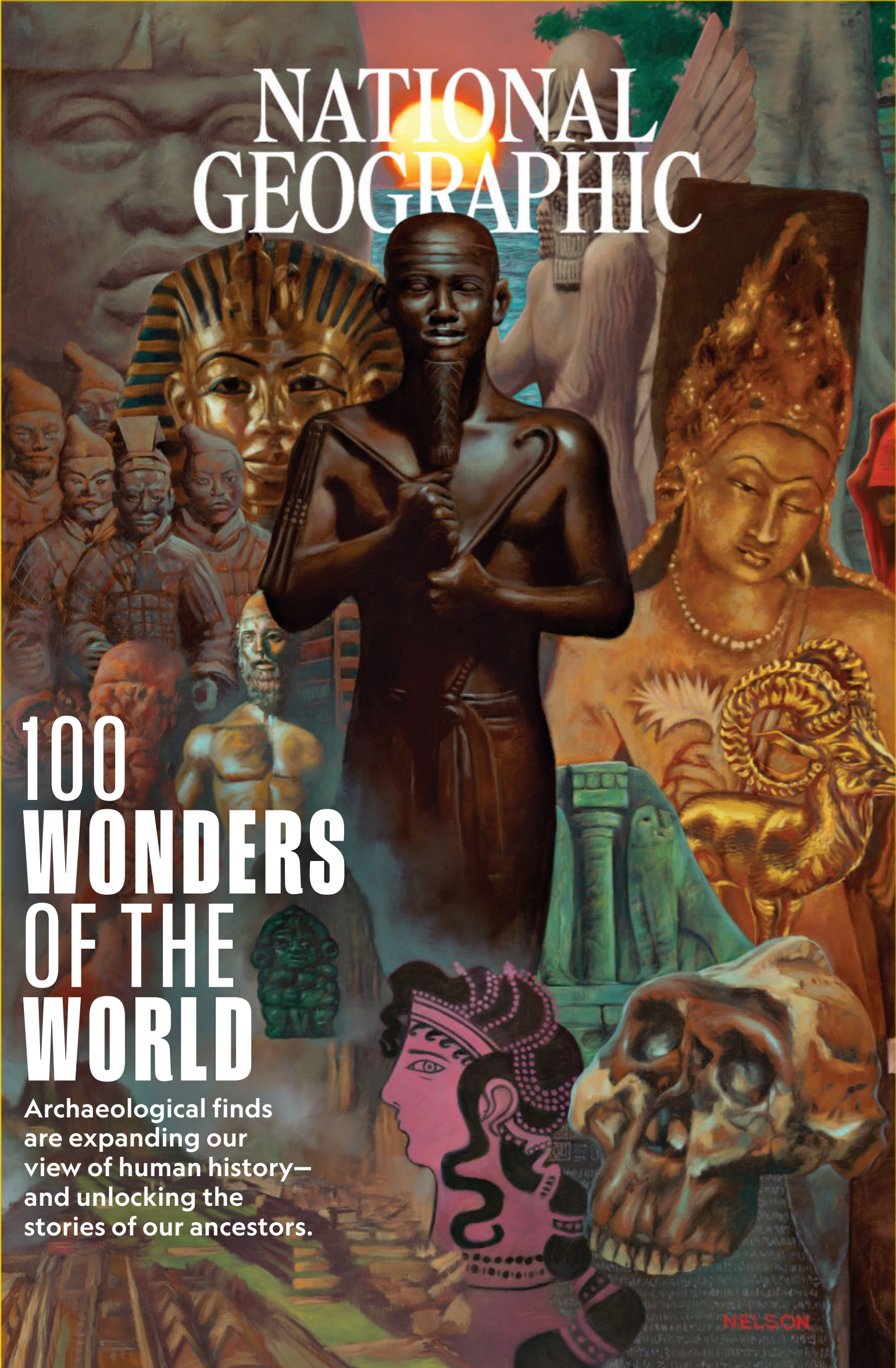


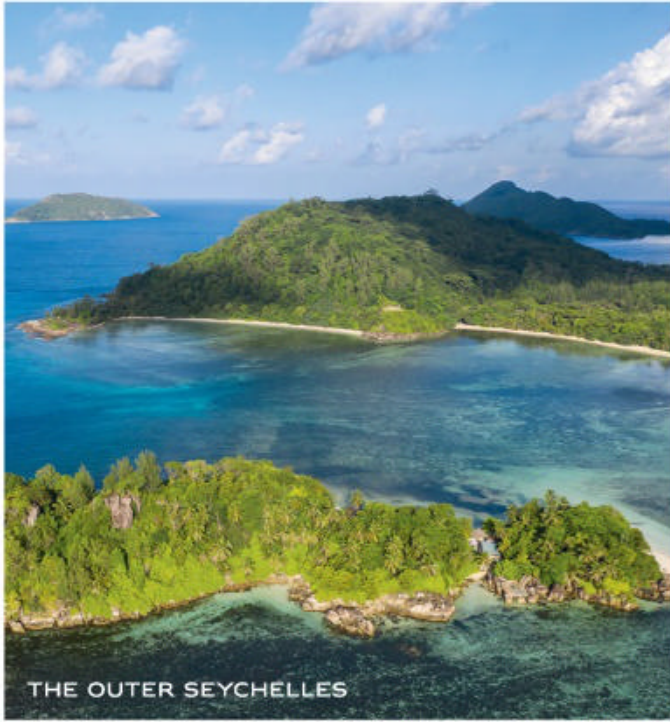
NATIONAL GEOGRAPHIC



100 WONDERS OF THE WORLD

Archaeological finds are expanding our view of human history—and unlocking the stories of our ancestors.

NELSON



THE OUTER SEYCHELLES



AZORES ARCHIPELAGO, PORTUGAL



FLORIDA GULF COASTLINE, UNITED STATES



SYLVIA EARLE EXPLORES COCOS ISLAND, COSTA RICA



THERE ARE OVER 130 HOPE SPOTS GLOBALLY



SYLVIA EARLE WITH VOLUNTEERS, THE OUTER SEYCHELLES



GREAT BARRIER REEF, AUSTRALIA



MOBULA RAYS, AZORES ARCHIPELAGO, PORTUGAL



SEA LION, GALAPAGOS, ECUADOR



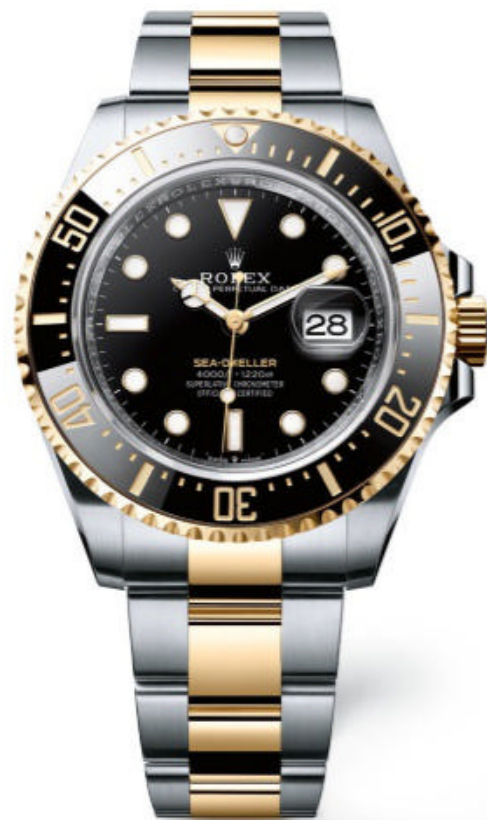
ON OUR WATCH

Hope can now be spotted across all our planet's seas and oceans. Sites are made into aquatic havens by local communities, to safeguard the richness and diversity of the ecosystems they depend on. Sylvia Earle's invaluable experience as an explorer and marine biologist continues to help further their goal, through her organisation, Mission Blue. Together, they have created over 130 Hope Spots and counting. Carrying a message of hope for generations to come.

It is that vision, that dedication to a perpetual planet, which we are proud to stand by.

For as long as it is needed.

#Perpetual

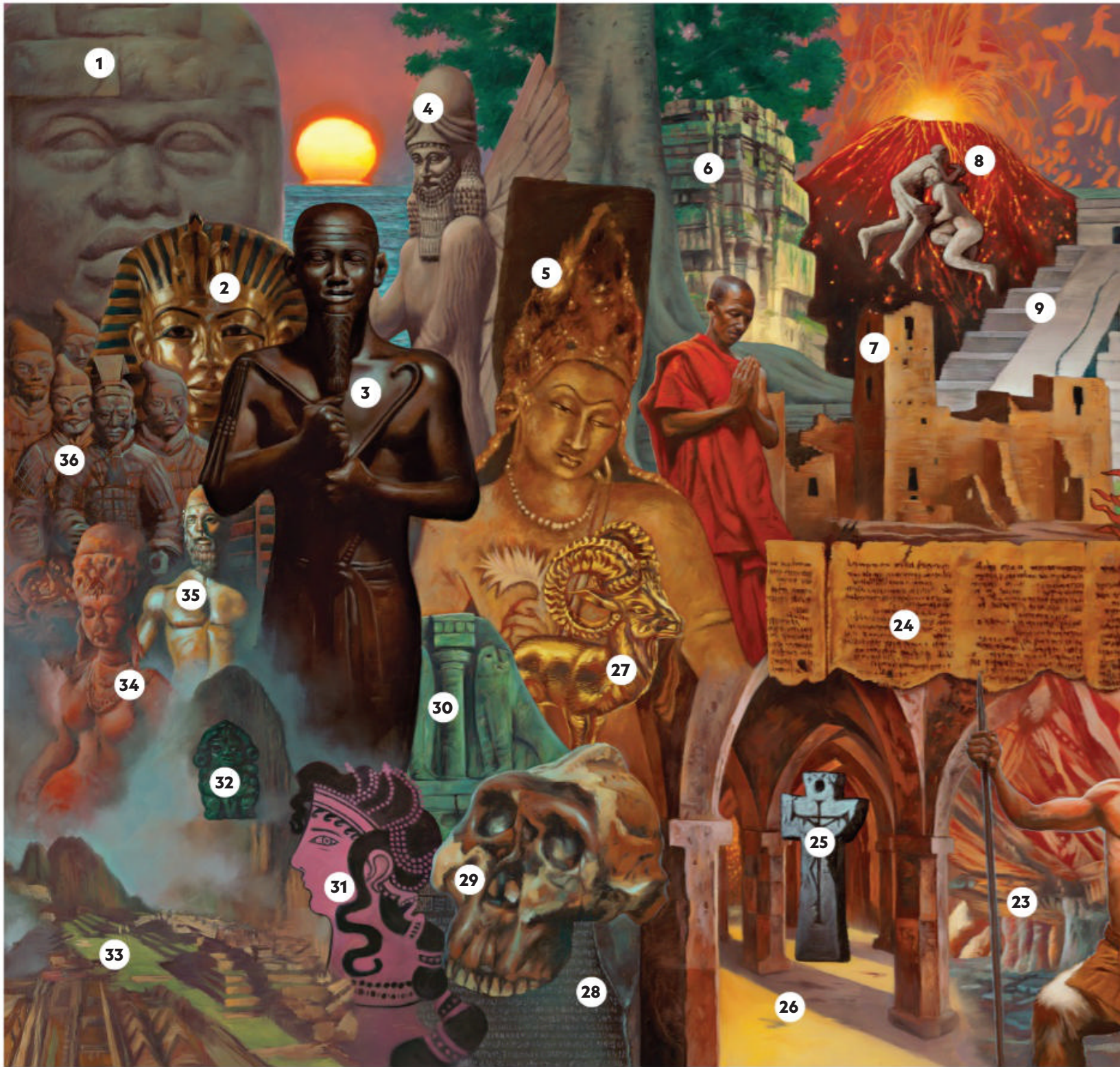


OYSTER PERPETUAL
SEA-DWELLER



ROLEX SUPPORTS MISSION BLUE
IN ITS COMMITMENT TO PROTECTING
30% OF THE OCEANS BY 2030





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A photographer's adaptation of Antoine de Saint-Exupéry's book reimagines *The Little Prince* as a nuanced look at Andean culture.

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Dr. Fauci: His Life and Work

In interviews with *National Geographic*, Anthony Fauci tells what has shaped him: from childhood in Brooklyn to serving seven U.S. presidents.

CLOSER LOOK

The Lost River of Paris

Conservation efforts aim to bring back the historic Bièvre.

BY MARY WINSTON NICKLIN

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- Color Perception in Fish
- A New Human Species?
- Animals in Space
- Mozambique Makeover
- Tips for Reducing Waste
- Feather Forensics Lab



On the Cover: An expanded version of Kadir Nelson’s painting depicts finds from the book *Lost Cities, Ancient Tombs: 100 Discoveries That Changed the World*.

1. Olmec colossal head; Mexico
2. King Tut mask; Egypt
3. Nubian pharaoh; Sudan and Egypt
4. Neo-Assyrian relief; Iraq
5. Art from Ajanta; India
6. Angkor Wat; Cambodia
7. Mesa Verde cliff dwellings; Colorado, U.S.
8. Destruction by Mount Vesuvius; Italy
9. Chichén Itzá; Mexico
10. Nebra sky disk; Germany
11. Great Pyramid of Khufu; Egypt
12. Stonehenge; England
13. Petroglyphs; Utah, U.S.
14. Lapita cemetery; Vanuatu
15. Moai; Easter Island
16. Nok terra-cottas; Nigeria
17. Sutton Hoo helmet; England
18. *Titanic*; Atlantic Ocean
19. Cave paintings; France
20. *Clotilda*; Alabama, U.S.
21. Kublai Khan fleet; Japan
22. Ötzi the Iceman; the Alps
23. Aboriginal rock art; Australia
24. Dead Sea Scrolls; West Bank and Israel
25. Jamestown crucifix; Virginia, U.S.
26. Great Mosque of Kilwa; Tanzania
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28. Rosetta stone; Egypt
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31. Knossos palace; Greece
32. Maya jade ornament; Honduras
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34. Relief, Ellora Caves; India*
35. Riace bronze; Ionian Sea
36. Terra-cotta warriors; China

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100 Wonders of Archaeology

Discoveries such as the cave art of Lascaux and the tomb of King Tut have yielded remarkable secrets dating as far back as 3.7 million years ago. From the new National Geographic book *Lost Cities, Ancient Tombs*, see the finds that changed history. INTRODUCTION BY ANDREW LAWLER P. 40

A War on Itself

In Tigray, Ethiopia, civilians have become the target of conflict. BY LYNSEY ADDARIO AND RACHEL HARTIGAN PHOTOGRAPHS BY LYNSEY ADDARIO P. 82

An Icy World Melts

The Antarctic Peninsula is an ecosystem in peril. BY HELEN SCALES PHOTOGRAPHS BY THOMAS P. PESCHAK P. 100

A Journey’s Lessons

Partway through his 24,000-mile walk around the world, a writer realizes the power of remembering. And he wonders who among the thousands of people he has met is “best equipped to survive—if not master—the challenges of our uncertain age.” BY PAUL SALOPEK PHOTOGRAPHS BY JOHN STANMEYER P. 122

*ART FROM THE ELLORA CAVES IS MENTIONED IN THE *LOST CITIES, ANCIENT TOMBS* BOOK, BUT IT IS NOT ONE OF THE 100 WONDERS CITED IN THE BOOK OR IN THE GRAPHIC ON PAGES 51-4 OF THIS ISSUE.

THE OUT OF
EDEN WALK

At a Purposeful Pace Through Our World

BY SUSAN GOLDBERG PHOTOGRAPH BY JOHN STANMEYER

PAUL SALOPEK IS nearly halfway through the most improbable hike imaginable: He is taking a 24,000-mile walk around the world, retracing our ancient ancestors' journey out of Africa to the tip of South America. So far, he's been on the road for nearly nine years, trying to see what might be learned about our frenetic world by experiencing it one step at a time.

"My aim has been simple," the two-time Pulitzer Prize winner explains in this issue. "To foot-brake my life, to slow down my thinking, my work, my hours. Unfortunately, the world has had other ideas. Apocalyptic climate crises. Widespread extinctions. Forced human migrations. Populist revolts. A mortal coronavirus." And earlier this year, in addition to all that, he walked into Myanmar—and straight into a coup.

The National Geographic Society has been the principal funder since the start of what Paul named the Out of Eden Walk. This issue's essay is the 10th feature by Paul that the magazine has published during the walk, along with his hundreds of dispatches for *National Geographic.com*.

Paul has written repeatedly about battlements and fortresses he has passed, vestiges of history's wars. They may have been strong enough to block out enemies, he notes—but they also locked in "intolerance, anti-rational purges, and, ultimately, stagnation."

Paul paints everyday scenes in moving detail. At a truck stop in Djibouti where Somalis offered red tea, "I was surely the most privileged walker within a thousand miles," he recalls. "Yet these men, who had left comrades dead of thirst in the desert, spooned my sugar for me as if I were the starveling."

And he writes of refugees—refugees



everywhere, of all nationalities, an army of the displaced. In Jordan, he talks with families picking tomatoes that they share with him. At every turn he sees Syrians—no surprise, given that some 6.6 million have fled their strife-torn country.

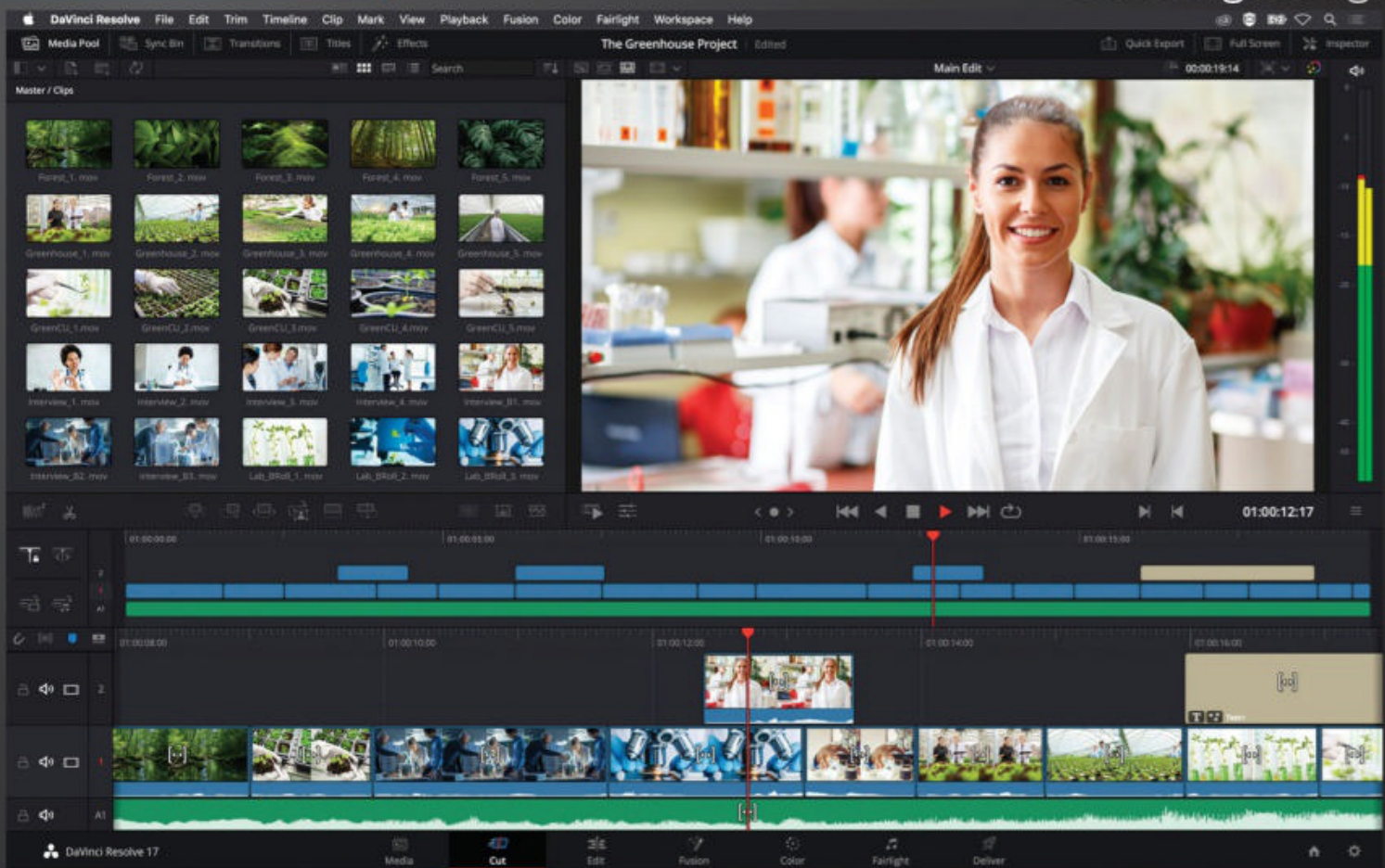
I glimpsed the refugee crisis, briefly but unforgettably, when I met up with Paul on the walk for a few days in 2014. In Şanlıurfa, in southern Turkey, distraught Syrians told us of their longing for their homeland and their certainty they would never see it again.

Often in the company of our extraordinary photographer John Stanmeyer, Paul Salopek is documenting the planet in a way no other journalist has. We're proud to publish his work and to share his insights about how we can navigate through our troubled century.

Thank you for reading *National Geographic*. □

What did Paul Salopek do after walking for more than 15 miles through the Qizilqum Desert of Uzbekistan—one of the most difficult passages of the Out of Eden Walk up to that point? He prepared a meal of hay for his donkey, Mouse.

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In this recasting of the story, main character Warawar Wawa—a cosmic name in the Aymara language—climbs in Bolivia’s Valley of the Moon, sporting a Barcelona soccer jersey. River Claire plays with symbols, local and global, to forge a nuanced Andean identity.

P R O O F

NATIONAL GEOGRAPHIC

VOL. 240 NO. 5



CHILD OF THE STARS



LOOKING
AT THE
EARTH
FROM
EVERY
POSSIBLE
ANGLE

PHOTOGRAPHS BY
RIVER CLAIRE

With both whimsy and weight, a photographer reimagines the classic story *The Little Prince* through an Andean lens.



Warawar Wawa walks through a metaphorical rose garden, where buds blossom from the braids of Indigenous Andean women known as *cholitas*, dressed in pollera skirts.



Like the little prince's beloved rose on Asteroid B-612, Warawar Wawa's rose is one of many. Even so, Claire says, Warawar Wawa will always consider his rose unique.



A decorative whip—sometimes carried by Andean community leaders as a symbol of authority—snakes around a cactus near the Bolivian town of San Cristóbal. The object embodies the power of the serpent in Warawar Wawa's quest to return home.



Viewing the world through virtual reality goggles, a *yatiri* (“one who knows” in Aymara, often a spiritual leader) represents the geographer. Here, Claire asks what’s lost when we obscure our senses and what’s gained by embracing our cultural roots.

THE BACKSTORY

A PHOTOGRAPHER'S TAKE ON *THE LITTLE PRINCE* POSES BIG QUESTIONS ABOUT CULTURE AND IDENTITY.

ONE DAY ON A WHIM, photographer River Claire googled “Bolivia.” That image search yielded expected tropes of his country: llamas, mountains, people in traditional dress. Photographs are often taken through an exoticizing foreign gaze, as if Andean cultures are frozen in time, Claire says. In reality, the cultures are evolving and thriving in today’s changing world.

Later, Claire thought more about this—how the images affected his view of himself, of his homeland—as he read the English version of Antoine de Saint-Exupéry’s *Le Petit Prince*. Then he began to question: What if one of history’s most widely read children’s books unfolded not in the Sahara desert but in the Andes Mountains? And what if the story’s main character, rather than a blond prince, was a dark-haired Andean child?

In *The Little Prince*, we see the world through fresh eyes. It’s a story that celebrates childhood and play; Claire

played with the story itself. He was inspired by how Bolivian sociologist Silvia Rivera Cusicanqui encourages people to reframe mixed cultural identities by embracing *ch’ixi*. In this concept—from Aymara, a language spoken across the Andes—weavers overlay strands of black and white thread to create the illusion of a third color, gray. Globalization has created “new gradations of identity,” Claire says. His visual lexicon juxtaposes Andean symbols with global ones, and asks viewers to see beyond the clichéd folkloric representations of the Andes.

In Aymara there’s no direct translation for the word “prince.” Claire renders the story’s title as *Warawar* (star) *Wawa* (child), an artistic interpretation he feels captures the spirit of the book, embodies the spirituality of the Andes—and leaves Eurocentric notions behind. Through his lens, Claire transforms the little prince into a child of the stars. —SARA A. FAJARDO



Warawar Wawa takes flight in a desert of salt, not sand, in Bolivia’s Uyuni salt flats.

