FOSSIL KIT I

Lesson Plan

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FOSSIL KIT I

OBJECTIVE

Fossil Kit I takes students on an interactive journey into the fascinating world of fossil exploration and identification. Genuine fossil replicas will be utilized to give students an up close look at the beauty and importance of fossils.

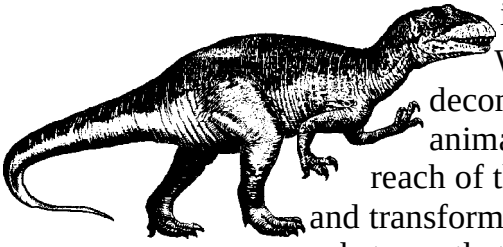
Upon completion of this activity, students should be able to (1) understand the basics of fossil formation; (2) grasp the importance of fossils to scientists; and (3) identify at least six important fossils and understand some of their basic anatomy.

MATERIALS PROVIDED

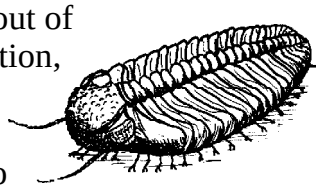
- Information on the development of fossils
- Detailed information on four important fossils
- 6 Fossil Replicas
  - Allosaurus Claw Fragment
  - Ammonite
  - Cave Bear Tooth
  - Crinoid
  - Saber Tooth Tiger Tooth Fragment
  - Trilobite
- Suggested exercises and projects
- Suggested reading list
- General Fossil Information

GENERAL INFORMATION ABOUT FOSSILS

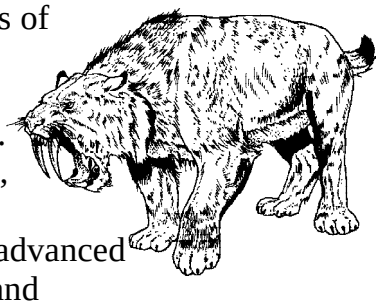
What is a fossil? A fossil is any trace of a once-living organism preserved in rock, a relic of the Earth's past. Much of what we know of our planet's history comes from fossilized plants and animals, some of which may be 600 million years old or even older. The tooth of an extinct bear, the claw of a dinosaur, and a flower from a prehistoric plant preserved in amber are all fossils.



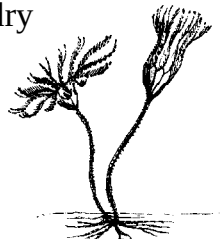
When living things die, their bodies usually decompose in a short time. But sometimes a plant or animal's body parts become buried out of reach of the factors that cause disintegration, and transform into a durable, rock-like substance that survives for millions of years. This is how fossils form. Generally, a living creature's soft parts do not fossilize; just the harder, more durable parts are preserved. So you are much more likely to see the skeleton or teeth of an animal in fossil form, instead of all the muscles, internal organs or skin.

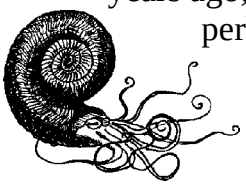


Animal fossils are divided into two basic groups: invertebrates and vertebrates. The invertebrate category consists of animals with no internal spinal column. Some animals from this category are worms, snails, coral, insects and shell fish. The vertebrate category, on the other hand, consists of animals with an internal spinal column. These are considered to be more advanced than the invertebrates. Fish, reptiles, birds and mammals are some of the animals considered to be vertebrates. Because vertebrates have an rigid internal skeleton, fossilized remains have been found for many specimens.



Scientists who study fossils are known as paleontologists. Over the past two or three centuries, they have learned much about the Earth's past by studying fossils. For example, they often find fossils of sea creatures in rocks that today are on dry land, far from any bodies of water. Sometimes such fossils occur high up on mountain slopes. This tells paleontologists that hundreds of millions of years ago, what is now dry land and mountains was once water—perhaps beneath a river delta, or bottom of a lake or sea.

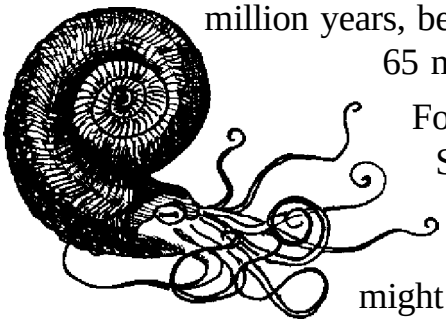




Studying fossils from different places around the world, paleontologists have also helped to confirm that the Earth's continents slowly change their positions over millions of years of time. Pretty neat, huh? Fossils teach us that the plants and animals of Earth's past were very different from those we see alive around us today. We also know that there were once dinosaurs alive on Earth, and roughly when humans first appeared on Earth, and how long ago sabertooth cats lived. No people existed to see these things; we know about them just from fossils. It is amazing what fossils can teach us!

AMMONITE

Ammonites were ancient marine mollusks belonging to the cephalopod class, related to today's squid and octopus. Each ammonite produced a hard, multi-chambered shell to protect its soft tissue. They existed on Earth for about 330 million years, becoming extinct at the end of the Cretaceous Period, 65 million years ago.



