

KIDS  
DISCOVER

# Fossil Hunters

Book #: 8

Property of: 6<sup>th</sup> Grade Science Department

THE SHIN BONES CONNECTED TO THE KNEE BONE,  
THE KNEE BONES CONNECTED TO THE THIGH BONE...

IT'S A BIRD  
IT'S A PLANE  
IT'S A PTEROSAUR!

TRAPPED  
IN TAR IN  
L.A.

3-YEAR-OLD  
PALEONTOLOGIST

PREHISTORIC  
POOP





# Fossil Hunters Forever!

A fossil hunter's job is never done. For a century, *Tyrannosaurus rex* reigned as earth's biggest, most ferocious meat-eater on two legs or four. But in paleontology (the study of fossil animals and plants from former geologic periods), uneasy rests the skull that wears the crown.

In South America in the mid-1990s, fossil hunters uncovered the bones of an even bigger meat-eater: *Giganotosaurus* ("monstrous lizard"). Within months, this carnivore king had to share its title with a newcomer from Africa: *Carcharodontosaurus saharicus* ("shark-toothed lizard of the Sahara"). Will fossil hunters soon dig up an even bigger dinosaur?

Only a handful of fossils find their way to the planet's surface, but earthquakes, water, and wind turn many of them to dust before humans find them. What about the fossils that remain in the earth's rocky crust? Without a doubt, a fossil hunter's job is never done.

To many people, dinosaurs are the celebrities of the fossil world. But the dinosaur is just a blip in the fossil record. (The fossil record includes all the known fossils.) Fossil hunters' quarry spans billions of years and includes not only dinosaurs but everything from bacteria and algae to early humans.

## FOSSIL HUNTERS



▲ **THE 19TH CENTURY** (1801–1900) was a time of "fossil fever." Mary Anning (1799–1847) caught the fever when she was 11 years old. She accidentally found a fossil fragment near her home in England. Anning later collected an entire pterosaur (flying reptile) and the skulls and pelvises of two sea reptiles—ichthyosaur and plesiosaur.

## What Prehistory Left Behind

The earth preserves many traces of prehistoric (before history was written) life, from fossils to objects made by early humans. At right are just a few.



**GASTROLITHS** (stones swallowed by big plant-eaters to aid in grinding and digesting food)



**FEATHER IMPRINT**



**FOOTPRINTS AND TRACKS**



**EGGS AND NESTS**



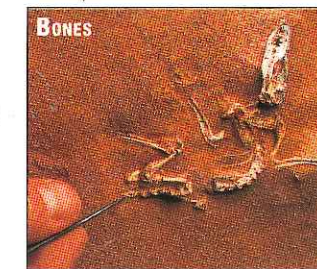
**COPROLITES** (fossilized droppings, or feces)



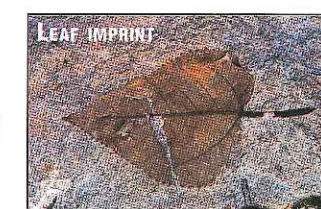
**SKIN IMPRINT**



**ARTIFACTS** (such as stone tools and bone spears made by humans)

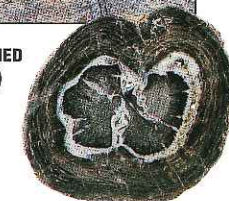


**BONES**



**LEAF IMPRINT**

**PETRIFIED (STONE) WOOD**

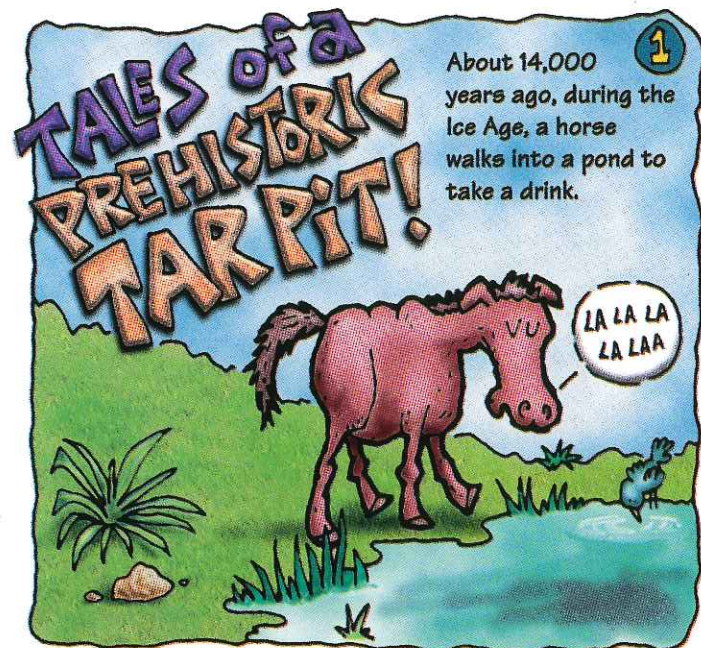


**AT DINOSAUR** National Monument on the Colorado-Utah border, technicians work to remove rock that surrounds dinosaur bones in a sandstone wall.