EXPLORE

IN THIS SECTION
New Human Species?
Animals in Space
Lost River of Paris
Feather Forensics



ILLUMINATING THE MYSTERIES—AND WONDERS—ALL AROUND US EVERY DAY

NATIONAL GEOGRAPHIC

VOL. 240 NO. 5

Dr. Fauci: His Life and Work

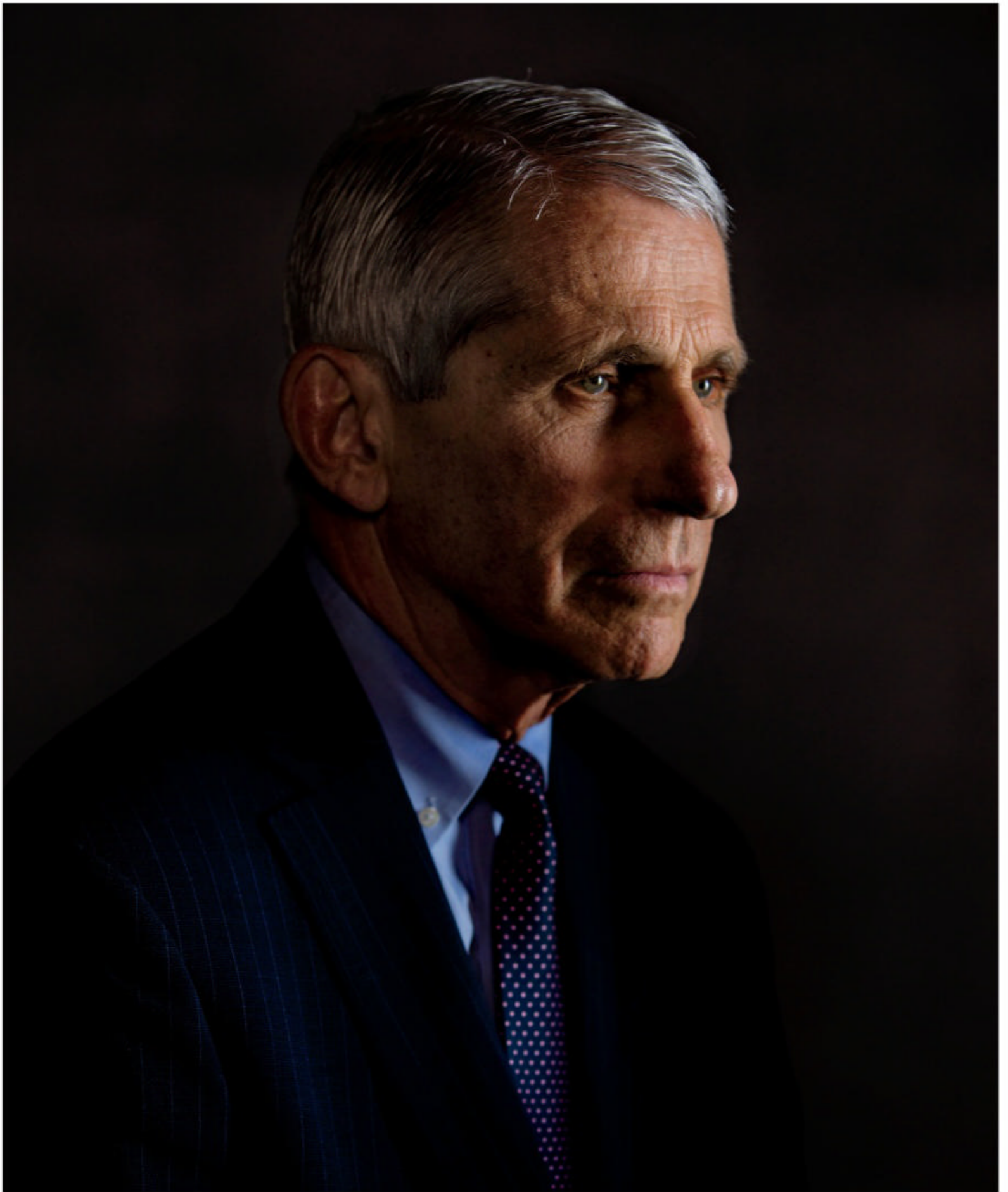
NATIONAL GEOGRAPHIC INTERVIEWED ANTHONY FAUCI ABOUT HIS PERSONAL HISTORY, HIS CAREER, AND HIS ROLE IN HEALTH CRISES FROM HIV/AIDS TO COVID-19. THE RESULTS: A BOOK (EXCERPTED HERE), WITH PROCEEDS TO BENEFIT CONSERVATION, AND A DOCUMENTARY.

I

Excerpts from the National Geographic book *Fauci—Expect the Unexpected: Ten Lessons on Truth, Service, and the Way Forward*

I WAS BORN ON Christmas Eve, 1940. As my father tells the tale... the obstetrician who was taking my mother through her pregnancy happened to have been at a black-tie cocktail party. And when my mother went into labor, apparently it was pretty quick. My father brought her to Brooklyn Hospital, and he remembers the doctor walking in with a tux on. He had to get into the delivery room very quickly, so he just washed his hands and put the scrubs over the tux... We always joked about it at home: Just how much had he had to drink before he actually came in to deliver me?

Anthony Fauci was almost five years old in 1945 when the United States detonated atomic bombs over the cities of Hiroshima and Nagasaki, unleashing catastrophic damage and spurring Japan's surrender to the Allies.



That moment when I saw my mother reading the *New York Daily News* with the big picture on the front page of the devastation in Hiroshima was a memorable moment for me. I had played war games as a child, where the good guys were the GIs and the bad guys were the Japanese, and when I saw the destruction in Japan, I thought, Wow, hey, that's great.

But I saw in my mother something that puzzled me at first... Many decades later I still remember that scene in the living room in our apartment in

Brooklyn. I can picture my mother sitting on the couch looking at the paper and me looking over her knee. She was really sad. That was a defining moment, understanding that you can feel empathy toward people who are very different from you—even people who might officially be the enemy.

We lived above my father's pharmacy. I would deliver prescriptions on my bicycle around the neighborhood, and my sister would help out behind the

counter. I had a Schwinn bicycle with a basket up in front, and I used to do it for tips. You would zip around the neighborhood, park your bike, knock on the door, deliver, and they would give you a 25-cent tip. That was a big tip!

You'd meet different people, and I got an appreciation of what illness was—you knew they were ill from the way they looked. That was my first introduction to illness and medicine. And helping out in the store, I got a better perspective of the family unit because we all worked together.

Fauci spent his early childhood in the Bensonhurst section of Brooklyn, New York, in a neighborhood he describes as “99.9 percent Italian American.” All four of his grandparents had emigrated from Italy via Ellis Island, then moved from the Lower East Side of Manhattan to raise their families in Brooklyn, where Fauci's parents met and married.

In the summer, when the windows were open, the smells were everywhere—mostly tomato sauce and sausages being cooked. And it was just something that becomes part of you. Whenever I happen to smell that now, decades and decades and decades later, it's an immediate flashback. It puts me right on 79th Street and New Utrecht Avenue, and you just can't escape it. There was a certain feeling of freedom—fresh air and sunshine and being outdoors on the streets of Brooklyn. It was the safest place in the world to be because all of the storekeepers would be sitting down with their little chairs in front of their shops, watching the kids go by. No one would in their wildest dreams imagine trying to intimidate any of these kids because the entire neighborhood was kind of like a protective squad. We felt perfectly secure all the time. It was an extremely happy childhood.

Fauci attended the prestigious Regis High School in Manhattan and went on to Holy Cross, an all-male college in Worcester, Massachusetts. By then, he already knew he was on a pathway to becoming a doctor.

In college I worked every single summer in construction as what's called a mason tender, who helps a bricklayer (you carry the cement, you carry the bricks, you clean up). I already knew then I wanted to go to Cornell's medical school, and it was just by happenstance that I got picked to work on the construction of the Samuel J. Wood Library at the medical school, right on York Avenue and East 69th Street in New York City. One day I decided I would get up the courage to go inside.

When the other construction guys sat down for lunch on the wall, whistling at the nurses going by, I walked up the steps and walked in. I looked into the auditorium, and I remember saying to myself, Wow, this is amazing. All of a sudden, the security guard who's standing at the door comes over to me, a big guy. He says, “Can I help you, sonny?” Sonny. He called me sonny.

I say, “Oh, I'm just looking around here.”

He says, “You got concrete all over your boots. Why don't you just step outside?” I looked at him, a little bit indignant. I said, “Someday I'm going to be a student in this medical school.”

He looked at me with a straight face and he says, “Yes, sonny. Someday I'm going to be police commissioner of New York City.”

But a year later I was a student there.

When you're a physician, it's just as important to know human nature as it is to know human physiology. The most important thing in the care of a patient is *caring* for the patient. You've really got to care about them as a person, not as a statistic or as somebody that you're going to bill or somebody that's one of a number of people.

Let me give you a personal example of the kinds of dramatic evolutions and changes that can occur totally beyond your control and that can profoundly impact the direction of your career and your life.

In 1968 I finished my medical training in internal medicine at the New York Hospital-Cornell Medical Center. That very same year, noted public health scholars... were opining and even testifying before the United States Congress that with the advent of antibiotics, vaccines, and public health measures, the war against infectious diseases had been won, and we should focus our efforts on other areas of research and public health.

As fate would have it, at that time I was on my way to begin, of all things, a fellowship for training in infectious diseases at the National Institutes of Health. I remember reflecting as I drove from New York City to the NIH in Bethesda, Maryland, with the words of the wise pundits resonating in my mind, that I felt somewhat ambivalent about my career choice, to say the least. Was I entering into a disappearing subspecialty? I sort of felt like I was going to Miami to become a ski instructor.

Fortunately for my career, but unfortunately and sadly for the world, even surgeons general are not always correct. Indeed, 13 years later, in 1981, the AIDS epidemic had emerged and transformed my professional career, if not my entire life.

You must be prepared at any moment to enter uncharted territory, to expect the unexpected, and where possible, seize the opportunities.

Fauci was working as one of the leading researchers on immunology and autoimmune diseases at the National Institutes of Health in 1981 when an unidentified infectious disease came onto his radar. The scientific publication Morbidity and Mortality Weekly Report (MMWR), published by the Centers for Disease Control and Prevention, reported that five gay men from Los Angeles with no apparent underlying illnesses had developed a very rare pneumonia called Pneumocystis pneumonia.

I was sitting in my little office on the 11th floor of the NIH Clinical Center on a hot summer day, the first week in June, when I saw the report. I had been studying drugs that suppressed the immune system, and we were seeing *Pneumocystis* cases. So I said, “There’s something strange going on here,” and put it into my desk drawer.

One month later, on the fifth of July of 1981, another *MMWR* appears on my desk. This time, 26 men. Amazingly, all gay men. Not only from Los Angeles, but from San Francisco and New York, who not only had *Pneumocystis* pneumonia but had Kaposi’s sarcoma: a tumor, a cancer seen in people whose immune system is dramatically damaged.

I remember looking at that and going, Oh my God, this is a brand-new infectious disease. I actually got goose bumps. I had no idea what the cause of the infection was, but I did know it destroys the immune system. As a physician/scientist trained in infectious diseases and immunology, if ever there was the disease that was made for me, it’s this.

I made a decision then that I was going to completely change the direction of my research. I had been extremely successful in my career, and my mentors, the people who recruited me here years ago, told me I was crazy. They said, “Why are you throwing away a promising career to go chasing after a disease that’s a fluke?” I decided that I was going to do it anyway. I felt obliged to explain it to the world.

Unfortunately, it turned out that I was right. It exploded into one of the most extraordinary pandemics in the history of our civilization.

Homophobia was clearly pervasive at the outbreak of AIDS. Because I was spending most of my time with sick gay men, I would see homophobia in society—and by association as their physician be on the receiving end of homophobic attacks.

I don’t think I ever had any element of homophobia or even any inkling of that in me. I think it gets back to my parents and their tolerance for other people. Empathy was a big component of my growing up in the family in which I grew up—and again, it was solidified and underscored in the training, in Jesuit training in high school and in college.

I have always felt an empathy towards people who were being treated unfairly, as well as the unfairness of the prejudice against a person whose sexual persuasion is beyond their control. It’s just who they are. The injustice of that dominated my attitude about what homophobia was and is. It made me angry to see people have that attitude. It made me a defender of someone’s right to be who they are.

My optimism is that there are going to be bad actors and there are going to be better angels. But I think there are more better angels than bad actors.

I’m really not afraid of very many things. But what I’m most concerned about is not getting the opportunity



From top: A 1940s photo shows young Anthony Fauci with his parents, Eugenia and Stephen, and his sister, Denise; a 1984 photo shows Fauci working at the National Institute of Allergy and Infectious Diseases.

to finish the things that I started decades ago and to add the finishing touches. I would like to see the defining public health challenge of my professional career, HIV, ended as an epidemiological pandemic. Everyone thought... we could cure or eradicate AIDS. And that turned out to be very difficult and could actually be impossible. I don’t think we’re going to eradicate HIV—in fact, I know we’re not—but I think we can almost eliminate it gradually throughout the world. First in countries that have more resources, like the developing countries, but then, ultimately, in sub-Saharan Africa... My fear is that I may not necessarily see that. But I hope I do. And I think I will.

Fauci’s work at the NIH made him uniquely prepared to face the coronavirus pandemic: He had already worked on treatment and prevention efforts for the Zika virus, Ebola, anthrax, pandemic flu, HIV, tuberculosis, and others. But he’s acutely aware of the public’s short memory. We say we learn from experience, but how can we make sure that’s really true?

I think when you get further and further away from a really profoundly defining event, the impact of that just attenuates. In 1918, during the Spanish flu

pandemic, my father was eight years old. I'm sure the horror of that year and a half influenced him as he got into his teenage years and his 20s and his 30s. And then it probably got less and less, but he never forgot it.

For those of us like myself who only read about it as a vague story in a history book, it doesn't have the same impact of being there yourself or being intimately connected with someone who experienced it...

World War II ended when I was five years old. The people who came back from the war and the experience they had could never be translated to people 40 years later: What do you mean you were in a place where you invaded an island and 10,000 of your friends got killed?

I don't think not understanding is a failing. It's just the way life is. Unless you're connected with something directly, it doesn't mean much to you. The COVID-19 epidemic is like nothing we have experienced in the past 102 years. Let us not forget that we were not as prepared as we thought we were or as we should have been. So let's get to being able to say, "Never again. We're never going to let this happen again." What I'm afraid of as we get out of this is that it's going to be five years from now, 10 years from now, and people are just going to either forget or not care how this outbreak completely gripped the world. They're going to forget.

And I say this with a little bit of despair: that we've always been aware of health disparities. We're always aware that African Americans and Hispanics get the short end of the stick when it has to do with diseases. And their disproportionate burden with COVID-19 now is staring us right in the face.

Let us make a commitment that in the next three or four decades, we're going to do something about that. Sounds great. But five years from now some other problem is going to come along, and we're going to forget about COVID-19.

I have worked with seven presidents over the course of 11 terms. I learned from the very beginning, you're doomed to failure if you are afraid of not getting asked back, if you're afraid of saying something that's going to get somebody upset. Nobody wants the president of the United States to be upset with you.

During the Trump administration, every once in a while, I would say something that they didn't like, and then I would be off television for a week or so. But I would always come back. I didn't want to lose that. I didn't want to lose the direct messaging to the American public.

Donald J. Trump and I kind of liked each other. I don't know... maybe it was the having-New-York-in-common thing... And we developed, as I think both of us have described, an interesting relationship, a good relationship. But more than once, as we would get into the press conferences, I would have to fine-tune something that he said. That seemed to be surprisingly OK until things started to get a little bit more tense. And yet when I would see him two days

Fauci, on page and screen



The documentary film *Fauci* explores the life and career of America's top infectious disease expert. From National Geographic Documentary Films, it's now streaming on Disney+.



Available November 2 where books are sold, *Fauci—Expect the Unexpected: Ten Lessons on Truth, Service, and the Way Forward* is a book drawn from interviews for the documentary film.

later in the Oval Office, it was like we were buddies again. I don't think he had a deliberate, malicious disdain for science. I think he just didn't think it was important. It's not even disdain; it's a disregard...

I felt my job was to do whatever I can to get us out of this outbreak. So, leaving was not an option. The only option I had was to take the chance, right in that venue, to contradict him. I could either keep quiet, which would be violating my own principles, or leave, which would have meant I can't do any good anymore. I felt the only way I could maintain scientific integrity was to speak up.

It was clear that my message to the American public was contrary to his message, so he allowed the legions around him to try and undermine my credibility. On the other hand, he had this interesting, complicated relationship with me, and I really don't think he wanted to hurt me. I think he was torn by the fact that, deep down, he knew that what I was saying was true. He liked me, but what I was saying was unacceptable to him.

One of the things that still completely baffles me is the lack of acceptance by some people in this country that COVID is a problem. There are people who think that this is a hoax, that this is some made-up thing for one reason or another, when the facts are staring us right in the face. That tells me that we have some fundamental lesions in this country that need to be addressed and healed. I know that people who are feeling that way are looking at me and saying I'm the crazy one. But I'm sorry, I have to call you on this. That's crazy to think that this is not real.

I hope that if historians look back at what I've done in my life, they see a life of commitment to having a positive impact on society. And I have had some degree of success in doing so. Maybe somebody many, many years from now goes back and reads about this and says, Hey, that guy was pretty good. □



THESE BEES BED DOWN IN BLOOMS

PHOTOGRAPH BY JOE NEELY

Where globe mallow plants bloom in the western United States, you'll often find a species of bee that shares the plant's name and taps it for food. Nature photographers Joe and Niccole Neely were walking in an Arizona field when they saw the bees' other use for the blooms: as crash pads. Globe mallow

bees don't make hives; females sleep in ground nests, males on plants. Near sunset, the Neelys saw bees enter one flower after another. "They'd just kind of crawl in and plop over," Joe says. And when one more bee alighted and saw all blooms occupied, it converted a single into a double. —PATRICIA EDMONDS

DISPATCHES FROM THE FRONT LINES OF SCIENCE AND INNOVATION



PALEOANTHROPOLOGY

WHO WAS 'DRAGON MAN'

AN UNEARTHED SKULL FROM MORE THAN 40,000 YEARS AGO MAY REPRESENT A NEW HUMAN SPECIES

NEARLY 90 YEARS AFTER it was hidden away in a cave, a stunningly preserved skull of a new human species was discovered. The artifact may represent a new human species, "dragon man" (reconstruction above). At 40,000 years old, the cranium sports a mash-up of ancient and modern features, but it's closely related to us—even more so, some researchers say. "I've held a lot of other human skulls, but never like this," says study co-author Xijun Chen at the Chinese Academy of Sciences. Yet the discovery sparks debate, with some experts suggesting it's a mysterious Neanderthal sister group representative. No matter its identity, the skull underscores that all human branches are in our human family tree.

ILLUSTRATION: CHUANG ZHAO. PHOTOS (FROM TOP): ROBBIE SHAW

Evidence of 'birth of art'?

Found at Germany's Unicorn Cave, this 2.2-inch-long piece of deer bone carved with slanted lines more than 50,000 years ago suggests Neanderthals were capable of creative expression. Archaeologist Thomas Terberger co-wrote a study of the piece; he says it shows "the start of abstract thinking, the birth of art." —ANDREW CURRY



OCEAN WARMING

More depth = less color

As seas warm, some fish are descending to cooler waters and may see less color, recent study models show. Photos below simulate what copperband butterflyfish may see at depths 66 feet apart; one researcher likens the dimming effect to "going back to the days of black-and-white TV." Reduced color perception can jeopardize a fish's critical ability to identify others—to tell prey, predator, and potential mate apart.

—HICKS WOGAN



'DRAGON MAN'?

MORE THAN 146,000 NEW HUMAN SPECIES.

At the bottom of an abandoned cave, scientists are getting its day in the sun. A new species: *Homo longi*, aka Dragon Man. At least 146,000 years old, the fossil has modern features that show it's more like modern humans than Neanderthals, some of whose skulls and fossils, but not DNA, have been found in Ni, a paleoanthropologist says. The "dragon man" is stirring up a storm. It could be a Denisovan, a species of hominid represented by scant fossils. Scientists are just how tangled the web of human evolution is.

—MAYA WEI-HAAS

PHOTO: LEONARDO STABILE, WIKIMEDIA COMMONS (BOTH)



ANIMALS IN SPACE

BY TAYLOR MAGGIACOMO AND ALEXANDER STEGMAIER

TWO SOVIET STEPPE tortoises had already flown around the moon by the time Neil Armstrong set foot on it in 1969. In fact, dozens of animals, including insects, traveled into space before humans did. In the 1940s, scientists began to explore the limits of our atmosphere. They wanted to understand if humans could survive a weightless environment and the rocket journey to get there—and

once they did, whether they'd be able to operate a spacecraft. While the research no longer involves canine cosmonauts (above), decades on, mice, fruit flies, even jellyfish continue to expand our understanding of biology in space and on Earth. The studies may one day hold the key to sending humans to the outer reaches of our solar system and to better treating earthbound diseases such as osteoporosis.

ISRAEL ▶
1 MISSION (2019)

An Israeli vessel containing tardigrades crashed on the moon during an attempted landing in 2019.



IRAN ▶
3 MISSIONS (2010-13)

As recently as 2013, Iran sent monkeys into space in a step toward developing a human spaceflight program.



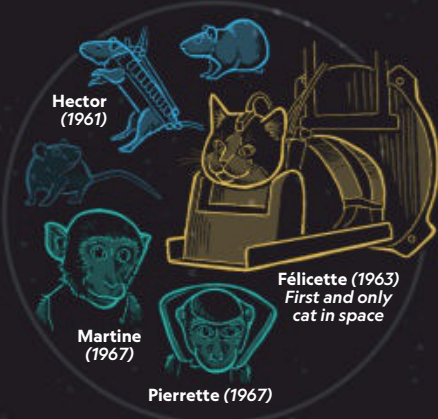
CHINA ▶
9 MISSIONS (1964-2018)

China's animal research began in the mid-1960s; efforts slowed after the Cultural Revolution ended a decade later. There's been limited public information on the space program since it was revitalized in the 2000s.



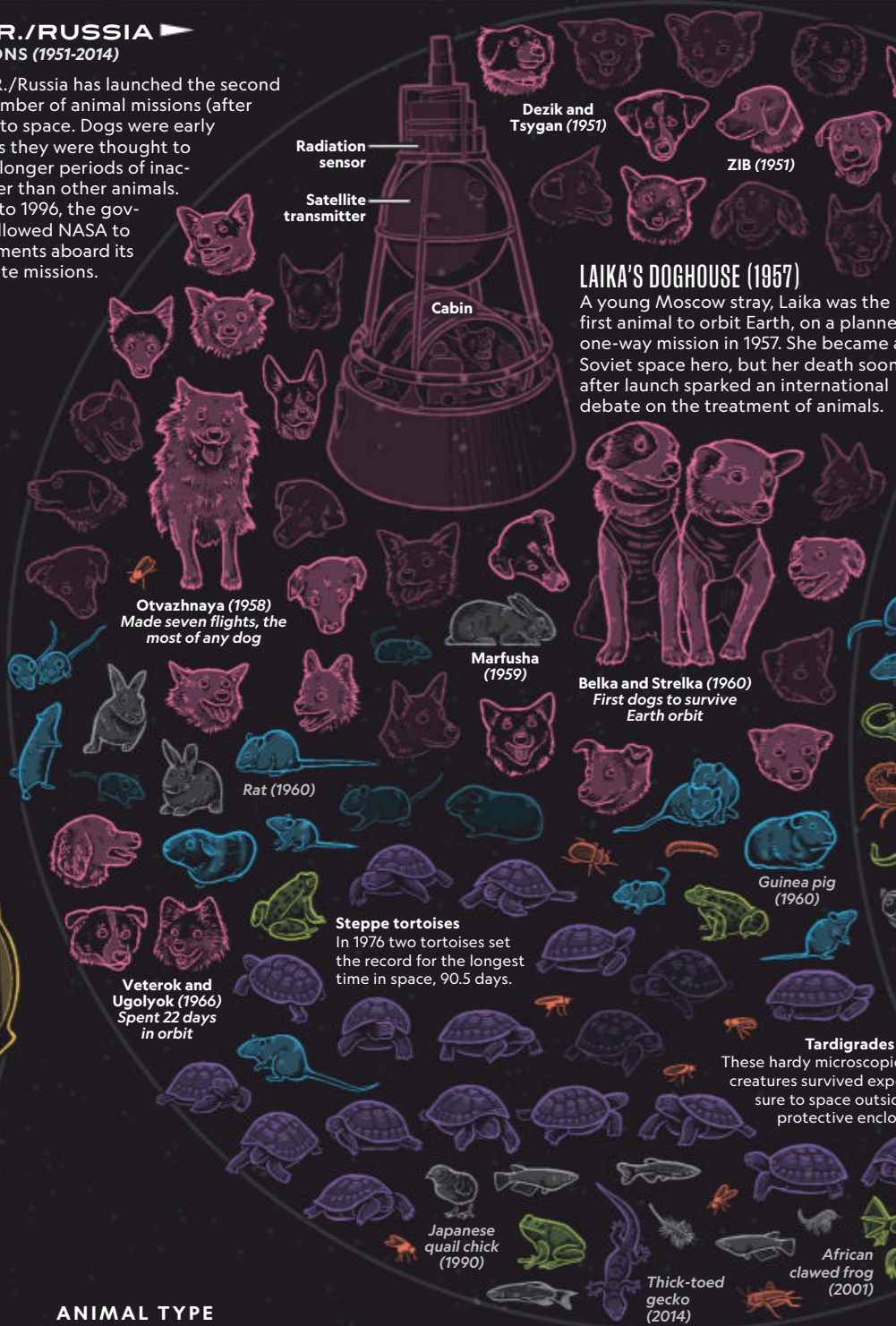
FRANCE ▶
6 MISSIONS (1961-67)

Before the European Space Agency (ESA) was established in 1975, France independently researched space travel and trained 14 cats for spaceflight. Only one successfully made a round trip, in 1963.



