cities have found since Lyon and Paris inspired the latest wave (Lyon launched in 2005, Paris in 2007), they're a boon to urban living—and don't require reinventing the wheel. *—Luna Shyr*

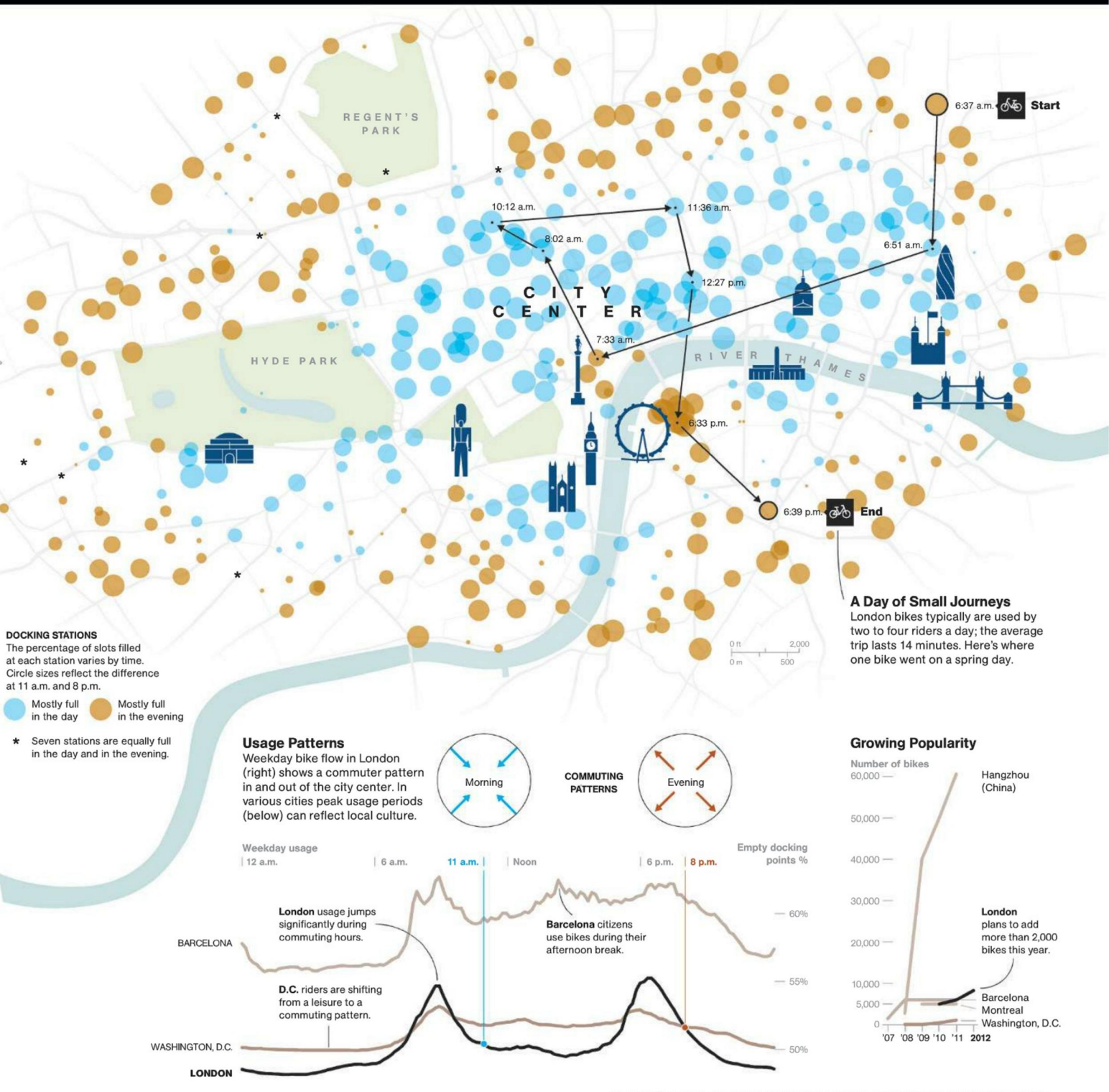
Shared bikes are making the world's great cities even greater.

London

Launched in July 2010, this urban bike-share system features some 6,000 bicycles across central London. An additional 2,000 were due this spring, with the expansion focused on areas in East London. Bikes can be picked up and returned at any of the docking stations shown here.

Smart by Design

Safety, durability, and theft protection are key considerations for shared bikes, like this one from Washington, D.C.



A Day of Small Journeys

London bikes typically are used by two to four riders a day; the average trip lasts 14 minutes. Here's where one bike went on a spring day.

DOCKING STATIONS
The percentage of slots filled at each station varies by time. Circle sizes reflect the difference at 11 a.m. and 8 p.m.

Mostly full in the day

Mostly full in the evening

* Seven stations are equally full in the day and in the evening.

Usage Patterns

Weekday bike flow in London (right) shows a commuter pattern in and out of the city center. In various cities peak usage periods (below) can reflect local culture.

COMMUTING PATTERNS

Growing Popularity

GRAPHICS: ÁLVARO VALIÑO. SOURCE: OLIVER O'BRIEN, UNIVERSITY COLLEGE LONDON. PHOTO: MARK THIESSEN, NGM STAFF

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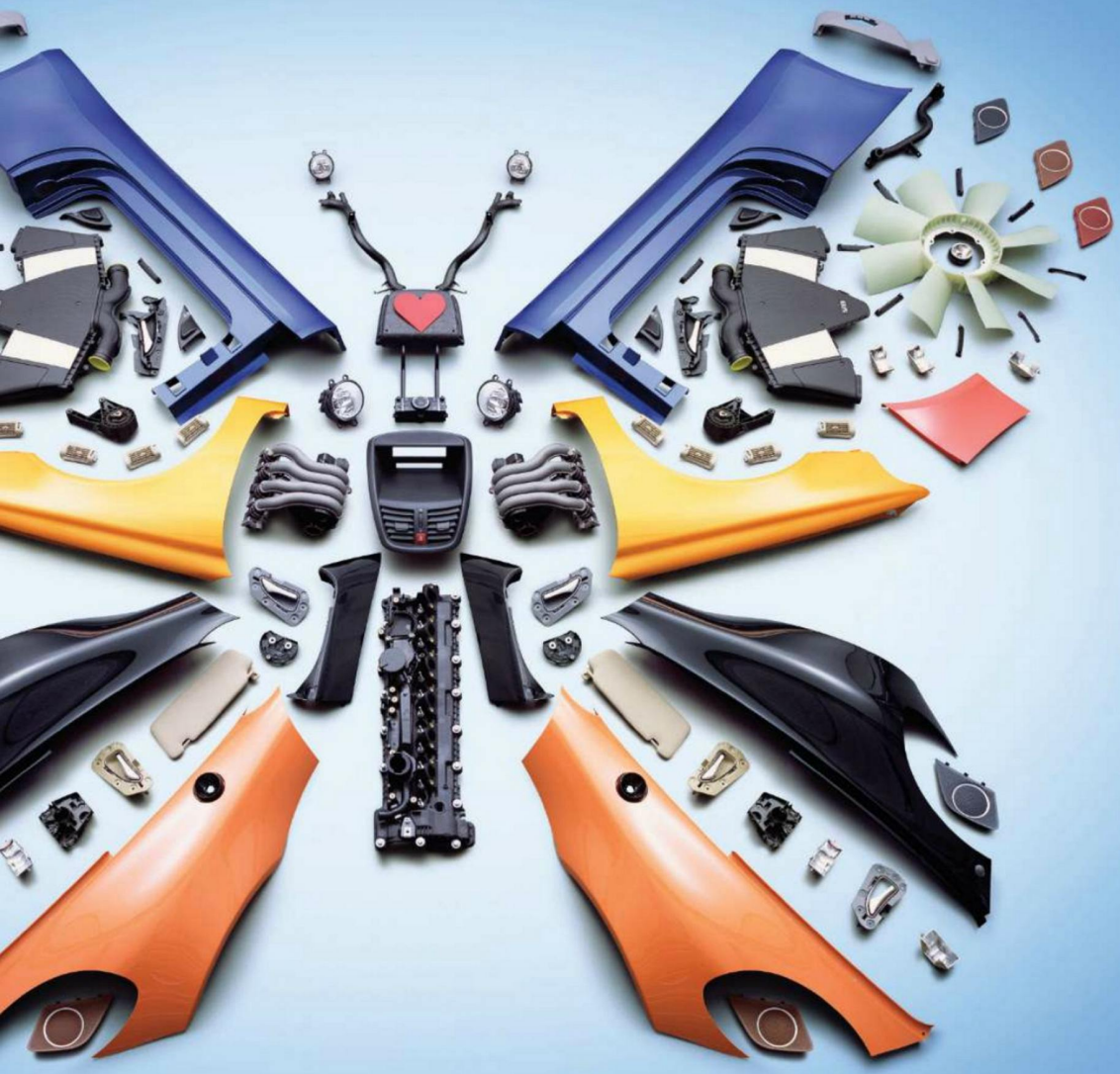


Coffee Buzz

For centuries coffee lovers in western Europe and North America had their pick of the beans grown in lush climates. Now they are getting some competition, as a new generation of urbanites acquires a taste for coffee and cafés multiply in cities across Asia, eastern Europe, and the Middle East.

Even in Brazil, long the world's largest coffee producer, there is a fast-growing thirst for the locally favored small cup of strong coffee. "Everyone likes to go out for a *cafezinho,* and young people are taking coffee as their favorite drink," says Robério Silva, the International Coffee Organization's executive director. "The domestic market is growing at astonishing rates."

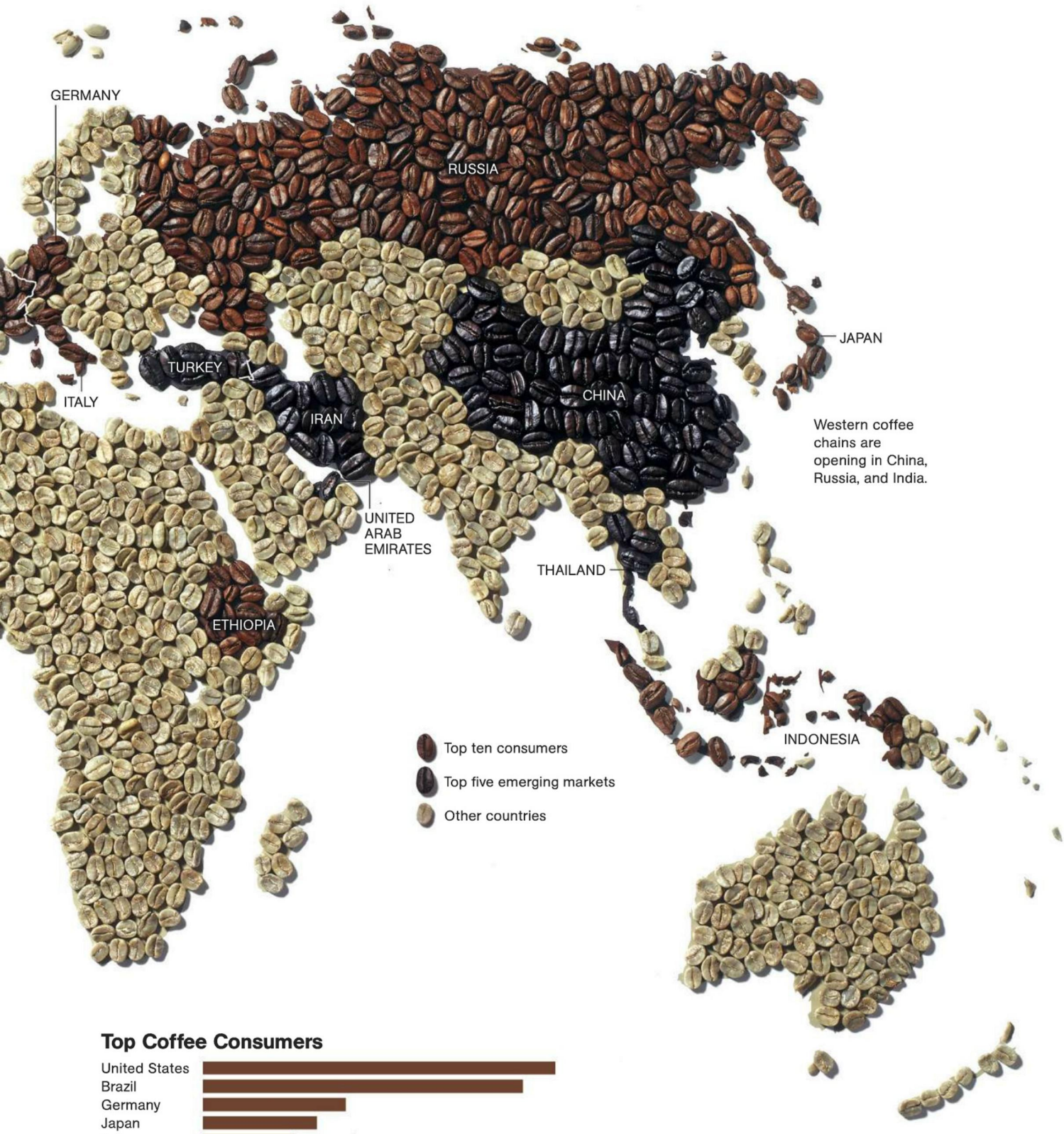
Silva attributes the global spike in coffee's popularity to new consumers, in places like Russia and Indonesia, with rising incomes and Western habits. Coffee-growing nations are also promoting domestic consumption to help stabilize prices for farmers. Together, says Silva, they are sure to give the industry a jolt. *—Murray Carpenter*

Although its market is saturated and slow growing, the United States is the world's top coffee consumer.

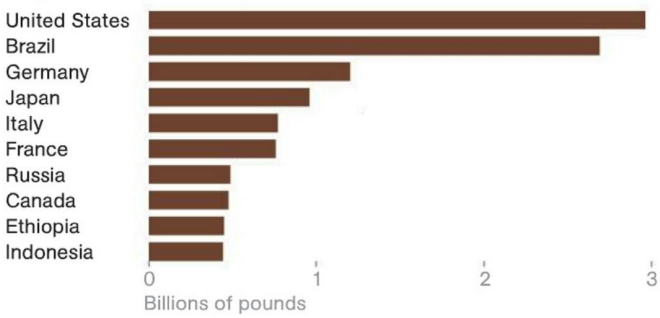
Rising urban populations mean booming demand in Brazil, the biggest coffee producer.

Bean Explosion

As café culture spreads worldwide, millions of new coffee aficionados are changing the market.



Top Coffee Consumers



Consumer data represent the most current annual figures available.
Emerging markets reflect various growth indicators from 2006 to 2011.

PHOTO ILLUSTRATION: REBECCA HALE, NGM STAFF; NGM ART
SOURCES: INTERNATIONAL COFFEE ORGANIZATION; EUROMONITOR INTERNATIONAL

Tiniest Titan

The idea was to bring the ingenious architecture of large structures like the Eiffel Tower and the Golden Gate Bridge down to the microscale. The result is the strongest and stiffest ultralight material ever.

Until now the internal structure of ultralight substances (including Styrofoam and aerogels) was random—and weak. The new material gains brawn from an orderly lattice of tubes with walls as thin as a thousandth of a human hair and made by shining light into a photosensitive liquid resin. After the resin hardens into cylinders, it's coated with nickel and then dissolved away, leaving only the hollow metal tubes. The coatings can also be changed to ones with a higher resistance to heat or corrosion. "We're talking about a whole new class of materials," says lead scientist Alan Jacobsen. His team had fuel efficiency in mind too. For spacecraft, planes, and cars, an ultralight material with muscle is no innovation to take lightly. *—Gretchen Parker*

This micro-material is 99.9 percent air and a tenth as heavy as Styrofoam—but still able to carry a load.

PHOTOS: DAN LITTLE PHOTOGRAPHY/HRL LABORATORIES, LLC

Celebrex can help relieve arthritis pain...so you can keep moving.

Staying active can actually relieve arthritis symptoms. But if you have arthritis, staying active can be difficult. Celebrex can help relieve arthritis pain...so *your* body can stay in motion.

- **Just one 200mg Celebrex a day can provide 24-hour relief for many with arthritis pain and inflammation.***
- **Celebrex is proven to improve pain, stiffness and daily physical function in clinical studies.****
- **Celebrex is not a narcotic.**

When it comes to finding the right arthritis treatment for you, you and your doctor need to balance the benefits with the risks. So ask your doctor about prescription Celebrex. It could be an important step towards keeping *your* body in motion.

Visit **celebrex.com** or call 1-888-CELEBREX for more information.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

*Individual results may vary. **Clinical studies with osteoarthritis patients.

Important Safety Information:

All prescription NSAIDs, like CELEBREX, ibuprofen, naproxen and meloxicam have the same cardiovascular warning. They may all increase the chance of heart attack or stroke, which can lead to death. This chance increases if you have heart disease or risk factors for it, such as high blood pressure or when NSAIDs are taken for long periods.

CELEBREX should not be used right before or after certain heart surgeries.

Serious skin reactions, or stomach and intestine problems such as bleeding and ulcers, can occur without warning and may cause death. Patients taking aspirin and the elderly are at increased risk for stomach bleeding and ulcers.

Tell your doctor if you have: a history of ulcers or bleeding in the stomach or intestines; high blood pressure or heart failure; or kidney or liver problems.

CELEBREX should not be taken in late pregnancy.

Life-threatening allergic reactions can occur with CELEBREX. Get help right away if you've had swelling of the face or throat or trouble breathing. Do not take it if you've had an asthma attack, hives, or other allergies to aspirin, other NSAIDs or certain drugs called sulfonamides.

Prescription CELEBREX should be used exactly as prescribed at the lowest dose possible and for the shortest time needed.

See the Medication Guide on the next page for important information about Celebrex and other prescription NSAIDs.

Pfizer helpful answers

Uninsured? Need help paying for Pfizer medicines?
Pfizer has programs that can help. Call **1-866-706-2400** or visit **PfizerHelpfulAnswers.com**

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Medication Guide
for
Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

(See the end of this Medication Guide for a list of prescription NSAID medicines.)

What is the most important information I should know about medicines called Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines may increase the chance of a heart attack or stroke that can lead to death.

This chance increases:

- with longer use of NSAID medicines
- in people who have heart disease

NSAID medicines should never be used right before or after a heart surgery called a "coronary artery bypass graft (CABG)."

NSAID medicines can cause ulcers and bleeding in the stomach and intestines at any time during treatment. Ulcers and bleeding:

- can happen without warning symptoms
- may cause death

The chance of a person getting an ulcer or bleeding increases with:

- taking medicines called "corticosteroids" and "anticoagulants"
- longer use
- smoking
- drinking alcohol
- older age
- having poor health

NSAID medicines should only be used:

- exactly as prescribed
- at the lowest dose possible for your treatment
- for the shortest time needed

What are Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

NSAID medicines are used to treat pain and redness, swelling, and heat (inflammation) from medical conditions such as:

- different types of arthritis
- menstrual cramps and other types of short-term pain

Who should not take a Non-Steroidal Anti-Inflammatory Drug (NSAID)?

Do not take an NSAID medicine:

- if you had an asthma attack, hives, or other allergic reaction with aspirin or any other NSAID medicine
- for pain right before or after heart bypass surgery

Tell your healthcare provider:

- about all of your medical conditions.
- about all of the medicines you take. NSAIDs and some other medicines can interact with each other and cause serious side effects. **Keep a list of your medicines to show to your healthcare provider and pharmacist.**
- if you are pregnant. **NSAID medicines should not be used by pregnant women late in their pregnancy.**
- if you are breastfeeding. **Talk to your doctor.**

What are the possible side effects of Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)?

Serious side effects include:

- heart attack
- stroke
- high blood pressure
- heart failure from body swelling (fluid retention)
- kidney problems including kidney failure
- bleeding and ulcers in the stomach and intestine
- low red blood cells (anemia)
- life-threatening skin reactions
- life-threatening allergic reactions
- liver problems including liver failure
- asthma attacks in people who have asthma

Other side effects include:

- stomach pain
- constipation
- diarrhea
- gas
- heartburn
- nausea
- vomiting
- dizziness

Get emergency help right away if you have any of the following symptoms:

- shortness of breath or trouble breathing
- chest pain
- weakness in one part or side of your body
- slurred speech
- swelling of the face or throat

Stop your NSAID medicine and call your healthcare provider right away if you have any of the following symptoms:

- nausea
- more tired or weaker than usual
- itching
- your skin or eyes look yellow
- stomach pain
- flu-like symptoms
- vomit blood
- there is blood in your bowel movement or it is black and sticky like tar
- skin rash or blisters with fever
- unusual weight gain
- swelling of the arms and legs, hands and feet

These are not all the side effects with NSAID medicines. Talk to your healthcare provider or pharmacist for more information about NSAID medicines.

Call your doctor for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

Other information about Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

- Aspirin is an NSAID medicine but it does not increase the chance of a heart attack. Aspirin can cause bleeding in the brain, stomach, and intestines. Aspirin can also cause ulcers in the stomach and intestines.
- Some of these NSAID medicines are sold in lower doses without a prescription (over-the-counter). Talk to your healthcare provider before using over-the-counter NSAIDs for more than 10 days.

NSAID medicines that need a prescription

Generic Name	Tradename
Celecoxib	Celebrex
Diclofenac	Cataflam, Voltaren, Arthrotec (combined with misoprostol)
Diflunisal	Dolobid
Etodolac	Lodine, Lodine XL
Fenoprofen	Nalfon, Nalfon 200
Flurbiprofen	Ansaid
Ibuprofen	Motrin, Tab-Profen, Vicoprofen* (combined with hydrocodone), Combunox (combined with oxycodone)
Indomethacin	Indocin, Indocin SR, Indo-Lemmon, Indomethagan
Ketoprofen	Oruvail
Ketorolac	Toradol
Mefenamic Acid	Ponstel
Meloxicam	Mobic
Nabumetone	Relafen
Naproxen	Naprosyn, Anaprox, Anaprox DS, EC-Naproxyn, Naprelan, Naprapac (copackaged with lansoprazole)
Oxaprozin	Daypro
Piroxicam	Feldene
Sulindac	Clinoril
Tolmetin	Tolectin, Tolectin DS, Tolectin 600

* Vicoprofen contains the same dose of ibuprofen as over-the-counter (OTC) NSAIDs, and is usually used for less than 10 days to treat pain. The OTC NSAID label warns that long term continuous use may increase the risk of heart attack or stroke.

This Medication Guide has been approved by the U.S. Food and Drug Administration.

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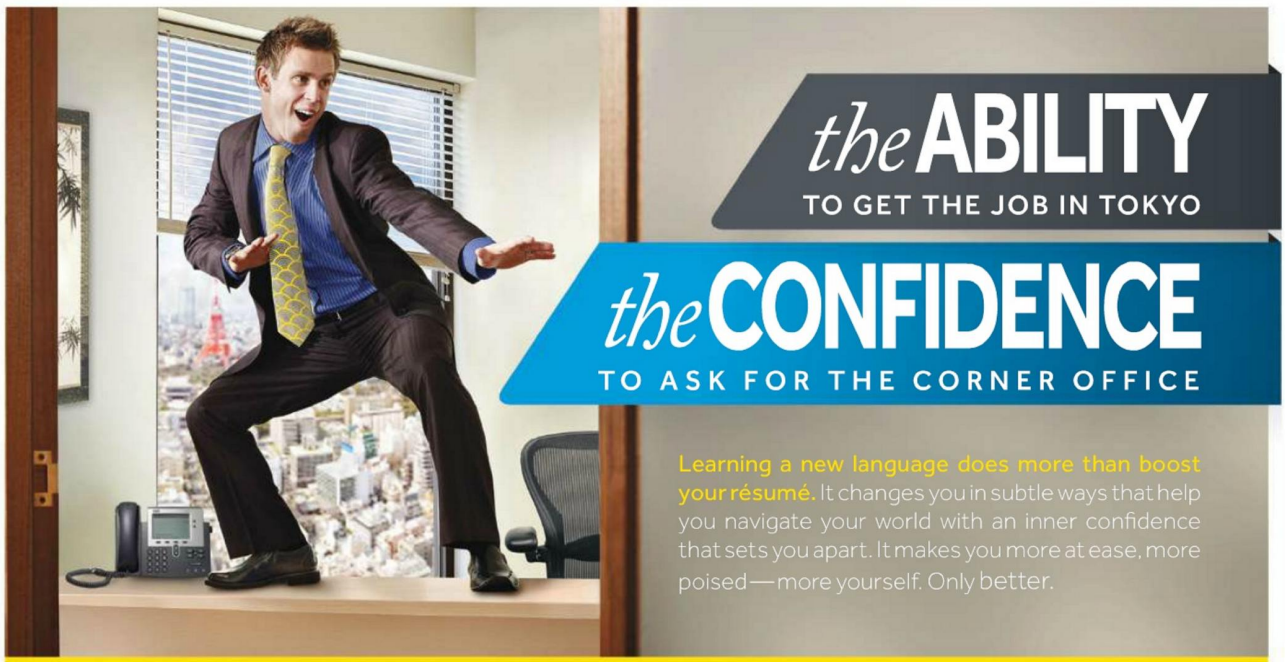

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TO GET THE JOB IN TOKYO

the CONFIDENCE
TO ASK FOR THE CORNER OFFICE

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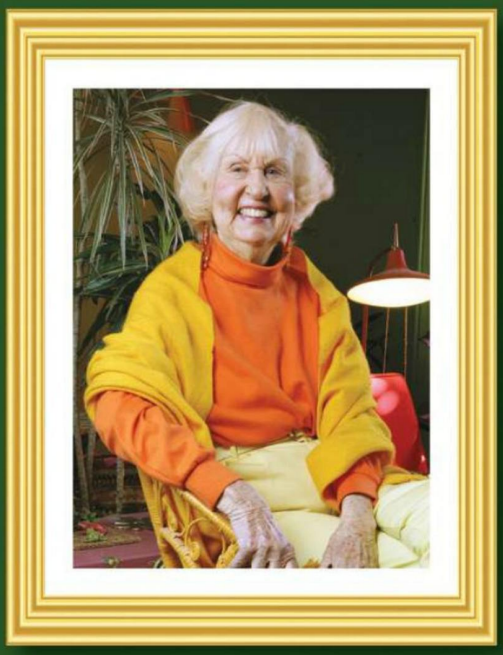
NATIONAL GEOGRAPHIC

Give An *Inspiring* Gift



Pat Minnick included National Geographic in her financial plans.