### CHECK IT OUT!

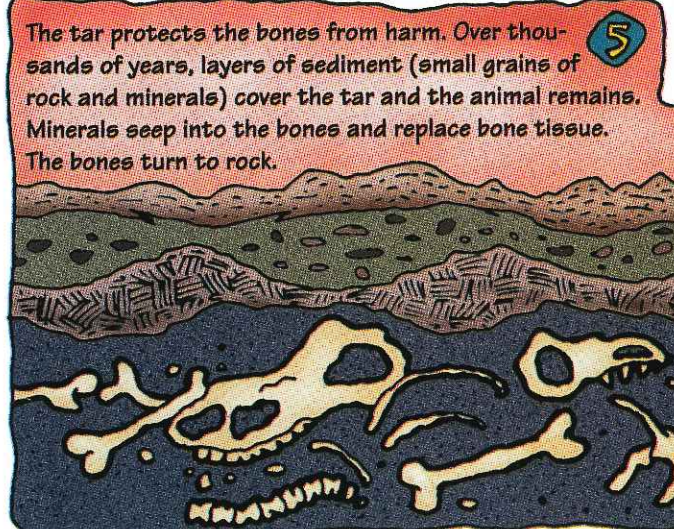
Which two American explorers turned into fossil hunters on their famous 1804–1806 journey? (answer on back cover)



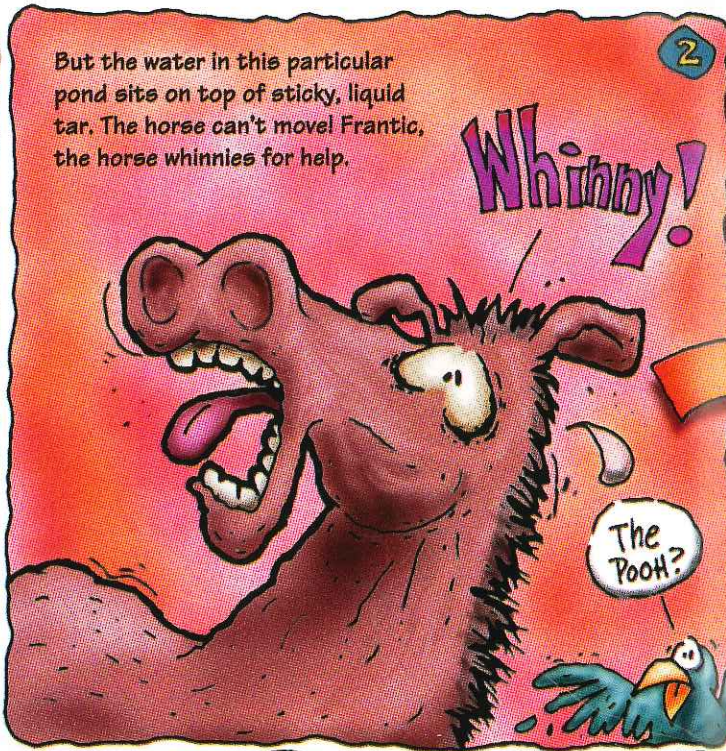


1 About 14,000 years ago, during the Ice Age, a horse walks into a pond to take a drink.

LA LA LA LA LA LA

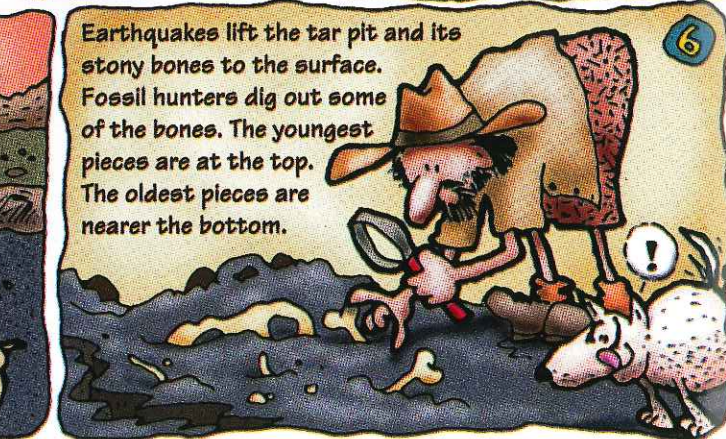


5 The tar protects the bones from harm. Over thousands of years, layers of sediment (small grains of rock and minerals) cover the tar and the animal remains. Minerals seep into the bones and replace bone tissue. The bones turn to rock.



2 But the water in this particular pond sits on top of sticky, liquid tar. The horse can't move! Frantic, the horse whinnies for help.

The Pooh?