U.S.S.R./RUSSIA ▶
69 MISSIONS (1951-2014)

The U.S.S.R./Russia has launched the second highest number of animal missions (after the U.S.) into space. Dogs were early favorites as they were thought to withstand longer periods of inactivity better than other animals. From 1975 to 1996, the government allowed NASA to run experiments aboard its Bion satellite missions.



Dezik and Tsygan (1951)

ZIB (1951)

LAIKA'S DOGHOUSE (1957)

A young Moscow stray, Laika was the first animal to orbit Earth, on a planned one-way mission in 1957. She became a Soviet space hero, but her death soon after launch sparked an international debate on the treatment of animals.

Otvazhnaya (1958)
Made seven flights, the most of any dog

Marfusha (1959)

Belka and Strelka (1960)
First dogs to survive Earth orbit

Rat (1960)

Guinea pig (1960)

Veterok and Ugolyok (1966)
Spent 22 days in orbit

Steppe tortoises
In 1976 two tortoises set the record for the longest time in space, 90.5 days.

Félicette (1963)
First and only cat in space

Tardigrades
These hardy microscopic creatures survived exposure to space outside protective enclos

Japanese quail chick (1990)

Thick-toed gecko (2014)

African clawed frog (2001)

MICROGRAVITY LAB

Initial animal studies focused on adaptability to and logistics of travel as many nations attempted the race to space. Animals were often jettied into the sky by themselves or in small groups, some even making multiple trips. Today, genetic sequencing and our understanding of an animal's life on Earth inform which creatures are best suited for a research mission.

ANIMAL TYPE

- Primate
 - Rodent
 - Dog
 - Amphibian
 - Cat
 - Arthropod
 - Reptile
 - Other
- Died during mission
 Returned alive

EVERY KNOWN PRIMATE, DOG, CAT, AND TURTLE SENT TO SPACE IS SHOWN; OTHER ANIMALS REPRESENT MULTIPLES OF THEIR KIND, SHOWN ONCE PER MISSION. ILLUSTRATIONS ARE NOT TO SCALE.

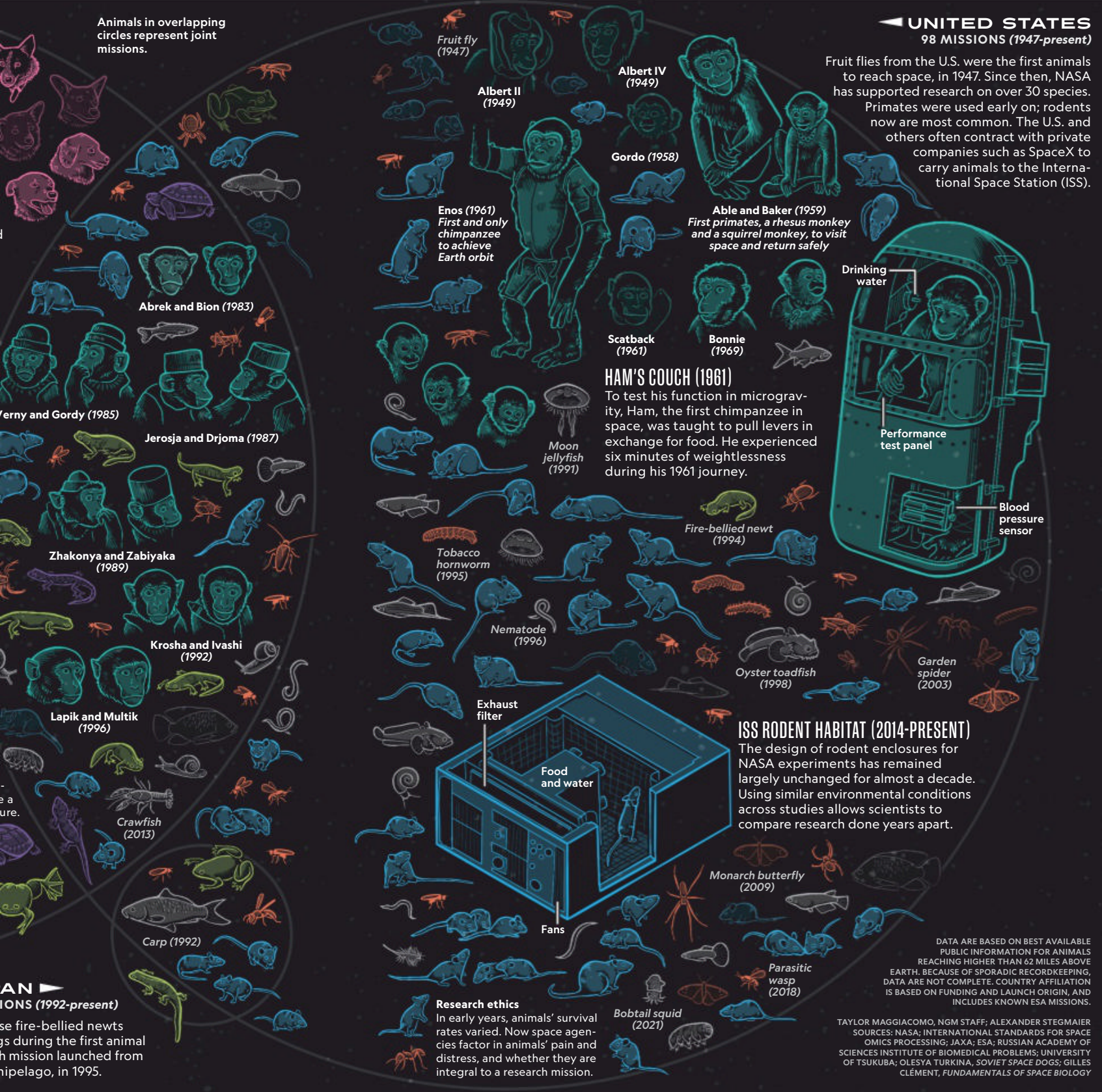
JAPANESE
5 MISSIONS

Japanese laid egg research the arch

Animals in overlapping circles represent joint missions.

UNITED STATES 98 MISSIONS (1947-present)

Fruit flies from the U.S. were the first animals to reach space, in 1947. Since then, NASA has supported research on over 30 species. Primates were used early on; rodents now are most common. The U.S. and others often contract with private companies such as SpaceX to carry animals to the International Space Station (ISS).



Fruit fly (1947)

Albert II (1949)

Albert IV (1949)

Gordo (1958)

Enos (1961)
First and only chimpanzee to achieve Earth orbit

Able and Baker (1959)
First primates, a rhesus monkey and a squirrel monkey, to visit space and return safely

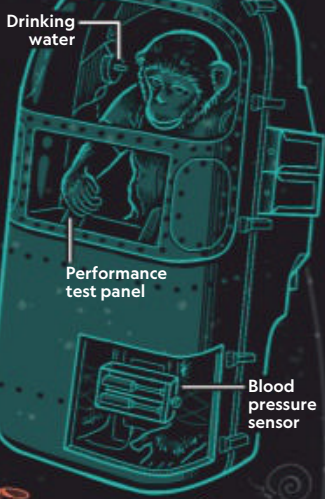
Abrek and Bion (1983)

Scatback (1961)

Bonnie (1969)

HAM'S COUCH (1961)

To test his function in microgravity, Ham, the first chimpanzee in space, was taught to pull levers in exchange for food. He experienced six minutes of weightlessness during his 1961 journey.



Moon jellyfish (1991)

Ferny and Gordy (1985)

Jerosja and Drjoma (1987)

Tobacco hornworm (1995)

Fire-bellied newt (1994)

Zhakonya and Zabayaka (1989)

Krosha and Ivashi (1992)

Nematode (1996)

Oyster toadfish (1998)

Garden spider (2003)

Lapik and Multik (1996)

Exhaust filter

Food and water

ISS RODENT HABITAT (2014-PRESENT)

The design of rodent enclosures for NASA experiments has remained largely unchanged for almost a decade. Using similar environmental conditions across studies allows scientists to compare research done years apart.



Crawfish (2013)

Monarch butterfly (2009)

Carp (1992)

Fans

Parasitic wasp (2018)

RUSSIA 10 MISSIONS (1992-present)

Use fire-bellied newts during the first animal mission launched from the International Space Station, in 1995.

Research ethics

In early years, animals' survival rates varied. Now space agencies factor in animals' pain and distress, and whether they are integral to a research mission.

Bobtail squid (2021)

DATA ARE BASED ON BEST AVAILABLE PUBLIC INFORMATION FOR ANIMALS REACHING HIGHER THAN 62 MILES ABOVE EARTH. BECAUSE OF SPORADIC RECORDKEEPING, DATA ARE NOT COMPLETE. COUNTRY AFFILIATION IS BASED ON FUNDING AND LAUNCH ORIGIN, AND INCLUDES KNOWN ESA MISSIONS.

TAYLOR MAGGIACOMO, NGM STAFF; ALEXANDER STEGMAIER SOURCES: NASA; INTERNATIONAL STANDARDS FOR SPACE OMICS PROCESSING; JAXA; ESA; RUSSIAN ACADEMY OF SCIENCES INSTITUTE OF BIOMEDICAL PROBLEMS; UNIVERSITY OF TSUKUBA; OLESYA TURKINA, SOVIET SPACE DOGS; GILLES CLÉMENT, FUNDAMENTALS OF SPACE BIOLOGY

NATURE MAKES A COMEBACK IN MOZAMBIQUE

BY MARYELLEN KENNEDY DUCKETT

GUERRILLA FIGHTERS once roamed the rugged mountains and misty forests along Mozambique's border with Zimbabwe. Now birdsong fills the air, and adventurers look for elephants, hike to waterfalls, and marvel at ancient rock art in what is one of the country's newest national parks.

Since its designation in June 2020, Chimanimani National Park has been an example of how conservation projects are working to bolster this East African country's protected wildlands.

During civil unrest from 1964 to 1992, the Chimanimani region was ravaged by poaching and sown with land mines. In recent years, illegal gold mining and slash-and-burn agriculture have destroyed habitat and degraded soil and water.

Today the park attracts scientists and public-private partnerships

determined to protect its biodiversity, which includes 76 plant and animal species found nowhere else.

Initiatives such as MozBio (Mozambique Conservation Areas for Biodiversity and Development) balance the needs of both wildlife and humans by promoting environmental awareness and sustainable economic activities—beekeeping, nature-based tourism, shade-grown coffee farming—that help reduce rural poverty in Chimanimani's border communities.

National Geographic Explorer Jen Guyton, an ecologist and photojournalist who participated in two Chimanimani biodiversity surveys, says one goal of the expeditions was training young Mozambican scientists to be conservation leaders. Says Guyton, "Their passion and their optimism give me great hope." □



PLACES OF A LIFETIME

Mozambique is one of National Geographic's Best of the World destinations for 2022. Check out the full list at natgeo.com/bestoftheworld.

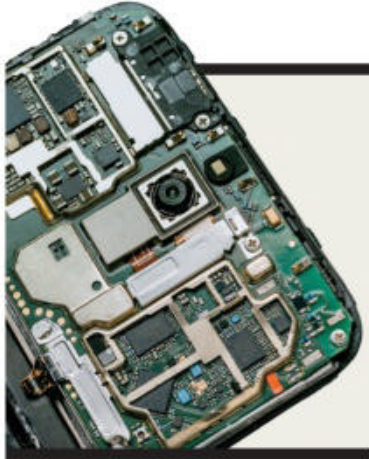
LOCAL BEAUTY

Manica sugarbush (*Protea caffra gazensis*) is found mainly in the massifs and mountains of the Chimanimani region.



PLANET POSSIBLE

For more stories about how to help the planet, go to natgeo.com/planet



1

CAN YOU FIX IT?

Rating Repairability May Reduce Replacing

Sometimes all that stands between your things and the landfill is whether they can be fixed if they break. That's why France now requires products (such as smartphones and laptops) to be labeled with a repairability score. Worldwide, the "right to repair" movement appeals to people who want the ability to service their own products, from cars to tractors to electronics, instead of buying new ones. Feel handy? Find repair guides and scores at ifixit.com.



GOT EXTRA FOOD?

COLLEGE STUDENTS ACROSS THE COUNTRY ARE COLLECTING SURPLUS CAFETERIA FARE AND DELIVERING IT TO AREA GROUPS IN NEED THROUGH THE FOOD RECOVERY NETWORK. FIND A CHAPTER OR START ONE YOURSELF: FOODRECOVERYNETWORK.ORG

Waste not! That goes for leftover cafeteria food, feathers that still fluff, and fix-it-yourself devices.

BY **CHRISTINA NUNEZ**



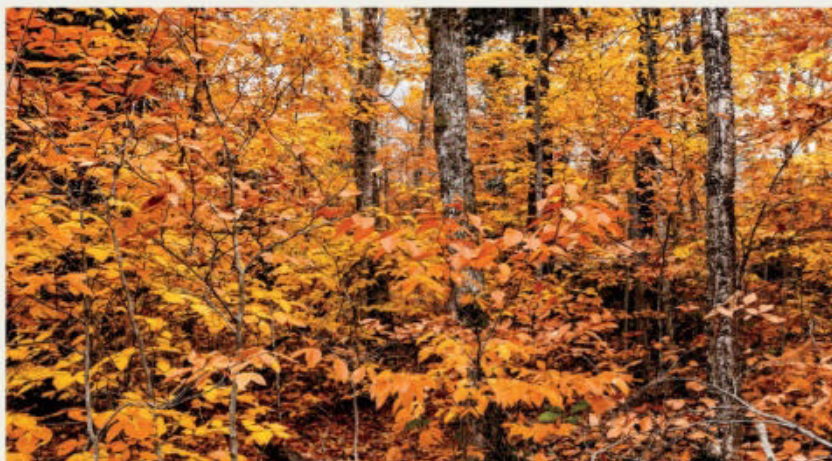
3

FLUFF FLIES AGAIN

RECYCLING DOWN YIELDS FOWL-FRIENDLY GEAR

If you're in the market for a winter jacket, keep an eye out for one with recycled down. Several retailers are gathering feathers for new products from reclaimed bedding and apparel. Longtime sustainability advocate Patagonia says the practice has markedly cut its carbon footprint related to insulation.

4



LEAVE THE LEAVES

Skip the annual ritual of raking and bagging fallen foliage. When left on the ground, autumn leaves provide shelter and food for beneficial insects and other wildlife. They can also enrich the lawn; running a mulching mower over leaves grinds them into nourishment for turf.



FORENSICS ON THE WING



PHOTOGRAPH BY REBECCA HALE

FOR MORE THAN 20 YEARS Carla Dove has run the Feather Identification Lab at the Smithsonian’s National Museum of Natural History in Washington, D.C. Her team of forensic ornithologists receives more than 10,000 avian remains a year from aircraft collisions—bird strikes—and matches them to specimens in the museum’s collections, using morphology and DNA analysis. An example: After the “Miracle on the Hudson” emergency landing in 2009, Dove’s lab ID’d the birds involved as Canada geese. By knowing what species are struck most, airfield staff can deter birds and reduce the number of damaging strikes. —HICKS WOGAN

1. Avian skull

The Smithsonian houses the world’s most diverse bird skeleton collection, including this skull of an American bittern. (See other aspects of the same species at 2 and 5.)

2. Study skin

Also in the archives are more than 500,000 bird specimens, or study skins, representing 85 percent of avian species worldwide.

3. Feather sample

Dove (that’s her hand pictured) and her team match mailed-in whole or partial feathers to study skins by color, size, or pattern.

4. Scanning electron photomicrograph

A scanning electron microscope reveals distinguishing features in downy feathers’ structures.

5. Snarge

A term for blood, guts, or other bird tissue scraped off a plane (here, an MD-10 aircraft in Miami in 2006).

6. Hand lens

This allows a close look at small birds—horned larks, mourning doves, swallows—the size most often hit.

7. Probe, forceps, scissors

These tools aid in handling feather fragments or preparing samples for study.

8. DNA sampling plate

Once a tray is filled with 96 bird strike samples, off they go for DNA testing, or bar coding.

9. Field guide

Which species live near a strike site? Alas, no book can explain some outlier IDs, such as parrots at New York’s JFK Airport.

10. Microslide supplies

Lab staff use microscopy to study a feather’s barbules (seen in 4) and barbs, the branches extending off its shaft.

11. Light microscope

Some barb traits are unique to groups of birds; with a light microscope, an expert can tell a duck from a pigeon, for example.

12. Reference microslides

The Smithsonian team can compare slides of feathers from bird strikes with slides of feathers taken from study skins in the museum’s collection.

AN ECOSYSTEM UNDER THREAT

Hong Kong's coral ecosystem is richly biodiverse, but under threat.

Without greater protective measures, Hong Kong's vibrant marine ecosystem could collapse, as two National Geographic Explorers warn.

Diving below the waves can be like entering another world, but for Hong Kong-based National Geographic Explorer Jonathan Cybulski, it is also like travelling back in time. A historical marine ecologist specializing in coral, Cybulski uncovers the stories of how underwater ecosystems have changed through time, and what can be done to reverse their decline.

"I look at coral reefs and try to set a historical baseline," says Cybulski. "What were they like in the past? How do we use that information to infer how they've changed? And what has caused that change, which—surprise!—it's usually humans. Then, how can we look at that ecosystem today and use my data to better conserve or restore it for the future?"

Having recently completed a Ph.D. in Ecology and Biodiversity at The University of Hong Kong (HKU), Swire Institute of Marine Science (SWIMS), US-born Cybulski has gained a unique insight into Hong Kong's coral ecosystem. Part of his work involves scuba diving to collect historical data, using a coring pipe

to dig deep into the seabed to extract layers of sediment containing fossils that provide a window into the past—and potentially a lifeline for the future.

As Cybulski explains, Hong Kong's coral has declined in the past few decades due to factors such as pollution and human activities. Areas that have been particularly affected in this regard include Tolo Harbour and the Ninepin Group of islands, and without greater conservation measures, some coral species could disappear from Hong Kong waters forever.

A Sustainable Future

Stan Shea, Marine Programme Director at oceanic-conservation NGO Bloom Association Hong Kong, is another National Geographic Explorer committed to safeguarding the territory's marine ecosystems. This includes raising awareness of sustainable fishing

practices and seafood consumption, from anti-shark-fin campaigns to research-focused initiatives like the "114°E Hong Kong Reef Fish Survey".

"Most people see Hong Kong as a heavily urbanized concrete jungle," says Shea, "but our location in the sub-tropics gives us incredible underwater biodiversity." However, as Shea explains, populations of many species have been decimated by decades of overfishing and habitat destruction, and a greater focus on sustainability is urgently needed



Dr. Jonathan Cybulski examines sediment samples at the SWIMS lab.

if the territory is to stand a chance of replenishing them.

Among the species that were once, but no longer, common in Hong Kong waters are the near threatened blackspot tuskfish, the endangered Hong Kong grouper and humphead wrasse, and the critically endangered Chinese bahaba (giant yellow croaker).

The city also lags far behind international standards in the provision and management of marine protected areas (MPAs), with only 5% of Hong Kong waters designated, or planned to be established, as MPAs by 2023, while fishing and vessels are banned from less than 0.01% of Hong Kong waters. WWF Hong Kong has pinpointed seven priority sites for new MPAs, including West Lantau, South Lamma, Shui Hau, Sharp Island and Shelter Island, the Ninepin Group, Tolo Channel and Harbour, and Pak Nai.

“If we continue to ignore the fragility of our marine ecosystem, and ignore the value, the wonder and the urgency for its conservation and protection, then it may soon collapse before our eyes,” says Shea.



Stan Shea and his team on a mission to chronicle Hong Kong's marine biodiversity.

Driving Change Through Awareness

Faced with such grave challenges, Cybulski and Shea insist that swift action is needed to preserve Hong Kong's marine ecosystem, and that better education is key. “The first step is to understand what we have,” says Cybulski. “Because once you understand, you'll start to care. And once you care, you'll start to protect it.”

Shea echoes this, adding that, “Through becoming educated, each person can begin to see why it's important to conserve our marine environment, and rebuild that sense of connection between our oceans and our culture, history, and identity. As

with many environmental issues, there's no silver bullet solution, and everyone has a role to play. We need to put effort every day into bringing marine conservation to the top of our agendas.”

Shining the spotlight on marine conservation, ‘Oceans Tomorrow’, produced for Swire's Trust Tomorrow Initiative by National Geographic Creative Works, is a series of articles and short films that chronicle the incredible diversity found in Hong Kong's waters, while highlighting the factors that threaten this unique ecosystem and what we can do to preserve it for future generations.

Hong Kong waters are home to a wide variety of fish species, but numbers have been in decline in recent decades due to overfishing and habitat destruction.





The Bièvre River flows through a park in the suburb of Fresnes, one of the few places it can be seen above ground.

THE LOST RIVER OF PARIS

VICTOR HUGO WROTE ABOUT THE BIÈVRE. NOW CONSERVATION EFFORTS ARE BRINGING PARTS OF THE HISTORIC WATERWAY BACK.

BY MARY WINSTON NICKLIN

A RIVER USED TO MEANDER through my Left Bank neighborhood in Paris. From the southern city limit that's now Parc Kellermann in the 13th arrondissement, the Bièvre fed mills and tanneries before its confluence with the Seine in the 5th arrondissement. But by the early 20th century, the Bièvre had become so odoriferous and polluted that it had been buried underground, its water diverted into the sewers.

Although the Seine evokes romance, the Bièvre is largely unknown to the millions of travelers who visit the French capital every year. But many Parisians have harbored a long-standing dream of resurrecting a river that, to them, has taken on mythic status. This dream is now close to becoming a reality. In recent years, sections of the river have been reopened in

upstream suburbs, and the Paris mayor's office has launched a feasibility study to look at uncovering stretches in the city. The renaissance of the Bièvre reflects a green shift in city planning. "There's new momentum for this project as we face the climate crisis, increasing heat waves, and the threat to biodiversity," says Dan Lert, the deputy mayor overseeing Paris's ecological transition, climate plan, water, and energy. "We can't continue the way we used to with urban development."

The Bièvre bubbles up from its source in Guyancourt, roughly 22 miles southwest of Paris. From this boulder-strewn stream, it snakes through the land, spilling into ponds that fed the fountains at the Palace of Versailles and hydrating a string of suburbs.



 NATIONAL
GEOGRAPHIC

SAVAGE KINGDOM



Now Streaming



A late 19th-century illustration depicts the Bièvre River rounding a bend in the Gobelins district of Paris.

Today fewer than 13 miles of this route are in broad daylight, and the river's waters are funneled into a sewage-treatment plant just outside Paris.

Historically the Bièvre has been profoundly altered by humans. Early monks channeled it for irrigation, tanners soaked animal skins, and ice cutters hacked blocks from ponds to source the city's ice supply. Competition for water access in this dirty, hard-working fiefdom soon led to conflicts between trade groups: dyers versus laundresses, tanners versus butchers. In the 1300s Parliament ordered butchers to dump animal guts in the Bièvre rather than sully the Seine, then reversed course but couldn't stop the flow of refuse. The Bièvre turned into a rancid cesspool.

Over the years the Bièvre also collected legends—some as muddied as its currents. There's the tale of Gentilia the nymph, transformed into the river by the goddess Diana to escape a Trojan soldier in hot pursuit. Then there's the dragon said to have terrified the land before Bishop Marcel banished the beast to the Bièvre in the fourth century.

Although small, the Bièvre had a mighty reputation, good and bad. The river inspired artists and writers such as François Rabelais and Victor Hugo, who referenced it in *Les Misérables*. It also became the great powerhouse of Parisian industry. The Bièvre's biggest claim to fame was the Manufacture des Gobelins, which began as a riverside dye works in the 15th century and later supplied tapestries for

the French monarchs. According to lore, something special in the Bièvre's water helped create the vivid red color that established the dyers' global reputation.

Fascination with the Bièvre has only grown since the last open-air stretches of it in Paris were covered completely in 1912. "It's a tiny river with a weak flow rate, but historically it's attracted great interest," says Alain Cadiou, a water expert and the head of the Union Renaissance de la Bièvre, a collective of 30-some nonprofits. Each of these organizations has a different focus—from promoting the river's cultural heritage to protecting the environment.

After an extensive study in 2001, Bertrand Delanoë, mayor of Paris at the time, decided that rehabilitating the ancient river was too expensive. But nonprofits alongside government coalitions in the Bièvre watershed have continued to campaign. The resulting reopening projects in the suburbs have been a victory.

