

PATHFINDER EDITION

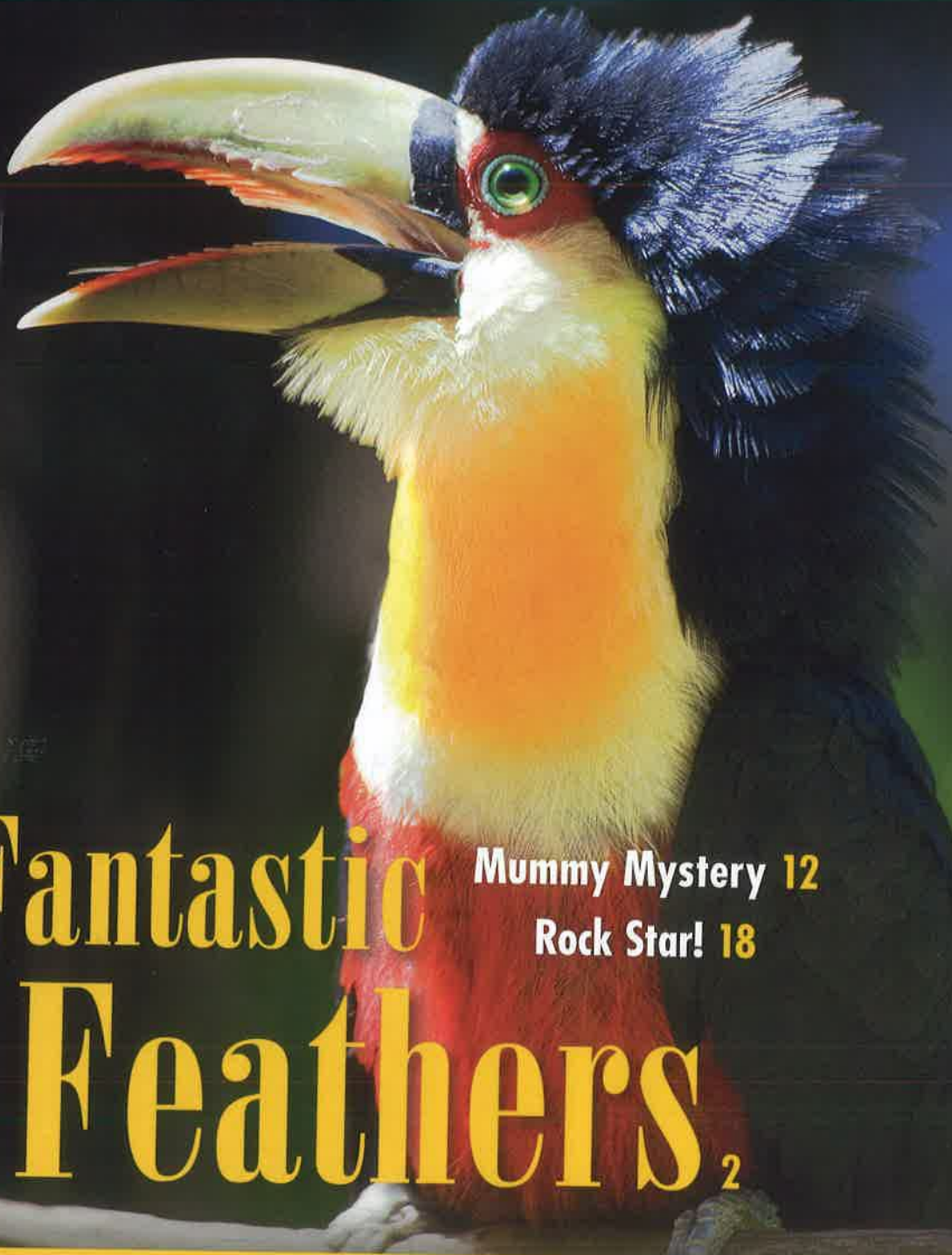
NGPATHFINDER.ORG

MARCH 2011



NATIONAL GEOGRAPHIC

Explorer



Fantastic
Feathers₂

Mummy Mystery 12
Rock Star! 18



By Michael E. Ruane

Fantastic



Comprehension Strategy: As you read, picture in your mind what you are reading. Think about the kinds of words that help you form these pictures.