In 2007 Pat Minnick, a professional artist, decided to establish a charitable gift annuity to support National Geographic.

"I feel good knowing that National Geographic is doing so much to protect endangered wildlife," says Pat. "The environmental problems we face are vast, but by joining with National Geographic and their history of remarkable accomplishments, I know we can pass on a more beautiful world."

Pat now receives a guaranteed life income and is a direct part of the Society's efforts to inspire people to care about the planet.

For more information about a charitable gift annuity or other ways to include National Geographic in your estate plans, please see below.

SAMPLE ANNUITY RATES FOR ONE BENEFICIARY

(Rates at other ages available upon request.)

Age 65=*5.3%* Age 75=*6.5%* Age 85=*8.4%*

Rates are subject to change.
Please contact us for the most current rates.

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to National Geographic, please use the following language: "To the National Geographic Society in Washington, D.C., I give _____% of my estate." Or you can name a fixed dollar amount.

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Birthdate(s)_____
Minimum age 45. Payments begin at age 65.

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☐ _____ Other *(Minimum gift $10,000)*

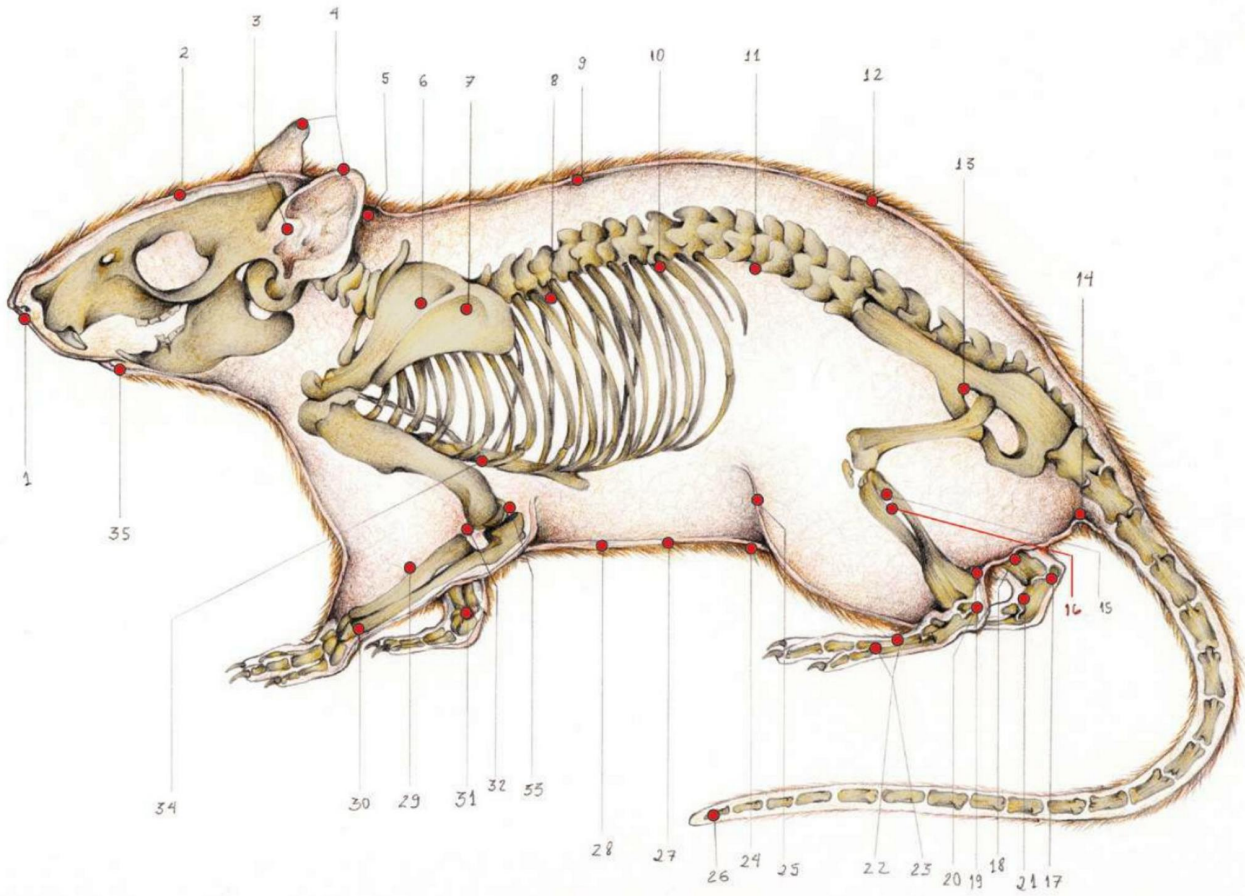
☐ Send me information on including National Geographic in my will.
☐ I have already included National Geographic in my will.

Name _____
Address _____
_____
Phone _____
Email _____

Mail to: National Geographic Society
Office of Estate Planning
1145 17th Street N.W.
Washington, D.C. 20036-4688

Photo: Nel Cepeda

Flight passengers in North America totaled more than 1.5 billion in 2010—the same number of people who rode on the New York City subway that year.



Pins and Needles

Rats like the shadows. This penchant for dark places gave physiologist Ladan Eshkevari an idea: She trained some to nestle into the toe of a sock so they felt safe. The rats' back legs dangled out, giving her access to an acupuncture point just below the knee called *zusanli,* Mandarin for "leg three mile," a potent point used to treat a variety of ailments. It also treats stress—in this case an hour in a cage carpeted with crushed ice.

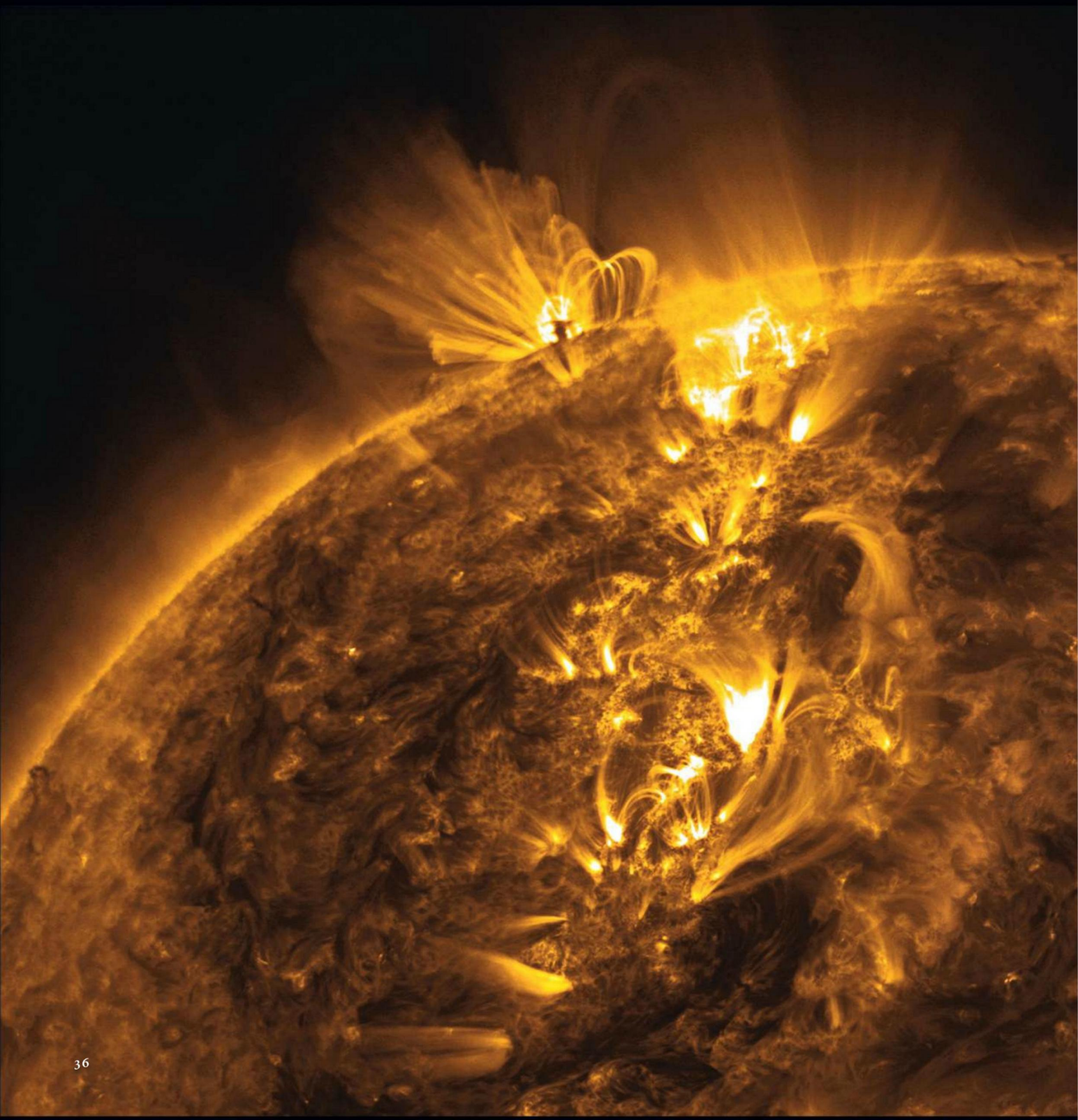
The rodents receiving the needles produced lower levels of neuropeptide Y, a molecule that's elevated in stressed-out rats. It's among the first molecular proofs that acupuncture decreases stress. The sock, which all the rodents shared because community scent is also a comfort, didn't fare so well. "It was the nastiest thing you've ever seen by the time the experiment was done," says Eshkevari. *—Juli Berwald*

Rats have 35 acupuncture points. Zusanli, *used to treat stress, pain, and abdominal ailments, is number 16.*

ET CETERA

Marine ecologists discovered a deep-sea-cold-vent **YETI CRAB** that grows its own food supply: bacteria cultivated on its hairy appendages. ▪ Archaeologists confirmed **CANNIBALISM** among Mexico's ancient Xiximes people, who ingested enemies to guarantee good corn crops. ▪ **EMPEROR PENGUINS** usually flap 237 times underwater, then start to surface, say University of Tokyo researchers. ▪ A UN committee delayed the possible demise of the **LEAP SECOND,** a moment that adjusts for Earth's rotation speed.

ART: WALMOR CORRÊA. SOURCE: SHANGHAI SCIENCE AND TECHNOLOGY PUBLISHERS. GRAPHIC: LAWSON PARKER, NGM STAFF
SOURCES: AIRPORTS COUNCIL INTERNATIONAL; METROPOLITAN TRANSPORTATION AUTHORITY



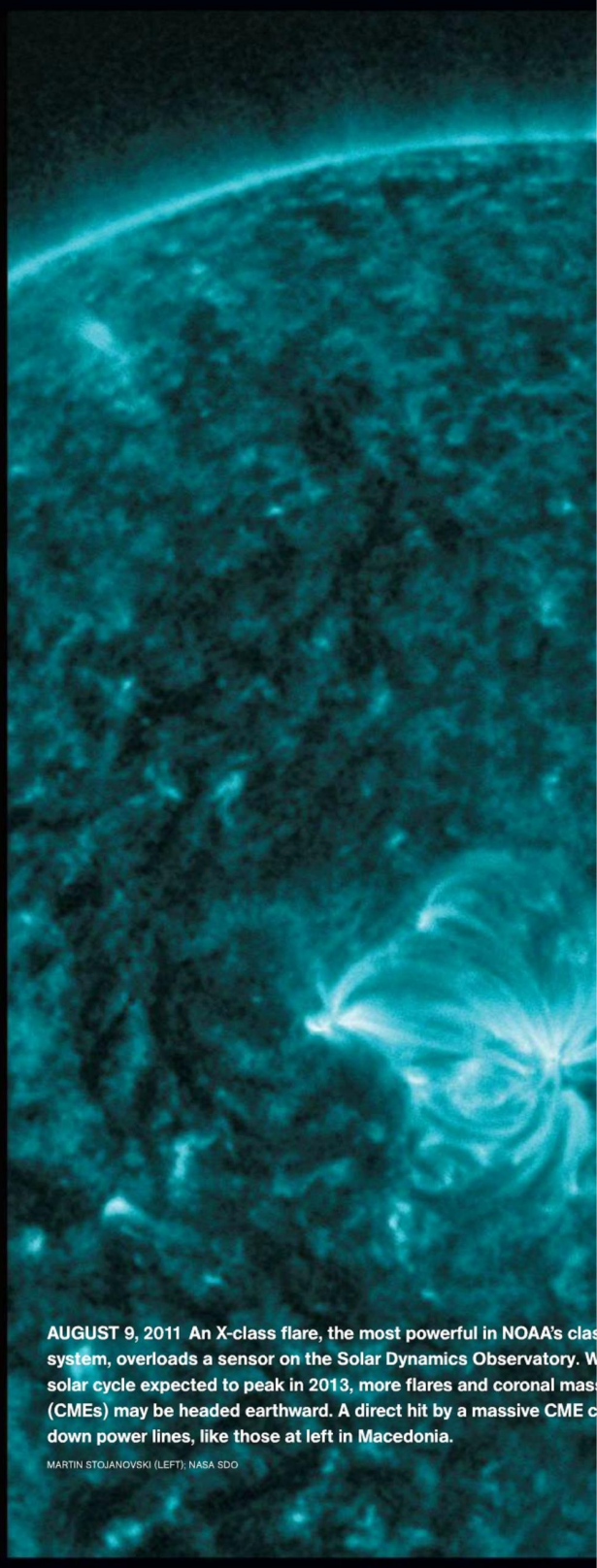
July 21, 2011 The seething turmoil in our sun's atmosphere is captured in extreme ultraviolet light by NASA's Solar Dynamics Observatory (SDO), launched in 2010 to better understand solar activity and its impact on Earth. In this colorized view (NASA color-codes SDO images to represent different wavelengths of light) bright coronal loops arc between regions of intense magnetic activity, while cooler, darker filaments hang suspended in the sun's magnetic field.

NASA SOLAR DYNAMICS OBSERVATORY (SDO)

Watch the commotion in the sun's atmosphere come alive on your iPad.

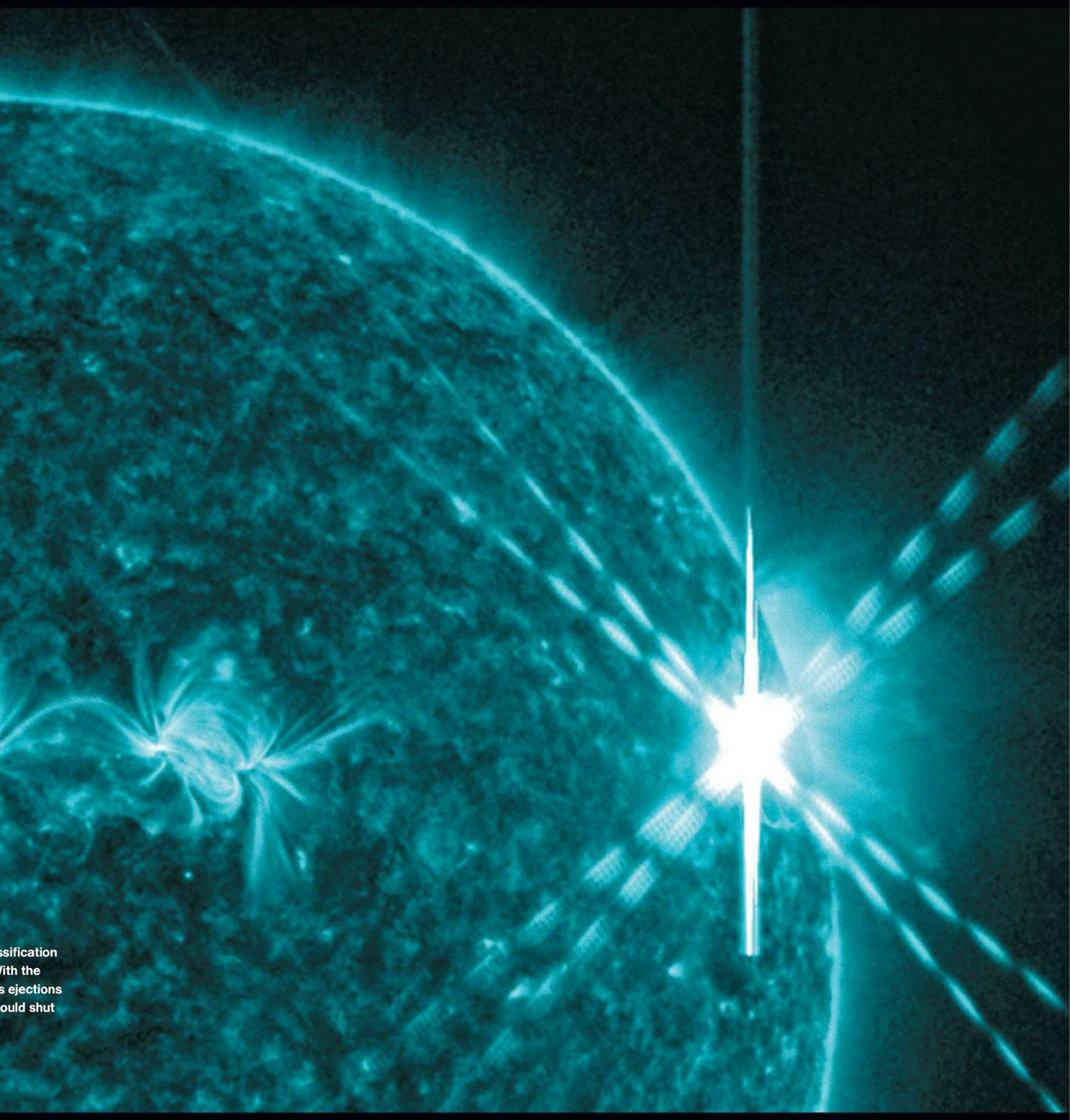
SUN STRUCK

The space-weather forecast for the next few years: solar storms, with a chance of catastrophic blackouts on Earth. Are we prepared?



AUGUST 9, 2011 An X-class flare, the most powerful in NOAA's clas system, overloads a sensor on the Solar Dynamics Observatory. W solar cycle expected to peak in 2013, more flares and coronal mass (CMEs) may be headed earthward. A direct hit by a massive CME c down power lines, like those at left in Macedonia.

MARTIN STOJANOVSKI (LEFT); NASA SDO



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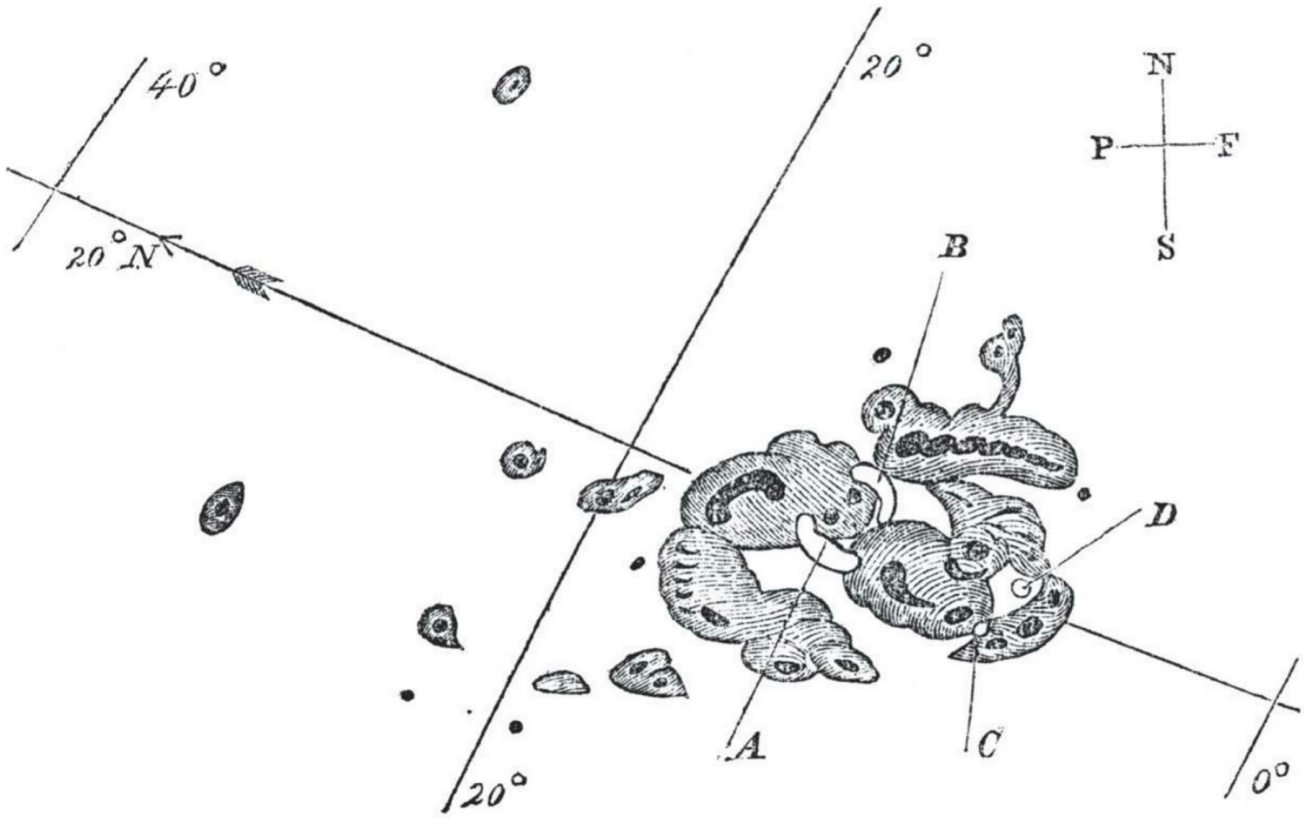
By Timothy Ferris

On Thursday, September 1, 1859, a 33-year-old brewer and amateur astronomer named Richard Carrington climbed the stairs to his private observatory near London, opened the dome slit, and as was his habit on a sunny morning, adjusted his telescope to project an 11-inch image of the sun onto a screen. He was tracing sunspots on a piece of paper when, before his eyes, "two patches of intensely bright and white light" suddenly appeared amid one large sunspot group. At the same time the magnetometer needle dangling from a silk thread at London's Kew Observatory began dancing wildly. Before dawn the next day enormous auroral displays of red, green, and purple illuminated the skies as far south as Hawaii and Panama. Campers in the Rocky Mountains, mistaking the aurora for sunrise, got up and started cooking breakfast.

The flare Carrington had observed heralded a solar superstorm—an enormous electromagnetic outburst that sent billions of tons of charged particles hurtling toward Earth. (Another amateur English astronomer named Richard Hodgson also witnessed the flare.) When the invisible wave collided with the planet's magnetic field, it caused electrical currents to surge through telegraph lines. The blast knocked out service at several stations, but telegraphers elsewhere found that they could disconnect their batteries and resume operations using the geomagnetic electricity alone. "We are working with the current from the Aurora Borealis alone," a Boston telegrapher messaged an operator in Portland, Maine. "How do you receive my writing?"

"Much better than with the batteries on," Portland replied.

Operators of today's communication systems and power grids would be less sanguine. No solar superstorm as powerful as the 1859 event has occurred since, so it is difficult to calculate what impact a comparable storm might have on today's more wired world. A hint came with the Quebec blackout of March 13, 1989, when a solar storm roughly a third less powerful than the Carrington event knocked out the power grid serving more than six million customers in less than two minutes' time. A Carrington-class storm could fry more transformers than the power



SEPTEMBER 1, 1859 Astronomer Richard Carrington was drawing sunspots—regions of intense magnetic activity on the sun's surface—when two brilliant bursts of light (A and B, above) suddenly appeared within one large group. Hours later Earth was hit by the most powerful geomagnetic storm on record.

companies keep stockpiled, leaving millions without light, potable water, sewage treatment, heating, air-conditioning, fuel, telephone service, or perishable food and medications during the months it would take to manufacture and install new transformers. A recent National Academy of Sciences report estimates that such a storm could wreak the economic disruption of 20 Katrina-class hurricanes, costing one to two trillion dollars in the first year alone and taking a decade to recover from.