The suburb of Fresnes unveiled a park in 2003—today a lush, forested area along the Bièvre and rich with wildlife. In 2016, L'Haÿ-les-Roses followed suit, reopening a 700-yard stretch of the river with a walking path tracing the newly landscaped banks. And the cities of Arcueil and Gentilly—the closest southern suburbs to Paris—will show off a joint reopening project in the Parc du Coteau-de-Bièvre in 2022.

"The Bièvre will return to the gates of Paris and once again find its confluence with the Seine," says Lert. With two million people, Paris is the most densely populated city in Europe, and urban planners have no intention of digging a canyon or tearing down buildings to uncover the river. But the Bièvre is less than 10 feet underground in open spaces such as the Square René Le Gall. Occupying the former vegetable garden of the Manufacture des Gobelins, this park is one of three spots identified for potentially reopening the river, along with Parc Kellermann and the Natural History Museum annex.

The Bièvre's renaissance isn't just a means of cooling the city, fighting global warming, and returning nature to the urban milieu. It also creates a better living environment for residents like me, who dream of walking on a greenway instead of concrete, sharing summer aperitifs with neighbors on the riverbanks once roamed by Rabelais. "The Bièvre flowed in Paris for thousands of years," says Cadiou. "It would be sensible to return it." □

Mary Winston Nicklin is a freelance writer and editor based in Paris and Virginia.

Changing Course

The river didn't always follow its current route (shown). In the early Neolithic period, the Bièvre flowed in what is now the Seine's riverbed in Paris, while the Seine curved around the hill of Montmartre. Floods and erosion allowed the Seine to seize the Bièvre's course—just as it stole the Bièvre's place in people's imagination.



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In the past year, we've learned that the impossible is possible when it comes to the resiliency of the planet. We each have an important role in protecting the planet and can accomplish more together.

WHEN PEOPLE WHO LOVE THE EARTH
COME TOGETHER,
ANYTHING IS POSSIBLE.



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FEATURES



100

‘PENGUINS ARE
IMPORTANT
SENTINELS
FOR THE WIDER
HEALTH OF
THE OCEANS.
SHIFTS IN
PENGUIN
POPULATIONS
IN THE
WATERS OFF
ANTARCTICA—
THE SOUTHERN
OCEAN—ARE
WARNING SIGNS
THAT THE
ECOSYSTEM
IS BEING
DISRUPTED.’

A photograph of several terracotta warriors from the Qin Dynasty, standing in a tomb. The warriors are made of dark, weathered terracotta and are wearing detailed armor with visible rivets and straps. They have distinct facial features and hairstyles. The background is a rough, earthen wall.

Our understanding
of **HUMAN HISTORY** has increased
dramatically during the past two centuries,
as **EXCAVATIONS** on six continents—
aided by breakthroughs in technology—
have unlocked the **STORIES**
of **OUR ANCESTORS**.

100 WONDERS OF



**Terra-Cotta
Warriors, 210 B.C.**

Buried to accompany China's first emperor in the afterlife, life-size statues of soldiers and servants were discovered by farmers in 1974. Since then, archaeologists have unearthed some 8,000 warriors, as well as horses, chariots, acrobats, and musicians.

O. LOUIS MAZZATENTA

ARCHAEOLOGY

**Tomb of a Teenage
Pharaoh, 1322 B.C.**

After archaeologist Howard Carter opened King Tut's treasure-filled tomb in Egypt in 1922, the young pharaoh became a global celebrity. His gold funerary mask, a star attraction at the Egyptian Museum in Cairo, is one of the most famous artifacts ever found.

KENNETH GARRETT







**Angkor Wat,
A.D. 802-1431**

At its height in the 13th century, the capital of the Khmer Empire was the most extensive urban site in the world. As archaeologists search for clues to the city's downfall, the temple complex in Cambodia endures as a revered religious shrine.

KIKE CALVO



BY ANDREW LAWLER

DIGGING FOR TREASURE IS AS OLD AS THE FIRST PLUNDERED GRAVE.

▼
THE URGE TO UNCOVER BURIED WEALTH has obsessed countless searchers, enriching a few and driving others to the brink of madness.

“There are certain men who spend nearly all their lives in seeking for—*kanûz*—hidden treasures,” wrote the British traveler Mary Eliza Rogers after she visited Palestine in the middle of the 19th century. “Some of them become maniacs, desert their families, and though they are often so poor that they beg their way from door to door, and from village to village, they believe themselves to be rich.”

Not all the fortune hunters whom Rogers came across were desperate vagabonds. She also encountered *sahiri*, roughly translated as necromancers, “who are believed to have the power of seeing objects concealed in the earth.” These esteemed clairvoyants, often women, entered a trance that Rogers said allowed them to describe in minute detail the hiding places of valuable goods.

Archaeology transformed those “objects concealed in the earth” from simple treasures into powerful tools that allow us to glimpse the hidden past.

At first, the fledgling science emerging in Rogers’s day differed little from old-fashioned plundering, as European colonialists competed to fill their display cabinets with ancient statues and jewelry from faraway lands. But the

Last Moments of Pompeii and Herculaneum, A.D. 79

Touring Pompeii in 1981, a group studies victims of the volcanic eruption of Mount Vesuvius that entombed two wealthy Roman towns. “Suddenly we are faced with human beings out of the dim past at their very moment of death,” wrote archaeologist Amedeo Maiuri, who was in charge of Pompeii’s excavations from 1924 to 1961. “Some show an attitude of fierce struggle against their fate; others recline peacefully as though in sleep.”

DAVID HISER

new discipline also ushered in an unprecedented era of discovery that revolutionized the understanding of our species’ rich diversity, as well as our common humanity.

If this seems an exaggeration, imagine a world without archaeology. No luxurious Pompeii. No breathtaking Thracian gold. No Maya cities looming out of dense jungle. A Chinese emperor’s terracotta army would still be hidden beneath the dark soil of a farmer’s field.

Without archaeology, we would know little about the world’s earliest civilizations. Lacking a Rosetta stone, we would still puzzle over the enigmatic symbols on the walls of Egyptian tombs and temples. The world’s first literate and urban society, which flourished in Mesopotamia, would be known only dimly through the Bible. And the



largest and most populous of these early cultures, clustered around the Indus River on the Indian subcontinent, would never have been revealed at all.

Without the systematic study of sites and artifacts, history would be held hostage by those few texts and monumental buildings that survived the vagaries of time. The immense Pacific of our past would be broken only by scattered atolls: a battered scroll here, a pyramid there.

Two centuries of excavations on six continents have given voice to a past that previously lay mostly submerged. Through recovered sites and objects, our distant ancestors—many of whom we didn't know existed—can tell their stories.



AT LEAST AS FAR BACK AS THE LAST KING OF BABYLON, more than 2,500 years ago, rulers and the rich have collected antiquities to bask in the reflected beauty and glory of previous times. Roman emperors transported at least eight Egyptian obelisks across the Mediterranean to embellish their capital. During the Renaissance, one of these pagan monuments was raised in the heart of St. Peter's Square.

In 1710, a French aristocrat paid workers to tunnel through Herculaneum, a town near Pompeii that had lain largely undisturbed since the deadly explosion of Vesuvius in A.D. 79. The unearthed marble statues sparked a craze that spread across Europe for digging up ancient sites. In the New World, Thomas Jefferson had trenches cut through a Native American burial mound not to find lucrative grave goods but to assess who built it and why.

By Mary Eliza Rogers's day, European excavators were fanning out across the globe. Few were dedicated scholars. More often than not, they were diplomats, military officers, spies, or wealthy businessmen (and they were, with very few exceptions, men) intimately tied to colonial expansion. They used their influence and power abroad to both study and steal, as they filled their notebooks and carted off Egyptian mummies, Assyrian statues, and Greek friezes for their national museums or private collections.

Fast-forward to the Roaring Twenties. The spectacular bling found in the tomb of the Egyptian king Tut and the Royal Graves of Ur captured headlines and altered the course of art, architecture, and fashion. By then, however, educated professionals had begun to grasp that the most valuable material from trenches lay not in the gold retrieved but in the data locked within broken pottery and discarded bones.

New methods of recording fine layers of soil provided novel ways to reconstruct day-to-day life. And starting in the 1950s, measuring the radioactive decay of organic matter

gave researchers their first reliable clock to date artifacts.

In our own century, archaeology increasingly is done less in the trench than in the lab. What once had little obvious worth—burnt seeds, human feces, the residue at the bottom of a pot—is the new treasure. Through careful analysis, these humble remains can reveal what people ate, with whom they traded, and even where they grew up.

Advanced techniques are even capable of dating rock art, providing insight into cultures such as those of the early Aboriginal peoples of Australia, who left behind little durable evidence. And the sea is no longer the impenetrable barrier that it had been from time immemorial, as divers gain access to shipwrecks ranging from a Bronze Age merchant vessel to the most legendary of all ocean disasters, the *Titanic*.

The single most revolutionary development of recent decades is our ability to extract genetic material from old bones. Ancient DNA has given us an intimate glimpse into how our ancestors interacted



The National Geographic Society, committed to illuminating and protecting the wonder of our world, has supported science journalist Andrew Lawler's reporting in Jerusalem and the United States.

ILLUSTRATION BY JOE MCKENDRY

with Neanderthals. It has also led to the long-lost cousins the Denisovans, as well as the tiny, rarely small people of the Indonesian island of Flores.

A host of new approaches, from satellite remote sensing to ultraviolet fluorescence, allow scientists to probe sites without putting a spade into soil or cutting up a highly valued museum object. This means that we can study sites without inadvertently wipe out data that we don't know later generations might yet recover.



ARCHAEOLOGY'S OFTEN UNSAVORY PAST continues to cast a long shadow. Not until the late 20th-century movement to repatriate ill-gotten foreign artifacts, from the Elgin Marbles to the Benin Bronzes, gained momentum. For centuries, American and European archaeologists train or promote Indigenous archaeologists. Even after the colonial empires crumbled, there were few researchers with the experience to carry on. Those who struggle to do so often are hindered by limited resources, and development pressures. One of the great ancient Buddhist centers, Mes Aynon, in Afghanistan has been threatened by looters, rocket attacks, and a government plan to mine the site, which sits atop a massive deposit of copper. In August it fell under Taliban control.

The past is a nonrenewable resource, and its loss is bulldozed or ransacked is a global loss. It is a loss today that local communities are an essential part of maintaining the health and well-being of nature, as parks and wildlife preserves. The same goes for the ancestors left behind.

The destruction that has afflicted sites in Southeast Asia, East and Central Asia is all the more terrible because impoverished villagers often have little stake in their heritage. Threats to this heritage include idol-smashing, terrorism, as al Qaeda and the Taliban, as well as the loss of looted artifacts. Peace and prosperity are hard to come by when new construction destroys ancient sites.

Despite daunting setbacks, there is good news: We are living in a second golden age of archaeology—despite its colonialist trappings and racist assumptions.

An influx of women and Indigenous researchers is revitalizing the field, while archaeologists (and other scientists in other disciplines. They are charting the past through the ages with the help of climate scientists, working with chemists to trace the ancient spread of substances as marijuana and opium, and investigating

the discovery of our
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dating methods with physicists.

Recent finds, meanwhile, show the power of archaeology to radically reshape the way we relate to our past. Göbekli Tepe in Turkey, the world's oldest known temple, dating back some 12,000 years, suggests that our urge to practice communal religious rites may have spurred us to settle down and plant crops, not the other way around. Egypt's pyramid builders were not enslaved people but skilled workers who earned decent wages and drank good beer. And ancient DNA paints a jumbled and complicated tale of our ancestors' journey across the planet that can't be contained within race theories and national myths.

But archaeology's real power remains rooted in its capacity to transcend intellectual knowledge and the creeds of the moment. Uncovering what has long been hidden connects us viscerally to our vanished ancestors. In that moment when an excavator brushes away the dirt to reveal an ancient coin or gingerly removes caked soil from a votive statue's delicately chiseled face, the immense distances of time, culture, language, and beliefs can fall away.

Even if we are just gazing through the glass of a museum case or at the pages of a magazine, we can find ourselves closely linked to the person who shaped a pot, secured a dazzling brooch, or carried a finely wrought sword into battle. There is a haunting poignancy to those 3.7-million-year-old footprints left one rainy day on the Tanzanian savanna, as if we are present at the dawn of our own creation.

The task of archaeologists is not to find buried treasure but to resurrect the long dead, turning them back into individuals who, like us, struggled and loved, created and destroyed, and who, in the end, left behind something of themselves. □



The selections that follow are drawn from the newly published National Geographic book **Lost Cities, Ancient Tombs: 100 Discoveries That Changed the World.**

20,000 YEARS AGO FRANCE



The lifelike cave paintings at Lascaux and Chauvet represent an explosion in human creativity thousands of years ago—and show artistry that was stunningly advanced.

O

ON A SEPTEMBER AFTERNOON IN 1940, FOUR TEEN-
age boys made their way through the woods on
a hill overlooking Montignac in southwestern
France. They had come to explore a dark, deep
hole rumored to be an underground passage to the
nearby manor of Lascaux. Squeezing through the
entrance one by one, they soon saw wonderfully
lifelike paintings of running horses, swimming
deer, wounded bison, and other beings—works of
art that may be up to 20,000 years old.

The collection of paintings in Lascaux is among
some 150 prehistoric sites dating from the Paleo-
lithic period that have been documented in France's
Vézère Valley. This corner of southwestern Europe
seems to have been a hot spot for figurative art.
The biggest discovery since Lascaux occurred in
December 1994, when three spelunkers laid eyes on
artworks that had not been seen since a rockslide
22,000 years ago closed off a cavern in southern
France. Here, by flickering firelight, prehistoric art-
ists drew profiles of cave lions, herds of rhinos and

mammoths, magnificent bison,
horses, ibex, aurochs, cave bears.
In all, the artists depicted 442
animals over perhaps thousands
of years, using nearly 400,000
square feet of cave surface as
their canvas. The site, now
known as Chauvet-Pont-l'Arc
Cave, is sometimes considered
the Sistine Chapel of prehistory.

For decades scholars had the-
orized that art had advanced
in slow stages from primitive
scratchings to lively, naturalis-
tic renderings. Surely the sub-
tle shading and elegant lines of
Chauvet's masterworks placed
them at the pinnacle of that
progression. Then carbon dates
came in, and prehistorians
reeled. At some 36,000 years
old—nearly twice as old as those
in Lascaux—Chauvet's images
represented not the culmination
of prehistoric art but its earliest
known beginnings.

The search for the world's
oldest cave paintings contin-
ues. On the Indonesian island of
Sulawesi, for example, scientists
found a chamber of paintings of
part-human, part-animal beings
that are estimated to be 44,000
years old, older than any figura-
tive art seen in Europe.

Scholars don't know if art was
invented many times over or if
it was a skill developed early in
our evolution. What we do know
is that artistic expression runs
deep in our ancestry.

UNEARTHING 100 TREASURES OF THE PAST

3.7 mya-50,000 ya

Roots of our family tree
Bone fragments reveal that human ancestry is far more complex than first thought.

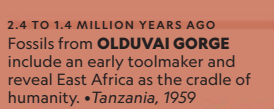
3.7 MILLION YEARS AGO*

The **LAETOLI FOOTPRINTS**, preserved in volcanic ash, prove that our earliest ancestors walked upright. •Tanzania, found in 1978



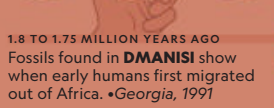
3.2 MILLION YEARS AGO

A fossilized skeleton, **LUCY**, is the most complete set of bones of those ancestors. •Ethiopia, 1974



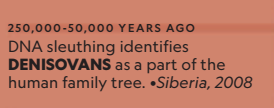
2.4 TO 1.4 MILLION YEARS AGO

Fossils from **OLDUVAI GORGE** include an early toolmaker and reveal East Africa as the cradle of humanity. •Tanzania, 1959



1.8 TO 1.75 MILLION YEARS AGO

Fossils found in **DMANISI** show when early humans first migrated out of Africa. •Georgia, 1991



335,000-236,000 YEARS AGO

An entirely new species of human, **HOMO NALEDI**, is found in a cave. •South Africa, 2013



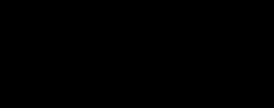
250,000-50,000 YEARS AGO

DNA sleuthing identifies **DENISOVANS** as a part of the human family tree. •Siberia, 2008



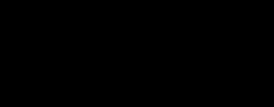
100,000-50,000 YEARS AGO

Bones of the tiny people of Flores Island are those of our **SMALLEST RELATIVES**. •Indonesia, 2003



75,000 YEARS AGO

Finds in **SHANIDAR CAVE** reveal Neanderthals cared for their sick and injured. •Iraq, 1950s



50,000 ya-3000 B.C.

The dawn of culture
Ancient storytellers begin to depict their daily lives and emerging belief systems.

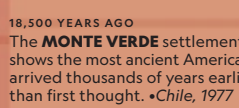
AT LEAST 30,000 YEARS AGO

Aboriginal **ROCK ART** is the world's longest continuing art form. •Australia, unknown



36,000 AND 20,000 YEARS AGO

Lifelike, Ice Age cave paintings are found at **CHAUVET AND LASCAUX**. •France, 1994 and 1940



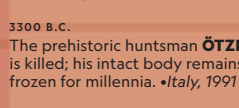
18,500 YEARS AGO

The **MONTE VERDE** settlement shows the most ancient Americans arrived thousands of years earlier than first thought. •Chile, 1977



9600 B.C.

Finds at **GÖBEKLI TEPE** suggest that it's the world's oldest temple. •Turkey, 1994



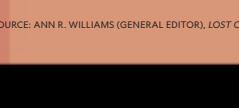
4500 B.C.

The Sumerians develop writing and urbanize the **FIRST CITY**, in Uruk. •Iraq, 1849



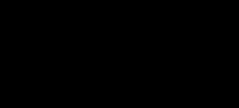
3300 B.C.

The prehistoric huntsman **ÖTZI** is killed; his intact body remains frozen for millennia. •Italy, 1991



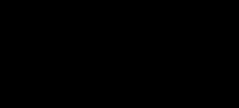
3000 B.C.

The homes and quarries of **STONEHENGE** architects are unearthed. •England, 2003



10,000-4000 B.C.

Rock art **MASTERPIECES OF THE SAHARA** depict a desert teeming with life. •Northern Africa, mid-1800s

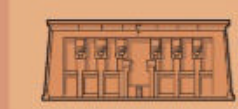


3000-1500 B.C.

The foundations of society
Nomads settle into urban areas, developing stratified social classes and division of labor.

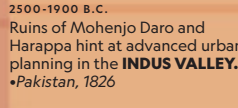
3000 B.C.

Evidence of sacrifices and funerals in **ANCIENT EGYPT** is found along the Nile. •Egypt, late 1800s



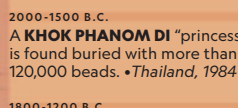
2600-2300 B.C.

Treasure is uncovered in **UR'S ROYAL TOMBS**. •Iraq, 1922



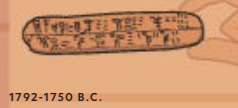
2500-1900 B.C.

Ruins of Mohenjo Daro and Harappa hint at advanced urban planning in the **INDUS VALLEY**. •Pakistan, 1826



2550-2470 B.C.

Excavations reveal the lives of those who built the **PYRAMIDS AT GIZA**. •Egypt, 1990s



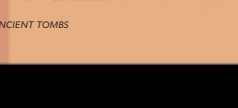
2000-1500 B.C.

A **KHOK PHANOM DI** "princess" is found buried with more than 120,000 beads. •Thailand, 1984



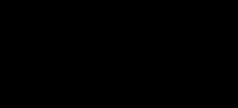
1800-1200 B.C.

KNOSSOS' CRYPTIC TABLETS tell the secrets of Minoan palace life. •Greece, 1878



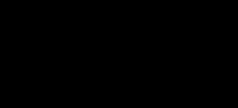
1792-1750 B.C.

The most complete list of laws from antiquity, the **LAW CODE OF HAMMURABI**, is found etched in stone. •Iran, 1901



1600 B.C.

The **RUINS OF AKROTIRI** show life at the zenith of the Bronze Age. •Greece, 1800s

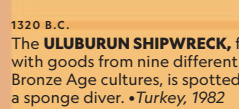


1500-1000 B.C.

Converging worlds
Civilizations become wealthy superpowers connected by trade but troubled by conflict.

1650-1200 B.C.

HATTUSHA'S WRITTEN records tell the story of the quarrelsome Hittite Empire. •Turkey, 1800s



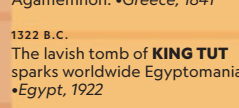
1320 B.C.

The **ULUBURUN SHIPWRECK**, filled with goods from nine different Bronze Age cultures, is spotted by a sponge diver. •Turkey, 1982



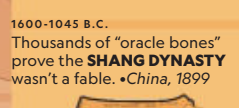
1390-1336 B.C.

CLAY TABLETS offer rare insights into ancient Egyptian diplomacy and power. •Egypt, 1887



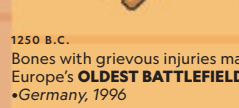
1700-1100 B.C.

Golden treasure is unearthed from **MYCENAE**, the legendary city of Agamemnon. •Greece, 1841



1322 B.C.

The lavish tomb of **KING TUT** sparks worldwide Egyptomania. •Egypt, 1922



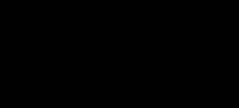
1750-1180 B.C.

An amateur archaeologist finds the **LEGEND OF TROY** is based on a real city. •Turkey, 1870s



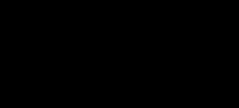
1600-1045 B.C.

Thousands of "oracle bones" prove the **SHANG DYNASTY** wasn't a fable. •China, 1899



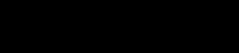
1250 B.C.

Bones with grievous injuries mark Europe's **OLDEST BATTLEFIELD**. •Germany, 1996



1000-800 B.C.

Preserved **PREHISTORIC HOUSES** of Must Farm are snapshots of daily life 3,000 years ago. •England, 1999

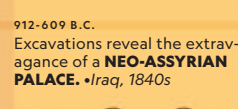


1000-500 B.C.

Ancient tribes and dynasties
Rulers conquer new territory while cementing power at home with palaces and pyramids.

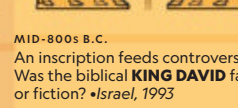
1000-750 B.C.

A **LAPITA CEMETERY** offers new clues to the peopling of the Pacific. •Vanuatu, 2003



912-609 B.C.

Excavations reveal the extravagance of a **NEO-ASSYRIAN PALACE**. •Iraq, 1840s



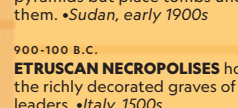
MID-800s B.C.

An inscription feeds controversy: Was the biblical **KING DAVID** fact or fiction? •Israel, 1993



1200-400 B.C.

COLOSSAL STONE HEADS carved from 10-ton basalt boulders likely honor Olmec leaders. •Mexico, 1858



730-656 B.C.

KUSHITE KINGS emulate Egyptian pyramids but place tombs under them. •Sudan, early 1900s



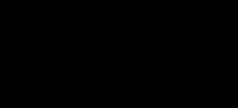
900-100 B.C.

ETRUSCAN NECROPOLISES hold the richly decorated graves of leaders. •Italy, 1500s



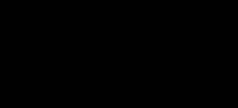
575 B.C.

Built by a fabled king, the **ISHTAR GATE** is Babylon's crowning glory. •Iraq, 1899



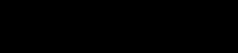
530 B.C.

A **CELTIC CHIEFTAIN** is buried like a pharaoh, bedecked in gold. •Germany, 1978



518 B.C.

Darius the Great immortalizes his reign with the **PERSEPOLIS** complex. •Iran, 1930s

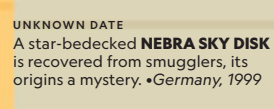


500-200 B.C.

An age of artisans
History is enshrined in art and imagery by skilled craftspeople from Greece to China and Africa.

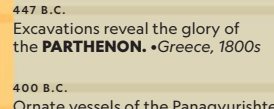
900-200 B.C.

SCYTHIAN graves hold horse-riding male and female warriors, and masterful goldworks. •Eurasian Steppe, Ukraine, and Russia, 1700s



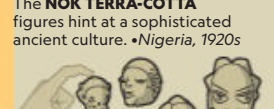
UNKNOWN DATE

A star-bedecked **NEBRA SKY DISK** is recovered from smugglers, its origins a mystery. •Germany, 1999



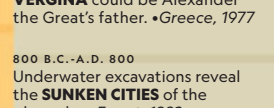
450 B.C.