Feathers




G

liding across the ocean in a straight line, five pelicans flap their wings just above the water. Wing tip to wing tip, their feathers nearly touch. Suddenly, they turn and head out to sea. Then they dive into the water, scooping up fish in their pouched bills.

Thousands of kilometers away, a smaller bird dances alone above the fields of southern Asia. The Indian roller dips and soars through the air. This fancy flier ends its show with a series of rolls.

Elsewhere, a great gray owl flaps its wings as it flies across Earth's northernmost skies. This night flier has a ghostly white face and sharp talons. With feathers built for silent flight, it quietly swoops down onto a mouse scurrying across the ground below.

All three of these birds are different. Yet, like all birds, they have one thing in common—feathers. Sure, feathers allow many birds to fly. Yet they do much more than that. Feathers help birds run, swim, and even stay warm and dry. Now those are some fancy feathers.



pelican



Fuzzy Feathers

Fancy or drab, feathers cover most of a bird's body. They can be blue, red, green, or even purple. They can be as small as your eyelash or as long as your arm.

When most baby birds hatch, they don't have many feathers. What they do have looks like fluffy fuzz.

Perhaps you've seen yellow fuzz on chicken chicks. Gray fuzz grows on long-eared owlets, making them look like puffballs with yellow eyes. Brown fuzz covers tall king penguin chicks. Only their black eyes, beaks, and feet stick out.

Don't be fooled by its softness or puffy looks. This fuzz is actually made of special feathers called **down feathers**. These feathers aren't just for baby birds, either. They grow on grown birds, too. You usually don't see them because they grow close to a bird's skin.

Together, down feathers act like a sweater. They trap air close to a bird's body. The trapped air keeps the bird warm, even in cold weather.

Hooked on Feathers

Larger feathers soon sprout over a chick's down feathers. These **contour feathers** cover its body like shingles on a roof. Tiny hooks line each of these feathers. A bird can latch these tiny hooks. That zips the feathers together, protecting the bird from bad weather.

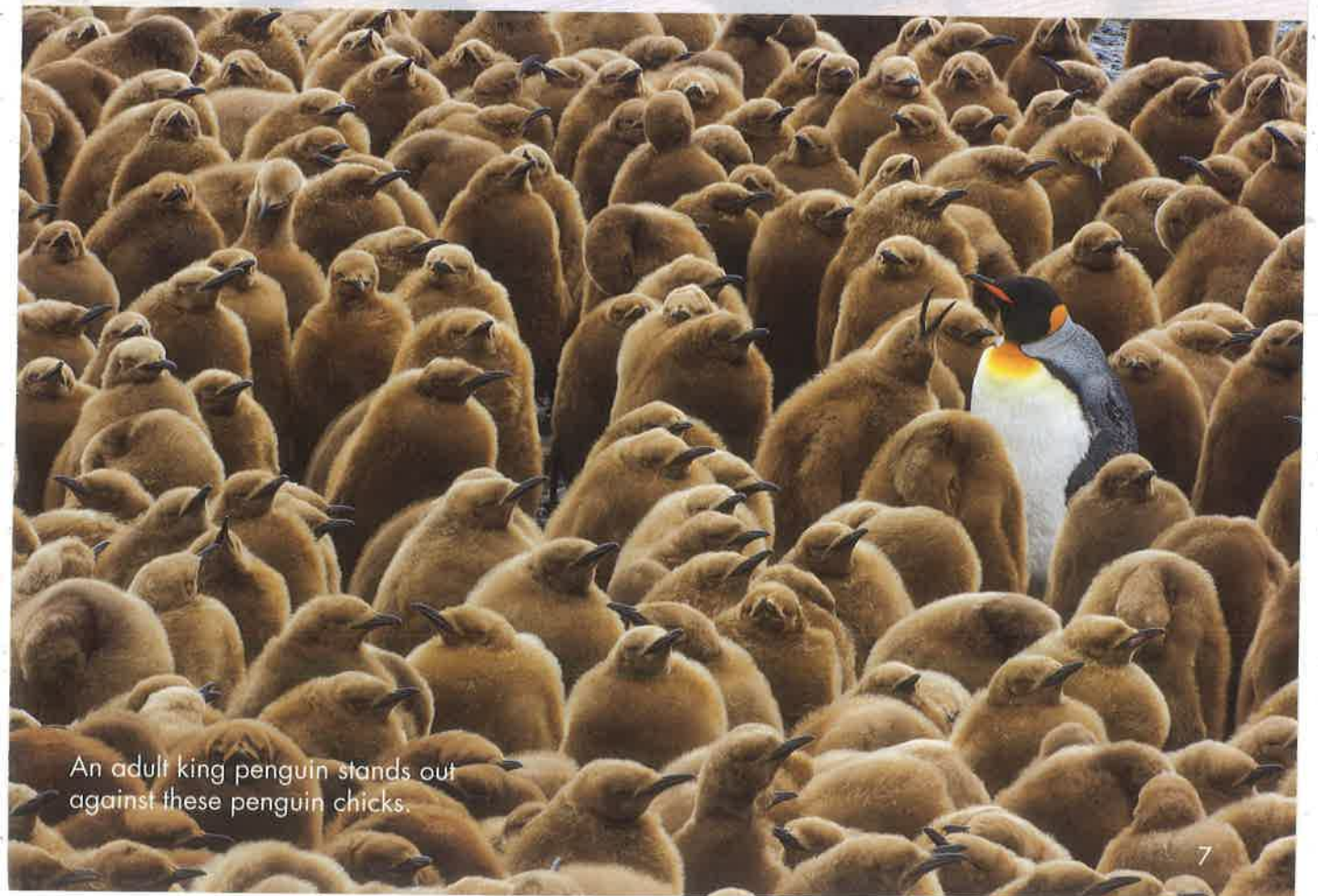
As a chick gets older, sturdy **flight feathers** also grow on its wings and tail. These are a kind of contour feather that allow a bird to fly. A bird can shift its flight feathers so it can take off, soar, dive, and land.