6 Earthquakes lift the tar pit and its stony bones to the surface. Fossil hunters dig out some of the bones. The youngest pieces are at the top. The oldest pieces are nearer the bottom.

# The Afterlife of Organisms

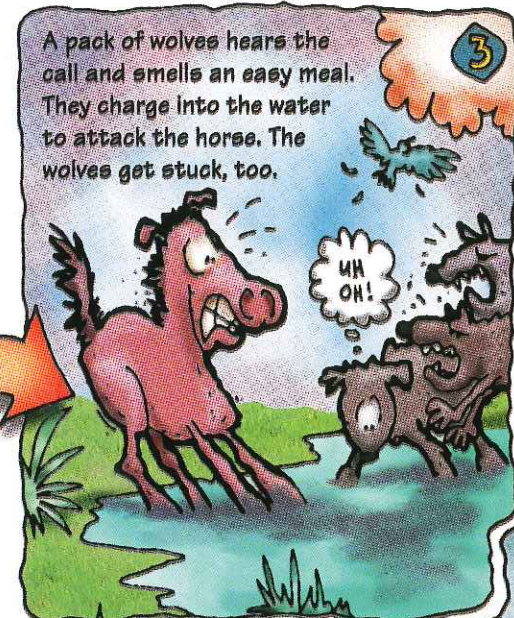
Look around you. Now imagine the same scene in 50 million years. What do you think will be left of it?

Probably nothing. That's right: not a thing. The earth has too many ways to make things "disappear": earthquakes, tornadoes, hurricanes, fires, and decomposers (organisms such as bacteria that rot things). So how does anything survive on this planet for millions of years?

Plants and animals have two slim chances of becoming a fossil when they die. The first opportunity depends on biology.

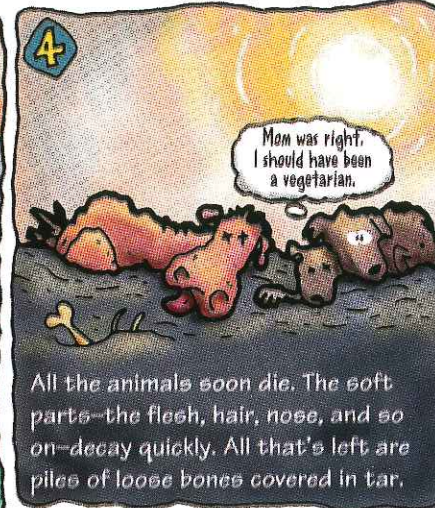
A plant or animal with many hard parts (teeth, bones, shells, wood) has a greater chance of fossilizing than one with soft parts (flesh, leaves, stems). The second way a plant or animal can become a fossil is if it is buried in a substance that can preserve it. Tar or ice might encase it. An acid bog (wet area) might keep bacteria away. A mudslide might bury it, protecting it from the elements.

Might. But then again, might not. In that case, the plant or animal will decompose and erode (wear away) into dust.



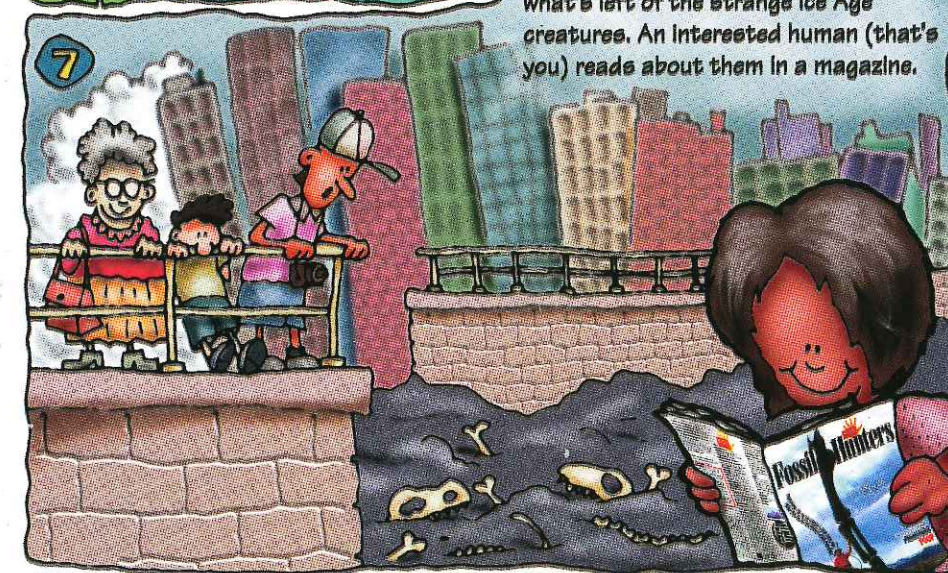
3 A pack of wolves hears the call and smells an easy meal. They charge into the water to attack the horse. The wolves get stuck, too.

UH OH!



4 All the animals soon die. The soft parts—the flesh, hair, nose, and so on—decay quickly. All that's left are piles of loose bones covered in tar.