Once lost at sea, the **RIACE WARRIORS** are icons of Greek sculpture. •Ionian Sea, Italy, 1972



447 B.C.

Excavations reveal the glory of the **PARTHENON**. •Greece, 1800s



400 B.C.

Ornate vessels of the Panagurishte hoard exemplify fine **THRACIAN GOLDWORKING**. •Bulgaria, 1949



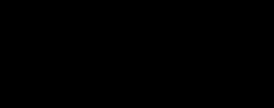
900-1 B.C.

The **NOK TERRA-COTTA** figures hint at a sophisticated ancient culture. •Nigeria, 1920s



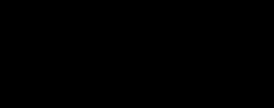
350-320 B.C.

Remains found in the **TOMBS OF VERGINA** could be Alexander the Great's father. •Greece, 1977



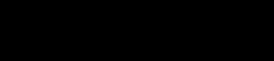
800 B.C.-A.D. 800

Underwater excavations reveal the **SUNKEN CITIES** of the pharaohs. •Egypt, 1992



210 B.C.

TERRA-COTTA WARRIORS are discovered by farmers. •China, 1974



100 B.C.

A **COMPLEX STAR CLOCK** is found in a Roman shipwreck off Antikythera island. •Greece, 1900

Centuries of sleuthing on six continents have transformed our understanding of human history. From early excavations in the ashes of Pompeii to discoveries aided by robotics or DNA sequencing, the findings shed light on our greatest mystery: Who are we, and how did we get here?

INFOGRAPHIC BY
ALBERTO LUCAS LÓPEZ
AND EVE CONANT
ILLUSTRATIONS BY
MATTHEW TWOMBLY

200 B.C. - A.D. 75

Rituals and religion

Fragile scrolls and preserved bodies are evidence of the growing roles of community and faith.

196 B.C.

Scripts on the **ROSETTA STONE** lead to the deciphering of ancient hieroglyphs. •Egypt, 1799

PREDOMINANTLY 800 B.C.-A.D. 400 Naturally **MUMMIFIED BODIES** found in bogs may have been victims of ritual sacrifice. •Northern Europe, 1800s



100 B.C. AND A.D. 790

Two sets of **MAYA MURALS** showing battles and celebrations are found in jungle pyramids. •Guatemala, 2001, and Mexico, 1946



300 B.C.-A.D. 100

The **DEAD SEA SCROLLS** reveal long-hidden biblical history. •West Bank and Israel, 1947-present

A.D. 50

Silk Road riches are found in the **TOMBS OF TILLYA TEPE**. •Afghanistan, 1978

22 B.C.

Divers explore King Herod's **CAESAREA MARITIMA** harbor. •Israel, 1800s

500 B.C.-A.D. 700

The **NASCA LINES** etched into the desert may have been ritual routes to beg for rain. •Peru, 1920s



A.D. 72-73

STANDOFF AT MASADA: Tragedy haunts a desert fortress from Roman-era Israel. •Israel, early 1960s

A.D. 75-600

Tombs and temples

Pyramids, treasure-laden tombs, and ambitious cities immortalize power, culture, and tradition.

300 B.C.-A.D. 700

Water-savvy Nabataeans carve a city of stone, **PETRA**, in the desert. •Jordan, 1812

79

A volcanic eruption encases the thriving Roman towns of **POMPEII AND HERCULANEUM** in ash—and in time. •Italy, late 1500s and 1709

250

A royal tomb of the **MOCHES** is found untouched. •Peru, 1987

100 B.C.-A.D. 900

The city of **COPÁN** showcases the Classic age of the Maya. •Honduras, 1839

100 B.C.-A.D. 650

The pre-Hispanic Mesoamerican city **TEOTIHUACÁN** is built to align with the stars. •Mexico, 1675

345

The purported **TOMB OF JESUS CHRIST** is opened for the first time in centuries. •Israel, 2016

200-800

The Buddhist complex of **MES AYNAK** is recognized as an archaeological gem, yet one under myriad threats. •Afghanistan, 1963

EARLY 400S

The **MOSAICS OF HUQOQ**, including depictions of Noah's Ark, are found under a synagogue's floor. •Israel, 2011



200 B.C.-A.D. 650

Buddhist carvings and frescoes are found hidden in the **CAVES OF AJANTA**. •India, 1819

EARLY 600S

A ship burial at **SUTTON HOO** reflects Anglo-Saxon wealth and power. •England, 1939

A.D. 600-1000

Surprises and mysteries

New societies emerge and expand, leaving behind more questions than answers.

700-1000

Gold artifacts shine new light on a little-known **GOLDEN CHIEFS** culture. •Panama, 2010

820

A farmer finds a priceless Viking burial, the **OSEBERG SHIP**. •Norway, 1903



800-1000

ANDEAN TREASURES are found in a tomb of the mysterious Wari people. •Peru, 2012

300-1300

The Fremont people carve a **PETROGLYPH CANYON**, then disappear. •U.S., late 1920s



936

Surveys unmask the grandeur of the Moors' **MEDINA AZAHARA**. •Spain, 1910

1000

L'ANSE AUX MEADOWS proves the Vikings were the Americas' first Europeans. •Canada, 1961

PEAK 800-1000

Mud-brick ruins of **JENNE-JENO** help rewrite West African history. •Mali, 1977

900-1600

Massive carved faces speak to remote **EASTER ISLAND'S** enigmatic past. •Oceania, 1722



A.D. 1000-1200

Great builders

Architects of the past construct temples, pyramids, and cliffside refuges from unknown dangers.

802-1431

In one of the largest cities ever built, **ANGKOR WAT** flourishes deep in a jungle. •Cambodia, 1500s



800-1200

The Maya's **CHICHÉN ITZÁ** holds links to the underworld and the cosmos. •Mexico, mid-1800s

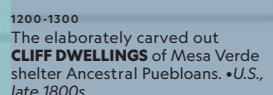
1000-1400

Lidar, light-detection technology, is providing the latest clues to Mesoamerica's **LOST CITY OF THE MONKEY GOD**. •Honduras, 2012



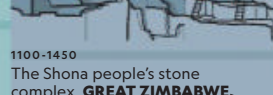
1050-1200

The ancient, agrarian Mississippian culture builds the first metropolis, the **CAHOKIA MOUNDS**, in what is now the U.S. mainland. •U.S., early 1800s



1200-1300

The elaborately carved out **CLIFF DWELLINGS** of Mesa Verde shelter Ancestral Puebloans. •U.S., late 1800s



1100-1450

The Shona people's stone complex, **GREAT ZIMBABWE**, inspires the name of a country. •Zimbabwe, late 1800s

800-1500

Excavations reveal the vast trade networks of **SWAHILI CITY-STATES**. •East Africa, 1960s

A.D. 1200-1600

Sovereigns and citizens

An era of sweeping empires reveals the different lives of rulers and their subjects.

1200-1600

LONDON'S BONES: A construction boom unearths the bones of thousands of forgotten Londoners. •England, 2000s

1000-1400

Dense, wet soil in **NOVGOROD** preserves everyday medieval correspondence. •Russia, 1951



1281

The drowned fleet of **KUBLAI KHAN** testifies to a failed Mongol invasion. •Japan, 1981



1325-1521

A buried Aztec pyramid, **TEMPLO MAYOR**, holds no sign of a feared leader. •Mexico, 1914

1400s

The royal retreat of **MACHU PICCHU** is hidden high in the Andes. •Peru, 1911

1100-1600

Carefully concealed manuscripts reveal **TIMBUKTU** at its peak. •Mali, 1960s

1500

FROZEN MUMMIES from Inca sacrifices lie undisturbed for some 500 years. •Peru, 1995

1545

The shipwreck of the **MARY ROSE** gives a portrait of life on King Henry VIII's favorite ship. •England, 1836



A.D. 1600-present

A changing world order

New finds, many aided by modern technology, help rewrite even recent history.

1250-1500

The **AMAZON** rainforest is a thriving network of villages and large-scale, ritual landscape designs, or geoglyphs. •Amazon Basin, unknown

1607

Artifacts and human remains found at **JAMESTOWN** tell a dark tale of desperation and cannibalism in the legendary colonial settlement. •U.S., 1994



1600s

Warming earth exposes a rich **INDIGENOUS HISTORY** in Alaska. •U.S., 2012

1692

An earthquake sinks the pirate haven of **PORT ROYAL** in the Caribbean. •Jamaica, late 1950s

1860

America's last slave ship, the **CLOTILDA**, is set ablaze after its illegal journey but found by underwater archaeologists. •U.S., 2019



1864

The sunken Confederate submarine **H. L. HUNLEY** is found after 130 years. •U.S., 1995



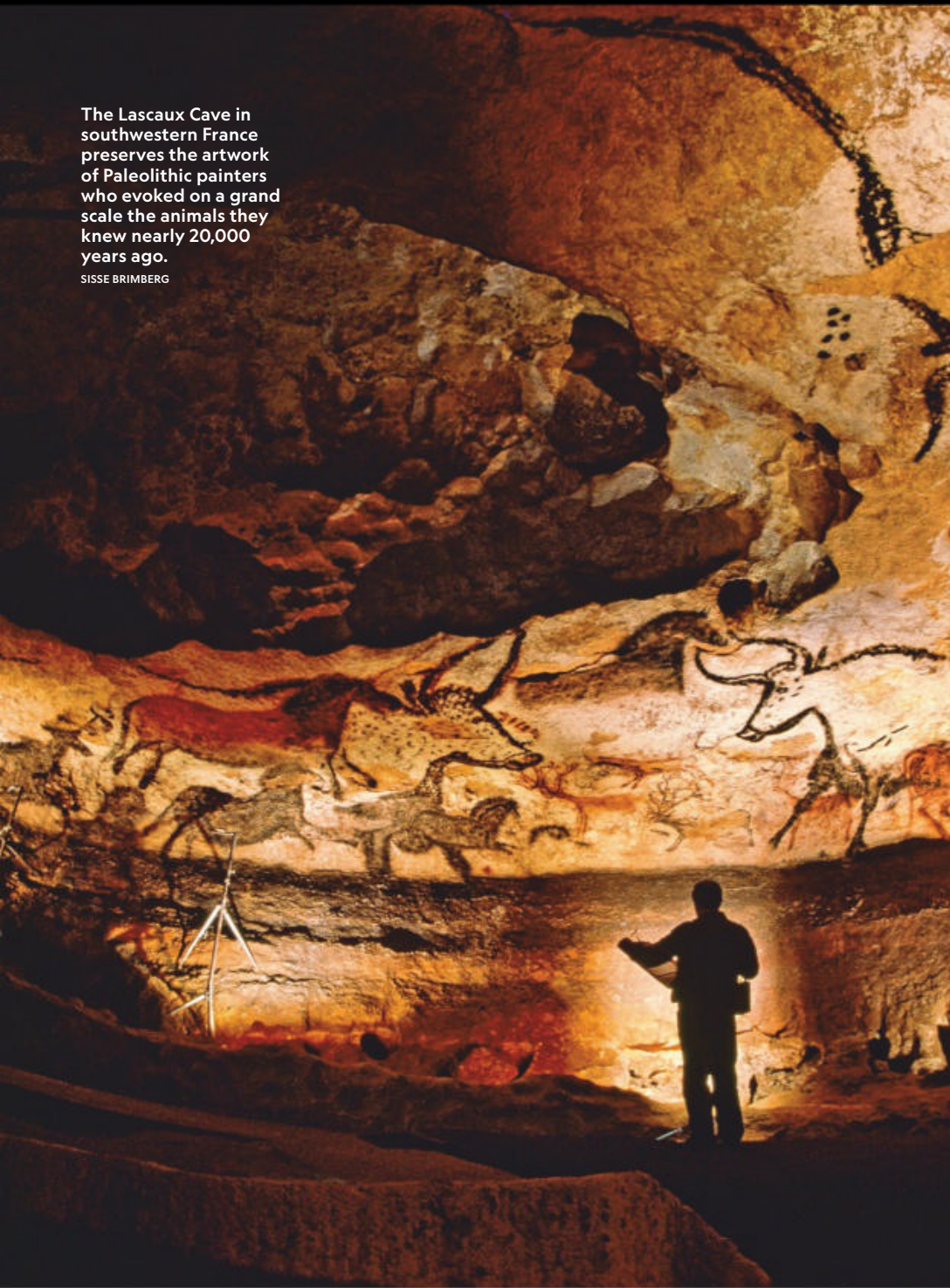
1912

Drowned on its maiden voyage, the **TITANIC** is found with the help of robotic submersibles. •Atlantic Ocean, 1985



The Lascaux Cave in southwestern France preserves the artwork of Paleolithic painters who evoked on a grand scale the animals they knew nearly 20,000 years ago.

SISSE BRIMBERG



CIRCA 3300 B.C. ÖTZTAL ALPS, ITALY



Frozen in time under a glacier in the Alps, this Neolithic hunter felled by a foe's arrow about 5,300 years ago is the oldest intact human ever discovered.

I

IN 1991, HIKERS HIGH IN THE MOUNTAINS ON ITALY'S BORDER with Austria discovered a mummified body protruding from a glacier. Little did they suspect that this "iceman" was a time traveler from the Copper Age. Indeed, further investigation revealed that the 5,300-year-old Ötzi the Iceman—named for the Ötztal Valley near his death site—is the oldest intact human ever found. "Not since Howard Carter unlocked the tomb of King Tutankhamun in the early 1920s had an ancient human so seized the world's imagination," wrote mountaineer and author David Roberts.

Over the ensuing three decades, scientists have used an array of high-tech tools, including 3D endoscopy and DNA analysis, to examine the iceman and refine his biography in exquisite detail. What at first appeared to be a tale of a solitary Neolithic hunter overtaken by the elements has morphed into a riveting murder mystery.

He was in his mid-40s, a rather elderly man for his time. He suffered from worn joints, hardened arteries, gallstones, advanced gum disease, and tooth decay. While these health factors made his life uncomfortable, they did not kill him.

In 2001, a radiologist x-rayed Ötzi's chest and detected a stone arrowhead, smaller than a quarter, lodged beneath the left shoulder blade. The forensic evidence became even more intriguing in 2005, when new CT scan technology revealed that the arrowhead, probably flint, had made a half-inch gash in the iceman's left subclavian artery. Such a serious wound would have been almost immediately fatal. The conclusion: An attacker, positioned behind and below his target, fired an arrow that struck Ötzi's left shoulder. Within minutes, the victim collapsed, lost consciousness, and bled out.

For all the answers that scientists have found about the iceman, many questions still remain. At the top of the list: Who killed this prehistoric hunter, and why?

ICE AGE ARTISTS

In a lab in Bolzano, Italy, scientists use an endoscope to view a lethal arrowhead lodged in the shoulder of Ötzi, the prehistoric

iceman. The arrow's shaft was broken, suggesting Ötzi struggled to extract it or that his killer tried to remove it. Scientists

also examined Ötzi's stomach contents. The hunter's last meal was a greasy, filling repast of ibex and grain.

ROBERT CLARK



ÖTZI THE ICEMAN



730-656 B.C. SUDAN AND EGYPT

THE BLACK PHARAOHS

A Sudanese camel driver, wearing a white turban and a white robe, is riding a white camel. The camel is facing left. In the background, there are several large, ancient pyramids made of stone blocks, set against a clear blue sky. The scene is set in a desert environment with sandy ground and some scattered rocks. The lighting suggests it is either early morning or late afternoon, with long shadows and a warm glow.

Sudanese camel drivers pass the 2,000-year-old tombs of Nubian kings and queens at Jebel Barkal. Nubian kings ruled over ancient Egypt for about 75 years, reunifying the country and building an empire.

ENRICO FERORELLI

In a long-ignored chapter of history, kings from a land to the south conquered Egypt, then kept the country's ancient burial traditions alive.



IN THE YEAR 730 B.C., A MAN NAMED PIYE DECIDED THE ONLY way to save Egypt from itself was to invade it. The magnificent civilization that had built the Pyramids at Giza had lost its way, torn apart by petty warlords. For two decades Piye had ruled over his own kingdom in Nubia, a swath of Africa located mostly in present-day Sudan. But he considered himself the rightful heir to the traditions practiced by the great pharaohs.

By the end of a yearlong campaign, every leader in Egypt had capitulated. In exchange for their lives, the vanquished urged Piye to worship at their temples, pocket their finest jewels, and claim their best horses. He obliged them and became the anointed Lord of Upper and Middle Egypt.

When Piye died at the end of his decades-long reign, his subjects honored his wishes by burying him in an Egyptian-style pyramid at a site known today as El Kurru. No pharaoh had received such entombment in more than 500 years.

Piye was the first of the so-called Black pharaohs, the Nubian rulers of Egypt's 25th dynasty. Over the course of 75 years, those kings reunified a tattered Egypt and created an empire that stretched from the southern border at present-day Khartoum all the way north to the Mediterranean Sea.

Until recently, theirs was a chapter of history that largely went untold. "The first time I came to Sudan, people said, You're mad! There's no history there! It's all in Egypt!" says Swiss archaeologist Charles Bonnet. But he and other modern researchers are now revealing the rich history of a long-ignored culture. Archaeologists have recognized that the Black pharaohs didn't appear out of nowhere. They sprang from a robust African civilization in a land the Egyptians called Kush that flourished on the southern banks of the Nile as far back as the first Egyptian dynasty, around 3000 B.C.





LEFT

About two inches tall, an amulet found in a Kushite queen's tomb is topped with a golden head of the Egyptian goddess Hathor.

ABOVE

Skilled goldsmiths created masterpieces such as this breastplate pendant of the goddess Isis, which lay across the mummy of a Nubian king entombed at Nuri.

KENNETH GARRETT (BOTH)

The Egyptians didn't like having such a powerful neighbor to the south, especially since they depended on Nubia's gold mines to bankroll their dominance of western Asia. So the pharaohs of the 18th dynasty (1539-1292 B.C.) sent armies to conquer Nubia and built garrisons along the Nile. Subjugated, the elite Nubians began to embrace Egypt's cultural and spiritual customs—venerating Egyptian gods, using the Egyptian language, and adopting Egyptian burial styles.

The Nubians were arguably the first people to be struck by "Egyptomania." Without setting foot inside Egypt, they preserved Egyptian traditions and revived the pyramid—a burial monument forsaken by the Egyptians centuries earlier—for their royal tombs. As archaeologist Timothy Kendall puts it, the Nubians "had become more Catholic than the pope."

In the seventh century B.C., Assyrians invaded Egypt from the north. The Nubians retreated permanently to their homeland, but they continued to mark their royal tombs with pyramids, dotting sites such as El Kurru, Nuri, and Meroë with the steep-sided profiles that characterize their interpretation of ancient Egyptian monuments. Like their mentors, Kushite kings filled their burial chambers with treasure and decorated them with images that would ensure a rich afterlife.

Little was known of these kings until Harvard Egyptologist George Reisner arrived in Sudan in the early 20th century. Reisner located the tombs of five Nubian pharaohs of Egypt and many of their successors. These discoveries, and subsequent investigations, have resurrected from obscurity the first high civilization in sub-Saharan Africa.

Extraordinary finds at the site of the ancient city of Copán in recent decades have helped archaeologists take a giant step forward in learning about the Maya.

I

IN A TUNNEL 50 FEET BELOW THE GRASSY PLAZAS OF COPÁN, an ancient Maya city in what is now Honduras, National Geographic staff archaeologist George Stuart peered through an opening in a wall of dirt and stone. There, in a hot, stuffy, earthquake-prone space, he saw a skeleton on a large stone slab. Stuart's archaeological colleagues had discovered a royal burial—most likely that of K'inich Yax K'uk' Mo', or Sun-Eyed Green Quetzal Macaw. The revered god-king, whose name appears in many of the site's hieroglyphic texts, was the founder of a dynasty that maintained the power of this Maya valley kingdom for some 400 years.

That momentous discovery was made in 1989, but Maya scholars had long recognized the enormous significance of Copán. From more than a century of research, they knew that the ruined buildings beside the Copán River served as the political and religious capital of an important kingdom before its collapse more than a thousand years ago. Early on, investigators came to realize that the section now known as the Acropolis—a roughly rectangular area that rises high above the river—served not only as the locus of some of the city's most spectacular architecture and sculpture but also as the seat of governing power during the height of the Maya Classic period, from about A.D. 400 to 850.

The rulers of Copán claimed descent from the sun and ruled by that right. They presided over a kingdom of some 20,000 subjects, ranging from farmers who lived in pole-and-thatch houses to the elite who occupied palaces near the Acropolis. As the archaeologists tunneled into the Acropolis, they came upon the most elaborately constructed and furnished tomb yet uncovered at the site. The remains of a noble lady rested on a thick rectangle of stone. She was richly attired and wore one of the most extraordinary arrays of Maya jade ever found. She was probably the wife of the founder,

A MAYA

archaeologists believe, the queen mother of the next 15 rulers of the Copán dynasty.

With the discovery of the queen's tomb, it soon became evident that this part of the Acropolis constituted a sort of axis mundi—in effect, a sacred stack of burials and buildings hallowed by the presence of one of almost unimaginable power in the eyes of the inhabitants of Copán. Given all the clues pointing to K'inich Yax K'uk' Mo', it seemed that his final resting place could not be far away. The eager archaeologists dug deeper into the complex.

Finally, behind a facade of red sun-god masks on a platform, they discovered a skeleton they believe is that of the founder himself. The king was at least 50 years old, had jade inlays in two of his teeth, and passed into the afterlife with a broken lower right arm. There were signs of other wounds, perhaps suffered in battle or from the rigors of the Maya's ritual ball game.

Burial goods in the royal grave included this deer-shaped vessel that held chocolate.



KING'S DOMAIN



Continuing investigations suggest that the power derived from the founder began to falter with the capture and sacrifice in 738 of Copán's 13th ruler by the king of a rival city-state. By King Yax Pasah's time, a quarter of a century later, the power of Copán's rulership had failed to rebound. After the Maya abandoned this site to the forest and the river, probably by the year 900, its stone buildings gradually crumbled. And yet, even in ruin, the site's remaining ornate buildings and sculptures make it one of the greatest treasures of art and architecture in the Americas.

Archaeologists made a stunning discovery in 1989 at the ancient Maya city of Copán in Honduras: the grave of a mighty king and founder of a dynasty that held sway for some 400 years.

KENNETH GARRETT (BOTH)



Battered by the ages, a stone portrait of the Maya ruler known as 18 Rabbit shelters the nest of a great kiskadee, a flycatcher. The eighth-century reign of this powerful lord saw the metropolis of Copán in its full flowering.


KENNETH GARRETT





A.D. 200-800 AFGHANISTAN

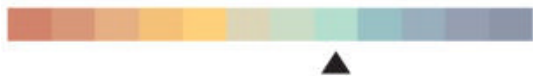
BUDDHIST SHRINES



Photographed from this perspective, an eight-foot-tall shrine at Mes Aynak, Afghanistan, appears much larger. Archaeologists have uncovered only a fraction of the sprawling Buddhist complex, which dates from the third to the eighth centuries A.D.

SIMON NORFOLK

AND MINES



Archaeologists hope to excavate a spectacular Buddhist complex before it's obliterated by a huge copper mine.

A

AN HOUR'S DRIVE ALONG THE GARDEZ HIGHWAY SOUTH OF Kabul, there is a sharp left turn onto an unpaved road. The path continues along a dry riverbed, past small villages, paramilitary roadblocks, and sentry towers. A little farther on, the view opens over a treeless valley creased with trenches and exposed ancient walls.

In 2009, a team of Afghan and international archaeologists and local laborers began to uncover thousands of Buddhist statues, manuscripts, coins, and holy monuments at this epic site. Entire monasteries and fortifications have come to light, dating back as far as the third century A.D. The excavation was by far the most ambitious in Afghanistan's history.

A fluke of geology put these cultural treasures in jeopardy, though. Mes Aynak means "little copper well" in the local dialect, but there is nothing little about it. The lode of copper ore buried below the ruins is one of the world's largest untapped deposits, an estimated 12.5 million tons. In 2007, a Chinese consortium won the rights to extract the ore on a 30-year lease. The company made a bid worth more than three billion dollars and promised to provide infrastructure for this isolated, underdeveloped district.

Before the deal with Chinese interests became public, artifacts already were in danger of being plucked out piecemeal by looters and lost to science. Afghan cultural heritage advocates demanded that the treasures be excavated and recorded properly before open-pit mining began.

Originally projected to begin in 2012, the mining project was stalled by contractual disputes, sagging copper prices, and Afghanistan's conflict with the fundamentalist Taliban. Now that the militants control the country, the future of the site is even more uncertain.

The past archaeologists have revealed presents a stark contrast to the violence and disorder of today. From the

third to the eighth centuries A.D., Mes Aynak was a spiritual hub that flourished in relative peace. At least seven multistory Buddhist monastery complexes form an arc around the site, each protected by watchtowers and high walls. Copper made the Buddhist monks here wealthy, and colossal deposits of slag—the solidified residue from smelting—attest to production on a major scale.

Much is known about ancient Buddhism's links to trade and commerce, but little is known about its relationship to industrial production. This is where Mes Aynak could one day fill in important blanks, hinting at a more complex economic system than has been understood previously.

Puzzling out the full meaning of Mes Aynak will require decades of research. Archaeologists can only hope that time is on their side—and that they get the chance to reveal more of this little-known chapter from Buddhism's glory days in Afghanistan.