All these feathers do different things. Yet they are alike in many ways. They are all made of **keratin**. That's a substance that also forms claws, beaks, and even your fingernails. Each lightweight feather has a hollow shaft with a quill at one end. The quill connects the feather to a bird's body. Soft barbs grow from the shaft, forming a feather's vane. With all its feathers in place, a bird is now ready for takeoff.

A Feather and Its Parts



These owlets have soft, downy feathers. Their contour feathers will grow in soon.



An adult king penguin stands out against these penguin chicks.

Pushes and Pulls

Hollow feathers are just one of the secrets that allow a bird to fly. So are wings. In many ways, a bird's wing is like your arm. It bends at the shoulder, elbow, and wrist. Being able to bend its wings in three places allows a bird to control how it flies.

A bird's wings are shaped to soar. They're curved on top and flat on the bottom. Air moves faster over the curved top than under the flat bottom. The faster-moving air pulls the bird up. The slower-moving air below pushes it up. So the air both pushes and pulls the bird up, up, and away.

Once in the air, birds fly in different ways. How a bird flies depends on the shape of its wings. Some birds have pointed wings. Others have large, broad wings. Both kinds of wings fly, but differently.

Winging It

To see how, start with the peregrine falcon. This high flier is built for speed. It soars and scans the sky for prey. When it spots a small bird, it flaps its long, pointed wings hard. Then it tucks its wings against its body and plunges down. It can dive 240 kilometers (150 miles) per hour to catch its dinner.

The hummingbird has super flexible wings. This flap-happy bird beats its wings up and down and back and forth up to 50 times a second. It can dart forward, stop, hover, and zoom backward. In fact, it's the only bird that can fly backward.

Other birds flap their wings as little as possible. Take the albatross, for example. It's one of the largest birds in the sky. Its long, thin wings can grow to be three times the length of its body. They can stretch up to 3.4 meters (11.2 feet).