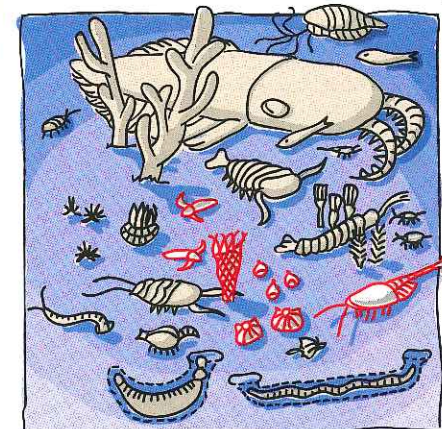
Mom was right. I should have been a vegetarian.



7 A big city called Los Angeles rises all around the tar pit. Tourists flock to see what's left of the strange Ice Age creatures. An interested human (that's you) reads about them in a magazine.

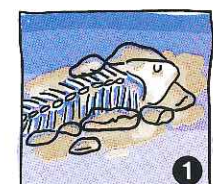
▼ **IN ROCKY WESTERN** Canada, sea life thrived 500 million years ago. But today, only a few fossils (high-

lighted) survive. How did seashells go from the ocean floor to the tops of mountains? (answer on back cover)



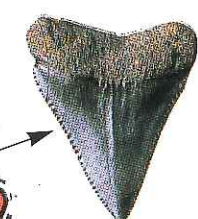
CHECK IT OUT!

► **TAR ISN'T THE** only fossil preserver. Sediment from rivers can cover bones [1]. The sediment hardens into layered, sedimentary rocks such as sandstone or shale [2]. Water seeping through the rock carries minerals that replace the soft tissue in the bone [3]. (Part of the bone is already mineral.) That's how a bone becomes fossilized.



▲ **CHALK AND OTHER** limestone rocks are often rich in fossils. Their main ingredient is crushed seashells—calcium carbonate. If you drop a bit of vine-

gar on these rocks, it bubbles, because vinegar is a weak acid that causes the release of carbon dioxide from the calcium carbonate.



◀ **SHARKS HAVE NO** bones. Their skeletons are made of cartilage, a softer material also found in your nose. All that's left of many prehistoric sharks is their scariest part: the teeth. All that's left of many prehistoric human noses is a hole in the face.

## Creature Feature Peltephilus

("shield-loving")  
**Time:** 30 mya (million years ago)  
**Place:** Southern Argentina  
**Close in size:** Three twin mattresses, end to end  
**Fossil fact:** Horns and an armor of hard outer skin protected the soft insides of this early armadillo.





# A Bone to Pick

Today's well-armed fossil hunter carries a rifle in one hand and an ordinary toothbrush in the other.

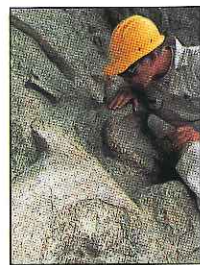
The rifle may sound like overkill. After all, fossilized animals have been dead for many millions of years. Nineteenth-century fossil hunters used rifles to ward off bears, cougars, and criminals. But today, the rifle has a new purpose: to produce a loud, clear sound. The sound bounces around underground, and a computer maps its echoes. Buried bones show up on the maps because their bounced sound is different from that of rocks.

And the toothbrush? That's just one of many tools used for unearthing a fossil. Fossils are fragile. They are often wearing away. Their fragile material is stuck inside hard rock. Let's find out how fossil hunters go about retrieving them safely.



▲ **ROCK DRILLS AND** saws can free large bones from a cliff. Pickaxes and chisels can loosen pieces of rock. Fossil hunters label and chart their fossil finds on site. They often paint them right away with a protective hardener. Freeing fossils from rock can take months or years! Fossil hunters wrap the

larger fossil finds in plaster and burlap and ship them to museums to be cleaned.