Copper brought wealth to this religious and industrial site. Excavators have uncovered thousands of rare treasures, including the oldest known complete wooden Buddha, dating from A.D. 400 to 600.

SIMON NORFOLK





Swahili city-states on the shores of the Indian Ocean enjoyed centuries of wealth, thanks to trade linking them to Arabia, India, and beyond.

T

“THE CITY OF KILWA IS AMONGST THE MOST BEAUTIFUL OF CITIES and elegantly built,” wrote Ibn Battuta, one of history’s great travelers. The city minted its own coins and had houses with indoor plumbing. Its residents wore clothing of imported silk. During its golden age, from the 12th to the 18th centuries, Kilwa was one of some three dozen prosperous ports that dotted what is known as the Swahili coast. Those ports, which stretched from present-day Somalia to Mozambique, had evolved into powerful city-states that grew rich from Indian Ocean trade. They flourished as ships from Arabia, India, and China called at their ports to carry away goods that made the Swahili wealthy.

Arabian sailors arriving in Africa found good harbors, a sea full of fish, fertile land, and opportunities for trade. Many stayed to marry local women, bringing with them the Islamic faith. The interplay of African and Arabian languages and customs created an urban and mercantile culture that is unique to this coast.

At its core, though, the culture was African—a fact that early archaeologists failed to recognize. Subsequent excavations at sites along the coast have shown how wrong they were. On Songo Mnara Island in Tanzania, for example, archaeologists uncovered a planned community that boasted a palace hung with tapestries, several dozen blocks of houses, six mosques, and four cemeteries, all inside a wall.

The Swahili trade network fell apart as the Portuguese muscled in and redirected goods toward the Mediterranean and Europe. But even as the trade hubs became backwaters, the rich Swahili culture endured through centuries of colonial occupation. “Swahili history is about adaptation and incorporation,” explains Abdul Sheriff, a Tanzanian historian. “Swahili culture may not be quite the same tomorrow as today, but then nothing living is.”



THE

A dhow plies the waters off Kenya's Lamu Island. For hundreds of years these vessels linked ports on the coast of

East Africa to Arabia and Asia. Swahili traders, consummate middlemen, sold gold, ivory, and enslaved people to merchants

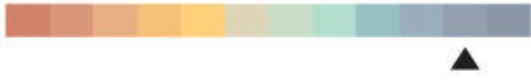
whose ships arrived on monsoon winds. Such boats still carry goods and people short distances.

MICHAEL S. YAMASHITA



SWAHILI EMPIRE

1400s PERU



A ghost town in the Andes became a treasured window into Inca history after explorer Hiram Bingham introduced it to the world.

O

ON HANDS AND KNEES, THREE MEN CRAWLED UP A SLICK AND steep mountain slope in Peru. It was the morning of July 24, 1911. Hiram Bingham III, a 35-year-old assistant professor of Latin American history at Yale University, had set out in a cold drizzle from his expedition camp on the Urubamba River with two Peruvian companions to investigate reported ruins on a towering ridge known as Machu Picchu (“old mountain” in Quechua, the Inca language). The explorers chopped their way through thick jungle, crawled across a “bridge” of slender logs bound together with vines, and crept through underbrush hiding venomous fer-de-lance snakes.

Two hours into the hike, at nearly 2,000 feet above the valley floor, the climbers met two farmers who had moved up the mountain to avoid tax collectors. The men assured an increasingly skeptical Bingham that the rumored ruins lay close at hand and sent a young boy along to lead the way.

When Bingham finally reached the site, he gaped in astonishment at the scene before him. Rising out of the tangle of undergrowth was a maze of terraces cut from escarpments and walls fashioned without mortar, their stones fitting so tightly together that not even a knife’s blade could fit between them. The site would prove to be one of the greatest archaeological treasures of the 20th century: an intact Inca ghost town hidden from the outside world for nearly 400 years.

Enrique Porres and other locals helped Bingham explore and excavate the site.

HIRAM BINGHAM

“It seemed like an unbelievable dream,” he wrote later.

Bingham acknowledged that he was not the first to discover Machu Picchu. Local people knew about it, and a Peruvian tenant farmer, Agustín Lizárraga, had even inscribed his name on one of its walls nearly a decade earlier. But Bingham did bring the mountaintop citadel to the world’s attention as the account of his work there, and at other sites in the region, filled the April 1913 issue of *National Geographic*.

Bingham was also the first to study Machu Picchu scientifically. With financial support from Yale and the National Geographic Society, he returned twice to the site. His crews cleared the vegetation that had reclaimed the peak, shipped thousands of artifacts to Yale’s Peabody Museum of Natural History—which were returned to Peru by 2012—and mapped and photographed the ruins. The thousands of photos that he shot would change archaeology forever, demonstrating the power of images to legitimize and popularize the science.

MACHU PICCHU



Seeing Machu Picchu
"fairly took my breath
away," recalled Bing-
ham, whose work drew
worldwide attention
to the ruins in 1913.
The royal retreat, with
its precision-cut stones
and perfectly placed
cascades of terraces,
is evidence of the
Inca's masterful build-
ing skills.

HIRAM BINGHAM







Centuries-old artifacts of the Yupik people, preserved in permafrost, are emerging as temperatures rise. Now the rush is on to save these treasures.

T

THE ARCHAEOLOGICAL SITE OF NUNALLEQ ON THE SOUTHWEST coast of Alaska preserves a fateful moment, frozen in time. The muddy square of earth is full of everyday things the Indigenous Yupik people used to survive and to celebrate life here, all left just as they lay when a deadly attack came almost four centuries ago.

As is often the case in archaeology, a tragedy of times past is a boon to modern science. Archaeologists have recovered more than 100,000 intact artifacts at Nunalleq, from typical eating utensils to extraordinary things such as wooden ritual masks, ivory tattoo needles, pieces of finely calibrated sea kayaks, and a belt of caribou teeth. The objects are astonishingly well preserved, having been frozen in the ground since about 1660.

Climate change is now hammering the Earth's polar regions. The result is a disastrous loss of artifacts from little-known prehistoric cultures—like the one at Nunalleq—all along Alaska's shores and beyond.

A massive thaw is exposing traces of past peoples and civilizations across the northern regions of the globe—from Neolithic bows and arrows in Switzerland to hiking staffs from the Viking age in Norway and lavishly appointed tombs of Scythian nomads in Siberia.

In coastal Alaska, archaeological sites are now threatened by a one-two punch of rising temperatures and rising seas. When archaeologists began digging at Nunalleq in 2009, they hit frozen soil about 18 inches below the surface of the tundra. Today the ground is thawed three feet down. That means masterfully carved artifacts of caribou antler, driftwood, bone, and walrus ivory are emerging from the deep freeze that has preserved them in perfect condition. If not rescued, they immediately begin to rot and crumble.

The global level of oceans has risen eight to nine inches

Precious items revealed by the thaw provide evidence of Yupik oral history and customs. Artifacts from Indigenous cultures worldwide are threatened by global warming.

KIERAN DODDS

since 1900. That's a direct threat to coastal sites such as Nunalleq, which is doubly vulnerable to wave damage now that the thawing permafrost is making the land sink. "One good winter storm and we could lose this whole site," lead archaeologist Rick Knecht says.

When wooden artifacts began washing up on the beach, community leader Warren Jones helped convince the village's board of directors that excavating Nunalleq was a good idea. Those conversations grew into a unique collaboration in which the community and the archaeologists work as partners.

Yupik from the wider area now drive ATVs to the site to learn more about their heritage and touch the artifacts. Workshops at a new culture and archaeology center celebrate Yupik culture then and now. Jones is proud of the partnership and looks forward to more discoveries at the site.

"I want our kids who are in college now to run the culture center and be proud that it's ours," he says.



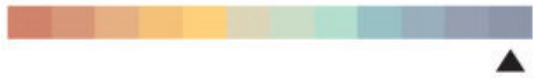
MARVELS



Archaeologist Rick Knecht uses an oar from his boat to support and protect a 400-year-old wooden bow, one of more than 100,000 native ancestral artifacts he and his team have recovered as they work to save the remains of the ancient coastal village known today as Nunalleq.

ERIKA LARSEN





In 1912 the largest, most luxurious cruise ship of its day sank. Its discovery after decades of searching revealed stunning details of the tragedy.

A

AT 2:20 A.M. ON APRIL 15, 1912, THE “UNSINKABLE” R.M.S. *Titanic* disappeared beneath the waves, taking with her some 1,500 souls. Why does this tragedy exert such a magnetic pull on our imagination more than a century later? The sheer extravagance of the *Titanic*’s demise lies at the heart of its attraction. This has always been a story of superlatives: A ship so strong and so grand, sinking in water so cold and so deep. The ship’s fate was sealed on its maiden voyage from Southampton, England, to New York City. At 11:40 p.m. it sideswiped an iceberg in the North Atlantic, buckling portions of the starboard hull along a 300-foot span and exposing the six forward compartments to the ocean’s waters. From this moment onward, sinking was a certainty.

Over decades, several expeditions sought to find the *Titanic* without success—a problem compounded by the North Atlantic’s unpredictable weather, the enormous depth (12,500 feet) at which the sunken ship lies, and conflicting accounts of its final moments. At last, 73 years after it sank, the final resting place of the *Titanic* was located by National Geographic Explorer at Large Robert Ballard and French scientist Jean-Louis Michel on September 1, 1985. The *Titanic* lay roughly 380 miles southeast of Newfoundland in international waters.

Recently declassified information has revealed that the discovery stemmed from a secret U.S. Navy investigation of two wrecked nuclear submarines, the U.S.S. *Thresher* and U.S.S. *Scorpion*. The military wanted to know the fate of the nuclear reactors that powered the ships, and to see if there was any evidence to support the theory that the *Scorpion* had been sunk by the Soviets. (There wasn’t.)

Ballard had met with the Navy in 1982 to request funding to develop the robotic submersible technology he needed to find the *Titanic*. The military was interested, but for the purpose of gathering its own intel. Once Ballard had

completed the submarine inspection, if there was time, he could do what he wanted. He was finally able to begin looking for the *Titanic* with less than two weeks to spare. And then, suddenly one night at 1:05 a.m., video cameras picked up one of the ship’s boilers. “I cannot believe my eyes,” he wrote about the moment of discovery.

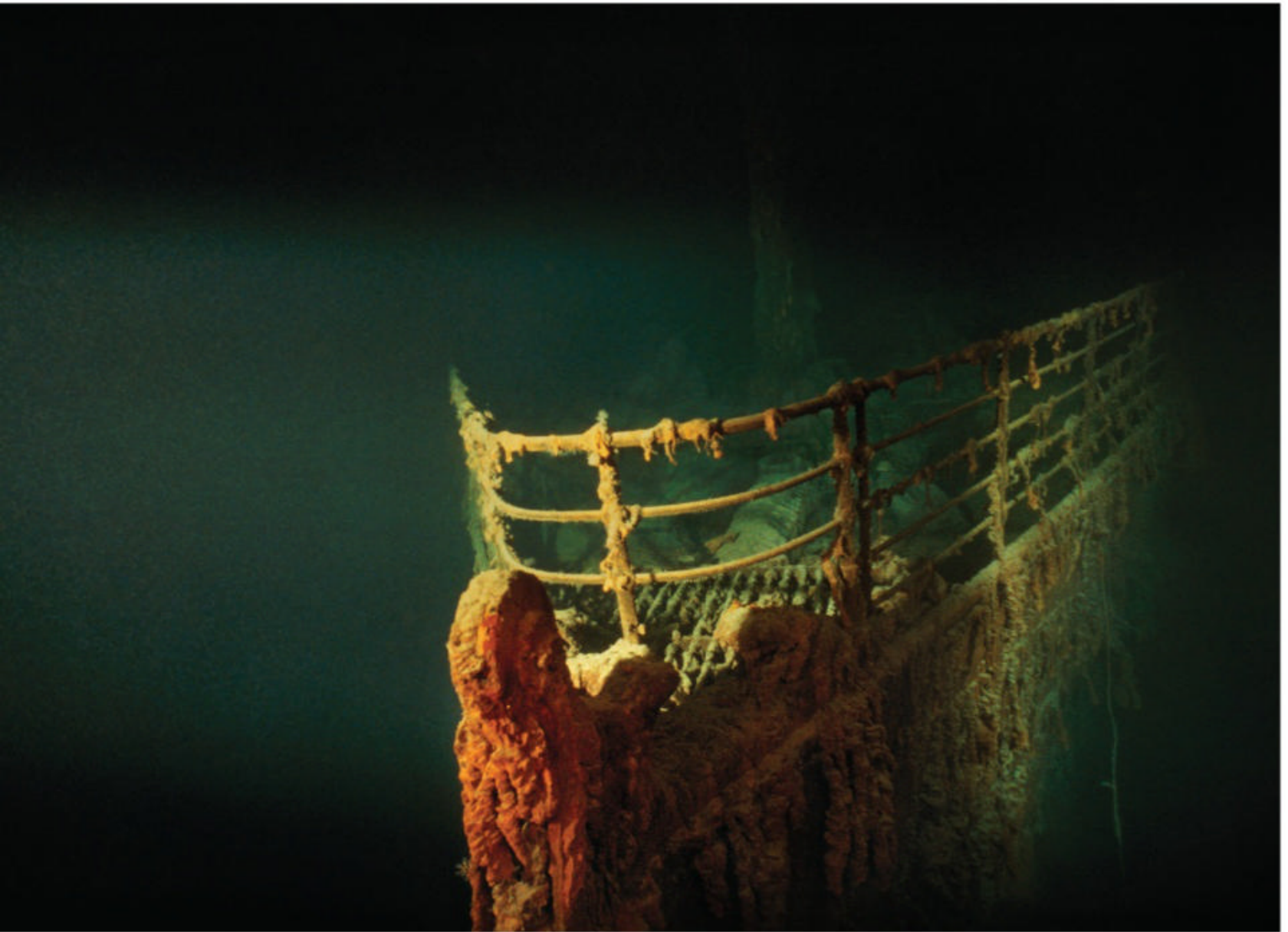
In the years since Ballard’s expedition, organic processes have been relentlessly breaking down the *Titanic*: Mollusks have gobbled up much of the ship’s wood, while microbes eat away at exposed metal, forming icicle-like “rusticles.” The hull has started to collapse, taking staterooms with it. “The most shocking area of deterioration was the starboard side of the officers’ quarters, where the captain’s quarters were,” said *Titanic* historian Parks Stephenson after a manned submersible dive in 2019. Using state-of-the-art equipment, the dive team captured images of the wreck that can be used to create

Items recovered from the disaster include this pocket watch.

MARK THIESSEN



FINDING THE TITANIC



3D models, helping researchers further study the past and future of the ship.

How long will the *Titanic* remain intact? “Everyone has their own opinion,” said Woods Hole Oceanographic Institution research specialist Bill Lange. “Some people think the bow will collapse in a year or two. But others say it’s going to be there for hundreds of years.”

However long the wreck lasts, the story will surely live on—of a vessel with too much pride in her name, sprinting smartly toward a new world, only to be mortally nicked by something as old and slow as ice.

More than two miles down, the ghostly bow of the *Titanic* emerges from the darkness draped in “rusticles”—orange stalactites created by iron-eating bacteria.

EMORY KRISTOF



BY LYNSEY ADDARIO AND RACHEL HARTIGAN

PHOTOGRAPHS BY LYNSEY ADDARIO

A War on Itself

ETHIOPIA'S CIVIL WAR
HAS BECOME A HUMANITARIAN CRISIS,
WITH MILLIONS DISPLACED,
THOUSANDS DEAD,
AND THE NATION'S EXISTENCE
IN JEOPARDY.

Civilians have been targeted with particular brutality during the conflict in Tigray. This woman says she was raped by 15 Eritrean soldiers in one week. She doesn't know where her children are. "This is doomsday for me," she says.

Soldiers from the Tigray People's Liberation Front (TPLF) patrol Adi Chilo village in central Tigray, the site of a reported massacre. When Ethiopian and Eritrean soldiers lost a battle against the

TPLF in February, residents say, the soldiers retaliated by executing most of the men in this village and others nearby. Many victims are buried in shallow graves near their homes.





The only roads open in the besieged state of Tigray in northern Ethiopia lead to endless tales of darkness.

Along a path on the outskirts of Abiy Adi, in central Tigray, Araya Gebretekle tells his story, tragic in its simplicity. He had six sons. He sent five of them to harvest millet in the family's fields. Four never came home.

When Ethiopian soldiers arrived in the village in February, "my sons didn't flee," says Araya, wiping his eyes with his white headscarf. "They didn't expect to be killed while harvesting." But the soldiers aimed their weapons at his sons, and a female soldier gave the order to shoot. "Finish them, finish them," she said. The brothers pleaded for their lives. "We're just farmers," they said. "Spare one of us to harvest and deal with the animals," they begged. The soldiers spared the youngest, a 15-year-old, and executed the others, leaving their bodies in the field where they fell.

Three months later, "my wife is staying at home, always crying," Araya says. "I haven't left the house until today, and every night I dream of them." He wipes his eyes again. "There were six sons. I asked the oldest one to be there too, but thank God he refused." (Ethiopians are referred to by their first names.)

East of Abiy Adi, at Ayder Referral Hospital



The National Geographic Society,

committed to illuminating and protecting the wonder of our world, has funded Explorer Lynsey Addario's work covering the COVID-19 pandemic since 2020.

ILLUSTRATION BY JOE MCKENDRY



Women line up behind barbed wire as they wait for food to be distributed in Agula-e. "We don't have any food, we don't have any medication, all our property was looted," says Salam Abraha (middle). "Every day, people are dying here." Ethiopian and Eritrean soldiers have blocked humanitarian aid.



in the state capital of Mekele, Kesanet Gebremichael wails as nurses change the bandages and clean the wounds on her charred flesh. The 13-year-old was cooking with a cousin in the village of Ahferom, in central Tigray, when her grass-mud home was hit in a mortar attack. “My house was destroyed in the fire,” says her mother, Genet Asmelash. “My child was inside.” The girl, already malnourished, suffered burns on more than 40 percent of her body.

At a women’s shelter in Mekele, a 33-year-old woman recalls being raped by soldiers on two occasions—in her home in Idaga Hamus and as she tried to flee to Mekele with her 12-year-old son. (The names of the rape victims in this story are not being used, to protect their privacy.) The second time, she was pulled from a minibus, drugged, and taken to a military camp, where

she was tied to a tree and sexually assaulted over the course of 10 days. She fell in and out of consciousness from the pain, exhaustion, and trauma. At one point, she awoke to a horrifying sight: Her son, along with a woman and her new baby, was dead at her feet. “I saw my son with blood from his neck,” she says. “I saw only his neck was bleeding. He was dead.” With her fists clenched against her face, she howls a visceral cry of pain and sadness, unable to stop weeping. “I didn’t bury him,” she screams between sobs. “I didn’t bury him.”

What started as a political dispute between Ethiopian prime minister Abiy Ahmed and Tigray’s ruling party, the Tigray People’s Liberation Front (TPLF), has exploded into a war with genocidal overtones—a grave humanitarian crisis threatening the lives of millions of people and

the existence of Ethiopia itself. Some two million people in Tigray, a third of the state's population, have been displaced. Millions need emergency food assistance, and thousands have been killed. Yet the full extent of the catastrophe is unknown because the federal government has shut down communications and limited access to Tigray.

By mid-May, when the photographs in this story were taken, the situation had become dire. Most routes north and south from Mekele were closed to journalists and humanitarian aid. A road west was lined with burned-out tanks and looted ambulances stripped of engines and wheels. Patches of towering eucalyptus trees gave way to rocky, untilled fields—and checkpoint after checkpoint manned by Ethiopian troops. Soldiers from neighboring Eritrea sauntered casually through villages. Men, women, and children—civilians—were terrified and traumatized, and praying for those who hadn't yet made it to Mekele or another relatively safe place. Over and over again, people mentioned countless others who were still in hiding. They feared what was to come.

THE FAULT LINES of this conflict stretch back decades through multiple regimes, several broken alliances, and one perpetually contentious question: How should Ethiopia's more than 80 distinct ethnic groups be united into a single, stable country?

"The real political issue in the country is between those who support the unitary state and those who support the multinational federation that guarantees self-rule for the ethnic groups," says Tsega Etefa, a Colgate University professor born in Ethiopia who has researched ethnic conflict in the region.

For much of the 20th century, political power was centralized. The last emperor of Ethiopia, Haile Selassie, ruled for 44 years until he was overthrown in 1974 by a group of military officers called the Derg. Led by Mengistu Haile Mariam, the Derg quickly established an authoritarian regime marked by brutal oppression. The opposition, which sprung up almost immediately, rose from ethnic groups, including the Tigrayans, who chafed under the dictatorial control. In 1975 the TPLF was founded as a militia, and it grew to be an especially effective one.

Mengistu's attempts to crush the TPLF and other rebel groups resulted in a situation reminiscent of what's happening today: a bloody

Tracking the violence

Communication blackouts and limited access make it difficult to document the conflict. The Armed Conflict Location & Event Data Project (ACLED)* provides a glimpse into the intense fighting and death toll in Tigray.

Each square represents 10 confirmed fatalities

- Violence against civilians
- Battle or remote violence (events involving at least two armed and organized actors)
- ⊗ Closed or damaged bridge or airstrip
- ▨ Disputed area

Frequency of violent events from Nov. 2020–July 2021

Fewer events More events

20 mi
20 km



Crisis in Tigray

Ethiopia—a landlocked, drought-susceptible country with a fragile federal structure—is plagued by a civil war between the national government and the Tigray People's Liberation Front (TPLF). Early gains last year by the national army, aided by Eritrean soldiers and Amhara militias, came with reports of ethnic cleansing and sexual violence. Now famine is looming—and Tigrayans are on the offensive.



Disputed borders

In 2018 the national government agreed to hand over borderlands, fought over in the 1990s, to Eritrea. The TPLF refused; Eritrean soldiers seized those areas when the current conflict erupted.

BADME TRIANGLE

Clashes in the west

Federal and Eritrean troops and Amhara militia seized all the territory west of the Tekeze River, blocking a potential supply route from Sudan. All groups have been accused of atrocities against civilians.

Dansheha
513 confirmed battle fatalities

Counterattack in the east

Early on, federal forces and allies took control of the east. In June the TPLF struck back, regaining control of the capital, Mekele, and pushing into Amhara and Afar to open supply lines.

Fearing another famine

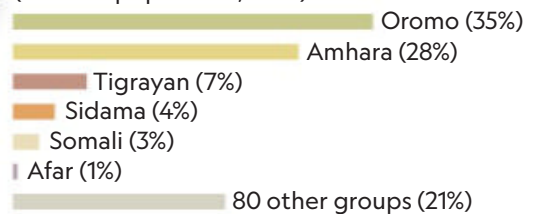
Fighting has forced more than two million people from their homes in northern Ethiopia, the arid highlands that suffered drought and famine in the 1980s. In August aid organizations estimated that 5.2 million people in Tigray faced catastrophic food insecurity, in part because pro-government forces were blocking and looting aid. Damage to bridges, roads, and airstrips also has hampered humanitarian aid efforts.

An unsteady federation

A 1994 constitution structured Ethiopia into nine (now 10) regional states predominantly based on ethnicity. The TPLF controlled the repressive central government for 27 years; widespread protests led to the election of new leadership in 2018. Attempts by the new government to centralize power have led to regional resistance.

Major ethnic groups

(share of population, 2016)*



Map shows ethnic majority or plurality as of latest census in 2007.

*ACLED data as of July 30, 2021

*Does not total 100% due to rounding



100 mi
100 km

More than two million people have been displaced by the war. Fifty thousand have fled to Sudan, but most have gone to larger towns within Tigray such as Mekele, the state capital, where they sought refuge in makeshift shelters such as this one at the Maiweini Primary School.





7-8-2

7-8-2

Gebray Zenebe holds his 15-year-old daughter, Beriha Gebray. She was shot in the face by Eritrean soldiers south of Mekele. It took Gebray two days to find transportation to the closest hospital. “Now it’s the season for planting,” he says, “but we are sitting here treating our children, so what will there be for our children?” Beriha is now blind.



counterinsurgency leading to a catastrophic famine. From 1983 to 1985 hundreds of thousands of people died of famine in Ethiopia, many of them in Tigray. The counterinsurgency failed: Aided by Eritrean forces, rebel groups from Amhara and Oromia united under the banner of a TPLF-led alliance called the Ethiopian People’s Revolutionary Democratic Front (EPRDF) and toppled Mengistu in 1991.

THE EPRDF took control of the country and established a system of ethnic federalism dividing Ethiopia into semiautonomous states demarcated along ethnic lines. The bond between politics and ethnicity was tightened.

In practice, power was still centralized. The TPLF, representing just 6 percent of Ethiopia’s population, settled in as the dominant political force in the ruling EPRDF coalition with Meles Zenawi as prime minister. The new government dramatically improved the economy and

reduced food insecurity. But, like the regime it had challenged, the EPRDF was repressive—stifling dissent, limiting free speech, and imprisoning and torturing political opponents.