"We cannot predict what the sun will do more than a few days ahead of time," laments Karel Schrijver of Lockheed Martin's Solar and Astrophysics Laboratory in Palo Alto, California. With a period of maximum solar activity expected to begin this year, space-weather centers are adding staff and hoping for the best. "We're trying to understand how space weather percolates into society and just how bad it can get," says Schrijver. "The morally right thing to do once you've identified a threat of this magnitude is to be prepared. It's like earthquakes in San Francisco. Not preparing for it has intolerable consequences."

FEW OBJECTS SEEM as familiar as the sun—there it is, up in the sky every sunny day—yet few are so strange. Look through a solar telescope, and the quotidian yellow disk is transformed into a dynamic wonderland, where planet-size prominences rise into black space like glowing jellyfish, only to loop and slither back hours or days later, as if enthralled by some unseen force.

Timothy Ferris has been covering the universe for more than 40 years. He last wrote for the magazine on the Magellanic Clouds, in December 2011.

ROYAL ASTRONOMICAL SOCIETY/PHOTO RESEARCHERS, INC.

As indeed they are. Neither solid, liquid, nor gas, the sun is made up of plasma, the "fourth state of matter," which forms when atoms are stripped down to naked protons and electrons. All those charged particles make the solar plasma a splendid conductor of electricity—much more conductive than copper wire. The sun is also packed with magnetic fields. Most remain buried inside the sun's massive girth, but some magnetic pipes, as thick as the Earth is wide, emerge on the surface as sunspots. This magnetism choreographs the slithery dance in the sun's atmosphere and powers the solar wind, flinging outward a million tons of plasma every second at a million miles an hour.

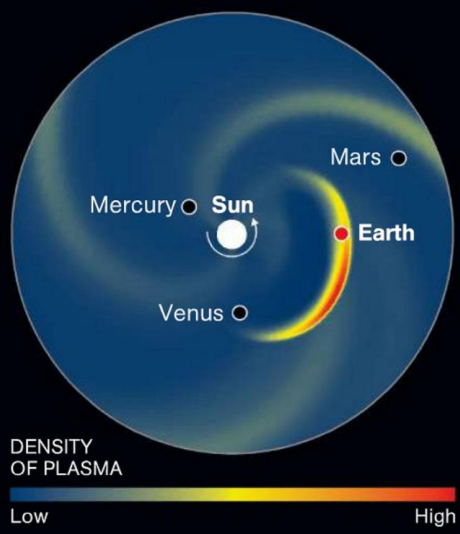
Driving all this activity is the intriguingly intricate machinery of an unexceptional star. The sun's core—a seething, 27-million-degree-Fahrenheit plasma spheroid six times as dense as gold—fuses 700 million tons of protons into helium nuclei every second, releasing the energy of ten billion hydrogen bombs in the process. The core throbs gently, expanding when fusion rates climb and contracting when they damp down. Superimposed on this slow, deep heartbeat are myriad other rhythms, ranging from an 11-year sunspot cycle to rhythms spanning centuries.

The energy produced by the fusion in the sun's core is carried outward by high-energy photons as they ricochet through a dense maze of ions and electrons. Matter is so tightly packed in this radiation zone that it takes more than 100,000 years for the photons to emerge into the surrounding convection zone, 70 percent of the way out from the solar center. After a month or so more, the photons emerge into the photosphere, the part of the sun that we see. From there, it takes a mere eight minutes for them to reach Earth as sunlight.

As one might expect, this titanic thermonuclear furnace makes a lot of noise. "The sun rings like a bell in millions of distinct tones," notes Mark Miesch of the National Center for Atmospheric Research in Boulder, Colorado. The tones generate ripples on the solar surface, which scientists study to map currents deep in the convection zone, a discipline called

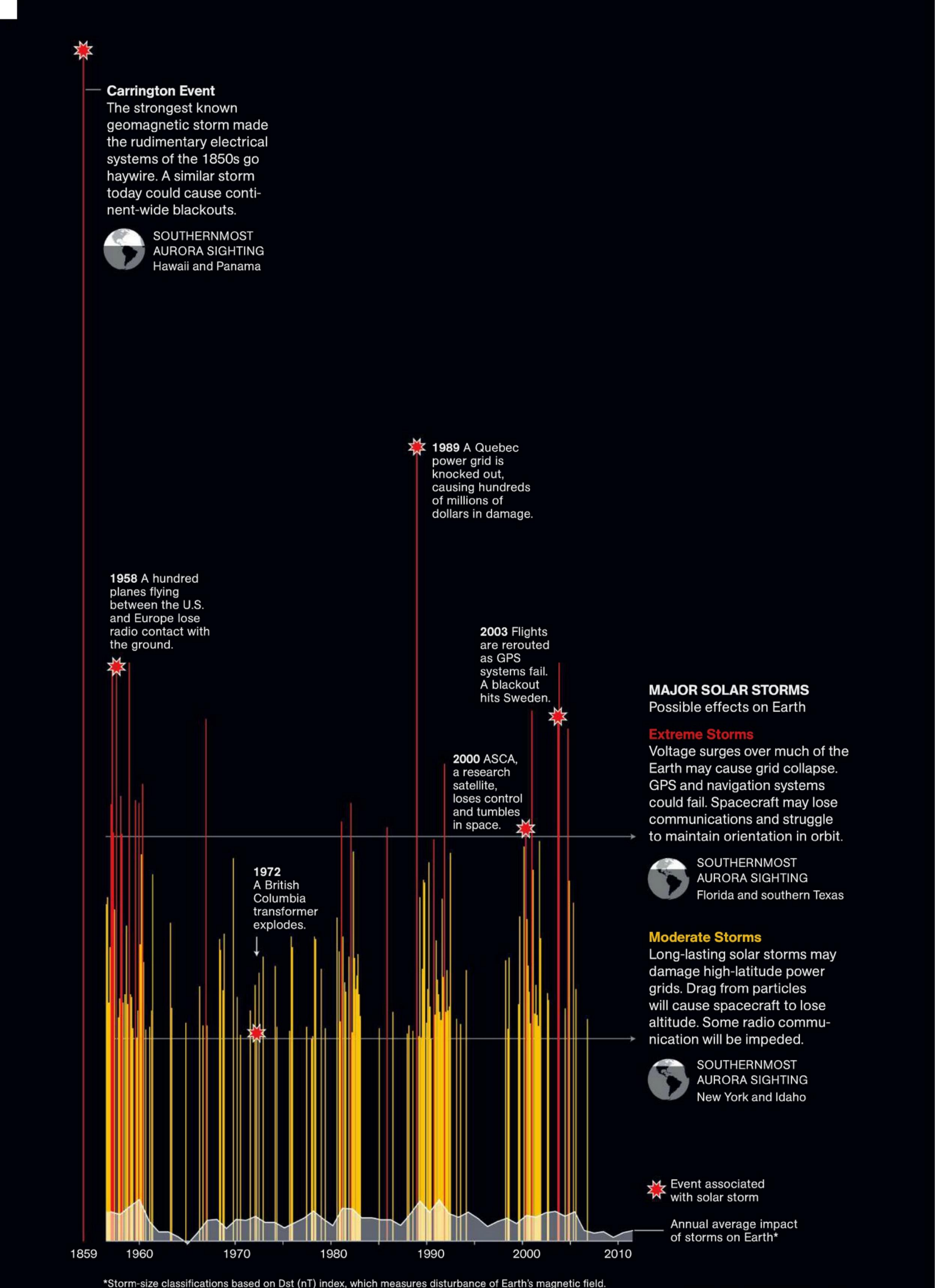
Tracking a stormy sun

Scientists have measured the impact of space storms on Earth for decades (right), as the sun's activity rises and falls in an 11-year cycle. The likelihood of Earth being hit by a major storm has not changed—but the damage one might inflict grows along with our increasing dependence on space-based communication and navigation technologies. Most Earth-based power grids are threatened only by rare extreme storms, which also trigger auroras deep into temperate latitudes.



WEATHER FORECAST January 19, 2012
Using a computer model showing the density of plasma hurled out by a coronal mass ejection, NASA scientists predicted when particles would hit Earth and where effects would be strongest. Such forecasts give a few days' warning, but researchers still can't be sure when eruptions will occur.

LAWSON PARKER, NGM STAFF. SOURCES: ANTTI PULKKINEN, CATHOLIC UNIVERSITY OF AMERICA AND NASA GODDARD SPACE FLIGHT CENTER (GSFC); STEN ODENWALD, NASA AND ADNET SYSTEMS; WSA-ENLIL (FORECAST MODEL)



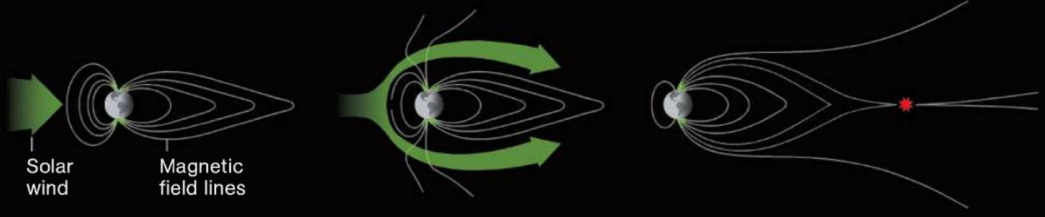
*Storm-size classifications based on Dst (nT) index, which measures disturbance of Earth's magnetic field. Carrington event = -850 nT; extreme storm = -300 nT; moderate storm = -150 nT

JANUARY 24, 2012 An aurora flutters above the Sommarøy bridge on the island of Kvaløy in northern Norway during a week of intense solar activity. Auroras appear when charged solar particles strike atmospheric gases, lighting them up like neon in a tube. Most common near the Poles, auroras also occur in lower latitudes during strong solar storms.

BJØRN JØRGENSEN

WHAT CAUSES AURORAS?

Energy produced by the interaction of solar winds and Earth's magnetic field pushes electrons down along field lines and into the atmosphere. Electrons excite Earth's atmospheric gases, which give off light and color.

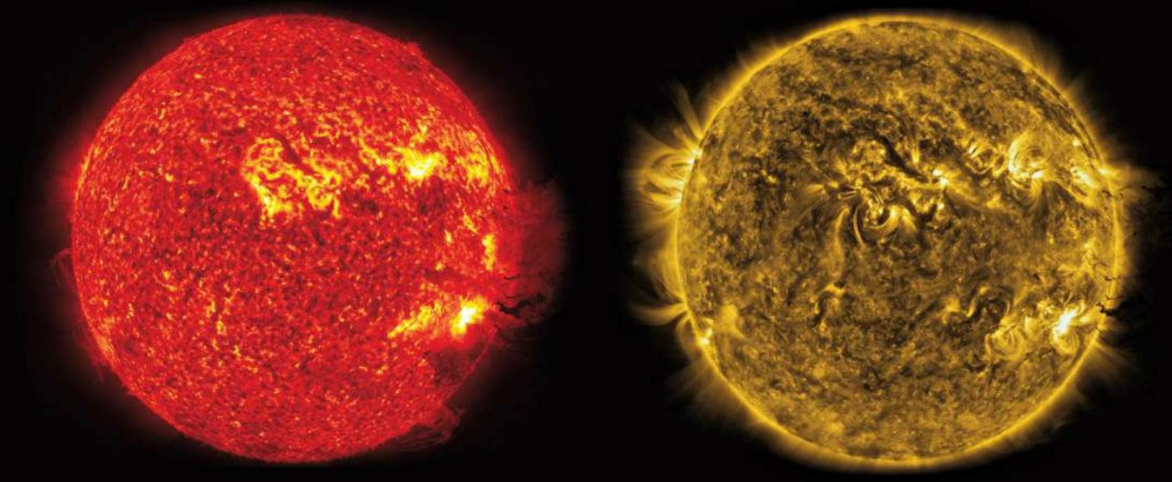


Solar winds compress Earth's magnetic field, elongating the back side into a tail.

Magnetic field lines are continuously broken and dragged over the Poles.

The lines reconnect on the back side and move toward Earth to start the cycle again.

LAWSON PARKER, NGM STAFF. SOURCE: ERIC DONOVAN, UNIVERSITY OF CALGARY



JUNE 7, 2011 The Solar Dynamics Observatory captured a coronal mass ejection (at four o'clock in all three images) using different wavelengths of light that reflect temperatures in layers of the sun's atmosphere. Temperatures in the relatively cool chromosphere (left) are a mere 90,000 degrees Fahrenheit but rise rapidly to almost two million degrees in the corona above it (center). Why the sun's atmosphere gets hotter farther from its surface remains a mystery. Regions of the corona can rise to more than ten million degrees during solar eruptions (right).

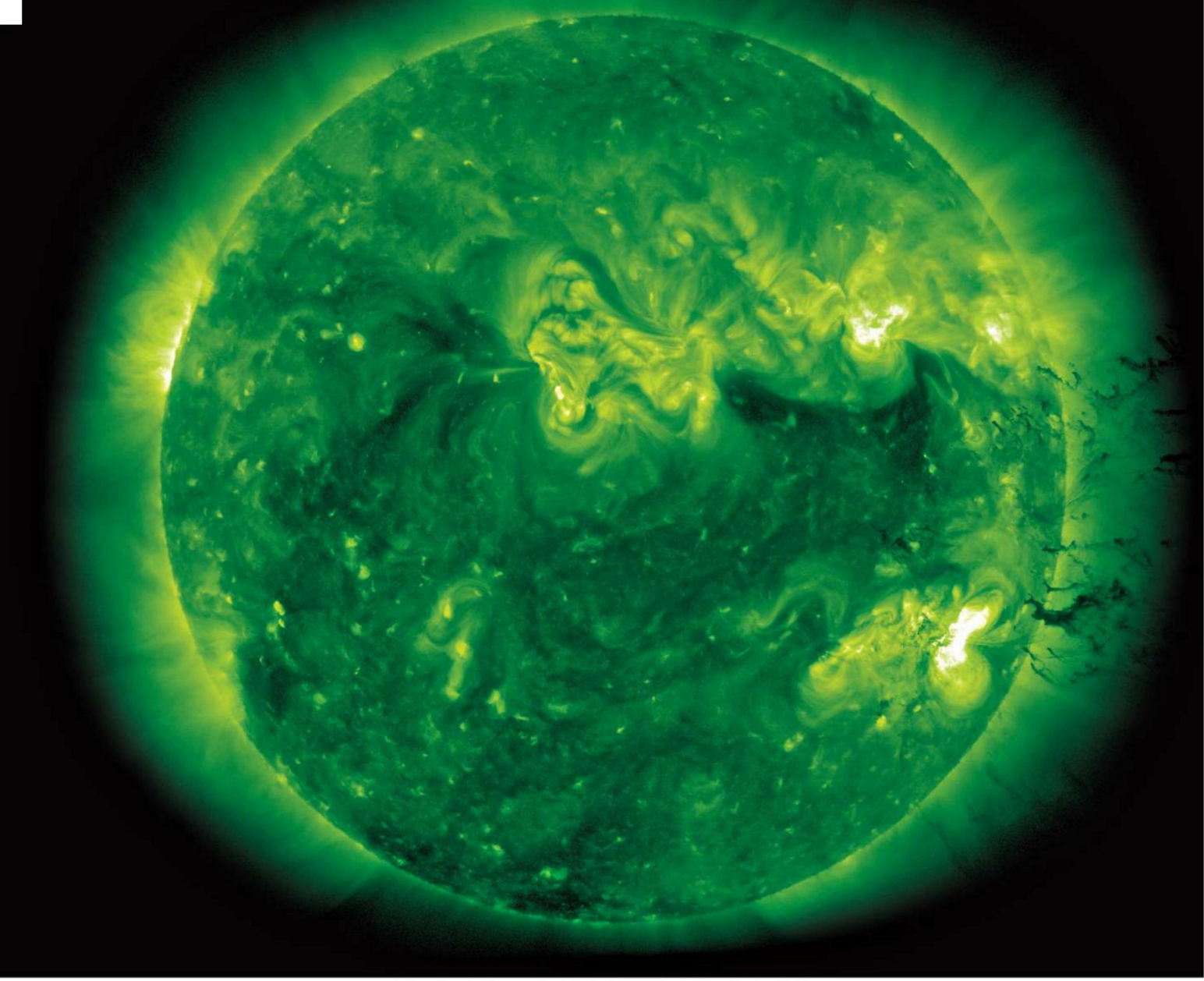
NASA SDO

helioseismology. Information conveyed by helioseismic sensors aboard NASA's Solar Dynamics Observatory satellite recently enabled Stanford University researchers to detect magnetic bundles 40,000 miles below the solar surface and to predict their emergence, days later, as sunspots.

Such data provide crucial information on how solar storms form. The sun functions as a gigantic dynamo, with global magnetic field lines encircling it from pole to pole like a birdcage. Local field lines, entangled with plasma in the convection zone, twist and kink and poke through the surface, forming loops made visible by the hot, glowing plasma. When loops cross, they can essentially short-circuit, causing the tremendous plasma explosions called solar flares. Such flares release the energy equivalent of hundreds of millions of megatons of TNT, spewing x-rays and gamma rays into space and accelerating charged particles to nearly the velocity of light.

In the 1859 solar superstorm, charged particles set off intense auroras over much of the Earth. Some people thought their cities had caught fire.

The Carrington event consisted of a powerful solar flare that produced the second of a rare pair of coronal mass ejections (CMEs)—gigantic magnetic eruptions of heated plasma belched into space. The first CME probably reached Earth in a normal span of 40 to 60 hours, clearing a path through the solar wind for the second one to make the trip in a mere 17 hours. Their combined impact squashed the Earth's magnetosphere—where the planet's magnetic field interacts with the solar wind—down from



its normal altitude of 40,000 miles to 4,000 miles, temporarily eliminating the Van Allen radiation belts girdling the planet. Charged particles entering the upper atmosphere set off intense auroras over much of the Earth. Some people thought their cities had caught fire.

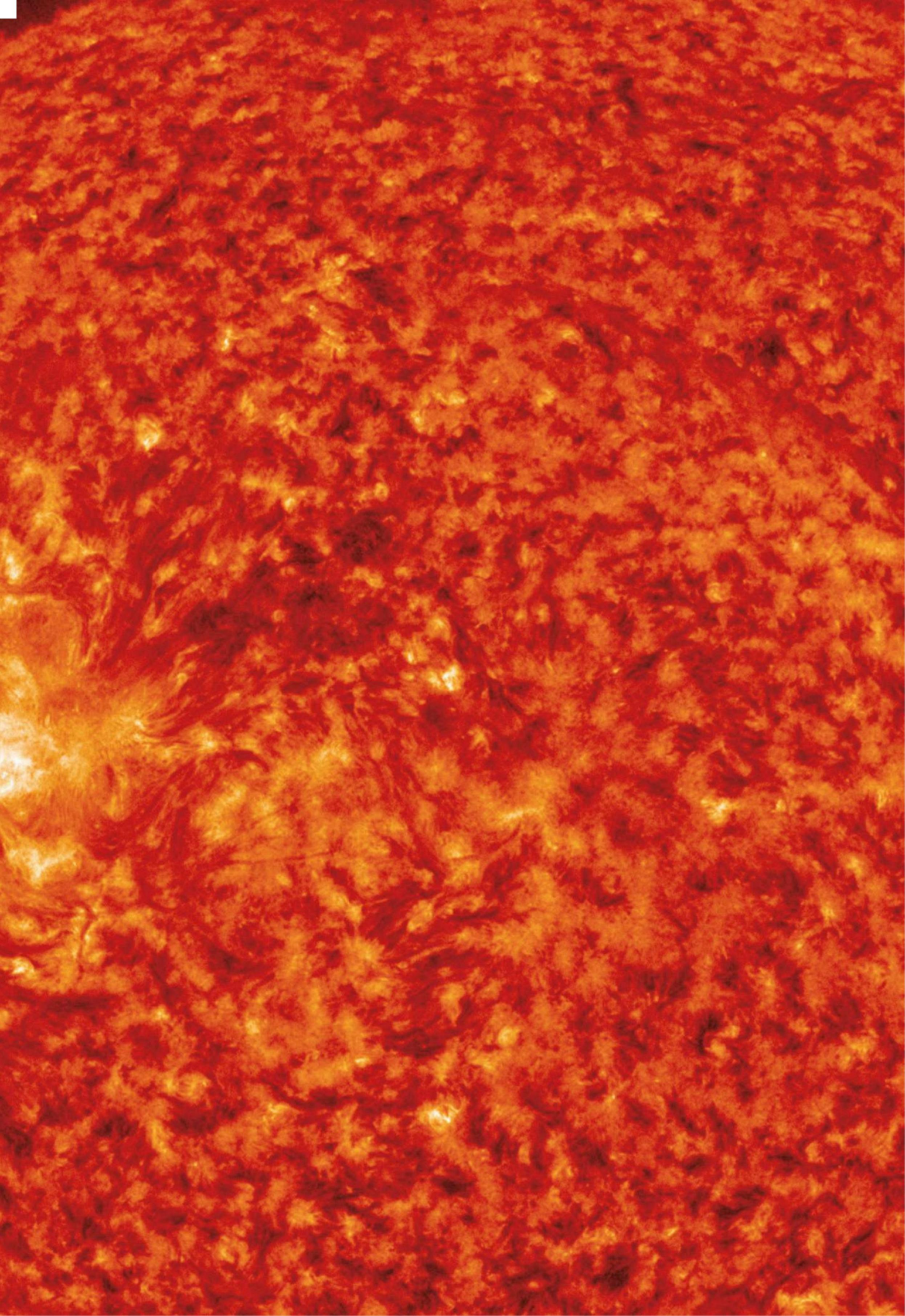
A Carrington-class superstorm probably occurs only once in several centuries. But even storms of much smaller magnitude can cause considerable damage, especially as humans become increasingly dependent on technology deployed in space. Solar storms disrupt the ionosphere—the layer of Earth's atmosphere where auroras occur, more than 60 miles above the Earth's surface. The pilots of the nearly 11,000 commercial flights routed over the north polar region each year rely on shortwave radio signals bouncing off the ionosphere to communicate above 80 degrees of latitude, beyond the range of communications satellites orbiting over the Equator. When space weather disrupts the ionosphere and interrupts shortwave communications, pilots are obliged to change course, which can cost $100,000 a flight. A flustered ionosphere deranges GPS signals as well, resulting in positioning errors that can be more than 150 feet. This means that surveyors must pack up and go home, floating oil-drilling rigs have trouble remaining on station, and pilots cannot rely on the increasingly popular GPS-based systems employed for landing at many airfields.

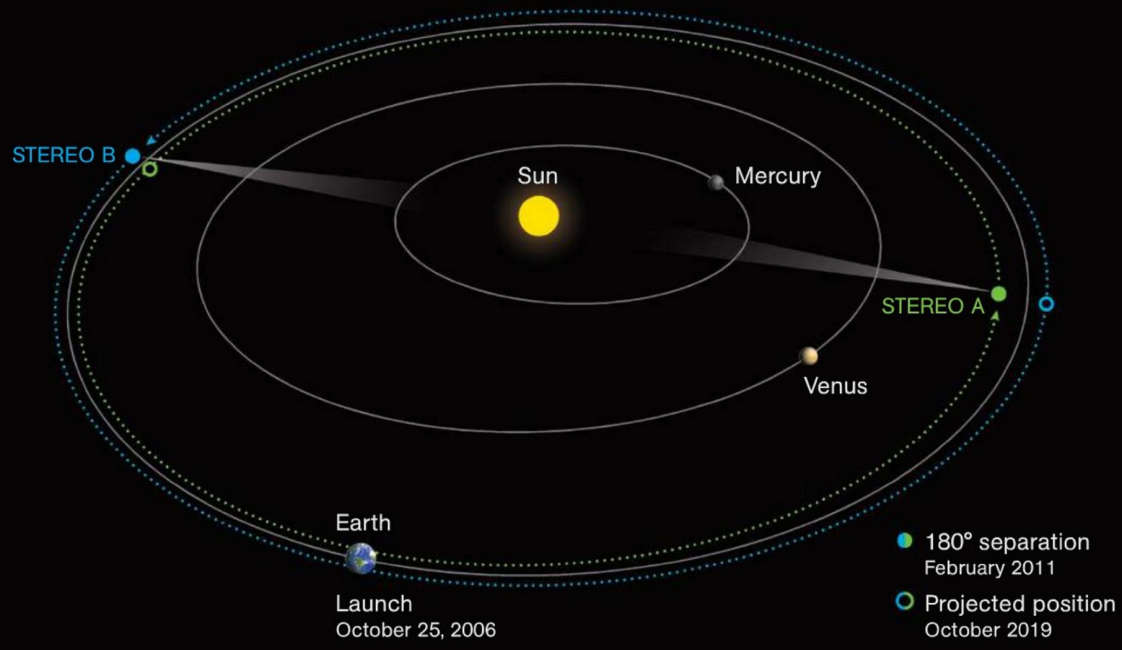
UV light emitted during solar flares can also disturb satellite orbits by heating up the atmosphere, which increases drag. NASA estimates that the International Space Station descends more than a thousand feet a day when the sun is acting up. Solar storms could also affect the electronics on communications satellites, turning them into "zombiesats," adrift in orbit and dead to the world.