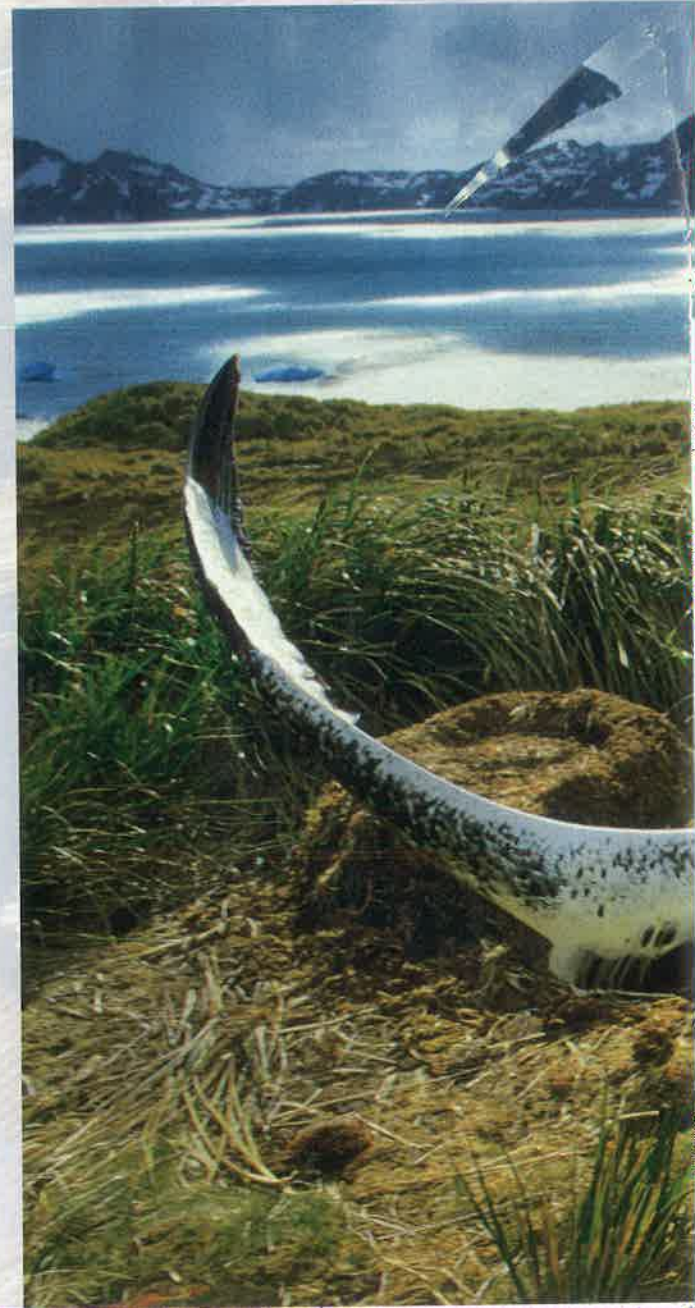
An albatross glides on the wind. It can ride the wind for hours without flapping its wings even once. This mighty bird mostly stays in the sky, swooping down to the ocean to catch squid and other sea creatures.

Showing Off

Feathers aren't just for flight, though. Many female birds have drab-colored feathers. This protects mother birds as they sit on their nests. They blend in, so predators can't see them.

In contrast, many male birds have fancier feathers. They use their feathers to attract mates. To do so, some males puff out their chest feathers. Others fan out their tail feathers. Still others strut about.

A male bird of paradise is a show-off. Some of its feathers look like streamers or ribbons. Others look like a crown. Fancy feathers aren't enough for this bird. It dances. It poses. It flaps. It even hangs upside down.



This male bird of paradise (left) uses his colorful feathers to attract a female (right).



This wandering albatross shows off its impressive wingspan.





Grounded!

What's stranger than an upside-down bird? Well, what about a flightless bird? In fact, from penguins to ostriches, some of the birds we know best keep their feet on the ground.

These birds aren't hurt or tired. They simply aren't built to fly into the sky. An ostrich is a good example. As the biggest bird on Earth, it has plenty of feathers. Yet instead of flying, it runs. That's because its wings are too small and its body is too heavy to get off the ground. Don't let its weight fool you, though. It can zoom across land at 70 kilometers (43 miles) an hour, using its wings to quickly turn.


Feathered but Flightless

Some other kinds of birds can't fly either. A takahe looks like a big chicken with beautiful blue and green feathers. It has a huge red beak and oversize pink feet. It mostly uses its wings to show off or to scare off other birds.

The Magellanic steamer duck is slate gray with an orange beak. It uses its feathered wings to paddle across water as fast as 24 kilometers (15 miles) per hour.

Then there's the penguin. This bird has many uses for its feathers. Flying is just not one of them. A king penguin uses its feathers to stay warm and dry. This is especially useful in icy, cold water. It can dive 565 meters (1,850 feet) after a fish dinner, much deeper than any other bird.