And, like the regime before it, this one was eventually at odds with Eritrea, which had been annexed by Ethiopia in 1962. In 1993 Eritrea declared independence. By 1998 the two former allies were at war over a disputed border, a standoff that lasted 20 years.

Federalism didn’t ease internal tensions either. In 2014 protests erupted in Oromia, Ethiopia’s most populous state, over the government’s plan to seize land to expand Addis Ababa, the national capital. Ethnic Oromos had long felt marginalized and persecuted; the annexation of their state’s territory was tinder to their grievances. The protests spread elsewhere, including to Amhara, where the boiling point was a land dispute with Tigray. After a brutal crackdown and increasing clashes between government



forces and ethnic militias, Prime Minister Hailemariam Desalegn, who had replaced Meles after his death in 2012, resigned. Abiy, ethnically Oromo, took office in 2018.

At first, Abiy appeared to be taking Ethiopia in a new direction. He released political prisoners, removed restrictions on the press, and made peace with Eritrea, which won him the Nobel Peace Prize in 2019. But he also prosecuted Tigrayans and purged them from government, and he reorganized the ruling coalition into a single political party, the Prosperity Party, a move that signaled a return to authoritarian rule.

Ascendant for nearly 30 years, the TPLF was sidelined nationally after refusing to join Abiy's Prosperity Party, which it saw as an attempt to weaken the ethnic federation it had created. But the TPLF was still potent in Tigray, controlling the regional government and as many as 250,000 troops. When elections were postponed in 2020 because of the pandemic, the TPLF held Tigray's

regional election anyway, claiming it would be unconstitutional to extend terms of office. The federal government retaliated by declaring the regional government unlawful and threatening to redirect funding.

On November 3, 2020, the TPLF commandeered a federal military base in what it said was a preemptive strike. The next day, the Ethiopian government launched an extensive military offensive and cut off power and communications in Tigray. Eritrean forces invaded Tigray from the north while militias from Amhara poured in from the south. Both held long-standing grudges against the TPLF: The Eritreans blame the party for their suffering during the war with Ethiopia, while Amharas claim the Tigrayans had used the establishment of ethnic federalism to annex some of their most valuable land.

It quickly became clear that the TPLF wasn't the only target. Reports of atrocities against civilian Tigrayans are rampant—including rapes, massacres, the indiscriminate bombardment of residential areas, and the flagrant looting of hospitals and health clinics. "The great majority of soldiers actually feel dirty and ashamed and humiliated by participating in gang rape or massacres," says Alex de Waal, director of the World Peace Foundation. "So why do they do it? Well, they do it because they're told to. When they do it on this scale, it is because there is an order."

All sides, including the TPLF, have been accused of war crimes, but witnesses blame Eritreans for some of the worst abuses. The woman who was tied to a tree for 10 days says that the soldiers who raped her and murdered her son were Eritreans wearing Ethiopian uniforms: "I could identify them by the cuts in their faces, and they wore plastic shoes," which Eritrean soldiers are known for. They spoke Tigrinya; Ethiopian troops speak Amharic.

Adiam Bahare, 19, watched Eritrean soldiers kill three of her relatives in May Kinetal, in central Tigray. "They gathered them along with other men from a nearby village and shot them execution style," she says. "I was at home, and I heard the gunshots and saw them falling one by one." She picked up a relative's child and fled to nearby caves in the hilly region. Eventually she made her way to the Maiweini Primary School in Mekele, which had been transformed into a shelter for displaced people.

Medical centers often aren't able to treat the wounded adequately because facilities have



Ethiopian troops ride through traffic in Mekele on May 14. They seized the city early in the conflict, forcing Tigray's political leaders and defense forces to flee into the surrounding mountains. The TPLF regained control of the city in late June.





Orthodox Christians gather to pray at Trinity Selassie Church in Mekele. "We are mourning what is happening all around us," says Tigist Yohannes, "and we are here to pray and reflect on the deep sadness that has taken over our lives." Orthodox Christians account for 44 percent of all Ethiopians and 96 percent of Tigrayans.



Farmer Kiros Tadros plows his land in the southeastern region of Tigray after Eritrean soldiers took the food, livestock, and seeds from his village. They demanded that the villagers not farm, but Kiros has no choice. If he doesn't farm, his seven children will have nothing to eat.



been stripped bare. “There were two types of looting here,” says Adissu Hailu, head of the general hospital in Abiy Adi. “First the Eritrean troops took what they can. Then this hospital was serving as a military base.” He says the soldiers sold everything, including the refrigerators. When the soldiers left, the hospital was able to reopen, but the staff didn’t have any medical equipment, not even microscopes. Still, the hospital was overwhelmed with patients.

MEANWHILE, people are starving.

“A total of 5.2 million people, a staggering 91 percent of Tigray’s population, need emergency food assistance,” says Peter Smerdon, a spokesman for the United Nations World Food Programme (WFP) in East Africa. Fifty percent of mothers and nearly a quarter of the children whom WFP has been able to screen are malnourished. Eritrean and Ethiopian soldiers wield hunger as a weapon, blocking and diverting the

distribution of humanitarian aid, looting provisions and livestock, and preventing farmers from tending their fields.

Abeba Gebru, pregnant with her sixth child, hid from the violence in a cave where she had only roasted beans to eat. Her baby was born malnourished and Abeba could not produce enough milk to breastfeed. “I was much worried about her,” she says. “I tried to squeeze my breast to get some.” She and her daughter are being treated at a clinic in Abiy Adi.

The war began during harvest season. In May it was time to plant. In a village on the road between Mekele and Abiy Adi, Kiros Tadros, a father of seven, was back in his fields. Climate change had already made the past few years difficult: “It’s like doomsday—all of this war followed the frozen rains and the locusts.

“Our land as well as the mountains overlooking our houses were invaded by Eritrean soldiers,” he says. “They came to each household and



demanded we provide them food, give them our livestock. They also demanded that we do not plow and that we give them information on the whereabouts of the militia.”

The United Nations has called for an investigation of war crimes, and the United States has cut economic and security aid to Ethiopia, banned travel to the U.S. by officials or combatants involved in the violence or in blocking humanitarian aid, and sanctioned the head of Eritrea’s military.

But Tigrayans have mounted the most effective countermeasures. The TPLF is flush with recruits galvanized by the violence against their communities. Twenty percent of the Ethiopian army, and a large proportion of the officers and technical staff, were Tigrayan; now they’re fighting for the TPLF. Battle-hardened commanders, including Tsadkan Gebretensae, a former chief of staff for Ethiopia’s military, have come out of retirement. In June they began

retaking large swaths of Tigray, later marching more than 6,000 captured Ethiopian soldiers through the streets of Mekele.

After responding to the defeats with a face-saving unilateral cease-fire, Abiy exhorted “all capable Ethiopians” to join militias and defend Ethiopia against the TPLF, which he described as “traitors that bit the hands that fed them and turned their backs on the Ethiopia that breast-fed them.” There are reports of Tigrayans being detained and disappeared and their businesses being closed in cities across Ethiopia.

Still, the TPLF is on the offensive. “You don’t win wars by mobilizing half a million peasants with small arms,” says de Waal, especially against a force “that has basically defeated your regular army and captured all its equipment.” The fighting has spread east into Afar, south into Amhara, and west within Tigray to open a supply line to Sudan.

Abiy faces an insurgency in his home state of Oromia. There’s conflict between the Afar and Somali people, between the Amhara and the Oromo, and between the Gumuz and the Amhara and Oromo.

External forces threaten Ethiopia as well. Sudan seized the disputed territory of Al Fasha, leading to the eviction of Ethiopian farmers and clashes between the two countries. The fertile borderland, called the Mazega by Ethiopians, is leverage in the ongoing wrangling over the Grand Ethiopian Renaissance Dam. The massive hydroelectric dam on the Blue Nile has raised tensions with Sudan and Egypt, and those two countries have signed a military cooperation agreement.

The future of Ethiopia is increasingly tenuous. A 47-year-old woman from Inda Silase in Tigray knows what’s at stake for her. She was raped in front of her children by soldiers who told her the Tigrayan race must be eliminated.


Recent TPLF victories can’t erase her pain—or that of all the others caught up in this churn of war. At Ayder Referral Hospital in Mekele, hundreds of women have been treated for rape. “But the numbers are not telling the reality on the ground,” says Mussie Tesfay Atsbaha, the hospital’s chief administrator. “If one person has come, another 20 are dead somewhere.

“I never saw hell before, but now I have.” □

Pulitzer Prize-winning photographer **Lynsey Addario** is the author of the memoir *It’s What I Do*. Staff writer **Rachel Hartigan** is writing a book about the search for Amelia Earhart.

MARINE LIFE OFF THE
ANTARCTIC PENINSULA NEEDS
PROTECTION AS SEA ICE DECLINES
AND FISHING BOATS MOVE IN
TO TAKE MORE KRILL.



An underwater photograph showing a leopard seal's tail fluke in the foreground, swimming towards a large, melting iceberg. The water is filled with numerous small air bubbles, likely from the melting ice. The scene is set off the western coast of the Antarctic Peninsula.

A leopard seal drifts next to an iceberg off the western coast of the Antarctic Peninsula. Air bubbles released from the melting ice stick to the lens of the underwater camera. For these seals, ice floes are a place to breed and molt, and they provide habitat for krill, an important prey.

AN ICY WORLD IN MELTDOWN

BY HELEN SCALES | PHOTOGRAPHS BY THOMAS P. PESCHAK





Only some 300 feet of this tabular iceberg's estimated 3,000-foot height is visible at the surface. A portion of its submerged bulk glows turquoise through the clear waters of Antarctic Sound, a narrow passage at the northern end of the peninsula. Icebergs that break off the Larsen C Ice Shelf in the Weddell Sea get swept along the sound, which is also known as Iceberg Alley.

PHOTOGRAPHIC FIELDWORK WAS FUNDED AND SUPPORTED BY THE SAVE OUR SEAS FOUNDATION.



Gentoo penguins at Neko Harbor incubate eggs in rocky nests and tend their chicks around a whale's vertebra—a reminder of the Antarctic Peninsula's history of commercial whaling. Now, a century later, whales are protected and people fish instead for krill, the main food for whales, fish, seals, and penguins.



A

AN INFLATABLE BOAT PULLS UP next to the snowy shore, and the gentoo penguins of Neko Harbor see people for the first time in almost a year.

Rather than a gaggle of tourists (absent because of the coronavirus pandemic), out climb Tom Hart, a penguin biologist from Oxford University, and several other scientists returning to the Antarctic Peninsula in January 2021. Honks and calls ripple through the colony of about 2,000 gentoos as one of the 2.5-foot-tall birds waddles through to find its nest. The penguins pay no attention to Hart as he makes straight for the time-lapse trail camera perched on a tripod and wedged in place with rocks. He retrieves the memory card from inside the camera's waterproof housing.

The camera has been taking pictures of the penguins every hour, from dawn till dusk, since they settled down at the nesting colony four months earlier to lay their eggs and rear their chicks. It's one of nearly a hundred cameras dotted across the 830-mile-long, 43-mile-wide peninsula that have been monitoring breeding colonies of three penguin species during the past decade.

Gentoo numbers on the peninsula have increased rapidly—more than tripling at many sites during the past 30 years—and the birds are expanding south into new areas that had been too icy for them, leveraging their flexible foraging and breeding strategies. In stark contrast, their sister species—the smaller chinstrap penguins and the sleek, black-headed Adélie penguins—have declined by upwards of 75 percent at many of the colonies where gentoos are thriving.

“Very roughly,” Hart says, “you lose one Adélie, you lose one chinstrap, you gain a gentoo.”

Penguins are important sentinels for the wider health of the oceans. They're highly sensitive to environmental changes and rely on productive seas and abundant prey. Penguin scientists aren't worried that chinstraps and Adélies



The National Geographic Society,

committed to illuminating and protecting the wonder of our world, has funded Explorer Thomas P. Peschak's storytelling around biodiversity since 2017.

ILLUSTRATION BY JOE MCKENDRY

will disappear from the planet—some beyond the peninsula appear to be some may even be increasing.

“What concerns us is that they're so sharply on the Antarctic Peninsula,” Heather Lynch, an ecologist at State University in New York State. Shifts in populations in the waters off Antarctica's Southern Ocean—are warning signs the ecosystem is being disrupted. “It tells us that something has changed about how the Southern Ocean works and that's unintended, that's the tip of the iceberg.”

This icy world is imperiled: The Antarctic Peninsula is one of the fastest warming on the planet. Air temperatures during a heat wave in February 2020 reached a record



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Tony Brook
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Antarctic
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A Weddell seal rests
in an iceberg meltwater
pool. One of the Ant-
arctic's top predators,
the seals hunt for fish

and octopuses under
sea ice, emitting sounds
that may act as echo-
location to find prey in
dark water.

at Argentina's Esperanza Base, toward the north-
ern tip of the peninsula. (Summer temperatures
normally aren't more than a few degrees above
freezing.) As air temperature rises, sea ice
around the peninsula recedes, and in 2016 it
dwindled to its least amount since satellite mon-
itoring of changes in the ice began in the 1970s.

That's a problem, because freezing sea-
water shelters pinkie-finger-size crustaceans—
Antarctic krill—that are the key to the web of
life in the Southern Ocean. Teeming shoals of



TOP: Wind, sun, and
snow combine to
create the intricate
shapes of Antarc-
tica's icebergs. Air
bubbles trapped in
the ice as it forms
are released when it
melts, adding to the
sculpted contours.

BOTTOM: The icy
seascape is highly
dynamic. "We
watched one of
these arches
collapse," says
photographer and
National Geo-
graphic Explorer
Thomas Peschak.

TOP (OPPOSITE):
Icebergs, such as
this rhomboid
one topped with a
turquoise meltwater
pool, rise at least
16 feet above the
water. As icebergs
shrink, they become
berg bits.

BOTTOM (OPPOSITE):
The shifting ele-
ments transform the
Southern Ocean's
icebergs into
ephemeral pieces
of art. "None of
them are the same,"
Peschak says. "They
always change."





A hundred thousand chinstrap penguins nest at Baily Head, Deception Island, 70 miles north of the Antarctic Peninsula. Green mosses and lichens grow on ground kept glacier free by geothermal heat. As Earth's climate continues to warm, many islands off the peninsula could look like this. "It's like a crystal ball," Peschak says.



A PROPOSAL TO HELP PRESERVE **WILDLIFE**
 ON THE WESTERN **ANTARCTIC** PENINSULA
 AS **TEMPERATURES** RISE WOULD
 CREATE FOUR **PROTECTION** ZONES.

VULNERABLE BOUNTY

The cold, nutrient-rich waters off the coast of the Antarctic Peninsula are home to a plethora of living things, including thousands of seals and penguins. At the base of the food chain are tiny, shrimplike crustaceans called krill they depend on. Unfortunately, the region's delicate—and threatened—ecosystem is being pushed to the edge by a way to formally protect the region's delicate—and threatened—ecosystem.

HUMAN ACTIVITY

- Krill fishing intensity**
- Lower Higher
- Year-round research station
 - ★ Seasonal research station
 - Main tourist landing site in 2020

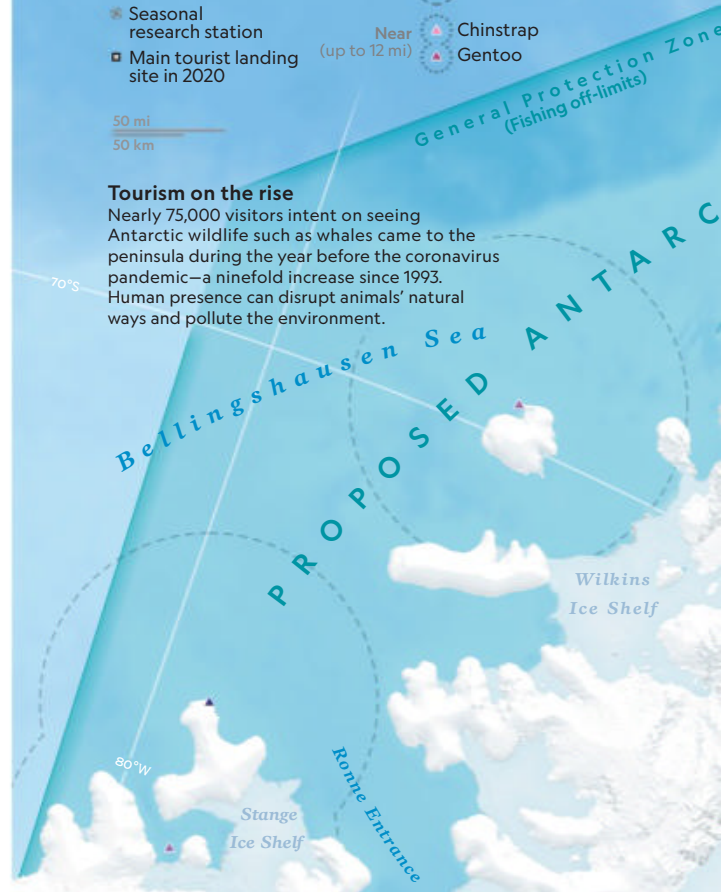
NATURAL ACTIVITY

- PENGUINS**
- ▲ Foraging limit (up to 75 mi)
 - ▲ Breeding colony
 - ▲ Emperor
 - ▲ Adélie
 - ▲ Chinstrap
 - ▲ Gentoos
- SEALS**
- Breeding island
 - Antarctic fur
 - Southern elephant

50 mi
50 km

Tourism on the rise

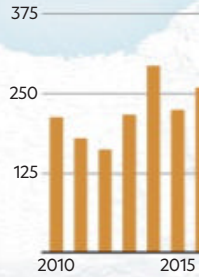
Nearly 75,000 visitors intent on seeing Antarctic wildlife such as whales came to the peninsula during the year before the coronavirus pandemic—a ninefold increase since 1993. Human presence can disrupt animals' natural ways and pollute the environment.



Krill anchor the food chain

The western coast of the Antarctic Peninsula is the hatchery for the krill that sustain many species, including migratory whales. But fishing vessels from Chile, China, South Korea, Norway, and Ukraine extract thousands of tons for products such as health supplements and fish food, and global demand for krill keeps growing. Under a new proposal, krill fishing could continue in designated areas but would be prohibited in general protection zones. Such areas bolster the entire fishery by giving species a refuge in which to feed and breed.

Antarctic krill catch (thousands of metric tons)



MATTHEW W. CHWASTYK, NGM STAFF
KELSEY NOWAKOWSKI, ERIC KNIGHT

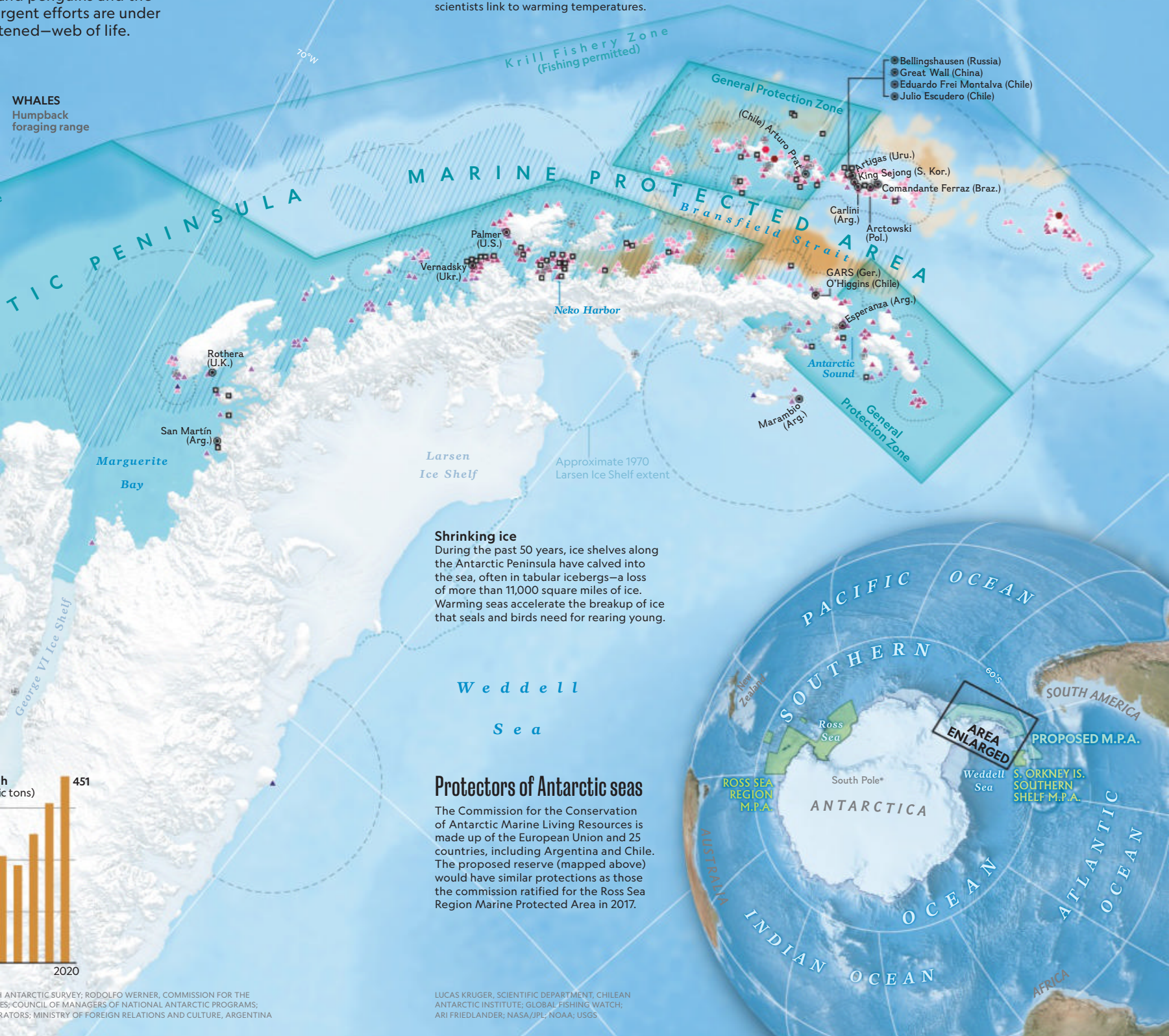
SOURCES: AUSTRALIAN ANTARCTIC DATA CENTRE; BRITISH CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES; INTERNATIONAL ASSOCIATION OF ANTARCTIC TOUR OPERATORS

Y Antarctic Peninsula support and penguins and the urgent efforts are under threat—web of life.

Vital breeding grounds

Four species of penguins and two seal species have long come to the coast of the western Antarctic Peninsula to breed. Censuses of nesting penguins record drastic losses—some chinstrap and Adélie colonies are down by half since 1970—that scientists link to warming temperatures.

WHALES
Humpback foraging range



Shrinking ice

During the past 50 years, ice shelves along the Antarctic Peninsula have calved into the sea, often in tabular icebergs—a loss of more than 11,000 square miles of ice. Warming seas accelerate the breakup of ice that seals and birds need for rearing young.

Protectors of Antarctic seas

The Commission for the Conservation of Antarctic Marine Living Resources is made up of the European Union and 25 countries, including Argentina and Chile. The proposed reserve (mapped above) would have similar protections as those the commission ratified for the Ross Sea Region Marine Protected Area in 2017.



ANTARCTIC SURVEY; RODOLFO WERNER, COMMISSION FOR THE CONSERVATION OF ANTARCTIC MARINE LIVING RESOURCES; COUNCIL OF MANAGERS OF NATIONAL ANTARCTIC PROGRAMS; SCIENTIFIC EXPEDITIONS; MINISTRY OF FOREIGN RELATIONS AND CULTURE, ARGENTINA

LUCAS KRUGER, SCIENTIFIC DEPARTMENT, CHILEAN ANTARCTIC INSTITUTE; GLOBAL FISHING WATCH; ARI FRIEDLANDER; NASA/JPL; NOAA; USGS

Pairs of chinstrap penguins, their bellies muddy from scrambling over ice-free spots where they build their nests, point their bills skyward and emit a honking call, perhaps to signal: “This is my patch.” Neighbors join in with a noisy chorus that ripples in waves across the colony. Chinstrap numbers along the peninsula appear to be declining, a sign that the Southern Ocean ecosystem is changing drastically, possibly because of a combination of climate change and commercial fishing for krill, a penguin staple.



krill feed great gatherings of other animals. Minke whales and humpbacks come to scoop up mouthfuls. Squid, fish, and penguins eat krill too. Many of those krill feeders in turn are hunted by top-level predators—leopard seals from below, skuas and giant petrels from above. Take away krill, and the ecosystem unravels.

It’s unclear what quantity of krill has been lost to warming conditions. Meanwhile, the waters around the Antarctic Peninsula supply the largest industrial krill fishery in the Southern Ocean; factory ships extract more than 800 tons a day. Krill are pumped up continuously from nets that may remain submerged for several weeks at a time. The crustaceans are processed on board to make products rich in omega-3 fatty acids, such as fish meal used in livestock feeds and krill oil that’s

added to nutritional supplements for humans and pets. Climate change threats and industrial fishing are closely entwined, Lynch says.