Unlike satellites in space, most power grids have no built-in protection against the onslaught

SEPTEMBER 22, 2011 Plasma loops wide enough to encompass many Earths are caught in profile on the edge of the sun, while a wavelike prominence above the loops slings charged solar particles into space. Scientists tune in to solar sound waves to detect active regions days before they bubble up to the surface.

NASA SDO





NOVEMBER 11, 2010 Twin NASA spacecraft STEREO A and B (above) provided the first nearly complete view of the solar surface. By June 2011 the gap had been filled in. Space-weather-watchers can now see active regions as they develop on the far side of the sun, allowing them to more precisely forecast the likely paths of CMEs. This improved imaging could mean a crucial margin of warning the next time the sun sends a violent storm toward Earth.

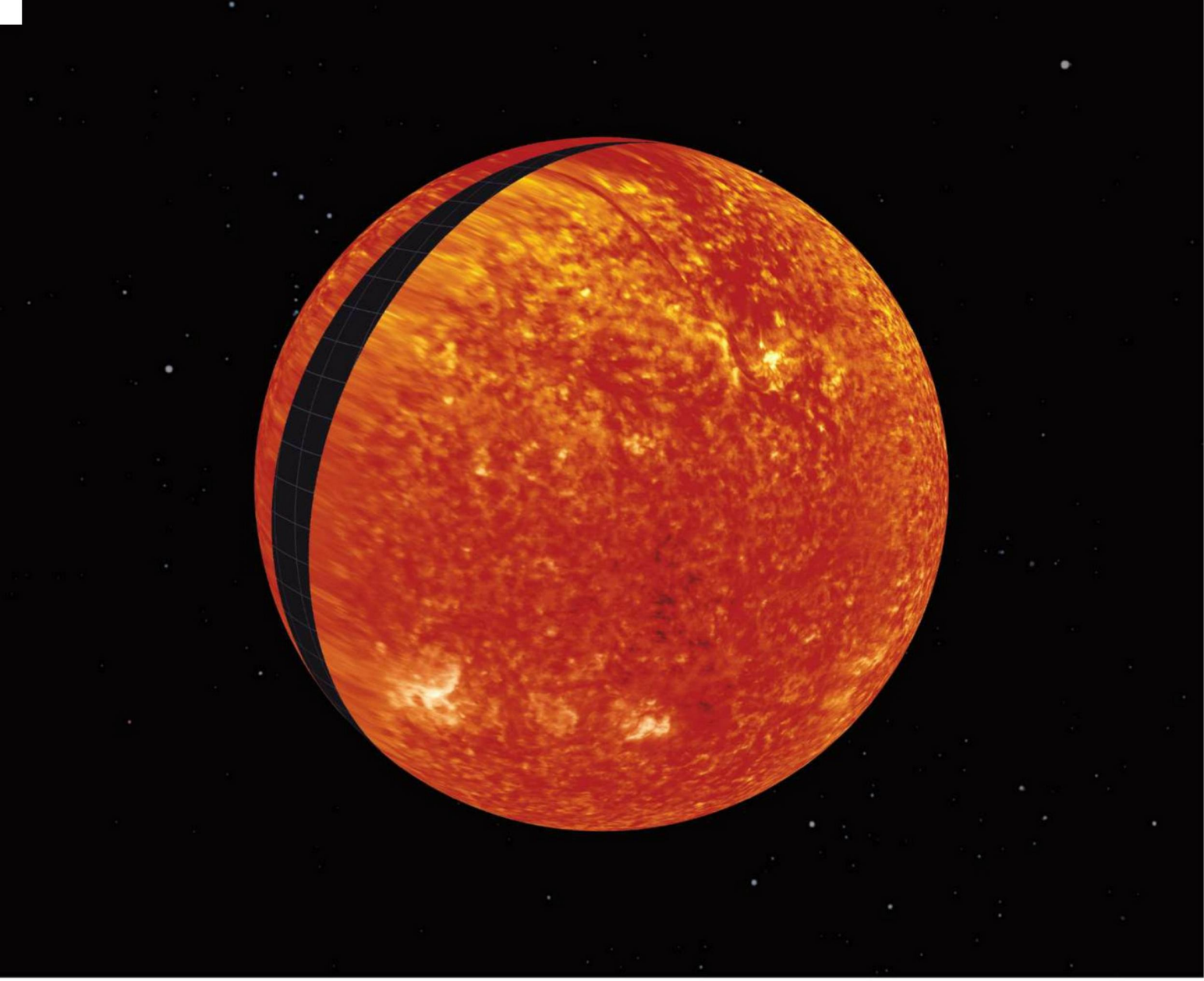
WALT FEIMER, NASA GSFC CONCEPTUAL IMAGE LAB AND STEREO
GRAPHIC: LAWSON PARKER, NGM STAFF. SOURCE: JOSEPH B. GURMAN, NASA GSFC

of a powerful geomagnetic storm. Since large transformers are grounded to the Earth, geomagnetic storms can induce currents that could cause them to overheat, catch fire, or explode. The damage could be catastrophic. According to John Kappenman of Storm Analysis Consultants, who studies the impact of space weather on the electrical grid, a solar storm like one that took place in May 1921 would today turn out the lights over half of North America. One on the order of the 1859 event could take out the entire grid, sending hundreds of millions of people back to a preelectric way of life for weeks or perhaps months on end. In Kappenman's words, we're "playing Russian roulette with the sun."

"The morally right thing to do once you've identified a threat of this magnitude is to be prepared... Not preparing for it has intolerable consequences."

–KAREL SCHRIJVER

AT LEAST WE'RE not playing blindfolded. In 1859 the world had few tools for studying the sun, beyond telescopes and a handful of magnetic monitoring stations. Today scientists constantly monitor our home star with an imposing armada of satellites that can take images in x-ray and ultraviolet wavelengths blocked by Earth's atmosphere. The venerable ACE (Advanced Composition Explorer) spacecraft, launched in August 1997 and still going strong, monitors the solar wind from an orbit around the L1 libration point, a stable gravitational spot located a million miles sunward of the Earth. SOHO, the Solar and Heliospheric Observatory, carries a dozen detectors that record everything from



high-speed solar-wind protons to low-speed solar oscillations. STEREO consists of a pair of satellites, one preceding and the other trailing Earth in its orbit, that together take 3-D solar images revealing how coronal mass ejections loft off the sun's surface and speed out through space. Meanwhile the Solar Dynamics Observatory, launched into a geosynchronous orbit in February 2010, downloads 1.5 terabytes of data every day on the sun's atmosphere, oscillations, and magnetic field.

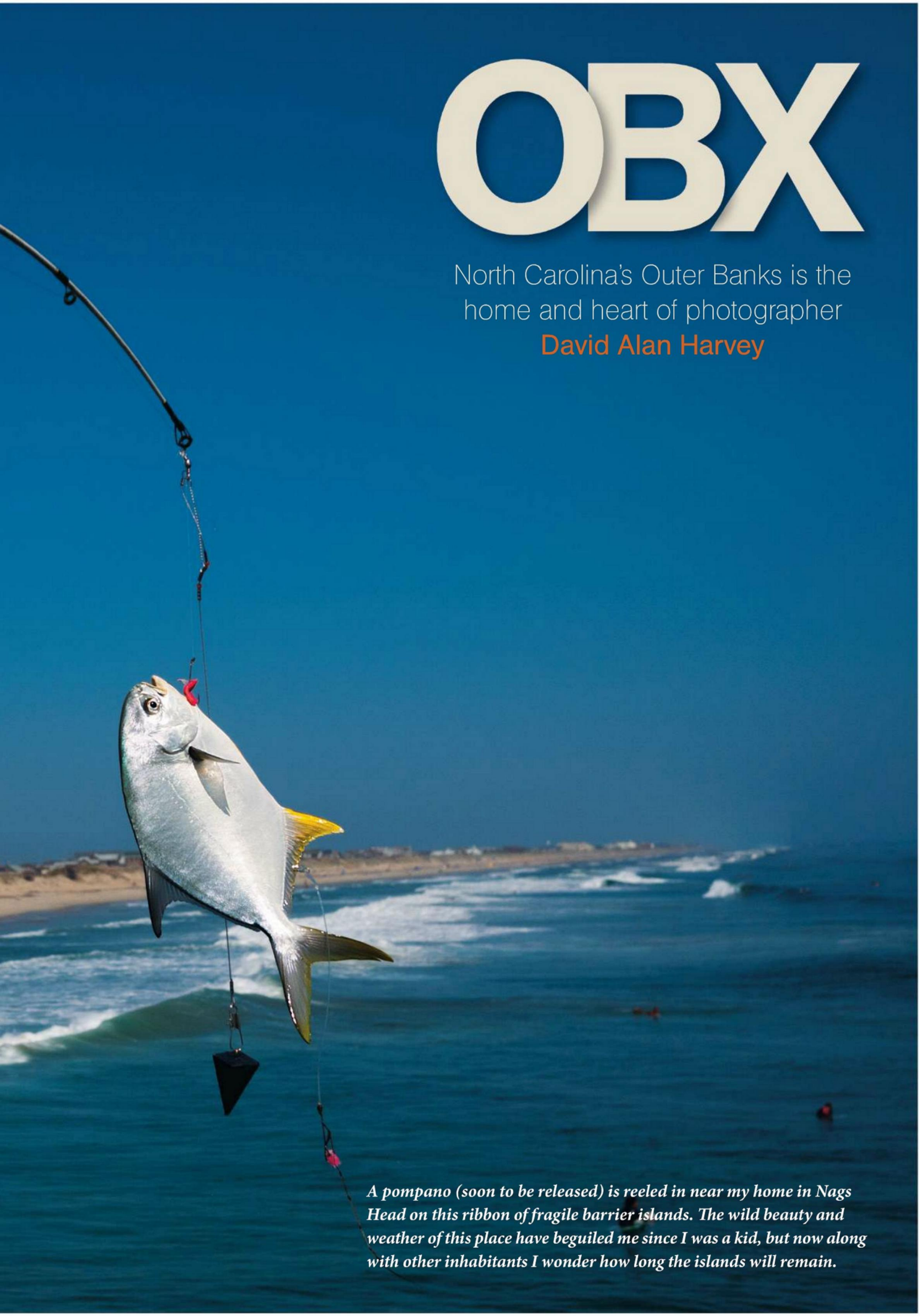
Yet much remains to be done. "Space weather is where terrestrial weather was 50 years ago," says physicist Douglas Biesecker of NOAA's Space Weather Prediction Center in Boulder, Colorado. Because the impact of a storm depends in part on how its magnetic field aligns with that of the Earth, scientists cannot be sure of the storm's intensity until it reaches the ACE satellite—sometimes a mere 20 minutes before it slams into Earth.

So researchers concentrate on forecasting a storm's potential strength and its likely arrival time, giving vulnerable systems time to prepare. Last October the NOAA group inaugurated a new computer model, called Enlil after the Sumerian god of winds, that can predict when a CME will hit Earth, plus or minus six hours—twice as accurate as previous forecasts. The modeling is complex, in part because CMEs can interact strongly with the normal solar wind, making their progress as unpredictable as that of a running back through a defensive line. The uncertainties notwithstanding, Enlil's forecast for the arrival of a potentially major storm on March 8 of this year was off by a mere 45 minutes. That storm turned out to be a bit of a dud. We may not be so lucky next time.

"We haven't seen anything big in this solar cycle yet," says Biesecker. "But now we know that when the big one comes, we'll be able to nail it." □

OBX

North Carolina's Outer Banks is the home and heart of photographer David Alan Harvey

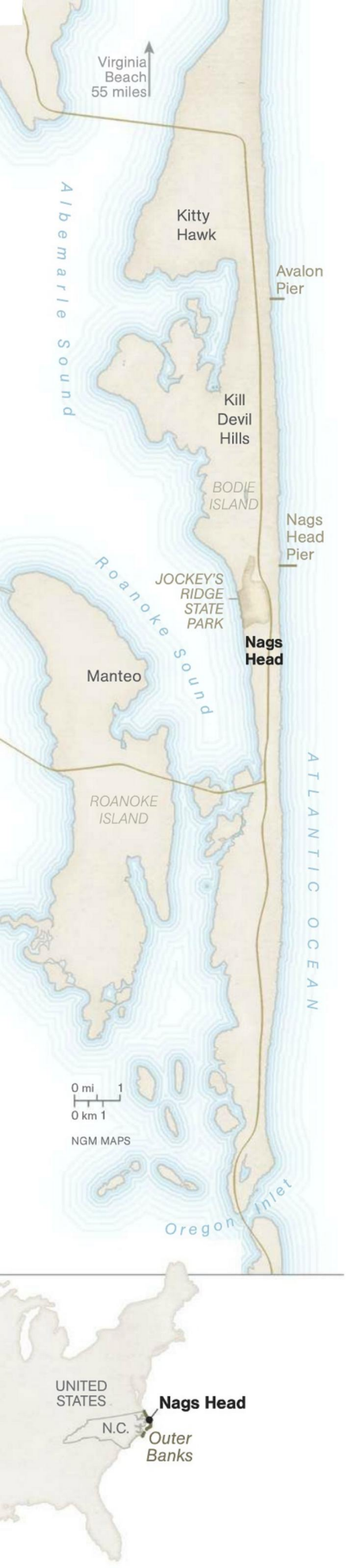


A pompano (soon to be released) is reeled in near my home in Nags Head on this ribbon of fragile barrier islands. The wild beauty and weather of this place have beguiled me since I was a kid, but now along with other inhabitants I wonder how long the islands will remain.

I found these folks packing up after a day on Nags Head beach late last May—at the kickoff to summer tourist season—when I was riding my bike around taking pictures. The population skyrockets near the Fourth of July.

AEROPOSTALE

Tree swallows swarm after eating wax myrtle berries at Jockey's Ridge, the tallest active dune system in the eastern United States. A few miles from here, the Wright brothers took to the air. They would have found plenty of inspiration among the OBX's hundreds of bird species.



It's difficult to explain to some folks why I've ended up living on what is essentially a hurricane-prone sandbar. But I've been coming down to North Carolina's Outer Banks, often referred to as OBX, since 1956, when I was 12, right around the time I got hit by a passion for photography. Now the smells, light, and rapid-fire weather changes that are so OBX are part of my psyche. When I'm not walking down a dusty road in Senegal or dancing in Rio during Carnaval, I make the Outer Banks my home. After more than 40 assignments for *National Geographic* I've seen a lot, and I've lived deep. But nothing seems sweeter than the view from my front porch.

For me the Outer Banks is personal. For everyone here it is. Nobody comes down to build a career. Escape one, yes. Build one, no. Even though I'm usually working down here, the pace suits me better. When my parents brought me here as a kid, the place was a Waldenesque backwater, a few summer cottages scattered among the trees. I camped on the beach and bodysurfed. As a teenager I let some air out of the tires on my family's '53 Chevy and drove a little too fast with my buddies on the low-tide flats, arm out the window, radio blasting—and please pass me another cold one. A few years ago I bought a house I'd had my eye on. I've spent my career trying to capture the right moment. Now the right moment is here.

Even my memories, though, don't fully explain the Outer Banks' hold on me. It is something more primal, something about the capriciousness of the weather. Every day unfolds with its own mix of sun, wind, surf, and rain. The wide, sweeping sky offers a broad stage for summer squalls that frequently blow through. A fleet of white clouds will appear on the horizon and then suddenly darken. Lightning flashes, waterspouts rise out of the sound, and sheets of rain mixed with sand pelt the windows. And then, just as suddenly, it's all over. The sun returns to dry out the beach chairs, and the breeze lifts the kites up again.

As a shy 19-year-old, I joined the photo service in nearby Virginia Beach. We snapped pics of tourists and sold them prints. The job taught me how to talk to strangers. That skill and my camera have taken me around the world.

My neighbors Billy and Sandra Stinson watch a squall roll over their house on Roanoke Sound. Hurricane Irene destroyed the place last August.

These little tempests serve as reminders that at any moment the fickle winds can hurl a boat onto the shoals. (As the wrecks of a couple thousand ships along the OBX coastline attest.) Or possibly fling you into the sky. (They carried Orville and Wilbur Wright into immortality.) Living here is a straight-up bet on the weather.

The islands are highly mobile piles of sand, and the Atlantic gnaws at them little by little. Moves them around. They're not going anywhere for a while, but building a house on the waterfront should not be considered an investment for your grandchildren. Major hurricanes and tropical storms blow through every few years, sometimes cleaving new inlets through the islands. My neighbors Billy and Sandra Stinson lost their historic summer cottage to Irene last year. It had been in Billy's family for more than 50 years and was one of the few remaining original Nags Head houses. It had been built on stilts over dry land, but slowly the waters of the sound had crept beneath it. Billy and Sandra are determined to rebuild. It's a classic gambler's move—doubling down on their weather bet.

Why would anyone live with such a lack of security? Because we're all gamblers, thinking our luck will hold. And because when there's no hurricane, life is at its best. It's that simple.

—David Alan Harvey

"Do you need a fish that bad?" I shouted at this boy as he repeatedly cast a line into the heaving sea. "Do you need a photo that bad?" he shouted back. We ended up agreeing that we were both a little crazy for being out on the Nags Head Pier during a nor'easter.

A Manteo crowd gawks at a mako shark hauled in during a fishing tournament.

The Outer Banks has long had a taste for spectacle. The trophy marlins and big sharks caught by deep-sea charters have always attracted crowds at the docks. There are lots of surfing dogs, and just about everyone has a story to tell. Exhibit A in the spectacle category, however, might be the OBX's long fascination with pyrotechnics. Back in the early days folks would bring trunkloads of fireworks down to the beach and put on their own dazzling displays. It wasn't such a big deal when there was less around to catch fire. A few years ago some rules and regulations were born, but there's always a pretty good show on the Fourth of July. On any given summer night you can still hear someone out on the sand lighting off a wad of firecrackers—or down near the water shooting Roman candles into the surf. Some places can't be tamed.

Skippy learned to surf as a puppy and can hang with the OBX's best surfing dogs.

Not much can beat the Fourth of July on the beach at Nags Head.

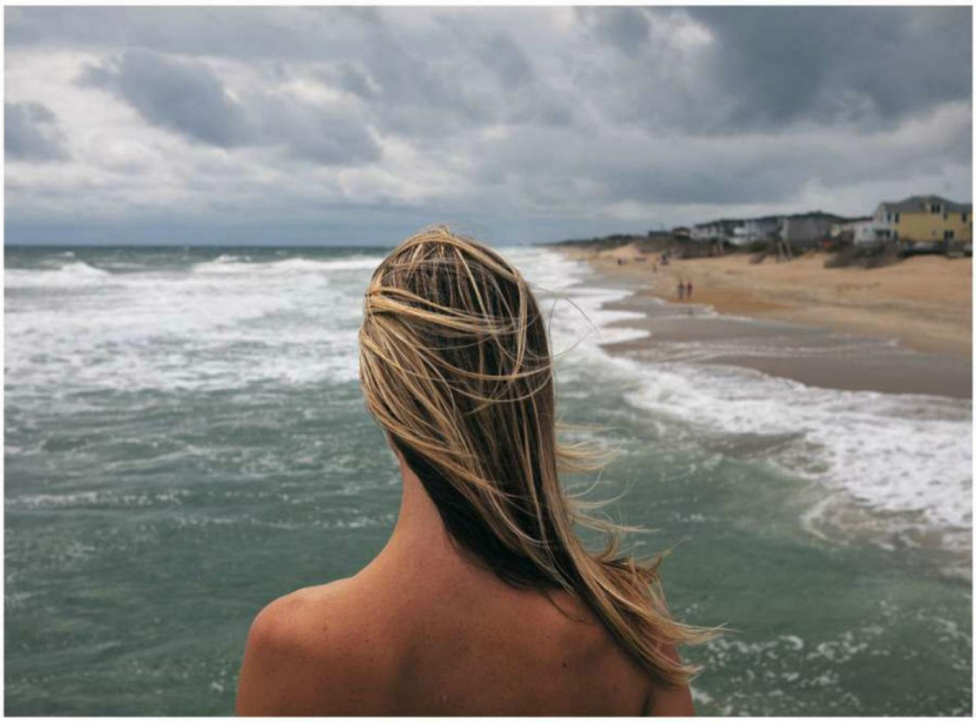
A couple packs up after a day of summer surfing near the Avalon Pier. The biggest swells won't arrive until fall. Since the '60s, when surfing made its way here, the sport has steadily become embedded in OBX culture, and pros from around the world come to sample the waves.

Newlyweds Alaina and Justin Crowder pose with a couple who paused while strolling on Kill Devil Hills beach to wish the youngsters good luck. In the past five years the wedding industry has exploded in the OBX; there were some 2,000 ceremonies in 2011.

When I was a teenager visiting in the 1960s, the Outer Banks was a place where a guy would let his beard grow long, hire an offshore boat to troll for mackerel and tuna, and channel his own inner Blackbeard. (The pirate died here in 1718.) But what an OBX summer is really about is the good old-fashioned dream of a carefree life. Riding my bike around to snap pictures in my neighborhood, I see a family place: a place to take the kids to a carnival, a place where teenagers do what teenagers do when it's summer, a place to meditate and to take in the wind and the surf and the ever changing weather. Are folks out of touch here? I hope so—even if they have to go back to the real world sooner or later. That's the way I feel here: out of touch with everything except what I would say is the best stretch of coast on the planet.

Nags Head hired a carnival to celebrate its 50th anniversary last summer.

The beach is for "boy meets girl," where teenagers perfect the art of hanging out.



A woman enjoys the OBX's finest entertainment—the theater of sky and ocean.

Sometimes I sit for hours just admiring waves: the aesthetics of each curl, the way the wind shapes a break, the colors morphing and shifting as a swell rises. Ultimately the waves will transform OBX. In that way each is both a harbinger of the end and a work of art.

BY BROOK LARMER
PHOTOGRAPHS BY O. LOUIS MAZZATENTA

It was a dazzling spectacle: a life-size army of painted clay soldiers buried to guard an emperor's tomb. Now archaeologists and artists, armed with the latest tools and techniques, are bringing that ancient vision back to life.

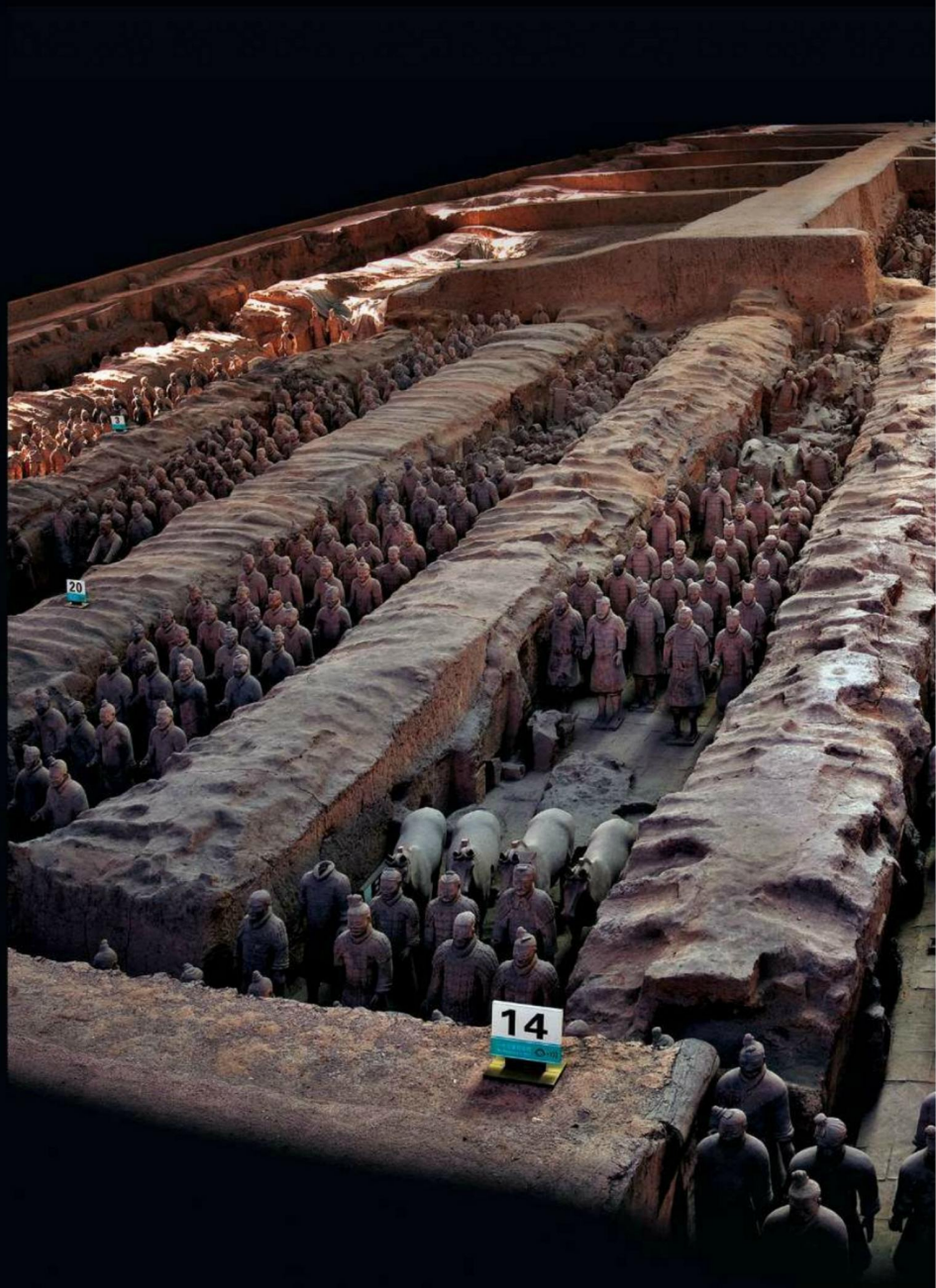
TERRA-COTTA WARRIORS *in* COLOR

IN AN EARTHEN PIT IN CENTRAL CHINA, under what used to be their village's persimmon orchard, three middle-aged women are hunched over an ancient jigsaw puzzle. Yang Rongrong, a cheerful 57-year-old with a pageboy haircut, turns over a jagged piece in her callused hands and fits it into the perfect spot. The other women laugh and murmur their approval, as if enjoying an afternoon amusement in their village near the city of Xian. What Yang and her friends are doing, in fact, is piecing together the 2,200-year-old mystery of the terra-cotta army, part of the celebrated (and still dimly understood) burial complex of China's first emperor, Qin Shi Huang Di.