So not all feathers fly. Birds use their fantastic feathers to swim, paddle, run, stay warm, keep dry, and show off, too. Feathers help birds survive. Whether birds are fliers, runners, or swimmers, though, feathers are what makes them birds. So the next time you find a feather, think about how a bird might have used it.



These ostriches have feathers, but they cannot fly.

Wordwise

contour feather: feather on the outermost part of a bird's body

down feather: feather closest to a bird's body; used for insulation

flight feather: feather on a bird's wings and tail that help it fly

keratin: what feathers are made of



nt tomb with a
solves a curious...

MY ERY

eme Council of Antiquities





This photo shows the Valley of the Kings (above). A wooden statue shows the face of King Tut (below).



It's hot inside the mummy's tomb. Yet no one is complaining. A member of my team holds up a small tool that looks like a corkscrew. He places it against the mummy's leg bone and cranks it. I wince. It makes a rusty, squeaking sound as it bores into the ancient bone.

Hanging out with mummies may seem scary, but I do it all the time. I'm an **archaeologist**. You've probably seen photos of me in my Indiana Jones hat. I wear it most days to protect my eyes from the blazing sun. Working outside digging up ancient objects is hot, slow, dirty, and difficult work.

Today, I'm inside one of the most famous tombs in the world. King Tut is buried here. His full name is Tutankhamun.

I look more like a doctor than an archaeologist. I'm wearing a doctor's white lab coat. Surgical gloves cover my hands. A surgical mask hides most of my face. Only my eyes are uncovered. I'm dressed to protect this marvelous mummy from dust and germs.

Tomb Raiders

Protecting Tut is important. He lived and died more than 3,000 years ago. We don't know much about that time.

Centuries passed. People forgot about Tut and where he was buried. Then about 90 years ago, archaeologists found his tomb. It's one of 63 tombs carved into cliffs in the middle of modern Egypt. So many kings are buried here, we call it the Valley of the Kings.

Over time, robbers raided many of the valley's royal tombs. Luckily, they never found Tut's tomb. It still held Tut's mummy and other **artifacts**, or objects from the past.

Crowning the Boy King

We've learned much from the artifacts found in Tut's tomb. They tell a stunning story about Tut. It's about a young prince. It's about a military leader. It's about a king who died before he could fully rule his kingdom.

The story begins with Tut's father, Akhenaten. He was the king of Egypt. Tut grew up in a city called Amarna. The palace there had courtyards with lush gardens and flowing fountains.

Tut became king after his father died. He was about nine. Most kings weren't that young. Nothing about Tut was typical, though. For example, he was a king with two crowns. That's because ancient Egypt was a divided country. A white crown represented one part of the country. A red crown represented the other. Wearing the two crowns meant Tut ruled both lands as one.

Tut may have had the crowns of power, but he didn't have real power. Because he was still a boy, he had adults who helped him rule. They had the real power.

Just as Tut became old enough to rule on his own, he died. The question of how he died has been a great mystery.



This art was found in King Tut's tomb.