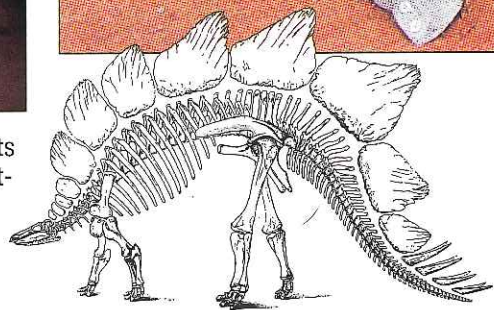
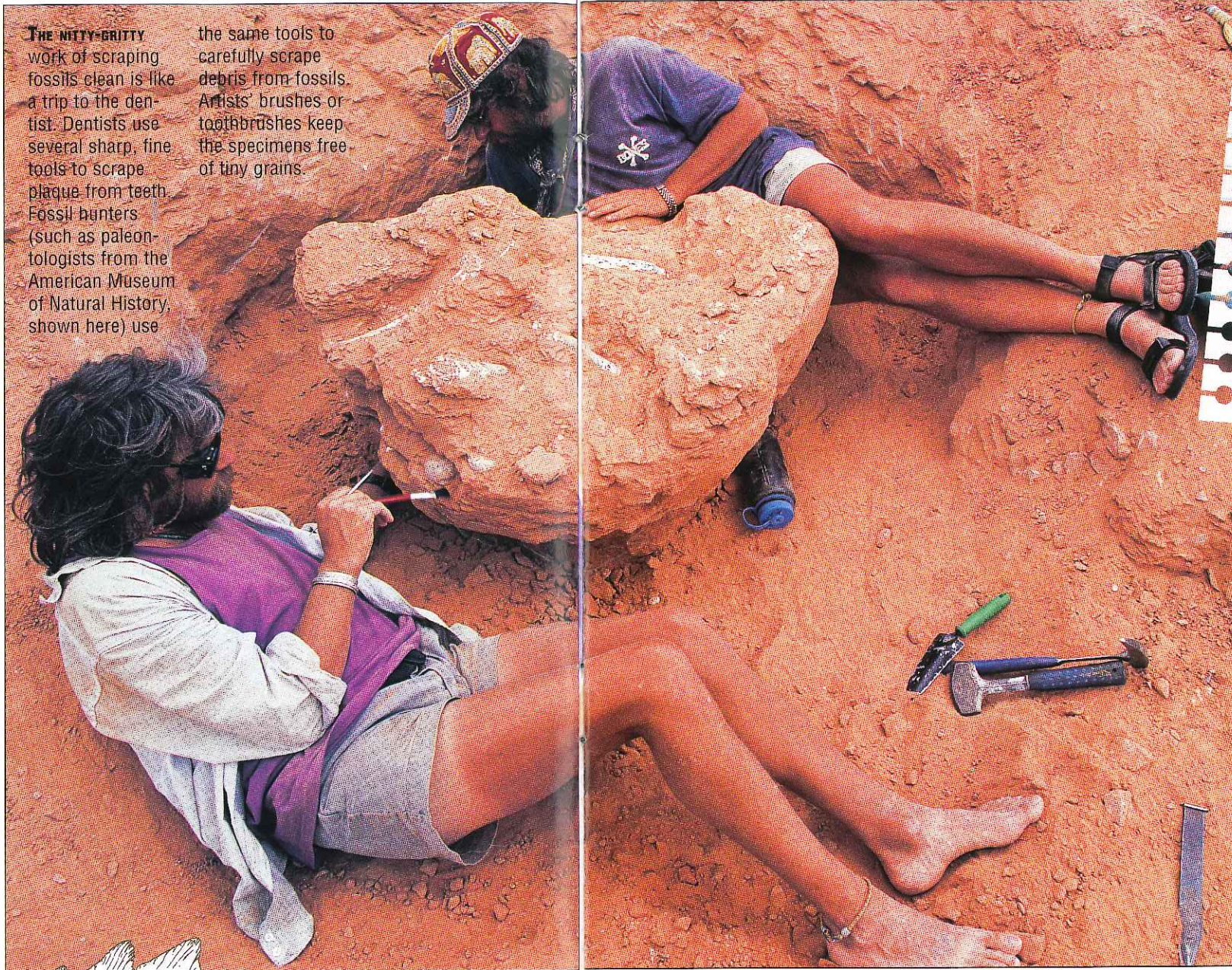


▲ **GOGGLES, HELMETS,** and other safety equipment help

prevent accidents while fossil hunting. One fossil hunter, while searching for ammonites (spiral-shelled fossils), whacked a rock wall with a sledgehammer. A piece of rock flew up, broke his glasses, and injured his eye. Another ammonite fan lost a front tooth in the same way.

**THE NITTY-GRITTY** work of scraping fossils clean is like a trip to the dentist. Dentists use several sharp, fine tools to scrape plaque from teeth. Fossil hunters (such as paleontologists from the American Museum of Natural History, shown here) use

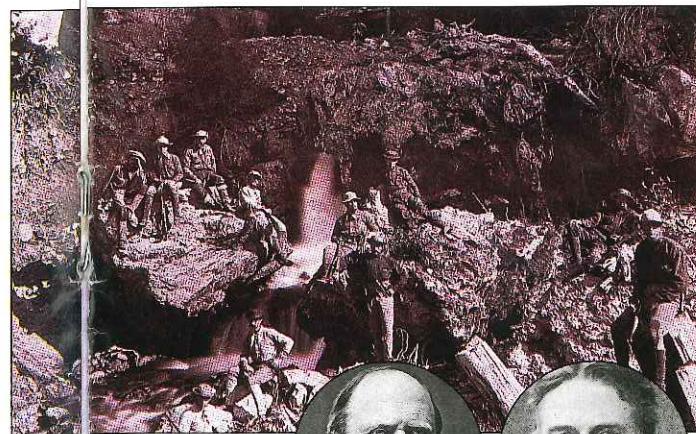
the same tools to carefully scrape debris from fossils. Artists' brushes or toothbrushes keep the specimens free of tiny grains.