It usually takes Yang and her co-workers many days to transform a heap of clay fragments into a full-size warrior, but today they are lucky, accomplishing the task in a matter of hours. "I have no special talent," insists Yang, who has been solving such puzzles since 1974, when farmers from her village of Xiyang first unearthed pottery and a sculpted head while digging a well for their orchard. "But nearly every warrior here has passed through *(Continued on page 86)*

An Infantryman's Faded Arm

Traces of paint offer a hint of the bold hues that decorated the army at the moment of burial more than 2,200 years ago. This fragment replicates typical armor of the era: pieces of leather covered with lacquer that were fastened together with red cords. The hand was formed to hold a weapon.

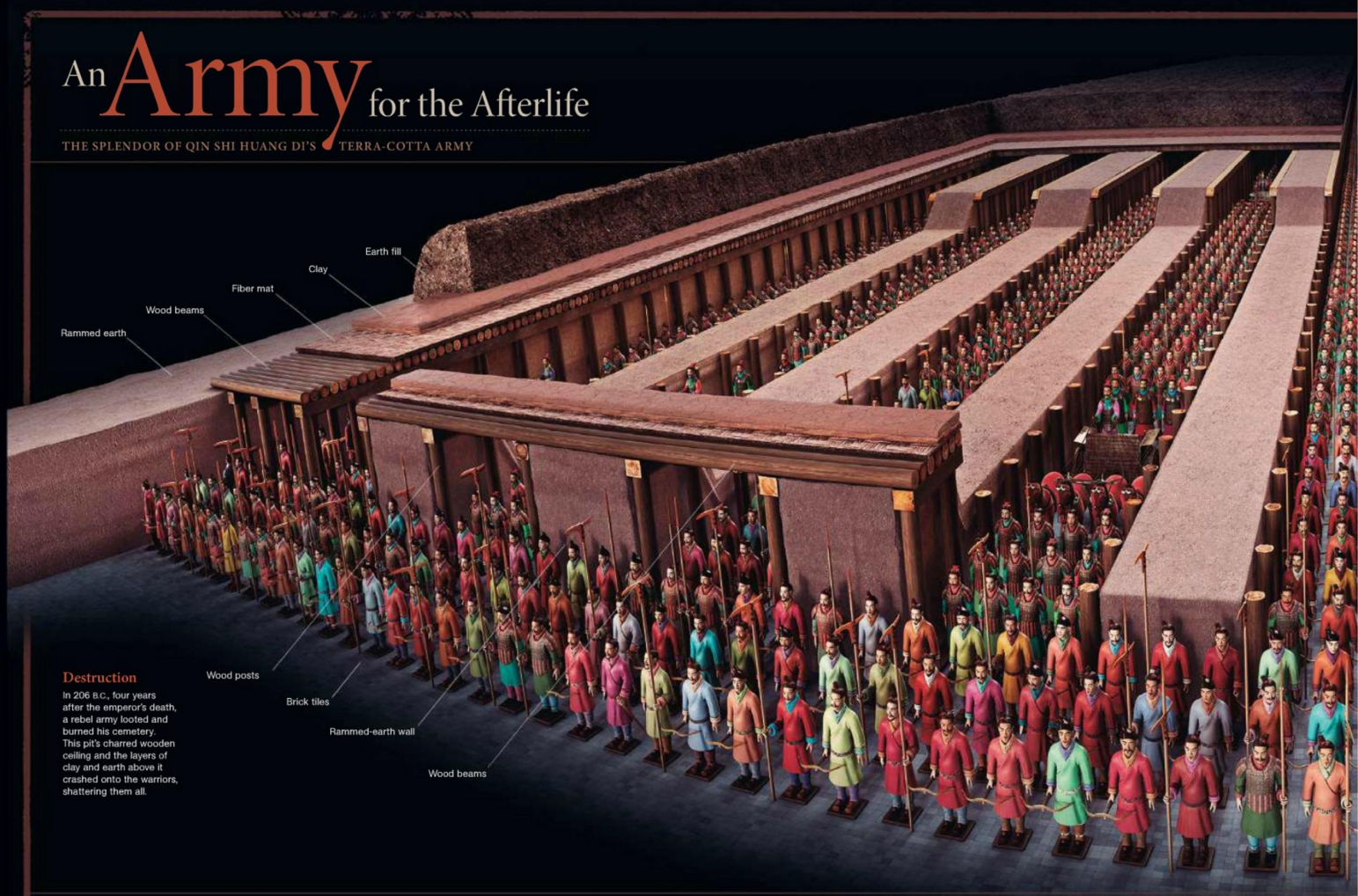


Birth by Mass Production

A face took shape in one of several dozen molds. The sculptor then added details, choosing from an array of basic hairdos, ears, eyebrows, mustaches, and beards. The body was created separately and displayed a similar combination of standard elements. All together, the completed figures gave an impression of infinite variety, as in a real army.

An Army for the Afterlife

THE SPLENDOR OF QIN SHI HUANG DI'S TERRA-COTTA ARMY



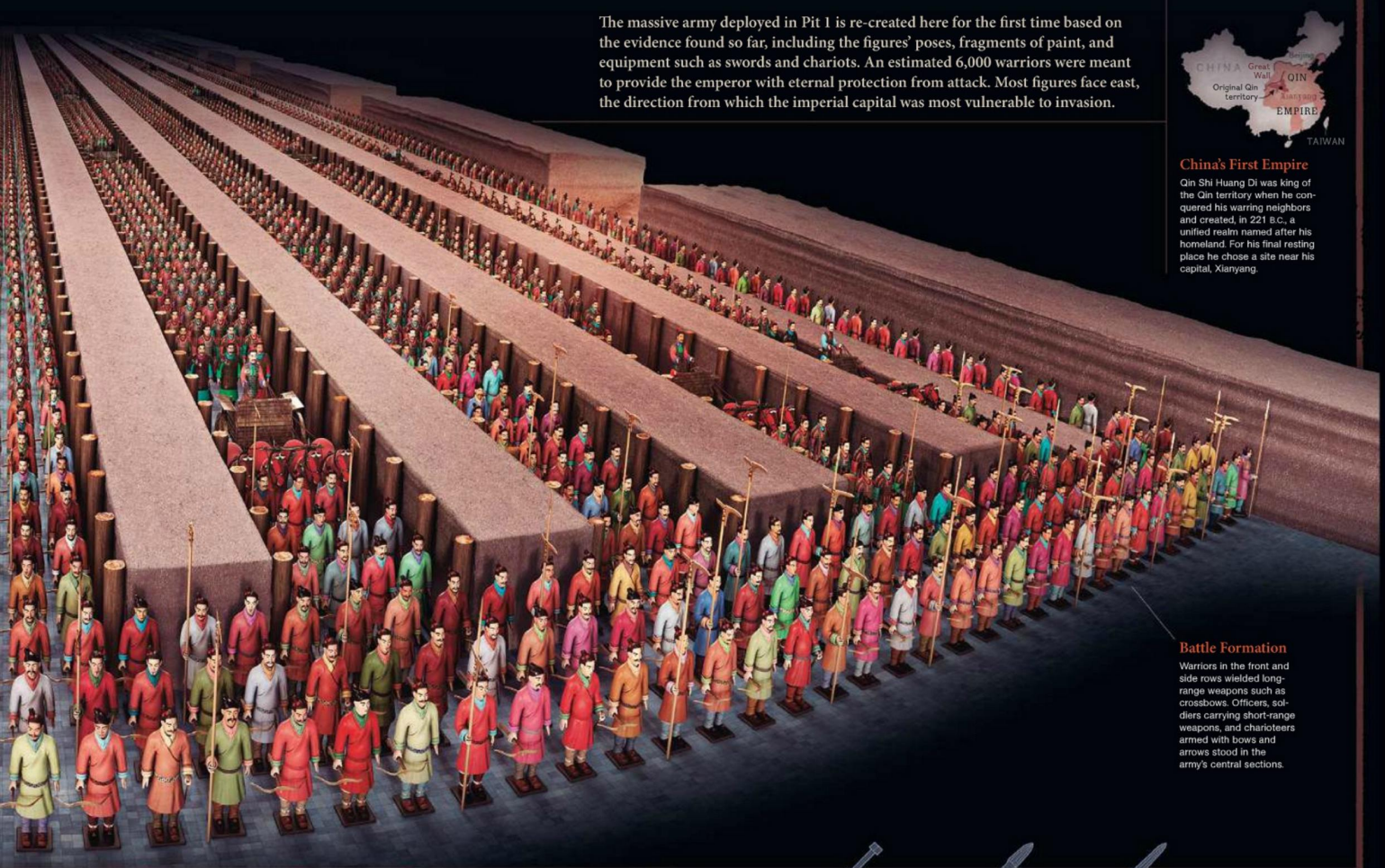
Destruction

In 206 B.C., four years after the emperor's death, a rebel army looted and burned his cemetery. This pit's charred wooden ceiling and the layers of clay and earth above it crashed onto the warriors, shattering them all.

WHO'S WHO

Most of the figures represent ground troops—soldiers and archers. About four dozen are charioteers and officers of varying ranks.

The massive army deployed in Pit 1 is re-created here for the first time based on the evidence found so far, including the figures' poses, fragments of paint, and equipment such as swords and chariots. An estimated 6,000 warriors were meant to provide the emperor with eternal protection from attack. Most figures face east, the direction from which the imperial capital was most vulnerable to invasion.



China's First Empire

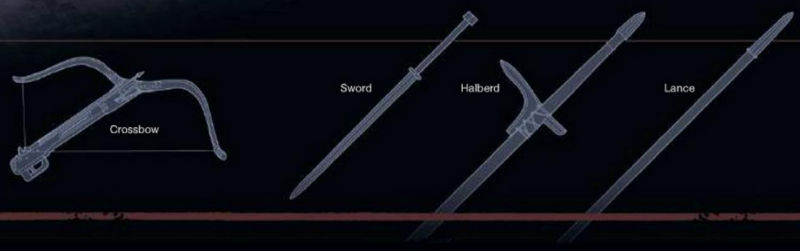
Qin Shi Huang Di was king of the Qin territory when he conquered his warring neighbors and created, in 221 B.C., a unified realm named after his homeland. For his final resting place he chose a site near his capital, Xianyang.

Battle Formation

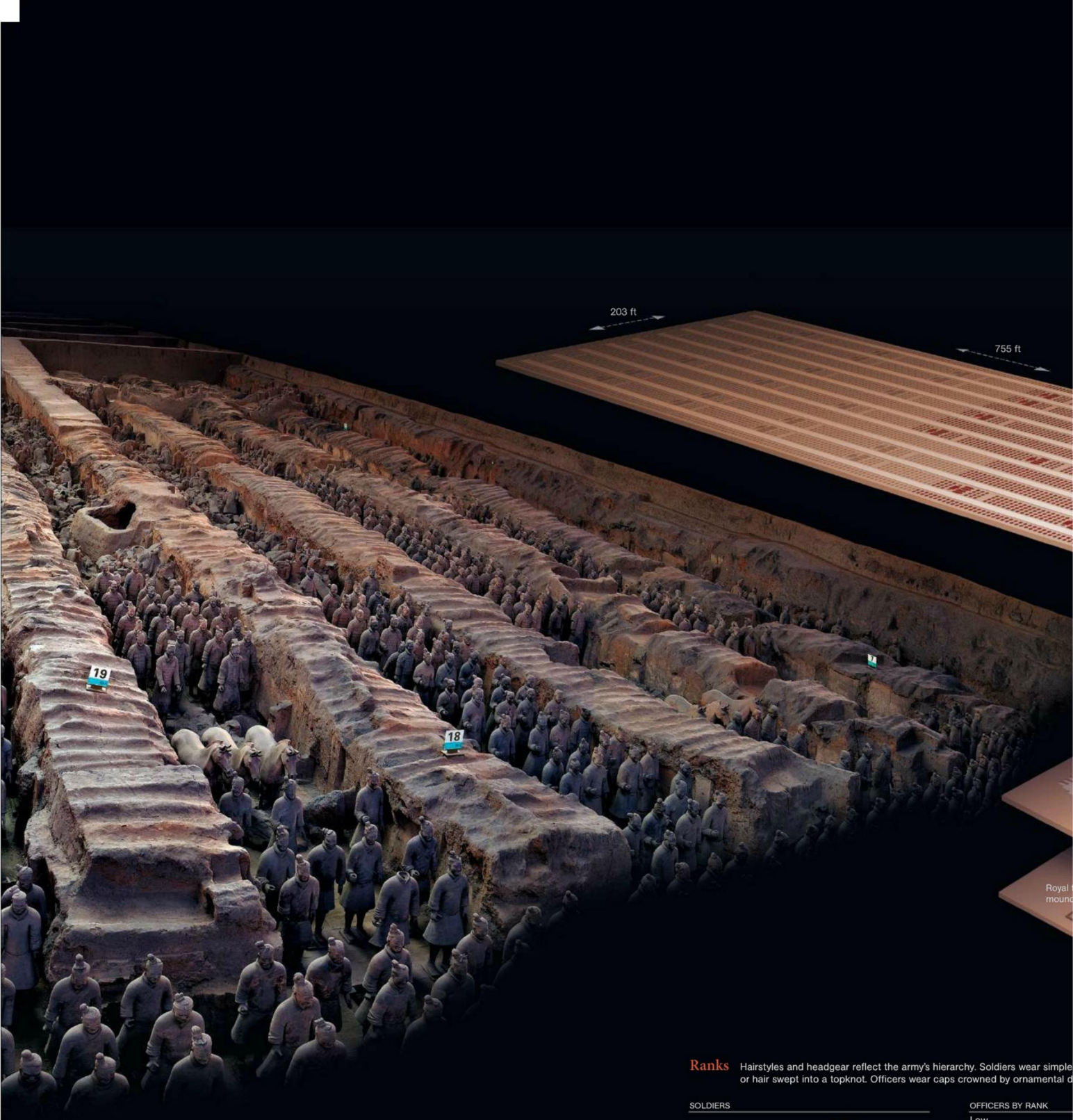
Warriors in the front and side rows wielded long-range weapons such as crossbows. Officers, soldiers carrying short-range weapons, and charioteers armed with bows and arrows stood in the army's central sections.

DEADLY ARMS

The army was pretend, but it bore real bronze weapons. Hundreds of blades and crossbow triggers have been found, along with more than 40,000 arrowheads.



THIS AND NEXT GATEFOLD:
JUAN VELASCO, NGM STAFF
ART: PURE RENDERING GMBH
PICTURE TEXT: A. R. WILLIAMS, NGM STAFF
FLAP PHOTO: XIA JUXIAN (ALTERED FOR ILLUSTRATION PURPOSES)
SOURCES: SHEN MAOSHENG AND RONG BO, QIN SHI HUANG DI TERRA-COTTA WARRIORS AND HORSES MUSEUM; *THE TERRACOTTA ARMY OF THE FIRST CHINESE EMPEROR QIN SHIHUANG*, INTERNATIONAL COUNCIL ON MONUMENTS AND SITES



An Army Emerges

More than a thousand warriors have been unearthed in Pit 1, burial ground of the emperor's main army, and many more will likely be found. The figures were once brightly painted, but the passage of centuries and the exposure to dry air during excavation have stripped away their colors.

Ranks Hairstyles and headgear reflect the army's hierarchy. Soldiers wear simple
or hair swept into a topknot. Officers wear caps crowned by ornamental d

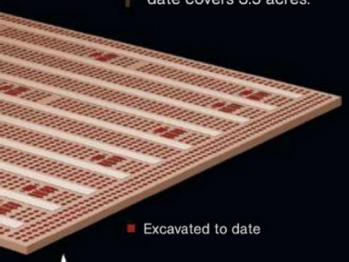
SOLDIERS

OFFICERS BY RANK

Low

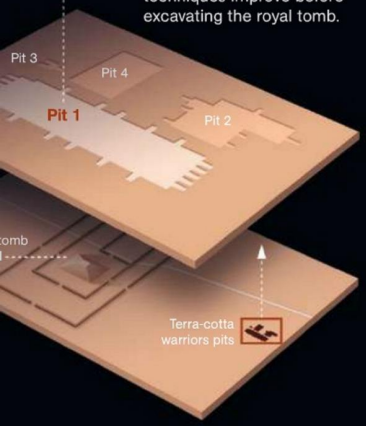
Pit 1

Situated about a mile east of the emperor's burial mound, the largest underground structure found to date covers 3.5 acres.



Excavated to date

The emperor's cemetery includes four pits—three with terra-cotta warriors and one unfinished and empty. An estimated 700,000 laborers worked for more than 30 years to create the complex. Archaeologists plan to wait until preservation techniques improve before excavating the royal tomb.



caps
esigns.

Pigments

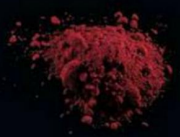
Various materials provided color, including precious stones ground into powder.

RED: Cinnabar

BLACK: Charcoal

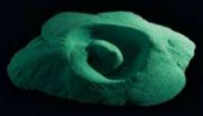
PURPLE: Cinnabar and barium copper silicate

BLUE: Azurite



DARK RED: Iron oxide

WHITE: Bones burned at a high temperature



GREEN: Malachite

Color unknown

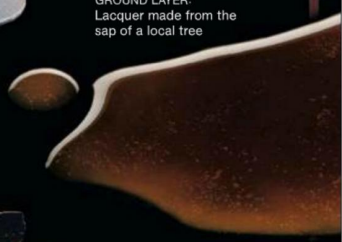
General, Pit 1

Fragile Paint

The army's rich coloring is reproduced on this figure (left), one of the few found with enough traces of paint so that experts could determine almost all of its original colors. On each warrior, egg-based paint was applied over two layers of lacquer. When archaeologists began to uncover the army, the lacquer dried and flaked off, taking the paint with it. Today new techniques are saving the ancient hues.

iPad Exclusive: Get a 360° view of this general, and fly over the warriors.

BROWN, BLACK, AND GROUND LAYER: Lacquer made from the sap of a local tree



PHOTOS: ROBERT CLARK (PIGMENTS)

(Continued from page 74) my hands." Having helped reassemble an army of a thousand warriors, Yang contemplates today's final piece: a clay head sheathed in protective plastic. Visible through the wrap are flashes of pink and red, brilliant hues that hint at the original glory of the terra-cotta warriors.

The monochrome figures that visitors to Xian's terra-cotta army museum see today actually began as the multicolored fantasy of a ruler whose grandiose ambitions extended beyond the mortal realm. The first emperor to unify China under a single dynasty, Qin Shi Huang Di packed a lot into his earthly reign, from 221 to 210 B.C. Aside from building the first lengths of the Great Wall, the tyrannical reformer standardized the nation's writing system, currency, and measurements, and provided the source for the English word we now use for China (Qin is pronounced Chin).

All the while, the emperor prepared for the afterlife, commanding the construction of the burial complex that covers 35 square miles. Qin's army of clay soldiers and horses was not a somber procession but a supernatural display swathed in a riot of bold colors: red and green, purple and yellow. Sadly, most of the colors did not survive the crucible of time—or the exposure to air that comes with discovery and excavation. In earlier digs, archaeologists often watched helplessly as the warriors' colors disintegrated in the dry Xian air. One study showed that once exposed, the lacquer underneath the paint begins to curl after 15 seconds and flake off in just four minutes—vibrant pieces of history lost in the time it takes to boil an egg.

Now a combination of serendipity and new preservation techniques is revealing the terra-cotta army's true colors. A three-year excavation in Xian's most famous site, known as Pit 1, has yielded more than a hundred soldiers, some still adorned with painted features, including black hair, pink faces, and black or brown eyes. The best-preserved specimens were found at the bottom of the pit, where a layer of mud created by flooding acted as a sort of 2,000-year-long spa treatment.

The last excavation in Pit 1 screeched to a halt in 1985 after a worker stole a warrior's head and was summarily executed—a head for a head, as it were. In the long hiatus that followed, Chinese researchers worked with experts from the Bavarian State Conservation Office in Germany to develop a preservative known as PEG to help save the warriors' colors. During the recent excavation, the moment a painted artifact was unearthed, workers sprayed any bit of exposed color with the solution, then wrapped it in plastic to keep in the protective moisture. The most colorful pieces (and the earth surrounding them) have been removed to an on-site laboratory for further treatment. To everyone's delight, the modern techniques for preserving ancient colors seem to be working.

IN A NARROW TRENCH on the north side of Pit 1, archaeologist Shen Maosheng leads me past what look like terra-cotta backpacks strewn across the reddish soil. They are, in fact, clay quivers still bristling with bronze arrows. Shen and I skirt the remnants of a freshly excavated chariot, then stop beside a plastic sheet. "Want to see a real find?" he asks.

Lifting the sheet, Shen unveils a jagged, three-foot-long shield. The wood has rotted away, but the shield's delicate design and brilliant reds, greens, and whites are imprinted on the earth. A few steps away is an intact military drum whose leather surface has left another glorious pattern on the dirt, its crimson lines as fine as human hair. Together with the imprints of finely woven silk and linen textiles also found here, these artifacts offer clues about the artistic culture that flourished under the Qin dynasty and the vibrant palette that infused it.

With so much color and artistry imprinted on the soil—the ancient paint, alas, adheres to dirt more readily than to lacquer—Chinese preservationists are now trying to preserve the earth itself. "We are treating the earth as an artifact," says Rong Bo, the museum's head chemist, who

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Beijing-based Brook Larmer wrote about Myanmar for the August 2011 issue. Lou Mazzatenta has photographed 29 stories for the magazine.

Digging Into New Discoveries

Crouching by a jumble of fresh finds, Yang Jingyi brushes away the last of the mud before restoration begins. As their excavations move closer to the central burial mound, archaeologists hope to reveal many more unusual twists in the story of the terra-cotta army.

helped develop a binding agent, now under patent, that holds the soil together so the color won't be lost. The next challenge, Rong says, will be to find an acceptable method for reapplying this color to the warriors.

With less than one percent of the vast tomb complex excavated so far, it may take centuries to uncover all that remains hidden. But the pace of discovery is quickening. In 2011 the museum launched two long-term excavation projects on the flanks of the 250-foot-high central burial mound. Exploratory digs in this area a decade ago uncovered a group of terra-cotta acrobats and strong men. More extensive excavations will yield "mind-boggling discoveries," predicts Wu Yongqi, the museum's director.

Down in Pit 1, Yang tightens the straps that hold her reconstructed warrior together. His head, still wrapped in plastic, is beaded with moisture. His lifelike pigment has been preserved, and his body will go on display at the museum with all of the cracks and fissures he received during his 2,200 years underground.