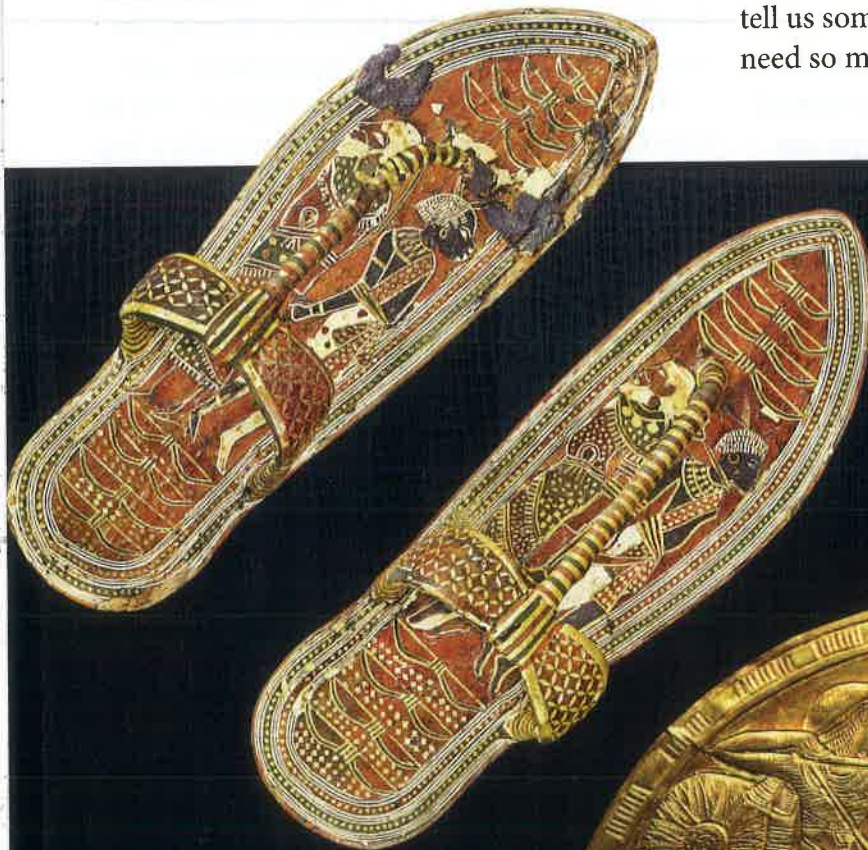


Royal Living

How Tut lived might help answer how he died. The ancient artifacts from his tomb tell us much about his daily life.

From head to toe, he dressed well. Some of his clothes were plain. Others were covered in beads and sewn with colorful threads. He wore heavy gold bracelets, rings, necklaces, and even earrings. Some of his sandals have painted portraits of his enemies. Every time Tut took a step, it looked like he was crushing his foes.

The king ate bread, cake, and meat. He munched on chickpeas, lentils, and vegetables. For dessert, he liked honey, dates, figs, and other fruits.



Tut's golden fan shows him hunting ostriches from his chariot.

The Warrior King

He may have liked to hunt. Images carved into a golden fan show Tut hunting ostriches. On one side, he is shooting at them from his chariot. On the other side, he is coming home with the birds he has killed.

Tut's life was not all fun and games, though. As king, he had to lead an army. Tut may have driven a chariot to lead his army as they battled Egypt's enemies.

It's not easy bouncing at high speed in a chariot, shooting arrows. It's even harder when foes are shooting back. So Tut had to practice.

From chariot driving to hunting, the ancient artifacts show a king who was active. Yet the more than 100 walking sticks in Tut's tomb may tell us something else. Why would a young man need so many walking sticks?

Some of Tut's sandals, like these, show images of his enemies. He symbolically crushed them with each step.





Tut enjoyed board games. Four versions of this popular game, Senet, were found in his tomb.

The Mummy's Secrets

The answer to this question is also in Tut's tomb. No, it's not in the objects in the tomb. I now know it's in the mummy itself.

Archaeologists have studied Tut's mummy several times. They've taken x-rays that showed a hole in the back of the mummy's skull. The hole made many people—even me—think Tut had been murdered.

I examined Tut's mummy for the first time several years ago. I will never forget that moment. I never thought I would get the chance to be that close to him. When I looked into Tut's face, I felt such joy.

My team used a CT scanner to take 1,700 pictures of Tut's body. We used the pictures to make a three-dimensional image of him. This image told us that Tut died when he was 19. It also showed that a murderer didn't make the hole in the back of his head. Instead, mummy makers made it after Tut had died.

I was shocked. All my life, I thought this hole meant Tut had been murdered.

Now I had to find what really killed him. I looked for new answers in the scan. It showed that Tut's left leg was broken. A wound over the break could have gotten infected. Infections can kill.

The scans also showed that Tut had a deformed foot. He had a bone disease. So the walking sticks were not just symbols of power. He needed a cane to walk.

Testing Tut

Everything was beginning to make sense. Still, I needed more information. That's why I took samples of the king's **genes**.

The tests confirmed that Tut had a bone disease. They also showed that he had malaria. It's a disease carried by infected mosquitoes. Their bite can kill their victims.

Putting everything together, I believe we have solved the mystery of Tut's death. The answers came from the walking sticks, the x-rays, the CT scans, the gene tests, and our thinking as scientists. Our **theory** is that Tut was weakened by a bone disease. When he broke his leg, an infection quickly spread. The infection and the malaria killed him.

At last, the case is closed, right? Not yet. I have new questions I hope to answer about this king and his family. I can't help it. I love digging into the unknown.