▲ **THE GIANT** *Stegosaurus* was discovered in 1877 by dinosaur pioneer Othniel Marsh, the first person to see and study many dinosaur fossils. Marsh thought the creature lived in

water, but later scientists proved it was a landlubbing giant called *Stegosaurus*. As the fossil record grows, scientists of the future will correct modern mistakes in the same way.

► **THE CALIFORNIA** gold rush began in 1849. The Wyoming and Colorado "bone rush" occurred in 1877. Fossil hunters raced to dig up the best fossils. Two bitter rivals, Othniel Marsh and Edward Cope, led the pack. While trading red-hot insults, the two fossil hunters expanded the universe of dinosaur knowledge farther than anyone before them.



OTHNIEL MARSH



EDWARD COPE

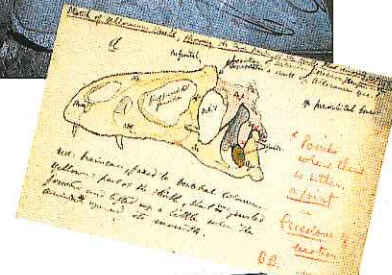
**TRY THIS!**

After a whole-chicken dinner, collect the bones. Ask an adult to help you boil them clean. Can you arrange the bones into a flat skeleton? (Hint: You have the same basic bones as the chicken!) Compare your handiwork to the skeleton on the back cover.

*Creature Feature*  
**Dimorphodon macronyx**  
 ("two types of teeth, big claws")  
 Time: 200 mya  
 Place: Southern England  
 Close in size: Eight-year-old human child  
 Fossil fact: This little pterosaur (flying reptile) had a head that was one-fourth the size of its body. That's the same head-to-body ratio of a human baby! Dimorphodon had wings like a bat's and a beak like a bird's (except with teeth), but it was a reptile.

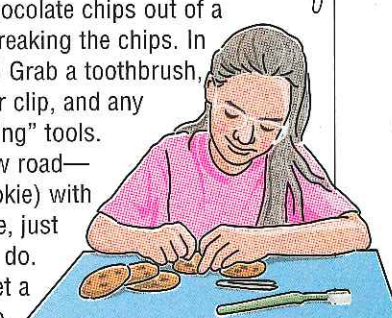


**FOSSIL HUNTERS** take field notes, draw illustrations, and plot maps to document (record) sites. Among other things, they try to discover: What part of the skeleton is the fossil? How large is it? Is the species known? Is there anything unusual about the fossil?



**TRY THIS!**

Trying to take a fossil from rock is a bit like taking the chocolate chips out of a cookie without breaking the chips. In fact, give it a try! Grab a toothbrush, tweezers, a paper clip, and any other "chip-hunting" tools. And take the slow road—dig (into that cookie) with care and patience, just as fossil hunters do. See if you can get a whole, clean chip.

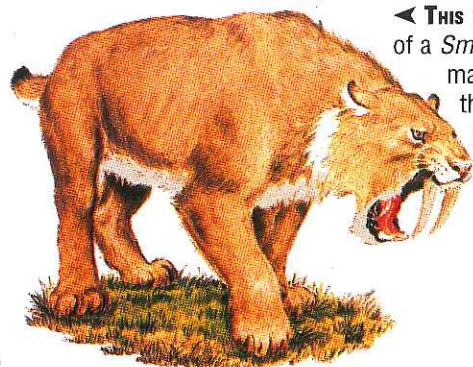




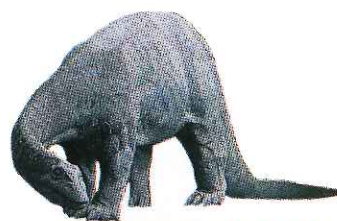
# If Bones Could Talk

Meet *Smilodon*, a saber-toothed cat. Tens of thousands of years ago, our Ice Age ancestors met *Smilodon* too—live and in person. After *Smilodon* became extinct about 10,000 years ago, no human ever saw one again.

Even without a face-to-teeth meeting, today's scientists know how *Smilodon* lived, what it ate, how it ate, what diseases it had, and more. All that information can come from only one source: *Smilodon*'s fossil remains. One fossilized bone can tell a life's story, if it is in the hands of an expert. The expert starts by making an assumption that the laws of nature have remained constant over the earth's life span. Check out a few of these laws in "Nature Says . . .," below.



◀ THIS IS AN ILLUSTRATION of a *Smilodon* as it may have looked thousands of years ago.