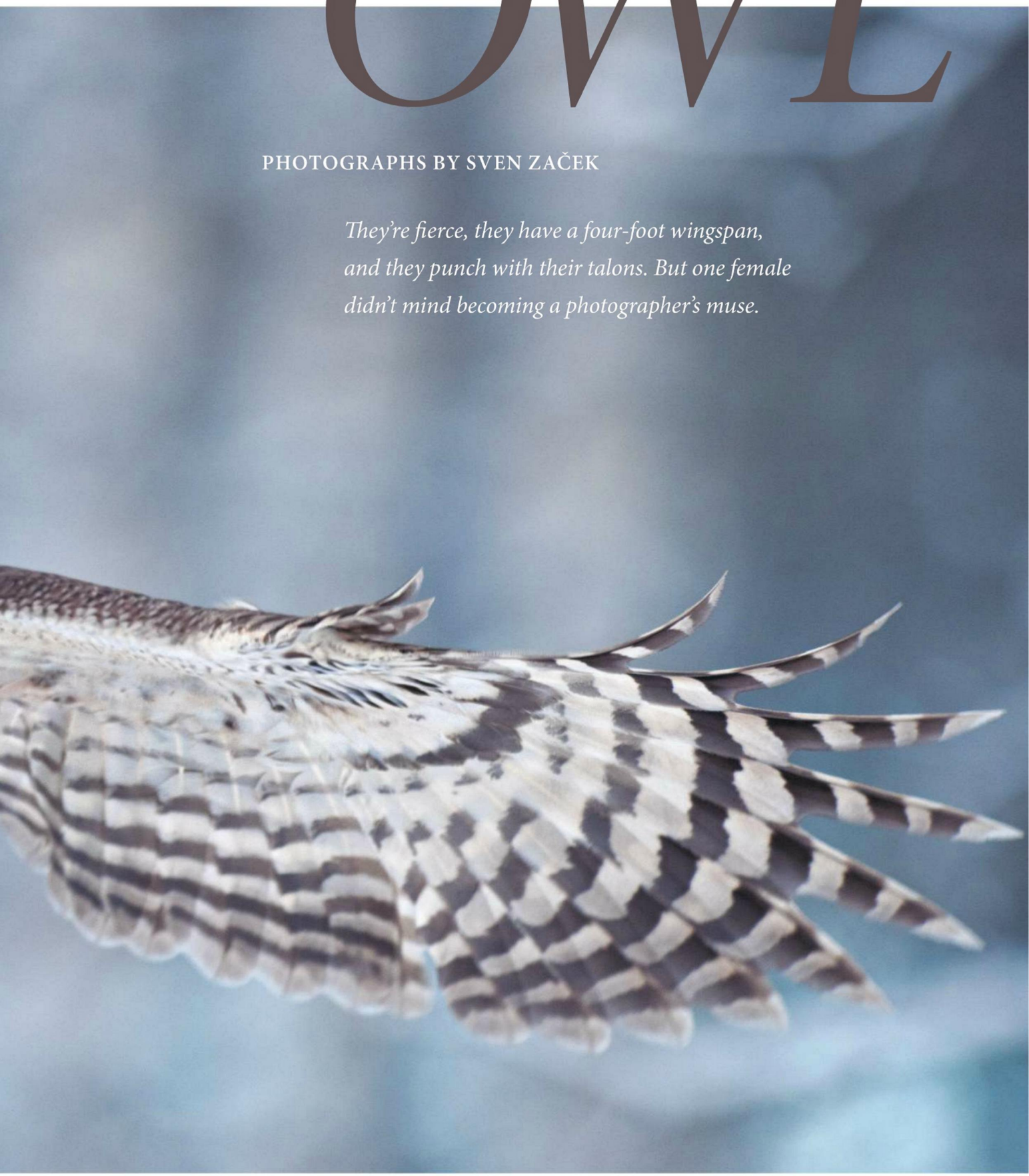
In the early days of the Xian excavations, the fractures and imperfections of the terra-cotta warriors were plastered over. Now, reflecting the evolution of the museum's views on historical accuracy, a new army is forming on the pit's west end, cracks and all. In every statue Yang's handiwork is plainly visible. "It's nothing special," she says with a modest smile. And with that, she and her village friends get back to work, piecing together the puzzle beneath the roots of their old persimmon trees. □

A love affair with

the Ural OWL

PHOTOGRAPHS BY SVEN ZAČEK

They're fierce, they have a four-foot wingspan, and they punch with their talons. But one female didn't mind becoming a photographer's muse.



The photographer's favorite subject—the female Ural owl that appears in all the photos except the one on page 92—found a natural nook to conceal her nest.

The young hunter was stalking moose in a frigid Estonian forest when he found himself locked in the sights of another creature: a Ural owl. He looked into her ebony eyes and softly fringed, heart-shaped face. Sven Začek was smitten.

He soon returned to the woods armed for a different kind of shot. He pulled his hood tight, fearing the owls' reputation for clobbering intruders' skulls. But the next female he met was aloof, matching his advances with equal retreats. After two months of silent standoffs, she dared to dive for a vole right in front of his lens.

"That was the turning point," says Začek.

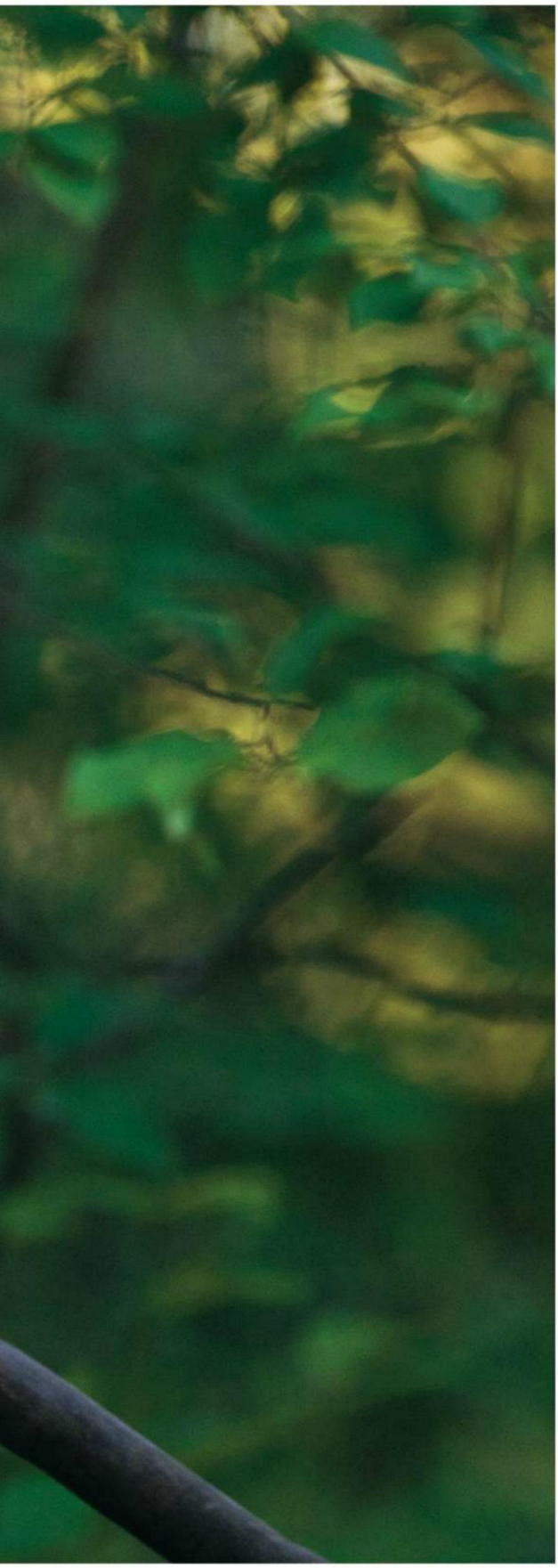
With the blitheness of a reality TV star, the owl let him record her domestic dramas for over three years. Courtships unfolded. Rodents were gobbled. Chicks chirped and wobbled their way to adulthood. In 2010 she disappeared. Začek blames nearby logging, which culls the rotten-at-the-core trees that Ural owls use as nests.

The species numbers a few hundred thousand in Europe, with millions more in northern Asia. Začek knows he will find others, but says none could replace his lost lady. *—Amanda Fiegl*

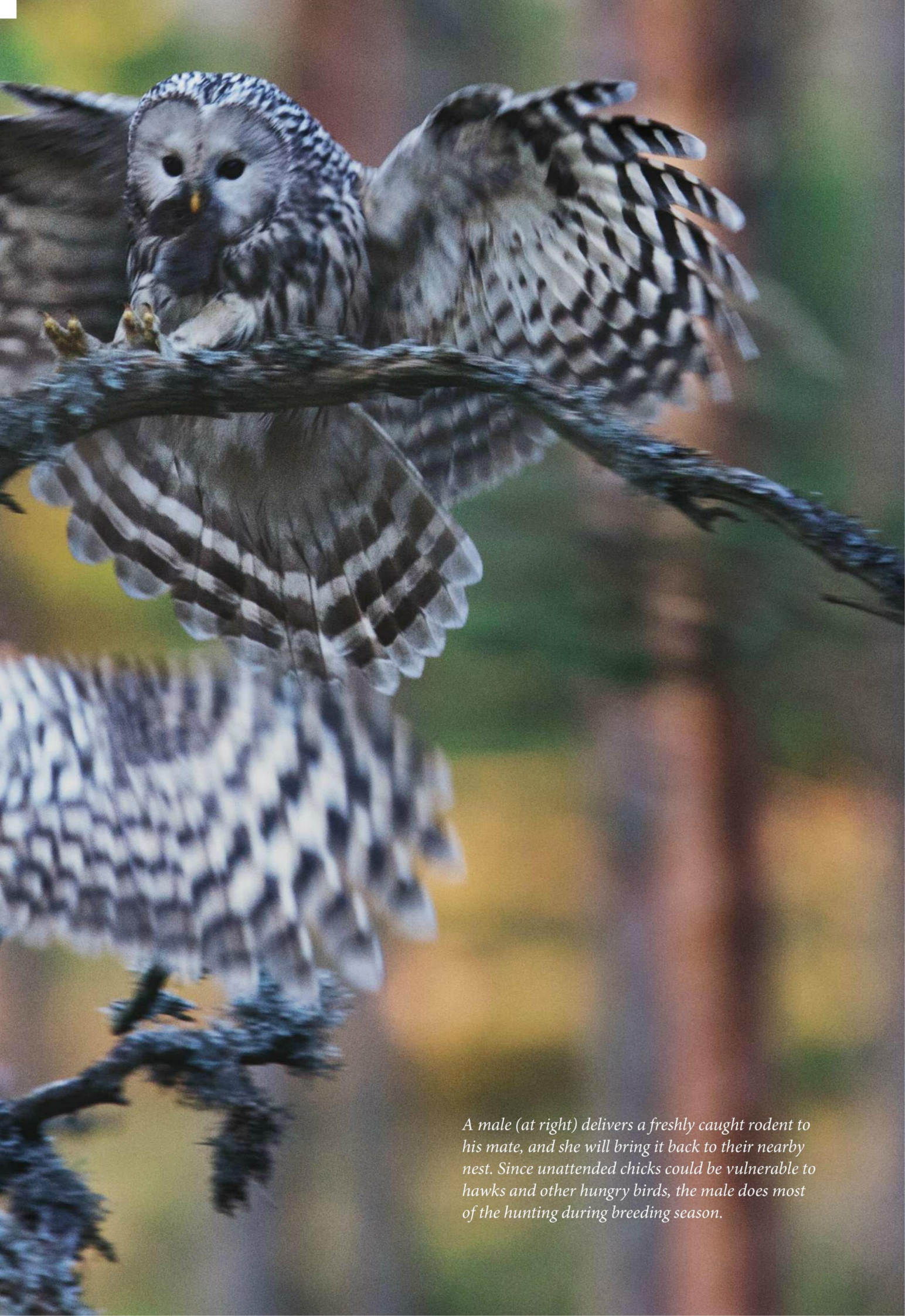
Nature photographer Sven Začek's latest book looks at his native Estonia from the perspective of its national bird, the barn swallow.

As the chicks

grow, their motley fluff morphs into elegantly streaked plumage.



She looks sweet grooming her chick, but don't mess with mom's nest: Ural owls are aggressively territorial. "I've made an 'agreement' with the females that the price to band and measure one nestling is six hard punches on the head," says Finnish ornithologist Pertti Saurola. Above, an owlet naps near the tail of a future meal.



A male (at right) delivers a freshly caught rodent to his mate, and she will bring it back to their nearby nest. Since unattended chicks could be vulnerable to hawks and other hungry birds, the male does most of the hunting during breeding season.

According to myth,

Snow can conceal prey like voles (above), but such protection is no match for the many hunting advantages nature has bestowed on owls. Concave faces help channel sound into supersensitive ears, while heightened vision and specialized feathers let owls fly under a cloak of darkness and silence. "I'm in awe of them," says photographer Začek.

owls symbolize the souls of the dead or the wisdom of the gods.

HONG KONG

IN CHINA'S SHADOW

Fifteen years after the handover to mainland China, Hong Kong residents worry that their identity—and their freedoms—are slipping away.

A fearless crowd holds a candlelight memorial in Victoria Park for democracy activist Szeto Wah, who died at 79 in 2011. Under China's "one country, two systems" policy, Hong Kong's citizens enjoy free speech, but voting rights are limited.

Fast-paced capitalism thrives in the Asian headquarters of the financial firm HSBC. Low taxes, limited regulation, and access to mainland China's market keep Hong Kong one of the best places to make money.

Beat-up armchairs await residents of a shanty-town built on the top of a mixed-use building. With affordable housing hard to find in one of the world's most expensive cities, low-income workers colonize rooftops in industrial neighborhoods.

BY MICHAEL PATERNITI
PHOTOGRAPHS BY MARK LEONG

At the edge of the South China Sea, the metropolis of Hong Kong flickers and glows, its iconic skyscrapers like molten columns, the bay reflecting all the cool blues and fuchsias of the city's desire. With little available flatland and the most skyscrapers in the world, Hong Kong is so dense with buildings, up to a hundred stories high, that they rise from the mountainsides as if full of helium. Hong Kong is a floating city: It floats between worlds, on fluctuating currency exchange rates and IPOs, real estate speculation, and the yuan of Chinese mainlanders, who come in droves on a wave of new wealth. It floats over the sedimentary layers of its past: the ancient fishing village, pirate haunt, former British colony. Now a Chinese special administrative region, it is being remade yet again under diamond pressure. And increasingly this city of over seven million inhabitants floats on a growing sense of unease, a discomfort that stands in direct opposition to the heady, auspicious days when Hong Kong was one of Asia's great business capitals.

What has cast the Hong Kong of once giddy acquisitive desire into a deep paranoia, of course, is the new China, the second largest economy in the world, which has become the shadow, the inference, the chimera, and the overlord in every conversation here. Mistrusted at every turn. Looked down upon—and up at in awe. You can feel the vapors of this unease everywhere in the city, like the mist that rises from the harbor or from steaming streets at dawn, a mix of confusion and fear and the sharpening premonition of erasure.

"If you want to see capitalism in action, go to Hong Kong," economist Milton Friedman is credited with saying. Yet to idealize the city today as a free market paradise, thriving in its 15th year after the British handover to China, is to sorely oversimplify, if not misconstrue, the darkening forces at work here. It's to miss the tensions and tectonic shifts beneath the glitzy financial center that Hong Kong shows to the world. In the city underneath, one finds asylum seekers and prostitutes; gangsters with their incongruent bouffants; thousands of Indonesian housemaids who flock to Victoria Park on their precious Sundays off; and those barely scratching out an existence, people crammed into partitioned apartment blocks of "cage houses" the size of refrigerator boxes. While Hong Kong's per capita gross domestic product ranks tenth in the world, its Gini coefficient, an index that measures the gap between rich and poor, is also among the highest.

Hong Kongers say their city reinvents itself every few years, citing the ever morphing skyline as one visible example. "We feel all of these great changes, but we don't know how to name them," says Patrick Mok, the coordinator for

Security cameras eye the traffic in Chungking Mansions, a 17-story hive of market stalls, restaurants, and cheap lodgings where global traders do business. Yemenis, Nigerians, Pakistanis all show up, buying made-in-China goods to sell back home.

the Hong Kong Memory Project, a $6.4 million effort to address Hong Kong's identity problem by creating an interactive website of old objects and photographs. "The pace of the city is too fast for memory."

Yes, Hong Kong is changing again, but into what and molded by whom?

A SHORT WALK from the tony designer stores along Canton Road and the opulent Peninsula Hotel in Kowloon's Tsim Sha Tsui district, a rundown, 17-story building called Chungking Mansions spreads over a block—home to 4,000 people who constitute an international brigade of buyers and sellers. They can be found at all hours under neon glare, ferreting through this world of no-frills hotels, restaurants offering African stews and Indian curries, and shops that sell everything from whiskey in a glass to saris and prayer mats.

Gordon Mathews, an American anthropologist who's studied and written about Chungking Mansions for the past six years, says 130 nationalities embark here each year, hoping to do big business in what he labels "the ghetto at the center of the world." When it was first built, Chungking Mansions was the domain of Chinese immigrants, who moved up and out. Today "this is more a Third World gentlemen's club," says Mathews, who estimates that 20 percent of the cell phones in use in sub-Saharan Africa pass through here. "This is probably the most important building in the world for low-end globalization," he says.

Hong Kong was built on this sort of global trade, owing its birth to opium, which may explain why to this day the city blurs the line between its legal and extralegal activities. When British traders arrived by frigate in the 1800s, looking to swap an embarrassment of Indian opium packed in wooden chests, they spied the granite island that would become Hong Kong on their way up the Pearl River estuary to Guangzhou.

Then came the First Opium War in 1839: The

Michael Paterniti is an award-winning writer working on a book about cheese and murder in Spain. Photographer Mark Leong documented the Asian wildlife trade in the January 2010 issue.

Under British rule a city took shape on the shores of a booming harbor, a transit point for trade with China.

Manchu empire ordered a halt to the trading of "foreign mud" by the "outer barbarians," confiscating over 20,000 chests of opium and destroying them in public; the British retaliated, bringing their naval forces within a hundred miles of Beijing before a cessation of hostilities.

The superintendent of trade, a man named Charles Elliot, negotiated for the seemingly worthless Hong Kong, believing its deep-water harbor might prove a boon but leaving the imperialists back home in a swivet—Why not farther up the coast?—and prompting Queen Victoria to admit bafflement at "the unaccountably strange conduct of Charles Elliot," while joking that her daughter should bear the title of princess of Hong Kong. Under British rule shanties gave way to granite buildings, a colonial infrastructure grew, and a city began to take shape on the shores of a booming harbor, one that acted as a transit point for trade with China.

It was the reaction to China's communist revolution of 1949, however, that transformed Hong Kong into a center of industrialized capitalism. Faced with Mao Zedong's nationalization drive, Chinese industrialists pulled up roots and reestablished themselves in Hong Kong, and a wave of refugees poured in, looking for work. A robust capitalism emerged, turning the city into a prodigious exporter of goods and a place of such unregulated ease that it invited money from all comers.

In time Hong Kong built its glowing skyscrapers—some by world-class architects like I. M. Pei and Norman Foster—as well as its more problematic housing estates, while behind its modern facade, social ills like prostitution, drug dealing, smuggling, and gambling continued to proliferate.

Chungking Mansions is a measure of how much has changed. "There's not much illegal except the illegals working here, many of them seeking asylum," says Mathews, who believes that the Mansions is where Hong Kong partly fulfills its promise, echoing back to an older version of itself from the 19th and 20th centuries: the melting pot, the open port, the unfettered global bazaar. "It is the truest encapsulation of what Hong Kong was, is, and could be."

In a Chungking Mansions curry shop, I meet a man who says he is Pakistani and asks to be called "Jack Dawson," after Leonardo DiCaprio's character in *Titanic*. He says he was threatened in his former country and came to Hong Kong without proper papers. He raised a bit of capital and began selling phones, and now he moves disposable "14-day phones," pulling down $60,000 a year. Gesturing to the stuffy hallway thronged with people coming and going, Jack Dawson says, "This is my land of dreams."

ON LOCKHART ROAD, in the Wan Chai district, the scene in a cramped lobby of a dilapidated building feels tense to say the least: male teenagers playing video games on their phones and suited men anxiously shifting from foot to foot, avoiding eye contact, all waiting to ride upstairs. When the elevator door draws open, one tribe of men glides out, while this tribe shuffles in—and up they go. Each floor of the 20-story building includes half a dozen thin-walled apartments offering one-woman brothels, barely masking the racket of the ministrations within.

During the 1980s human trafficking was facilitated by triads—criminal gangs who define themselves by dialect, profession, and political affiliation—who imported sex workers to Hong Kong in speedboats. The triads began as

NGM MAPS

Seven million people crowd into Hong Kong's special administrative region on China's southeastern tip (shown in white on the inset, left). The region's urban buildup is clustered on just a quarter of its landmass because much of the terrain is too steep to develop.

criminal secret societies in more lawless times but rose to prominence in the 1960s and early '70s during Hong Kong's golden age of corruption. The violent triad films of John Woo reinforced the concept of gangster as hero while highlighting the jagged dichotomy that still lingers over the city: In the gleaming towers the money flows on a white-collar stream of speculation and profit, while in the boiling, overcrowded streets, triads knife, blast, and amputate civilization until it lies bleeding on the brink of demise.

The truth today is much fuzzier—and less dire. Some triad-related criminal activity, such as the illicit drug trade, has shifted to the mainland. And the triads of today, says Alex Tsui, a former anticorruption official, no longer carry the vestiges of loyalty and patriotism that spurred some of the conflict. Rather, everything has been reduced to business. With profits in the offing, triads are more willing to collaborate with each other, resolving their differences around a table rather than in the streets. They run bus lines and dabble in interior decorating, while still holding on to everyday thuggery. But the lines have blurred. The children of the triad brass go to fine colleges and find their fulfillment in new iPads rather than in street bullying. High-level gangsters are more interested in their investment and real estate portfolios, or in buying racehorses, than in risking their lives in a bloody shoot-out.

"What some realized was that if you break the law in Hong Kong, you go to jail," says Tsui. "But if you go about 20 miles away, to Shenzhen and the mainland, you have carte blanche." Adds triad expert Kent Lee, "Those who've stayed aren't as violent and are more profit-oriented now."

Changes in the law have also minimized the triads' hold on the underground economy. Today prostitution is legal in Hong Kong, with restrictions designed to keep it from the public eye and ordinances in place to shield sex workers from triads or pimps who attempt to profit as middlemen. Not that the law isn't broken, but it's ushered in a new era that has brought an influx of sex workers from mainland China, in numbers that have made policing the trade difficult.

Now entire apartment buildings, unmarked from the outside, provide floor after floor of single-room apartments filled with sex workers, who

A neon-soaked district beloved by Hong Kong film directors, Mong Kok blazes with massage parlors and karaoke joints, conjuring visions of gangster shoot-outs. Triads, the local gangs, stay low profile, specializing in extortion and loan-sharking.

JASPER SAUNA
TOURIST WELLCOME
MOST CHEAP MONEY ONLY
深圳消費
全新裝修
足球直播
保証全港最平
MANLY COMM BLDG 3/F
雲南桂林過橋米線
TRADITIONAL CHINESE NOODLE
MASSAGE PLACE
エンペラー井ウナ
SUN HOTEL
KFC
HOTEL
P

Today gangsters are more interested in their investment portfolios than in risking their lives in a shoot-out.

advertise their services on Internet sites where they are rated by their customers, who in this building, on this day, will pay $60 for 40 minutes.

Upstairs, I find a woman willing to talk, if not give her name. "After paying rent, I make over $100,000 a year," she says in a Betty Boop voice, standing in a pink negligee of plunging décolletage in a room with floor-to-ceiling mirrors and a wet bathroom floor after yet another shower between clients. "Since doing this work, I've bought three apartments for my family," she says proudly.

Doing the math, one realizes that, for better or worse, she's a busy woman. And comparing this world to the misguided Hollywood portrait of exotic seediness and found love conjured in a film like *The World of Suzie Wong* ("With you, it's different," Suzie, the prostitute, tells William Holden's character. "I feel something in heart."), one also realizes that the most intimate act is just another transaction in a city of transactions, a service rendered in 40-minute clips, money exchanged, investments employed, money made to make more money—and sent back home to the family on the mainland.

IN NO OTHER MONTH does the ghost of China loom over Hong Kong more than in June. The anniversary of the Tiananmen Square crackdown—June 4, 1989—is Hong Kong's own symbolic 9/11. Coming as it did in the years just before the handover, the massacre of hundreds of protesters sent a chill howl through the colony, casting the Chinese government as a jackbooted police state willing to go to extremes to crush any claim to freedom of expression.

In the fashionable Causeway Bay district of the city, on the concrete plaza in front of Times Square, Sam Wong, 22, stands beneath massive banner ads of George Clooney sporting an Omega watch and supermodels striking sexy poses. Wong wears a white T-shirt that reads, "Freedom Now!" in English and a declarative headband reading, "Hunger Strike!" in Chinese.

Already stick-thin with a spray of stubble on his chin, Wong is 24 hours into his 64-hour hunger strike to mark the Tiananmen anniversary. He is joined by 18 other youthful protesters in an improvised tent city replete with brochures and sing-alongs that include lyrics calling for China to be more democratic and to release imprisoned political dissidents.

Shoppers stream past, barely taking note. Yet the evening before, a large group of mainland tourists stopped to watch a documentary about Tiananmen Square, viewing scenes of the massacre under a JumboTron of movie trailers. Afterward a group stayed to talk, some claiming they'd just learned for the first time what actually happened, others politely questioning what they took to be the protesters' antigovernment version of events. "We're not afraid of people with different ideas," says Wong. "We're worried that the police will overuse their power and arrest us, that they'll squelch our right to free speech."

This is an idea that gets expressed repeatedly in Hong Kong these days: the unpredictability of the authorities, who many believe are simply puppets for the hidden intentions and directives of their masters in Beijing. Despite China's promise of "one country, two systems," which guarantees Hong Kong's right to an autonomous political and economic system until 2047, residents cringe at the specter of China's control, limiting the freedoms and freewheeling ways of the past, imposing its will, subsuming what is quintessentially different about Hong Kong, and recasting the city in its image.

The real winners at Happy Valley Racecourse are members of the elite Hong Kong Jockey Club, whose perks include the right to enter restricted areas to size up horses. The city's biggest taxpayer, the club controls legal gambling and lottery sales.

Leung Kwok Hung—a leading pro-democracy activist and legislative council member known as Long Hair, for the hippie mane that falls between his shoulder blades—rails against what he sees as a growing prohibition against free speech. "The police kowtow to Beijing, because if you say no to what the Communist Party wants, you're saying no to your career," he says. "But that extends to government officials too, and the tycoons who own the media or want to do business in China. More and more, we're becoming too passive. Half the media won't even report on our protests."