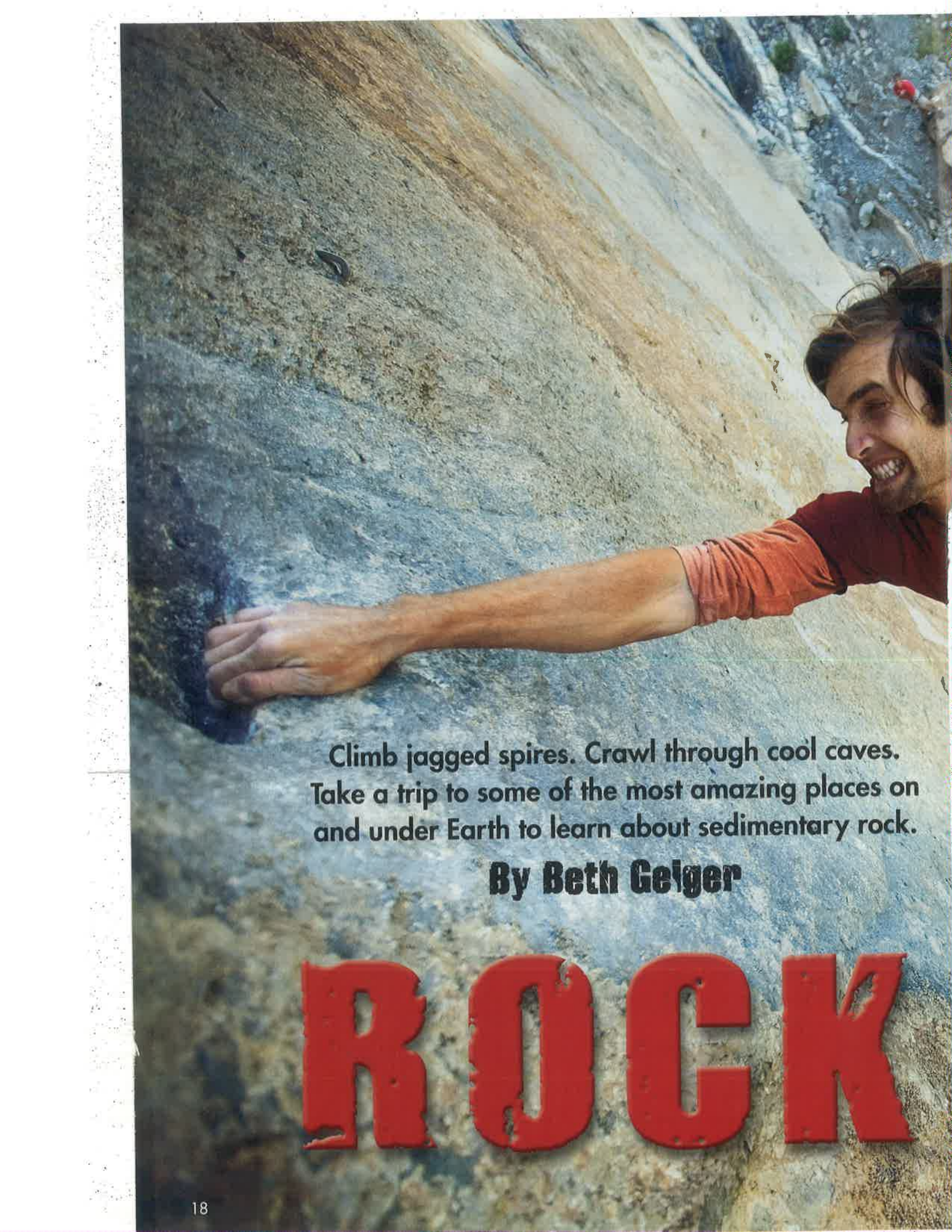
Wordwise

archaeologist: scientist who studies things and places from the past

artifact: object left by people of the past

gene: part of a cell that determines how an organism grows and looks

theory: statement explaining what scientists observe

A photograph of a man with long brown hair, wearing a red t-shirt, climbing a steep, layered rock face. He is smiling and looking towards the camera. His right arm is extended, with his hand gripping a dark, textured rock surface. The background shows more of the rock face and a glimpse of a rocky streambed at the top right.

Climb jagged spires. Crawl through cool caves.
Take a trip to some of the most amazing places on
and under Earth to learn about sedimentary rock.

By Beth Geiger

ROCK