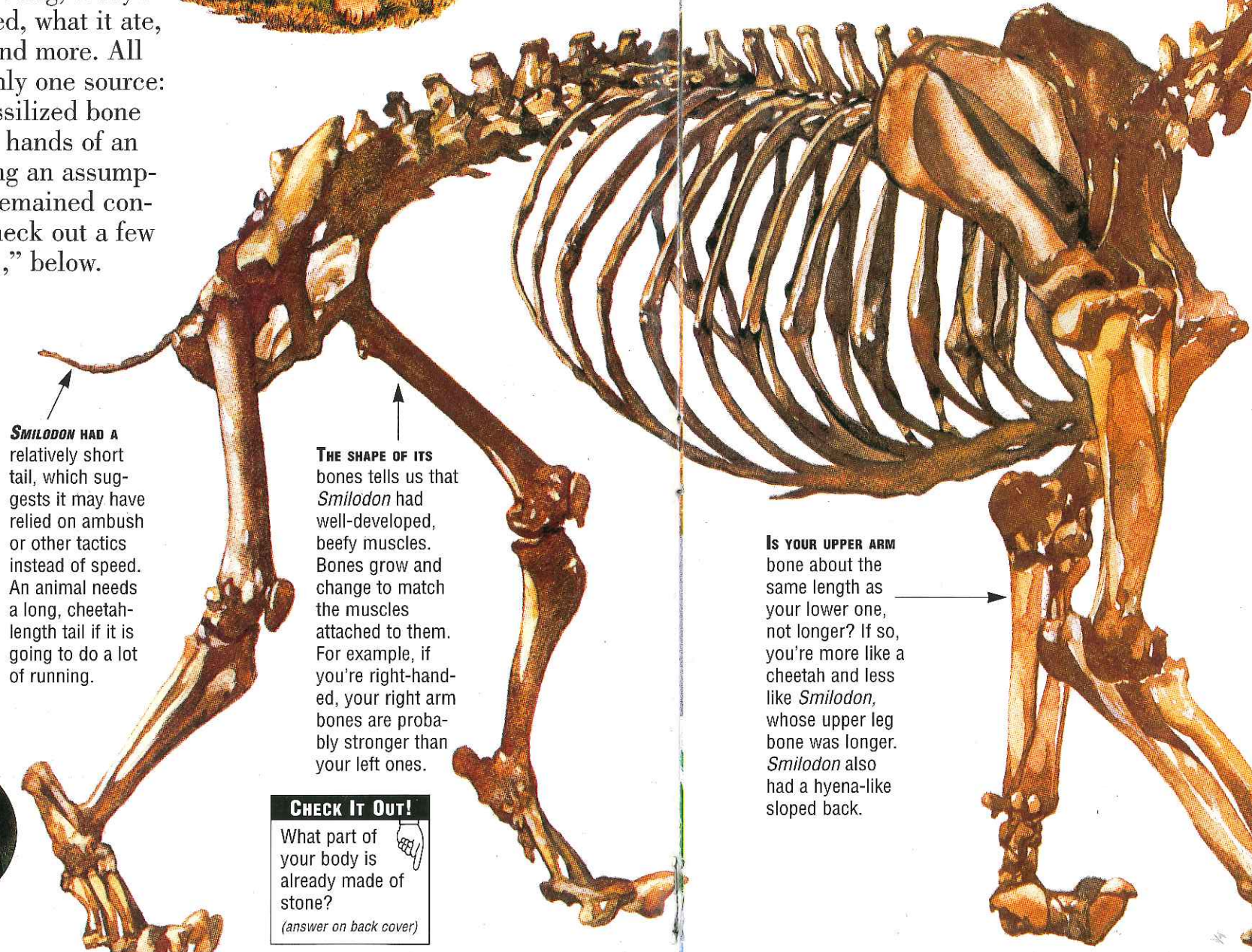


◀ **FOSSIL HUNTERS** can't always follow living models to piece together skeletons, so they sometimes make mistakes. Consider *Diplodocus* (dih-PLAH-dih-kus). No living creature has such a long neck and a long tail. No wonder 19th-century fossil hunters put the head on the wrong end!

## FOSSIL HUNTERS

**BARON GEORGES CUVIER**  
(1769–1832)

While Napoleon Bonaparte built an empire, Cuvier (coo-vee-AY) built a leg for paleontologists to stand on. Lacking live prehistoric animals, scientists turned to modern animals for clues. Cuvier dissected and studied an animal in every major living group. He also started the science of vertebrate paleontology. (Vertebrates are animals with backbones.) Unlike Napoleon's empire, Cuvier's work still stands.



SMILODON HAD A relatively short tail, which suggests it may have relied on ambush or other tactics instead of speed. An animal needs a long, cheetah-length tail if it is going to do a lot of running.

THE SHAPE OF ITS bones tells us that *Smilodon* had well-developed, beefy muscles. Bones grow and change to match the muscles attached to them. For example, if you're right-handed, your right arm bones are probably stronger than your left ones.