Clad in a Che Guevara T-shirt and listening to Richie Havens in his book-lined office, Long Hair says he's been arrested nearly 20 times over the years, convicted a dozen times, imprisoned four times. He is trying to defend what he considers the most important parts of Hong Kong's identity: free expression, a free media—all of which were taken for granted under the "positive noninterventionism" of British rule and are now feared to a greater or lesser extent by the Chinese Communist Party. Because Hong Kong is neither autonomous nor a full-fledged democracy, Long Hair senses a dangerous vacuum. But on his best days, he believes that Hong Kong is an important bastion of civil liberties and, if put to it, capable of standing up to China.

Last year's June 4 protests—the only ones allowed in all of China—seemed to carry extra gravitas given the uproar over the detention of a Chinese artist, Ai Weiwei, whose provocative work and social protest caused him to run afoul of the communist government. (He was arrested and accused of tax evasion while boarding a plane for Hong Kong.) There were agitprop demonstrations on East Point Road: A man inviting people to scribble their protests on Post-it notes that were then attached to his body; a woman lighting an herbal powder on her palm, then blowing the flames out just before they burned her flesh.

Tens of thousands gathered in Victoria Park for a candlelight vigil. Organizers claimed 150,000 attended, while the police estimated half as many. The urgency of the protest was underscored by a profusion of T-shirts, banners, and buttons reading, "Who's Afraid of Ai Weiwei?" There were songs ("We're the new

There's growing resentment toward mainlanders, who were referred to as "locusts" swarming the territory.

youth, and there won't be fear") and speeches, and a video screen showing messages taped by mothers of Tiananmen Square victims, calling for remembrance and strength. It was, by turns, heartrending, melodramatic, utterly compelling, and weirdly hopeful, but what made it most poignant was the real sense among the protesters that what happened at Tiananmen might indeed one day happen in Victoria Park, that they in fact might be next.

Afterward a group of young protesters cleaned the park, thoroughly scrubbing the pavement, using paint scrapers to bring up the candle wax. There was no rowdiness, no spontaneous call to march or occupy or throw Molotov cocktails. This was protest, Hong Kong-style, polite, temporary, fervent until the goodbye, then strangely complacent and without final provocation.

In the emptying park after the evening's protest, I met a man with a red fan, wearing aqua blue shorts. He carried a bag with leaflets and brochures, some extolling the pro-democracy movement or calling for the release of imprisoned political dissidents, including Nobel Prize winner Liu Xiaobo and Falun Gong members. "The Communist Party hates me," he proclaimed.

Part of a landowning family in China, he'd moved to Hong Kong in 1951, at the age of 17, to escape Mao Zedong's rule. Some of his uncles had been imprisoned, while another uncle had become an official in the Communist Party. "Our family has lived all sides," he said. He'd retired from the jewelry business in his 50s and since then returned once a month to his home village in Guangdong Province. "I scold the communists," he said, "and preach Hong Kong's form of democracy." What was he going to do with all the pamphlets in the bag? "Bring them back to China," he said.

IF HONG KONGERS are subtly exporting their political ideas to China, it's the mainlanders who have buoyed the city with their buying power, especially after it was crippled by the bird flu epidemic in 1997 and the SARS crisis in 2003. "The Rolex store at Times Square sells 200 watches a day, mostly to mainlanders," declares Francis Cheng, a leading event planner for some top brands in Hong Kong and personal assistant for Pansy Ho, the socialite and billionaire who runs the MGM China gambling empire. Where it was once Hong Kong that sent food packages to China in its time of need and supported the Chinese real estate market through investment, the tables have turned: It's China that helps keep Hong Kong afloat these days, the mainlanders flocking to the metropolis to buy its real estate and goods, often in cash, since credit cards still account for only a fraction of retail purchases in China.

"Growing up, we felt superior to the Chinese," says Cheng. In Hong Kong people joke about how the mainland's nouveau riche visit fine restaurants and insist that their wineglasses be filled to the brim. In one case a mainlander is said to have toted a bag of cash into a fancy boutique and blurted, "Where's the most expensive stuff?" Stories like these support the long-held stereotype of the mainlanders as *ah chan,* or country bumpkins, but as Cheng points out, today the city's nine Gucci stores have long lines in front, a trail of seemingly endless demand. "There'll always be the next group of mainland farmers who've made it big," he says.

This shift in economic power has exacerbated Hong Kong's identity crisis, to the point where it is now the mainlanders who refer to their

Behind closed doors legal prostitution thrives in Hong Kong. Many sex workers come from the mainland—like "J," a 32-year-old who operates a one-woman brothel, the only type of operation allowed. In two years she has made enough to invest in real estate.

Hong Kong brethren as *kong chan,* or Hong Kong bumpkins. The University of Hong Kong's Public Opinion Program reports that in recent surveys, most residents view themselves first as Hong Kongers, not Chinese, underscoring a growing resentment toward mainlanders, who were referred to in a Hong Kong newspaper ad as "locusts" swarming the territory. Nearly half the babies born in Hong Kong's reputable hospitals last year belonged to mainlanders, spurring protests by Hong Kong mothers worried that, in this auspicious Year of the Dragon, when birthrates are sure to spike, the already overtaxed Hong Kong hospital system will be unable to handle its own.

At a Dolce & Gabbana store recently, Hong Kong residents were banned from taking pictures in front of the store's window display. In response, over a thousand Hong Kongers gathered in the street in front of the store to demand an apology, while venting pent-up frustration that they were being treated as second-class citizens in their own home.

Tensions are building, layer upon layer in the floating city. "Visitors see Hong Kong as the emerald city on the mountain," Alex Tsui says, "but it's an ailing city. The head is not working right. The limbs don't work. The footwork is off."

Back at Times Square, Sam Wong approaches the end of his hunger strike so groggy and fatigued he takes refuge in a tent, holding his head and closing his eyes as the endless stream of oblivious shoppers comes and goes. He feels someone must stand up to China, though he will be glad when it's over.

Night falls; the buildings are lit, lined like candles. The ferries churn in the bay. The planes glide overhead like silver pterodactyls, the streets a river of consumers. Hong Kong, city of a hundred cities, seems as restless as it ever was, morphing once more.

"People are shocked when I show them pictures of the rice paddies that were here in the 1970s," says Patrick Mok, the memorykeeper. "Then, we lived in the streets, in the open-air markets and stalls. Afterwards, everything moved indoors, into the malls, behind closed doors, in air-conditioned spaces. We're not sure who we're becoming now, but we can feel ourselves disappearing." □

A forest of high-rises, many of them public housing projects, covers central Kowloon, one of the world's most crowded pieces of real estate. Despite Hong Kong's glittery reputation, almost half of its seven million residents live in subsidized housing.

Expensive tastes fire Hong Kong's economy. At a party for Chanel's new line of watches, a prospective buyer, his face lit by a camera sensor, tests the feel of a $6,000 timepiece. Many of Hong Kong's biggest spenders now come from the mainland.

An alley cuts behind shops, away from the hustling streets. The city's booming economy pleases Beijing. What rankles is Hong Kong's stubborn sense of independence, a trait that shows little sign of dimming.

Where the weird things are

Isolated Socotra, 220 miles from mainland Yemen, is home to a panoply of strange plants and animals uniquely adapted to the hot, harsh, windswept island.

MICHAEL MELFORD

Botanical icon of Socotra, the dragon's blood tree uses its upraised branches to grab moisture from highland mists. Conservationists fear that poor reproduction threatens the species' future.

MARK W. MOFFETT

Chamaeleo monachus is found solely on Socotra, as are 90 percent of the island's other reptiles. Local people believe the chameleon is magic: It's said that a person hearing its hiss will lose the ability to speak.

MARK W. MOFFETT

By Mel White

Photographs by Mark W. Moffett
and Michael Melford

It's nearly midnight on the broad hill called Firmihin, where a dragon's blood forest grows. The moon, a night past full, floods the jagged landscape with cool silver.

Inside the rock wall of a shepherd's compound, flames light the faces of four people sitting barefoot around a fire, sharing a pot of hot tea mixed with fresh goat's milk.

Neehah Maalha wears a saronglike garment called a *fouta;* his wife, Metagal, wears a long dress and matching head scarf in rich purple. They talk about their lives on the island of Socotra, in a language whose origins are lost in time—unchanged for centuries and understood today by fewer people than live in Ames, Iowa.

Although the couple can't read, they know that the new sign down the hill says that Firmihin has been declared a protected nature reserve. Foreigners come to their village, they say, to photograph the dragon's blood trees and the desert rose plants and the *mishhahir* flowers. Scientists come and turn over rocks, claiming to be collecting insects and lizards. What are they really looking for?

Two hundred twenty miles across the Arabian Sea from the rest of troubled Yemen, Socotra was once a legendary place at the edge of maps of the known world. For sailors it was fearsome, with dangerous shoals, ferocious storms, and residents who were believed to control winds and turn ships toward shore for capture and plunder. Today Socotra's rich biological diversity brings new explorers, who hope to learn its secrets before the modern world changes it forever.

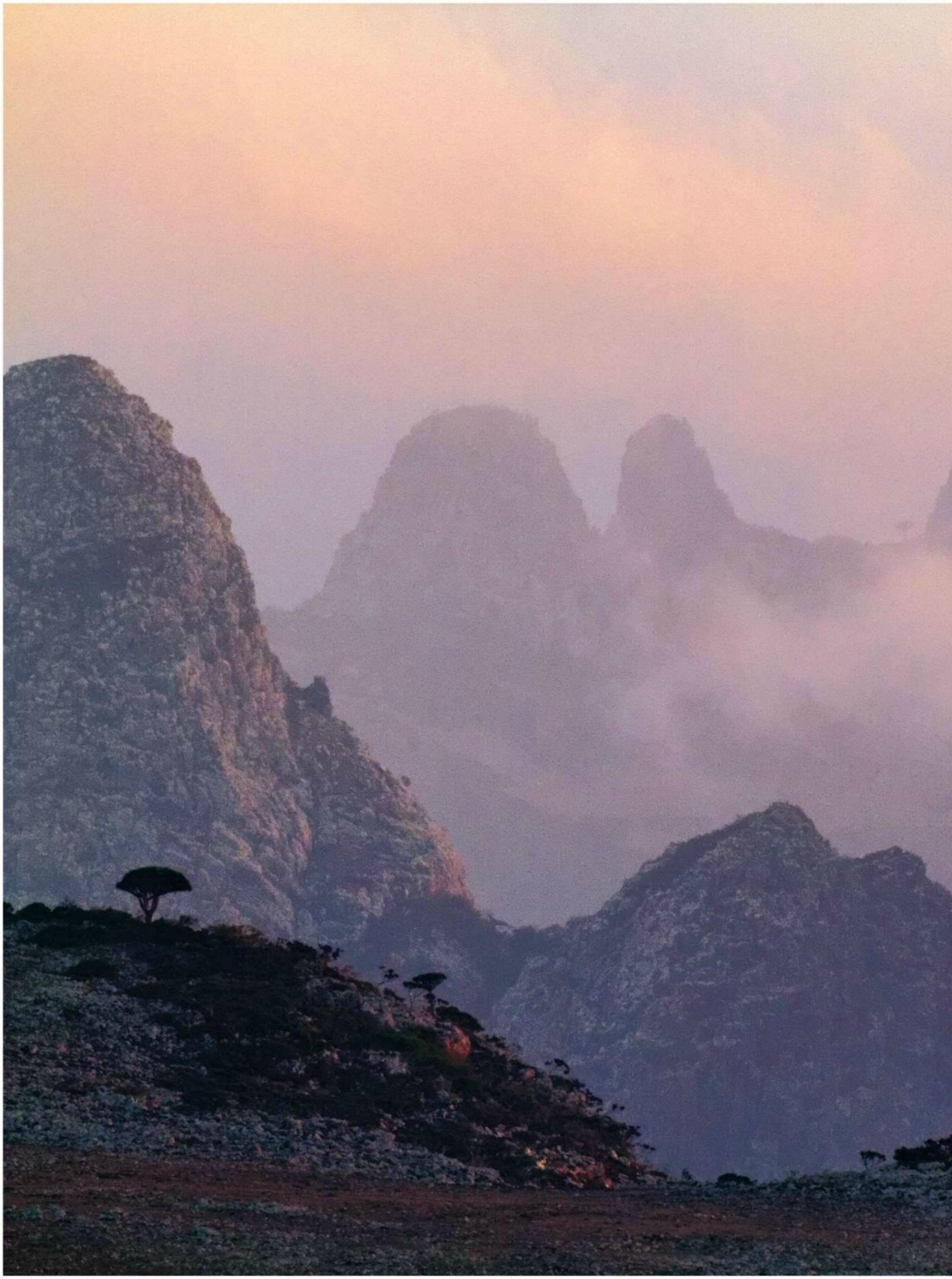
Land snails climb trees on Socotra's arid Zahr Plain to escape heat—and also carnivorous beetles—but then they're exposed to hungry birds.

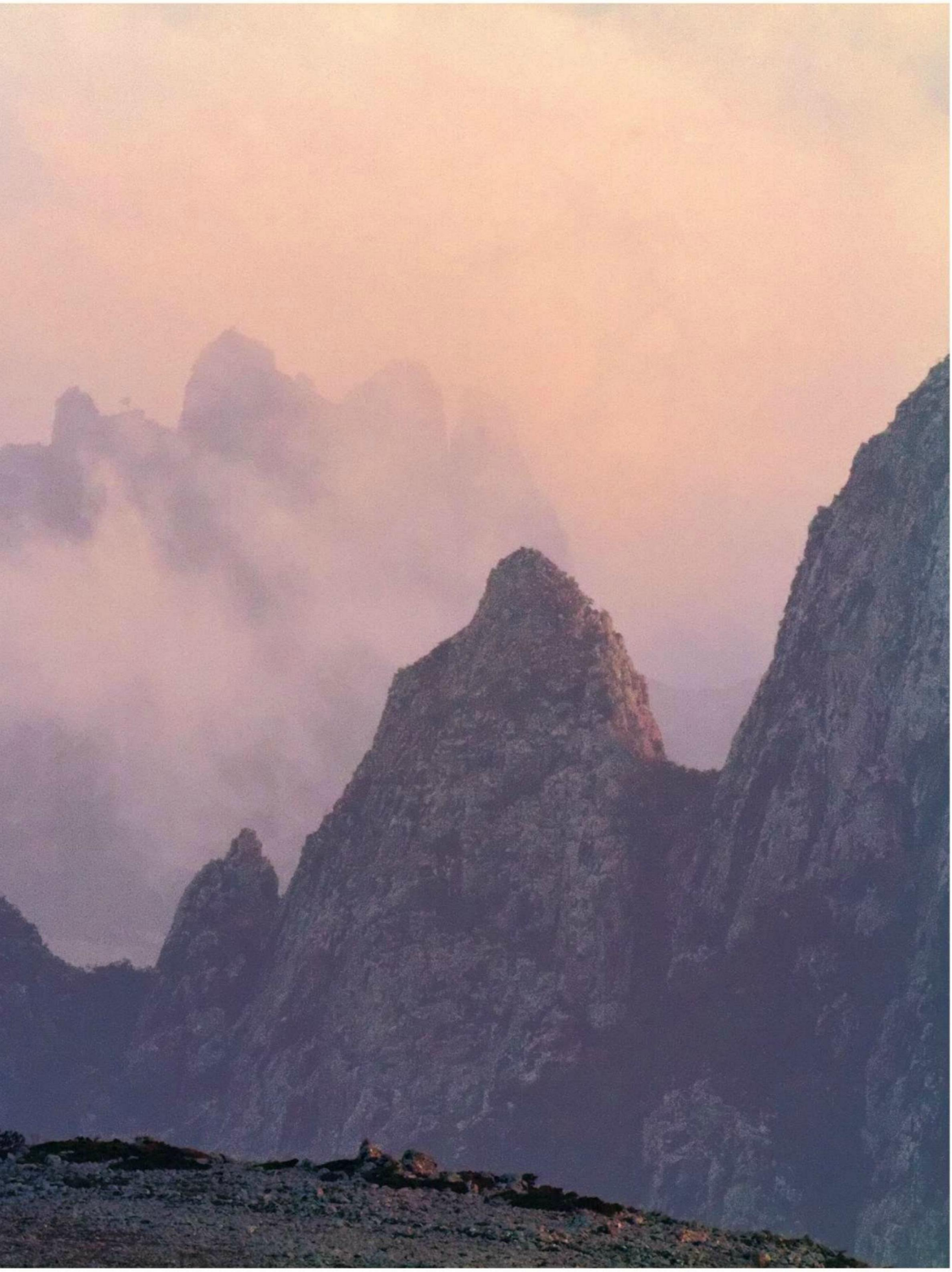
Suddenly the worry on Metagal's face gives way to a bemused smile. She disappears into the darkness and returns to offer me a small, paper-wrapped package. Would I like to buy some frankincense? Neehah takes a tiny piece and places it on a coal from the fire. Smoke rises and swirls, and we breathe the lush scent that perfumed the funerals of Egyptian pharaohs and the temples of Greek gods.

THE ANCIENT EGYPTIANS, Greeks, and Romans all tapped the treasures of Socotra's natural world: aromatic resins such as frankincense, medicinal aloe extract, and the dark red sap of the dragon's blood tree, used for healing and as an artist's color. Adventurers came to harvest the island's wealth, despite stories that it was guarded by giant snakes living in its caves. The Queen of Sheba, Alexander the Great, and Marco Polo were among those who coveted Socotra's riches.

The value of incense and dragon's blood peaked during the time of the Roman Empire. Afterward, the island served mostly as a way station for traders, passing centuries in relative cultural isolation. Socotra's residents lived generation after generation as their ancestors had: the mountain Bedouin minding their goats, the coastal residents fishing, and everyone harvesting dates. Island history was passed down through poetry, recited in the Socotri language.

Other than its strategic location off the Horn of Africa, there simply wasn't anything about Socotra that interested the outside world. But that has changed.





MICHAEL MELFORD

Ancient periods of volcanic activity built the Hajhir Mountains, where rugged granite peaks rise to nearly 5,000 feet. Nightly clouds provide moisture for plant life that's among the most diverse in Asia.

Research around the turn of the 20th century proved that this tropical island, despite its size of only 83 by 27 miles, ranks among the world's most important centers of biodiversity, combining elements of Africa, Asia, and Europe in ways that still puzzle biologists. The number of endemic plant species (those found nowhere else) per square mile on Socotra and three small outlying islands is the fourth highest of any island group on Earth—after Seychelles, New Caledonia, and Hawaii. The Hajhir Mountains, the rugged granite peaks that rise to nearly 5,000 feet in the center of the island, are likely home to the highest density of endemic plants in southwest Asia. Every vista on Socotra, from the hot, dry lowlands to the mist-shrouded mountains, reveals wonders seen nowhere else.

One sweltering afternoon I took a walk near the dusty town of Hadibu with botanist Lisa Banfield, a Socotra specialist then on the staff of the Royal Botanic Garden Edinburgh. We climbed a rocky hillside and stopped beside a plant that would have been at home in a Salvador Dalí painting—a squat thing that looked as though a much taller tree had simply melted in the heat. Its fuchsia flowers inspired the common name desert rose, though it's no more a rose than I am a porpoise.

"This is a famous example of a strategy that Socotra plants have evolved to withstand the harsh drought conditions here," Banfield said. "This is *Adenium obesum sokotranum*. It also grows on the Arabian and African mainlands, but there it's much smaller than on Socotra. Its trunk stores water, and it grows in these weird and wonderful shapes to anchor itself into the rocks. Some people call it grotesque, but I actually think it's a very attractive tree." Spoken with the true soul of a scientist. One 19th-century visitor called the desert rose "the ugliest tree in creation."

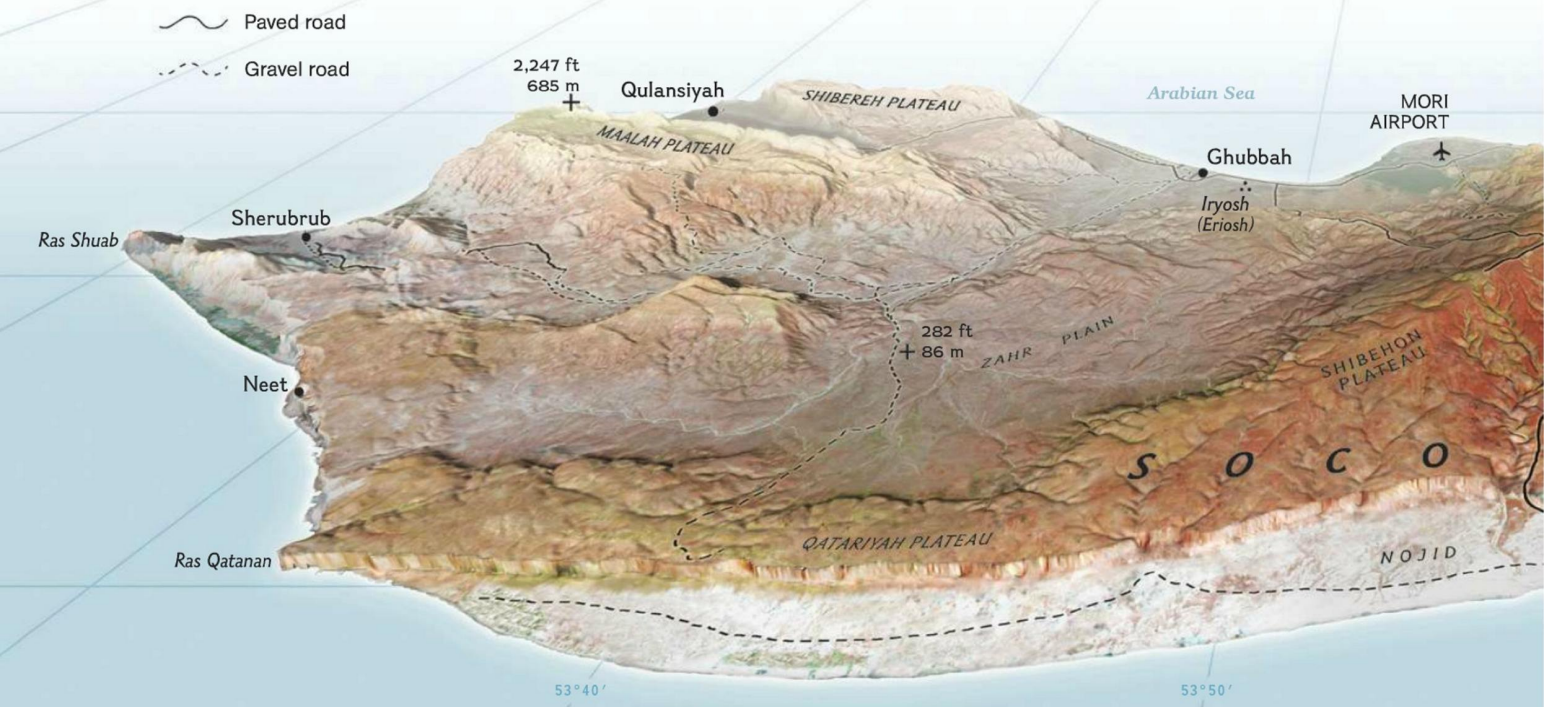
We walked a few yards to a plant that would be the undisputed weirdness champion anywhere but Socotra—one that could also deserve the species name *obesum*. Its swollen trunk rose above our heads, topped by a floppy mop of leafy branches sprouting haphazardly like dreadlocks.

Only on Socotra

Socotra and its three smaller outlying islands, separated from other landmasses for 18 million years, are home to more than a thousand endemic species: plants and animals found nowhere else on Earth. These species have adapted to a widely varying range of temperatures, moisture levels, and elevations. Now biodiversity and sustainable development are threatened as newly paved roads cut through delicate landscapes.

1,142
TOTAL ENDEMIC SPECIES

800 Terrestrial and marine invertebrates (estimate)
308 Plants
27 Reptiles
7 Birds



"In its growth habit this is very similar to *Adenium,*" Banfield said, "but actually it's *Dendrosicyos socotrana*—the cucumber tree."

Cucumber?

"Yes, it's the only tree species in Cucurbitaceae, a family that we'd expect to be growing as straggly climbers or vines. But here you can see some really big ones, with huge trunks. They look completely out of this world."

It is, however, another endemic tree, the dragon's blood, that's come to symbolize Socotra, its distinctive shape even depicted on Yemen's 20-rial coin. A relative of the common houseplants of the genus *Dracaena,* it grows on the plateaus and mountains over much of the island. The most extensive dragon's blood forests are found on Firmihin, where I'd spent the evening with Neehah and Metagal. The next day, under a relentless sun, Lisa Banfield and her Socotra colleague Ahmed Adeeb took me out for a hike around Firmihin.

The landscape was a jumble of limestone rocks eroded into knife-edge shapes. The burnt brown harshness was interrupted here and there by the brilliant crimson flowers of the succulent mishhahir, as anomalous as a flag on the moon. All around us dragon's blood trees lifted their branches skyward, looking, as many have remarked, like blown-out umbrellas. Even in a forest of dragon's blood, the individual trees keep their distance, like shy people at a party.

Hundreds and hundreds of dragon's blood trees stretched in all directions, but Banfield pointed out a troubling fact: Almost no young trees sprouted from the rocks beneath the mature ones.