“As the sea ice declines, the krill fishing boats are able to move in.”

Against the backdrop of these pressures, an international team of Antarctic scientists has drawn up plans for a marine protected area (MPA) covering 250,000 square miles—almost the size of Texas—to safeguard the seas along the western coast of the Antarctic Peninsula.

Decisions on whether to create such protected areas are made by the Commission for the Conservation of Antarctic Marine Living Resources, an international body formed in 1982 to conserve Antarctic marine life in response to increasing commercial interest in krill fishing. The



commission operates under the Antarctic Treaty, an agreement signed in 1959 by 12 nations that shelved their territorial disputes and devoted Antarctica to peace and science. Commission membership now stands at 25 countries and the European Union.

Nearly two decades ago, the commission pledged to form a network of protected areas in the Southern Ocean.

The first, established in 2009, safeguarded waters off the South Orkney Islands, 375 miles northeast of the tip of the Antarctic Peninsula. The second, finalized in 2016, set aside part of the Ross Sea, on the other side of the continent. The commission was to consider the western Antarctic Peninsula proposal and two others at its annual meeting, in late October 2021.

The proposed measures for the western Antarctic Peninsula would keep krill boats away from the most important waters identified for wildlife within four general protection zones. The largest is in the south, an area that hasn't been exploited, because it's covered in sea ice. It would be off-limits to commercial fishing in the future, even if the ice melts enough to make commercial fishing possible. The rest of the protections would designate a zone where krill fishing could continue under renewed regulations.

THE FIRST STEPS in setting up an MPA involve gathering scientific data on what's there. Starting in 2012, scientists from Argentina and Chile led that effort for the Antarctic Peninsula MPA, bringing together experts from around the world. This is an intensively studied part of the continent, with most research bases dotted along the peninsula's west coast and islands. To identify priority areas for protection, computer software analyzed volumes of information accumulated on the animals that live, eat, and breed in this part of the Southern Ocean.

The Argentine and Chilean delegations sought input from other nations that are members of the commission. "One of our most important goals was to try to build a collective vision," says Mercedes Santos, a marine biologist who participated in the process as a researcher with the Argentine Antarctic Institute, under the Argentine Ministry of Foreign Affairs.

One objective is to help ensure the resilience of the peninsula's ecosystems to the changing climate, primarily by regulating where fishing takes place. This is especially important in the Southern Ocean, where so many animals depend on krill.

"An MPA will not prevent the impact of climate change but will reduce the stress on the ecosystem," Santos says.

The commission has set an annual krill quota for waters surrounding the Antarctic Peninsula of 171,000 tons—less than one percent of the estimated standing stock, as fisheries managers refer to the total biomass. Overall, experts say, that should be an ecologically sustainable fishery, with a caveat: Krill fishing must be targeted.

"For the penguins whose krill supply has dried up, it matters absolutely nothing to them that the krill that was taken was a small percentage of all the krill available in that region," Lynch says.



Gentoo penguins take a break on a drifting iceberg between rounds of foraging. They use claws on their feet to climb up the ice. Their numbers on the Antarctic Peninsula have increased more than sixfold during the past four decades. Gentoos rely less heavily on krill than chinstrap and Adélie penguins do.



“If you explore the fishing patterns in the last 10 or 15 years, they have been consistently going to the same spots,” says César Cárdenas, of the Chilean Antarctic Institute. He’s working on plans for the protected area. Fishing fleets favor the richest areas for krill, where whales and penguins go to feed. A 2020 analysis of more than 30 years of monitoring data indicated that when local krill catch rates are high, penguins do poorly according to a suite of measures including the weight of their fledglings and their breeding success.

Restricting krill fishing in certain parts of the protected area can help ensure the krill populations stay robust in places where parent penguins forage, so they don’t have to compete with fishing boats in securing food for their young.

With the scientific basis of the Antarctic Peninsula MPA in place, the next step lies largely within the political sphere—reaching consensus among all members of the commission. Given the importance of krill fishing, vigorous discussions are likely to lie ahead—especially if negotiations for the Ross Sea Region Marine Protected Area, which came into play four years ago after protracted wrangling, are any indication.

THE ROSS SEA is a deep embayment of Antarctica between Marie Byrd Land and Victoria Land, 2,300 miles south of Christchurch, New Zealand. Dubbed the “Last Ocean” because of its remarkably untouched nature, it’s considered one of the last large intact marine ecosystems left on Earth. Huge numbers of top predators roam its waters: orcas, snow petrels, Weddell seals, emperor and Adélie penguins.

“It has a disproportionate amount of all the amazing marine life that we know Antarctica for,” says Cassandra Brooks, a University of Colorado Boulder marine scientist who has worked in the Southern Ocean since 2004. “It really was this place that the international community rallied around,” she says.

The Ross Sea became a top priority for protection because of climate change and a commercial fishery for Antarctic toothfish that was burgeoning in the mid-2000s. Even so, it took more than 10 years of scientific planning and five years of intense negotiations by the Commission for the Conservation of Antarctic Marine Living Resources for the Ross Sea MPA to be adopted.

Discussions stalled over fishing rights and the MPA’s boundaries, and bit by bit, the original parameters changed. Major fishing



nations—including Norway and South Korea—cooperated when the MPA was reduced by 40 percent. (Later additions brought the total area back up.) The Ross Sea has no commercial krill fishery, but that option was kept open. Designation of a krill research zone and agreement that krill could be caught in the toothfish fishing zone helped gain China’s support in 2015.

Russia, the last holdout, chaired the commission’s October 2016 meeting, in Hobart, Tasmania. Final adjustments included a sunset clause of 35 years, when the Ross Sea protections will come up for review.

At the end of the two-week meeting, members announced the Ross Sea MPA. It’s the world’s largest marine protected area, covering approximately 589,000 square miles of ocean



PL AN ET
POSSIBLE

The National Geographic Society's Pristine Seas project has helped create 24 of the largest marine protected areas worldwide, covering 2.5 million square miles, and aims to help protect at least 30 percent of the ocean by 2030. Learn more at natgeo.org/pristine seas.

Adélie's are the most ice dependent of the penguins along the peninsula's western coast, where their numbers are in decline as ice keeps melting. Protecting this region of the Southern Ocean "will not prevent the impact of climate change but will reduce the stress on the ecosystem," says Argentine marine biologist Mercedes Santos, who has been instrumental in drawing up plans for the new marine protected area.

in addition to 183,000 square miles under the Ross Ice Shelf—in all, an area roughly the size of Mexico.

"Everybody was applauding and hollering and hugging and crying," says Brooks, who was present throughout the negotiations. "It was truly this remarkable moment."

In June 2021 the G7, a gathering of government leaders from some of the world's richest nations, gave its full support to the commission's interest in establishing a network of protected areas in the Southern Ocean. Along with the Antarctic Peninsula proposal, two other areas—the East Antarctic and the Weddell Sea—are being considered for MPA status. The EU, Australia, Norway, the United Kingdom, and Uruguay are taking leadership roles. The United States—represented by

former Secretary of State John Kerry, who was instrumental in the Ross Sea negotiations—is actively engaged again after being on the sidelines during Donald Trump's presidency.

The October 2021 meeting of the commission was to take place online because of the coronavirus pandemic, with any hugging virtual this time. This year is the 60th anniversary of the Antarctic Treaty coming into force, adding to the optimism of those seeking greater protections for the Southern Ocean. As Mercedes Santos says, "It's a reminder that we have to do, again, great things." □

Helen Scales wrote about the threats to emperor penguins in the June 2020 issue of the magazine. Photographer **Thomas P. Peschak** is the director of storytelling for the Save Our Seas Foundation.

What does a walk
across the world teach
about navigating our
troubled century?

TREAD LIGHTLY
upon the Earth.

A JOURNEY'S LESSONS

By PAUL SALOPEK | *Photographs by* JOHN STANMEYER



SHARE
what you can.

But most of all,
REMEMBER.



While journalist Paul Salopek was in Myanmar, pro-democracy demonstrations intensified. Since the military seized power in February, hundreds have been killed and thousands detained or tortured. Salopek had to break his global Out of Eden Walk and fly to China.

PANOS PICTURES/M.O.

PREVIOUS PHOTO

Children of nomadic Afar herders in northern Ethiopia gather in Herto Bouri, the Milky Way lighting the night sky. From here our ancestors began their spread across the planet, and Salopek set out, in January 2013, on his 24,000-mile storytelling odyssey.



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AUNG SAN SUU KYI

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အလိမ္မော်

WE WANT
OUR LEADER
FREE
DAW AUNG SAN SUU KYI

Gaspen

အိမ်အာဏာရှင်

Salopek walked through Jordan in 2014. At the time, Mohammad, then 11, one of hundreds of thousands of Syrian civil war refugees, was moving around the country with his family, picking

fruits and vegetables. A Syrian family in the hills of Wadi Rum shared dinner with Salopek. "There is no meat," his host bemoaned. "Here we only dream of chicken."







**NO ONE KNOWS PRECISELY WHY,
AFTER KNOCKING ABOUT AFRICA
FOR ROUGHLY 240,000 YEARS,
ANATOMICALLY MODERN HUMANS
BEGAN WALKING IN EARNEST
OUT OF THE MATERNAL CONTINENT
AND CONQUERED THE WORLD.**



Selwa, a trusty cargo mule, accompanies Salopek across challenging terrain near the ancient ruins of Petra, in southern Jordan. Camels and horses have helped him carry supplies during his quest to trace humans' migration.

Our dominion was hardly fated. After all, as everyone knows, life is mostly accidental.

This question preoccupies me because for nearly nine years as part of a storytelling project, I've been trekking along our ancestors' Stone Age trails of dispersal out of Africa. I've reached Southeast Asia. Eventually, the plan is to slog to the tip of South America, where *Homo sapiens* ran out of continental horizon. My aim has been simple: to foot-brake my life, to slow down my thinking, my work, my hours. Unfortunately, the world has had other ideas. Apocalyptic climate crises. Widespread extinctions. Forced human migrations. Populist revolts. A mortal coronavirus. For more than 3,000 mornings, I've been lacing up my boots to pace off a planet that seems to be accelerating, shuddering underfoot, toward historic reckonings. But until Myanmar, I'd never walked into a coup.

In Yangon, I woke one morning in a quarantine hotel and hurried to fill the bathtub with rusty drinking water. It was the first of February. A murderer in uniform had announced on TV that the elected government of Aung San Suu Kyi had just been arrested. Soldiers and police roamed the streets. Soon enough, they would start shooting protesters—men, women, children—in the head. Poets would later be declared subversive, arrested, and killed. (The body of one, Khet Thi, was returned to his family with signs of torture.) That first morning of the putsch, however, my concerns were myopic. I searched the trash bin for yesterday's leftover rice. What to do with the mini-fridge? Barricade the door? Or drop it on the heads of the Visigoths below? (I was on the ninth floor.)


Hypotheses abound about why we scattered from Africa.

Some researchers contend that a gigantic hunger pang slung us, like two-legged locusts, into the larger world: We'd eaten holes through our native savannas. Other experts say "green Arabia," a lush version of the Middle East, lured our long-legged forebears into new hunting grounds. Still others claim we took up beachcombing and strayed from our African comfort zone along shorelines newly exposed by dropping sea levels (the coastal migration theory).

My preferred hypothesis for the origins of human restlessness involves the voice of memory. It goes like this:

For the longest time, archaic humans tottered at the cliff edge of extinction. Our presence was vanishingly rare in antique lands. Someone might invent, say, a new tool, yet that innovation became lost when her clan died out. Advances never got



 **The National Geographic Society**, committed to illuminating and protecting the wonder of our world, has funded Explorer Paul Salopek and the Out of Eden Walk project since 2013 and Explorer John Stanmeyer's work on human migration. Learn more at [natgeo.org/impact](https://www.natgeo.org/impact).

ILLUSTRATIONS BY JOE MCKENDRY





Syrians pour into Turkey in 2014, part of a wave of people, mostly Kurds, escaping ISIS. The nearly four million Syrians in the country today—the largest refugee population worldwide—also make up the greatest mass migration to another country in the region since the fall of the Ottoman Empire a century ago, when ethnic Armenians fled Turkish persecution and genocide.

disseminated, passed along. And so it went for dreary millennia: discovery, loss, reinvention. Call it a long rut. Only when human populations grew large and stable enough to retain and build on breakthroughs did we at last unlock the planet's door. We remembered each other's memories. We won the battle against forgetting. We advanced.

I am nearing the middle of my absurd 24,000-mile walk eastward to sunrise. It is only natural, I suppose, to recall the thousands of faces I've encountered along my route. Who among them seemed best equipped to survive—if not master—the challenges of our uncertain age? Who could walk out of this century with their faculties intact?

As the crackdowns grew bloody, a strange amnesia settled over Yangon. It was the disappearing messages.

Burmese friends—pro-democracy activists, artists, students, youths in hard hats manning the barricades—had switched to encrypted apps. Soldiers were nosing through civilian phones at checkpoints. You set a timer on your texts for security reasons (six hours, one hour, a minute) and watched your life in digital conversations fade forever. *My mom said i don't want to see both of my daughters in prison ... they're shooting people in Tamwe ... Be safe ... I am trying to apply for political refugee status in third country ... I'm so sorry for my late reply. I had a bit of a breakdown ...*

Defiant screeds, pleas for help, bitter jokes, an endless cascade of rumors. These anxious records of fear, anger, and reassurance were gone each time I opened my eyes to another yellow dawn. I was walking through a revolution in a state of aphasia. It was the closest I've come, I imagine, to the days of our birth.

**REMEMBER A STROLL
IN NEW YORK
WITH TONY HISS.**

Hiss, a writer and public intellectual, is a bookish man in glasses who deployed pessimism so humane, so erudite, that it often recurved back to solutions, to a bruised sort of optimism. He had recently published a book called *In Motion*, in which he expounded on a condition he has called deep travel, a feeling of “waking up while already awake,” which bewitches human beings in their natural state, that is to say, when they are on the move.

What new trends should I keep an eye on, I

asked Hiss, as I inch through an accelerating 21st century? It was 2011, the year of the Arab Spring. A tsunami had wiped out coastal Japan. Goaded by bigots, America's first Black president had released his birth certificate to prove citizenship.

“Anticipatory loss,” Hiss replied without hesitation.

By this he meant the growing anxiety of a privileged minority who by accident of race, gender, or nationality had inherited an inordinate share of power on Earth—wealth, jobs, property, social status rooted in settled hierarchies—and who now sensed their advantages inexorably ebbing away.

Hiss must have sensed my skepticism. He squinted up to the shimmering steel ziggurats of Manhattan. “Remember,” he grinned, removing and wiping his glasses matter-of-factly. “All this is temporary.”

**REMEMBER
KADER YARRI'S FEET.**

Thick with calluses, flat as slabs of beef, they swung from Yarri's high, girlish hips the way weights do on a pendulum: smoothly, tirelessly—I am tempted to say eternally—across the Great Rift Valley of Ethiopia. As if the desert surface consisted not of gravel and dust but of ball bearings. We covered about 150 miles of freakishly beautiful desert together, Yarri and I, walking with two cargo camels through panes of burning light toward the Gulf of Aden. Yarri's rubber sandals seemed to clear the ground by a micron. They slid over the Earth like skates. It was a gait of superhuman efficiency: transcontinental, very old, designed for swallowing endless miles of geography in the pursuit of rain.

Yarri was an Afar pastoralist.

Early on, I mistook his silences for aloofness: To herders, all sedentary people without livestock are inferior beings. But it wasn't that. It was his watchful steadiness. “What will the camels eat?” he asked me one day, worried about a poorly chosen camp. I shrugged. I picked up a stone, held it out. It was the only time in a month that I saw him laugh.

Yarri was the alert man. He swept his eyes across the horizons, back and forth, like Doppler radar. He said he was looking for clouds. Clouds meant moisture. Moisture meant grass. Lately, the climate had gone berserk in his paradise of white thorns. Rains vanished. Water holes were drying up. The grasses never came

The world, step by step

Paul Salopek has walked some 11,000 miles since 2013, when he began following the footsteps of our ancestors out of Africa and across the world to the tip of South America. He's continuing his trek through China's heartland, heading toward Siberia.



The COVID-19 pandemic and the coup in Myanmar upended Salopek's plans. He had to fly to Shanghai to prepare for the China segment of his walk.

back. A resource war was simmering between his people and the Issa, ethnic Somalis moving up from their own threadbare plains.

Movement is our oldest survival strategy. Pastoralists navigate through cataclysms with their feet. The Stone Age people I follow likely did the same. They remind us: Carry your home, like a prayer bead rubbed between thumb and index finger. Don't lift your feet unnecessarily. Be ready to pivot.

**WALKING THE 21ST CENTURY
DIVIDES HUMANS
INTO TWO TAXA.**

The winners move on their asses, sitting in machines. The rest travel atop their bones—they walk. All along the global trail you meet many of the latter category: the invisible ones. Refugees. Outcasts. The displaced. The jobless, homeless, and stateless. Forced migrants—the United

Nations tallies no fewer than 80 million of them.

Remember their meals.

In the mountains of Nagorno-Karabakh, I knocked at a dilapidated apartment occupied by Armenian refugees from Syria. “Spasek!” the women hollered through the closed door. “Wait!” They had spied me coming up the road. I heard them frantically preparing a meal of cucumber, salt, cheese, and stale flatbread. They kept restocking my plate, a sheet of newspaper. They refused to even sit down. Two suitcases held all their worldly goods.

At a truck stop reeking with drunkards in Djibouti, a table of shy Somali migrants invited me to glass after tulip-shaped glass of red tea. They were smugglers’ chattel en route to Arabia. White, male, with a bankable passport, I was surely the most privileged walker within a thousand miles. Yet these men, who had left comrades dead of thirst in the desert, spooned my sugar for me as if I were the starveling.

Buses carry shoppers to and from the Kumtepa Bazaar in Margilon, Uzbekistan, in 2016. For centuries this was an important stop on the Silk Road, a complex web of commercial trails that, as Salopek writes, connected the markets and minds of Asia, Europe, and Africa. Today local people here buy everything from motor oil to onions.







LEFT: In Gaziantep, Turkey, Syrian brothers peer out the window in the two-room apartment they share with six other relatives. The refugee family makes about three dollars a day selling discarded plastic items.

RIGHT: A woman in Zhyngghyldy, Kazakhstan, prepares a meal as her child rests. Her husband engages in the modern micro-migrations of commuting, in his case to and from the oil-rich region of Mangystau.

The Syrians displaced from Homs, a city of several Roman empresses, survived by picking—and eating—tomatoes in Jordan. “There is no meat,” one apologized. “Here we only dream of chicken.” Homs had been smashed to atoms by Syrian president Bashar al Assad’s artillery. Some exiles wept telling their stories. One family laughed when the grandpa described eating wild grass to avoid starvation. They shared what they had: stewed tomatoes, raw tomatoes, pickled tomatoes. I awoke nights covered in their blankets.

My walking partner, a gruff Bedouin named Hamoudi Alweijah al Bedul, distributed all our food. We walked away from these encounters stunned to silence for miles by the Syrians’ generosity. Let epicures keep their Maine lobster and Kobe beef. Never in my life have I ever felt richer, more nourished, than in those sandy tents.

REMEMBER

KHIVA.

I stumbled down the nomad steppe of Karakalpakstan to a city that shone like a confection of yellow sandstone under the sun. More than four centuries before Europe achieved enlightenment, the oasis of Khiva—like Bukhara and Samarqand—was a center of global culture in what today is Uzbekistan: an entrepôt of free-wheeling ideas, science, art, technology, and languages. Greek philosophy imported from the Mediterranean helped ignite a glorious



age of Islamic intellectual achievement. Asian innovations like pulp paper, forged steel, and early advanced mathematics rocked westward to Europe atop camel trains. The Silk Road blew open the mind of the Old World.

“To survive in this desert, you need farming,” explained Gavkhar Durdieva, an architect in Khiva. “To farm, you need to understand irrigation, and that requires engineering. We used math to feed ourselves.”

With pride, Durdieva listed for me the Silk Road geniuses who a millennium ago invented the algorithm or calculated the radius of the Earth. Yet Khiva today was a sepulchral city. It was an artifact preserved under a bell jar. Busloads of German tourists sipped cappuccino under imposing stone ramparts that now defended nothing from nothing.

Antique walls are a feature of the Silk Road.

For two years, I hiked past old battlements, parapets, and bulwarks. While it’s true that such

medieval defenses kept armed nomads and raiders at bay, the larger truth is that the rich, multiethnic trading kingdoms of Central Asia rotted from within. They succumbed to political and religious polarization, to the chaos of dynastic struggles, to sectarian fanaticism (the Shiite-Sunni schism), intolerance, anti-rational purges, and, ultimately, stagnation. By the 1200s, Genghis Khan had walked right over them.

Walls were monuments to policy failure. Be careful what you lock in.

REMEMBER SAROJ

DEVI YADAV.

She wore a bright fuchsia scarf, and her right foot was bandaged against a thorn puncture. She lived on a farm in Rajasthan, India, about 10 miles east of Jaipur. Her fields of wheat shimmered under the sky, and there were buffalo wallows of black mud. I’d been crossing such



landscapes for weeks. As farms go, it was as ordinary as Yadav was extraordinary.

“We run things here. It is a necessity,” said Yadav, the stern matriarch of her all-woman smallholding. “All the men are away working in the city.”

I asked about harvests. (Not good.) About fickle weather. (The monsoons now gave out too soon.) Yadav was among the 600 million people—nearly half the Indian population—enduring the worst water crisis in the world. I saw stabs at sustainability at the ant level. Villagers hoed tens of thousands of small check dams to try to capture each drop of rainwater. Some were adopting older, less profitable but drought-adapted crops such as millet. But these efforts overlooked worse bottlenecks.

When lost in a wilderness, goes the adage, follow rivers. Water flows to civilization. I always had taken this advice. And civilization looked like this:

Saroj Devi Yadav, forced into marriage at 13,

tilled the fields with her granddaughters. Such women make up the bulk of the agricultural workforce across much of India. But like other women, she didn’t own the actual soil. Her absent husband did. India still lies squarely under the feet of men.

**I BROKE MY WALK
IN YANGON.**

The military was shooting hundreds of citizens. A prolonged civil war was ramping up. The trail ahead was too dangerous. Violating the protocol of my journey, such as it is, I left Myanmar and flew to China.

In Svetlana Alexievich’s oral history *Chernobyl Prayer*, a child recalls a grandmother taking leave of her poisoned, radioactive farm, emptying her millet in the garden “for God’s birds,” and then scattering hen’s eggs for the abandoned cat and dog. “Then she bowed to the house. She



bowed to the barn. She went round and bowed to every apple tree ... My grandfather, when we were going away, took his hat off.”

I felt like bowing to Yangon. Believe me when I tell you that in this life, or the next, I will pay for abandoning my Burmese friends under such circumstances.

I visited a tree-shaded neighborhood to say goodbye to some. They were pro-democracy activists in hiding. The interior of the house resembled a college dorm. Bicycles packed the foyer. A guitar was propped in a corner. My friends stood around a coffee table, earnestly learning to use a bamboo bow and arrow against the troops of the junta. How old are such scenes? The earliest known arrowpoint dates back 61,000 years. It was found at Sibudu Cave, in South Africa. The archaic *Homo sapiens* I’m following doubtless invented it.

“Everybody’s going to have to take some heat in this thing,” said a tattooed video producer in the safe house. “Nobody will come out unscathed.”

LEFT: This young man in India’s Haryana state earns money by keeping wedding guests dry with his umbrella. Late October to early December—auspicious months for unions—is the busiest time for weddings in India.

RIGHT: A man breaks from work during the night at a round-the-clock rice-processing plant in Punjab. Over-use of pesticides in this part of the country has contaminated the water table—and cancer rates are increasing.

This seemed a benediction for the collective journey ahead. What advice could I possibly offer? To always walk toward rain? To share what little you have? To never trust a wall? We wished each other luck. The arrows lay stacked on the table next to an iPad.

I told myself: Remember this. □

This is Pulitzer Prize-winning journalist **Paul Salopek**’s 10th story about the Out of Eden Walk. **John Stanmeyer** has photographed 18 stories in the magazine.



Women pray at an ancient cemetery in Kazakhstan's Mangystau region. Salopek hiked through this largely empty Central Asian hinterland of clay deserts and limestone mountains and buttes, once covered by an ocean.





INSTAGRAM

DIANA MARKOSIAN

FROM OUR PHOTOGRAPHERS

WHO

A documentary and conceptual photographer born in Moscow

WHERE

Markosian's home in California

WHAT

iPhone 11 back dual wide camera with 4.25mm lens

Like most people, Markosian spent many early days of the pandemic at home. With her world made smaller and her creative spirit still strong, she turned her focus inward, finding subjects within her walls. For one series, she took a smartphone into her bathroom and staged self-portraits. To set up this image, she brought in a live butterfly, photographing it and her hand against a window with opaque privacy glass. In the moment, Markosian imagined a similarity with the insect: having wings but being unable to fly away.

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