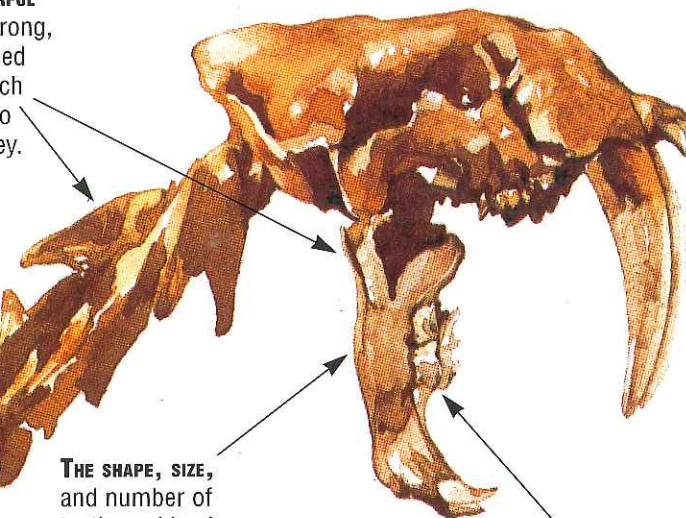
### CHECK IT OUT!

What part of your body is already made of stone?  
(answer on back cover)

▼ THE POSITION OF A skeleton goes a long way toward explaining how an animal died. Many animals look as if they had just lain down to rest. They were probably old, sick, or starving.

▼ GRACILE (SLENDER) animals are often carnivores. Being trim helps them sprint after prey.

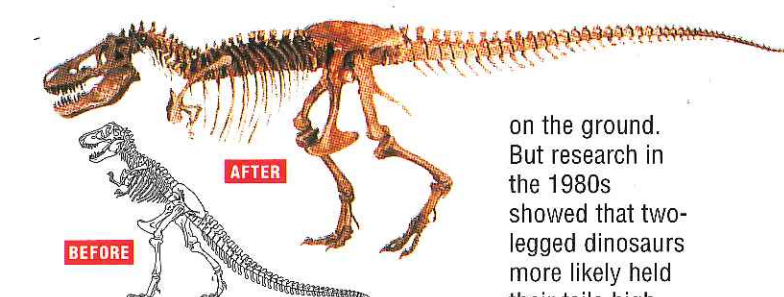
▲ A THICK, POWERFUL neck and a strong, wide jaw helped *Smilodon* reach and hold on to struggling prey.



THE SHAPE, SIZE, and number of teeth are big clues to an animal's diet. *Smilodon* had extra-large canine teeth to slice dead meat. If these fangs had stabbed live, struggling prey, they might have

broken off. Unlike dogs, *Smilodon* had only slicing teeth—no teeth for crushing bones. It probably ate only the soft, "choice" parts of a kill.

WORN-OUT TEETH OR arthritic joints are signs of old age. Teeth not yet erupted (grown in) point to a youngster still dependent on its mother.



▲ MODERN SCIENTISTS guessed that the tails of meat eaters like *Tyrannosaurus* dragged

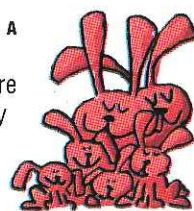
on the ground. But research in the 1980s showed that two-legged dinosaurs more likely held their tails high, for balance. Museums had to reconstruct their skeletons to fit the new data.

## Creature Feature *Gerrothorax* ("idler chest")

Time: 150 mya  
Place: Greenland  
Close in size: Two computer keyboards, side by side  
Fossil fact: Stranger beasts than dinosaurs lurked on prehistoric earth. This amphibian could survive full-time in lakes and streams or part-time on land. The three "feathers" on either side are gills for breathing underwater. *Gerrothorax* hid flat as a pancake on the lake floor—all the better to watch for prey.

## Nature Says...

► MEMBERS OF A species must reproduce more often than they die, or the species will die out.



► EACH CLASS OF VERTEBRATE (fish, amphibian, reptile, bird, mammal) has the same basic bones in the same basic places. The main difference is size. The *Smilodon* skeleton looks like that of a house cat, only bigger.



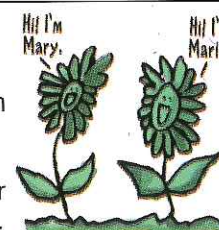
► A SPECIES must adapt or die. If the environment changes, so must it.



► SOME ANIMALS ARE either meat eaters or plant eaters. Each group has its own body traits—teeth, limbs, stomach—for finding and eating food.



► NO TWO individuals are alike. In a field of daisies, each flower is different.





Time present and time past / Are both perhaps present in time future, / And time future contained in time past.  
—T. S. Eliot

**THESE ARE FOSSIL** remains of crinoids, marine invertebrates of the class Crinoidea, found in Mississippi. Crinoids have cup-shaped bodies and five or more arms. Their internal skeletons make the thousands of extinct crinoid species important Paleozoic fossils. About 700 living species of crinoids are known; most dwell in deep waters.