Many plants here rely on mists for water. Some of Socotra's rarest endemics grow on steep cliffs in the mountains and around the island's perimeter, where they soak up moisture that collects when mist condenses on rocks. Those upturned dragon's blood branches are in fact an evolutionary adaptation to gather precious moisture from mist in the air—and there is less of that water available now. If climate change is responsible for the lack of regeneration of dragon's blood and other rare plants, there may be no short-term solution. In the meantime Banfield and other conservationists are equally concerned about other human-caused threats to Socotra's biodiversity.

NO DEVELOPED AIRPORT existed on Socotra until 1999, nor were there any paved roads. Since then, though, the pace of development has been rapid. Changes that in other places took decades have been compressed into a few years here. More and more vehicles crisscross the island on an ever growing highway system.

The outside world has come to Socotra both figuratively, through television, mobile phones,

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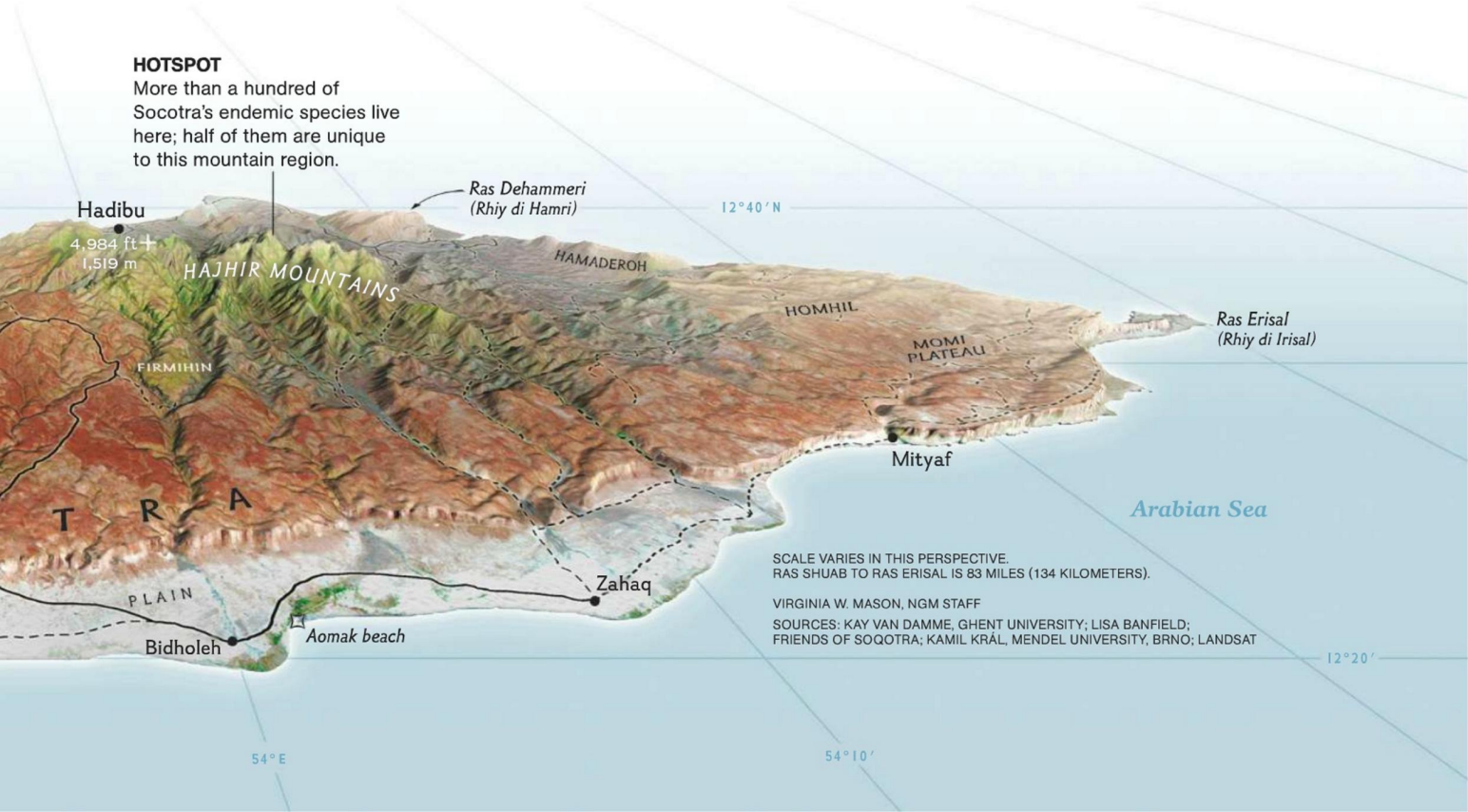
Natural history writer Mel White teamed with Mark Moffett, sometimes called Doctor Bugs, and landscape photographer Michael Melford to tell the story of Socotra. The three are regular contributors to National Geographic *magazine.*



MARK W. MOFFETT

Dragon's blood forests are nearly devoid of seedlings and young trees. Some scientists blame a lack of water caused by a decrease in seasonal cloud cover—and predict that many stands could disappear within a century.

Dazzling white sand dunes stretch for miles in places along Socotra's southern coastline, here at Aomak beach. Extremely high winds during the monsoon season constantly reshape the dunes.

Just below us, and out of sight above, were the bulldozed curves

and the Internet, and literally, through tourism. Though recent political unrest temporarily limited foreign travel, over the previous decade the island's beautiful beaches, rugged mountains, unique biodiversity, and ancient culture attracted a burgeoning number of travelers—from 140 international visitors in 2000 to almost 4,000 in 2010. Some of Socotra's admirers fear that the Yemeni government's rush to bring the island into the 21st century may have already irreversibly damaged the very things those people came to see and could bring an end to a way of life that has endured for centuries.

BELGIAN BIOLOGIST Kay Van Damme first came to Socotra in 1999 as part of a scientific expedition, flying on an Antonov cargo plane chartered from the Yemeni military. A specialist in freshwater crustaceans, he remembers that he and his colleagues discovered new species simply by walking trails or wading along creeks collecting lizards, snails, insects, plants, and other life-forms—sometimes finding several previously undescribed species in a day.

As he returned to Socotra year after year, Van Damme's purely scientific focus gave way to a broader concern for the island and its culture. "We were invited into people's houses, and I learned that on Socotra people have a very strong connection to their environment," he says. "I realized that the only way all these species have been able to survive all this time has to do with the traditional ways in which the people have guarded their island."

More than 600 villages, in most cases simply the clustered houses of extended families, are scattered across Socotra, each with its *muqaddam,* or respected elder. Over the centuries Socotrans developed practical ways of dealing with grazing, wood harvesting, land ownership disputes between clans, water-resources use, and similar issues. Unlike their counterparts in mainland Yemen, where violent feuds and tribal disputes have long been a way of life and where many men

A brown booby lands on the western coast. At least ten kinds of seabirds breed on Socotra or the small islands around it, making the archipelago a regionally significant home for them.

of an unfinished road, a project undertaken despite protests.

carry a gun and *jambiya* (ceremonial dagger) as a matter of course, Socotrans have a tradition of resolving issues peacefully in meetings among neighboring villages. Resource conservation was the only option for survival in the harsh island environment, and it had the side effect of protecting Socotra's outstanding biodiversity.

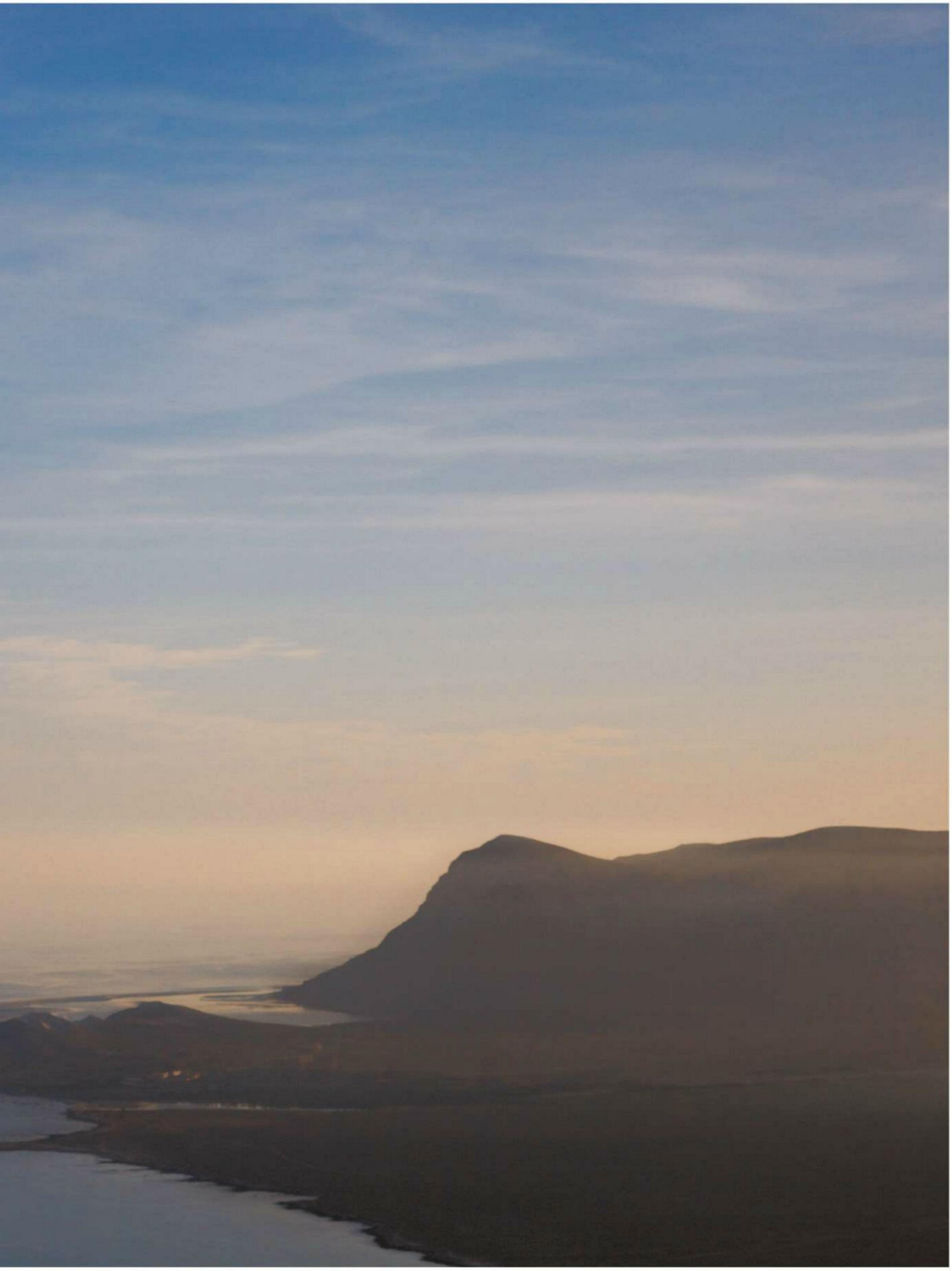
Van Damme has looked carefully at the effects of development on other islands, and what he's seen worries him. "You have habitat loss, habitat fragmentation, invasive species, loss of biodiversity," he says. "Eighty-six percent of all reptile extinctions have occurred on islands. Look what's happened to Guam, Easter Island, and even New Zealand."

Threats to Socotra's environment abound on both the macro and micro scales, though many have been at least temporarily averted by security issues. One beautiful beach was set to become a major new port, despite no one being able to say why the facility was needed. (When I visited, a sign announcing the development had been torn down by residents protesting the loss of their traditional fishing and recreation site.) Rumors in coffee shops ranged from the seemingly well founded (a politically connected Yemeni had bought land adjoining an important marine reserve for a resort hotel) to the sketchy (the U.S. military would establish a base on the southwestern coast).

One day Lisa Banfield and I scrambled up to the cliffs near the village of Qulansiyah, on the western end of Socotra. On the red rocks here she showed me the bizarre *Dorstenia gigas,* a fig with a bulbous shape reminiscent of, well, nothing I can think of, and also rare myrrhs and aloes and an array of other island endemics. The Maalah cliffs and adjacent plateau, Banfield said, shelter Socotra's second highest diversity, after the Hajhir Mountains—not just plants and invertebrates but also reptiles, whose endemism on the island tops 90 percent.

Yet just below us, and out of sight above us, were the bulldozed curves of an unfinished

MICHAEL MELFORD (BOTH)



MARK W. MOFFETT

A desert rose anchors itself on the Maalah cliffs, in the company of more than 300 other rare plant species on Socotra. In the distance lies Qulansiyah, one of the island's largest towns.

Called *mishhahir* in Socotri, this succulent has served as emergency food for island inhabitants during periods of famine. Its flowers provide rare points of color amid the gray limestone of the Firmihin area.

We stopped beside a plant—a squat thing that looked as

road that would have cut directly across this biological treasure-house. The road project had been undertaken despite protests of conservationists; the cliffs were left unscarred only because the builders lacked the technical expertise to traverse them. Better planning would have protected biodiversity and made construction more practical. At another lowland site, called Iryosh, petroglyphs found on flat rocks may contain clues about Socotra's earliest settlement. But in 2003 the government destroyed at least 10 percent of them by cutting a road across the area.

Such construction opens new areas to development, and if tourism regains its momentum, pressure will grow to sell land to foreign investors. On an island with a tradition of communal ownership, disputed land claims and the possibility of quick profits are dividing villages and even families, as well as eroding long-standing respect for natural resources. Already, newly built roads snake around Socotra's perimeter, and new hotels and shops are under construction in Hadibu, most of them owned by people who don't live on the island.

Yet in the Hajhir Mountains the old ways seem as enduring as the granite peaks. Village muqaddams arise at dawn and sing to their goats, and rural people still go to traditional healers who burn them to drive away disease. The night mist lifts with the sun, the Socotra starlings flit through the dragon's blood trees, the small doves sing their throaty *oh, rococo* calls, and mysterious flowers bloom on hillsides where no one ever walks.

Toward the end of my trip I traveled with Kay Van Damme, Lisa Banfield, and our guides to the Momi Plateau, an area of rolling limestone ridges and scattered shrubs underlain by vast caves full of rare endemic freshwater shrimps and other invertebrates. As we began our walk, an old man with a wispy white beard came rushing up, shouting, What were we doing on his land? We must leave! He said that if he were

The freshwater crab *Socotrapotamon socotrensis* is endemic to the island. With no native fish as competitors, these predatory crabs occupy the top spot on the aquatic food chain.

though a much taller tree had simply melted in the heat.

to let us stay, it would mean that more tourists would come to poison scorpions.

When we agreed to pay him ten dollars, he said he would guide us over the hillside to the escarpment beyond. He walked barefoot across the sharp-edged rocks, carrying a staff that he used to accentuate his arguments. We hiked to cliffs rising nearly 2,000 feet above the shimmering blue Arabian Sea, and as we returned, the old man used his green shawl to gather a large bundle of branches, slinging the heavy load over his shoulder to carry to his hut.

Back at the village, he said he had something to show us: a strange and mysterious object that he had found nearby. He believed it might belong to the magic snakes that guard the caves, but he wanted the foreigners' opinion about what it might be. He took a piece of white cloth from the folds of his fouta and unwrapped it. Inside was a marble—a brown-swirled glass marble that a child might play with, yet in his world a thing of wonder.

"Socotra is still relatively pristine," Van Damme says. "But that also means that this period right now, this whole wave of civilization and development, is the biggest threat ever to Socotra biodiversity. Socotra people have practiced conservation through their traditions, but now it's up to all of us to keep this going in the future, to keep it strong against threats. Socotra is one of the last places on Earth where we can actually still protect a unique island environment, where we can still do something positive before it's too late."

When stability returns to Yemen and roads, resorts, and eager travelers spread across Socotra, will its residents' peaceful ways of settling disputes hold? Will people still gather in mountain villages to recite their poems in a language all their own, and will centuries-old traditions of conservation endure? If so, perhaps those who climb high into the limestone hills will still hear the song of the Socotra bunting, part of the island's weird and wonderful array of life. □

MARK W. MOFFETT (BOTH)

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DIGITAL EDITION

Field Test: Mount Everest

Filmmaker Cory Richards and mountaineer Conrad Anker will take one route to reach the top of Everest; writer Mark Jenkins will take another. Track their daily progress live on the *National Geographic* app for the iPad, or see highlights at *natgeo.com/oneverest.*

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EXHIBIT

BRIAN SKERRY'S OCEAN SOUL *National Geographic* photographer Brian Skerry probes the world's oceans to capture rarely seen creatures in unforgettable ways. This exhibit, based on Skerry's book of the same name, is at the Oregon Museum of Science and Industry in Portland, Oregon, until July 10. Go to *omsi.edu* for ticket information.

LECTURE

EASTER ISLAND Archaeologists Terry Hunt and Carl Lipo offer a radical new history of Easter Island on June 21 at National Geographic headquarters in Washington, D.C. For details visit *nglive.org.*

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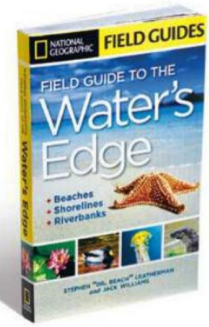

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Sticking Points

On June 4, 1989, the year Mark Leong started photographing in China, he was in Hong Kong in the midst of protests against the government crackdown in Beijing's Tiananmen Square. Last year, on the eve of the event's 22nd anniversary, a similar scene unfolded. This time the protesters were a group of artists in Causeway Bay, an upscale shopping district. "Hong Kong's continued freedom allows for playful creative expression," says Leong. "These artists used the color yellow to represent freedom, peace, and the Chinese people." *—Luna Shyr*

BEHIND THE LENS

What stood out to you about this scene?

ML: I was struck that the artist felt, or knew, he could make his body into a sounding board for antigovernment rhetoric. He stood there for around two hours while his collaborators offered pens and sticky notes to passersby, telling them to write a June 4 message. The messages include "Justice and ethics," "We won't forget," and "Release activists." Lots of them just say "6.4" or "June 4."

People seem transfixed by the person lying down in the background. What was going on?

Hong Kong is as camera-happy a place as I've ever been. "Post-it man" was a great draw, and I had a hard time taking his picture without someone else jumping into the shot with their own camera. Attention shifted when the other artist lay down, poured some water in his mouth, and let little river crabs swim around inside. It's a visual play on a Chinese euphemism for censorship. This photo reminds me of the 1985 film *Brazil.* In it a rebel character meets his demise when sheets of paper start sticking to him, overwhelm him en masse, then blow away but leave no trace of him behind.

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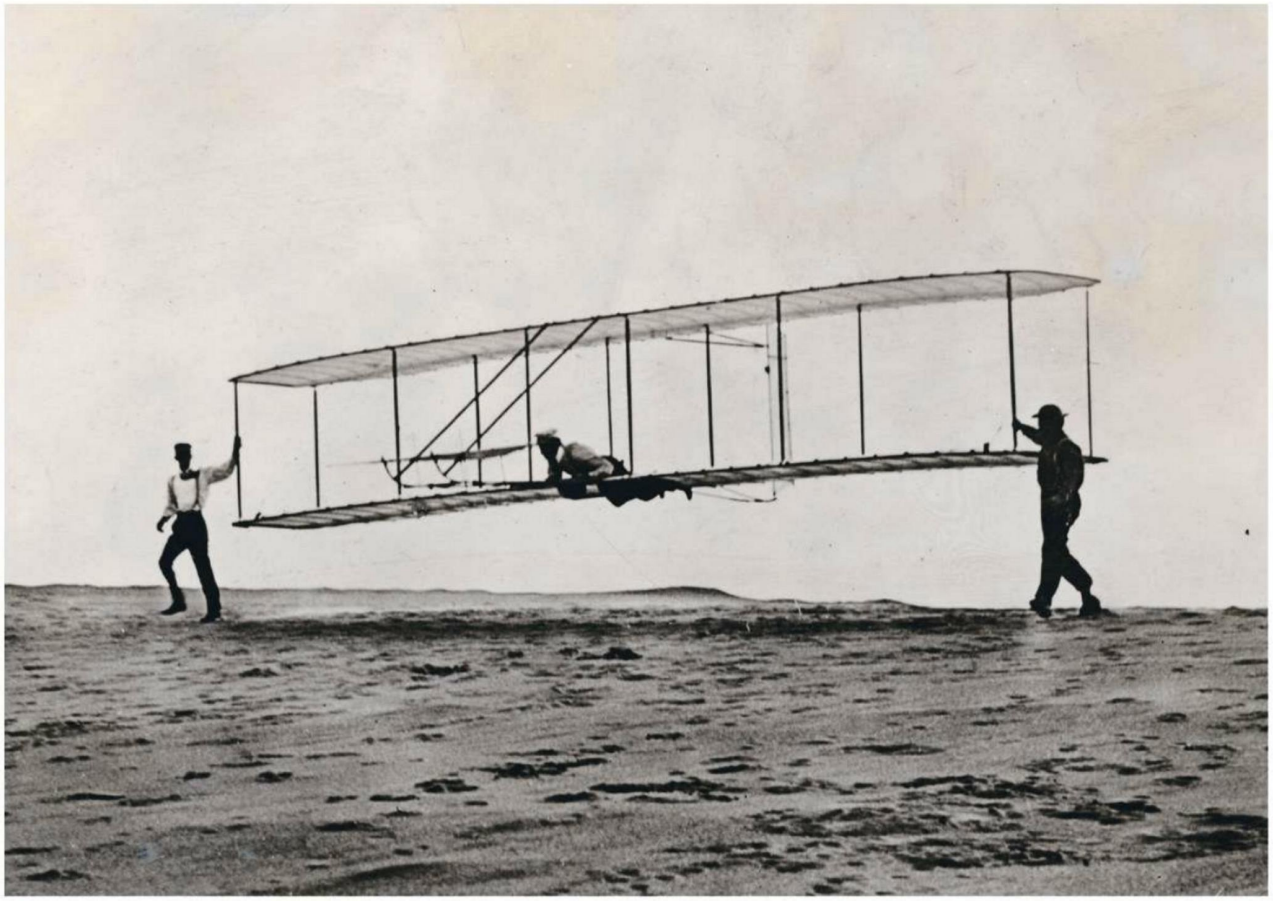

Up in the Air Though Wilbur had piloted all the glider tests since the Wright brothers had started their flying project in Kitty Hawk, North Carolina, in 1900, Orville—junior by four years—finally got his chance in the fall of 1902. Wilbur helped launch him.

When their airplane was ready to fly a little more than a year later, the two tossed a coin to see who would pilot. Wilbur won—but his attempt ended in less than four seconds. Three days later, when the damage from Wilbur's try had been fixed, it was Orville's turn. The younger brother's stab at sustained, controlled, free flight succeeded, and "the flying problem," as the brothers called it, was solved. *—Johnna Rizzo*

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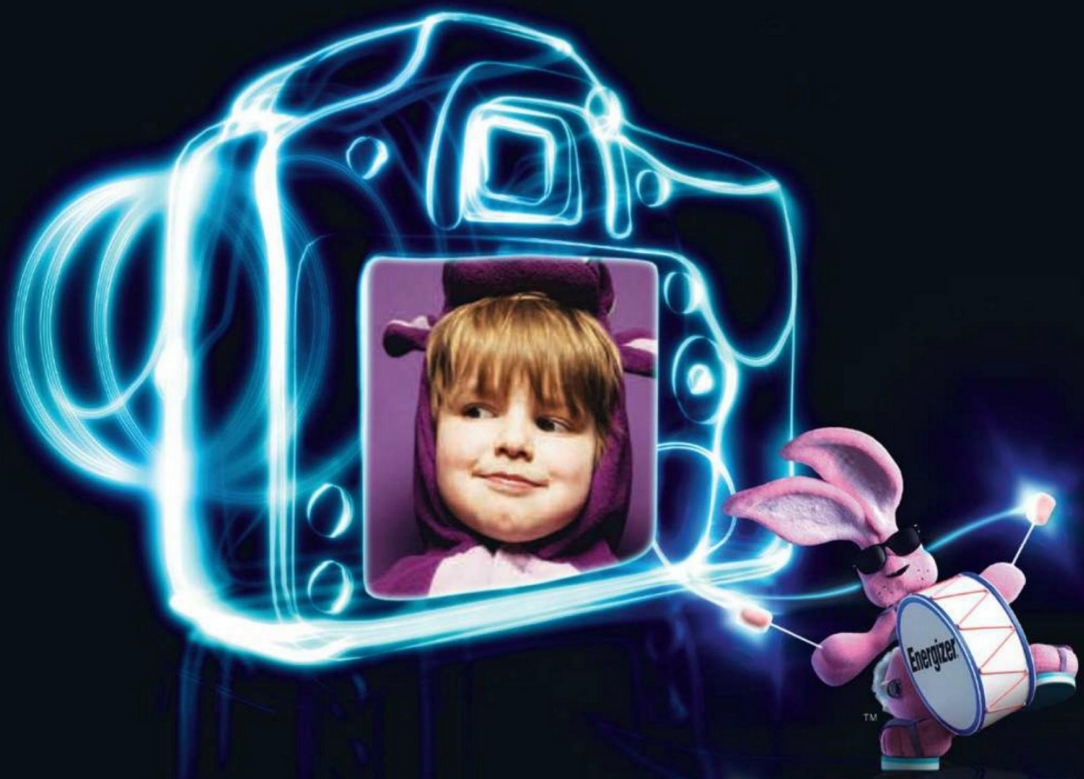

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