Fossil ammonite shells are common in North America. Such shells are virtually the only ammonite remains available for study; soft body parts are very rarely preserved. Scientists study how a living ammonite might have lived by examining its closest living relative, the hard-shelled chambered nautilus. Like the nautilus, ammonites probably used their shell for flotation as well as protection, becoming buoyant by replacing fluid inside the shell's chambers with gas. This enabled them to maneuver through ocean waters.

Because they are plentiful and occur in great variety, ammonites help paleontologists to date the Earth's rocks. When the same kinds of ammonites are found in rocks at different places, we know that those rocks were created at about the same time, millions of years ago, regardless of how far apart the places might be.

CAVE BEAR

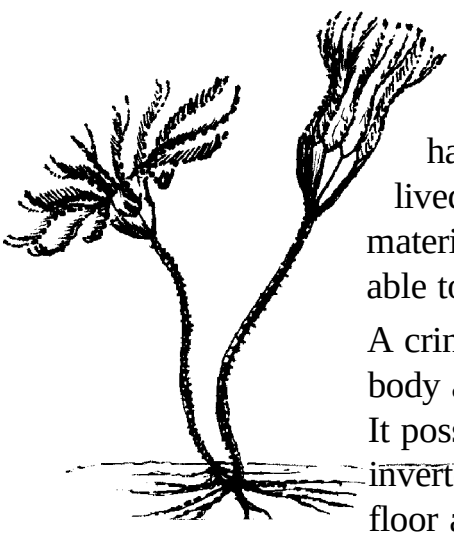
The Cave Bear (scientific name: *Ursus spelaeus*) was a very large bear that thrived about 80,000 years ago and became extinct about 10,000 years ago. Cave Bear skeletal remains have been found in caves throughout the mountainous regions of Europe. By studying these fossils, paleontologists have determined the bear's size, behavior and diet. Cave Bears were large compared with the most modern bears, about the same size as the largest Grizzlies and Brown Bears but perhaps stouter and more heavily built. By measuring its fossil leg bones, paleontologists calculate that Cave Bears weighed about 900 to 1000 lbs. The structure of their leg bones shows that Cave Bears were slow-moving animals possessing great strength. Cave Bears belonged to the vertebrate class.

Although bears belong to the order Carnivora (meat eating mammals), they eat a wide range of meat and vegetable matter. Because they consume both animals and plants, bears are classified as omnivores. Studies of Cave Bear teeth show, however, that they were primarily vegetarians: The large teeth (molars) in the back of the mouth were used to grind fibrous vegetable matter. Cave Bears' powerful claws were designed to dig up and forage for food. Although Cave Bears dined on succulent plants, berries, roots and tubers, they did have occasion to eat the carcasses of animals killed by other carnivores. Thus, like modern bears, Cave Bears are also considered omnivorous.

The Cave Bear tooth replica that you are examining is an upper canine - the same kind of tooth as the long sabers of the Saber Tooth Cat.

CRINOID

Crinoids are flower-like marine animals belonging to the echinoderm phylum. Fossil crinoids are abundant at various sites around North America . They lived from the Ordovician Period to the present, with large numbers living during the Paleozoic Era. Crinoids varied greatly in size and shape and may have been beautifully colored. Although most species lived on the ocean bottom, attaching themselves to material on the deep sea floor, some ancient forms were able to crawl or swim.

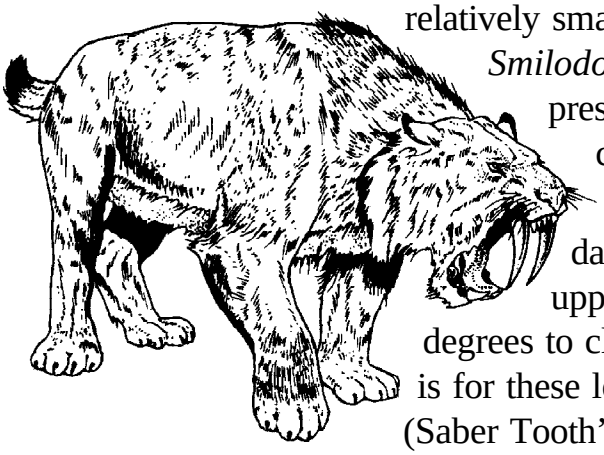


A crinoid, or “sea lily” is made up of a root, a stem, a body and arms, and looks very much like an ocean flower. It possesses no internal spinal cord and is considered an invertebrate. The root attaches to an object on the sea floor and helps to keep the crinoid from being moved. The stem is generally the longest part of the crinoid; fossil crinoids have been found with stems up to 50 feet long. The body contains the vital organs, including the mouth, the anus, the gonads, the podia and the water inlet. The arms or tentacles, spread like an opening flower to catch passing food. Crinoids resisted extinction since their appearance more than 500 million years ago.

SABER TOOTH TIGER

The Saber Tooth Tiger was the most lethal feline (cat) killing machine ever to stalk the Earth. Ancestors of this immense fanged beast existed for about 35 million years (compared to man's 3 to 4 million year lineage). It perished only 12,000 years ago when the large, slow moving mammals it preyed upon died out as the Ice Age came to an end.

The Saber Tooth Tiger was about the size of an African Lion, tipping the scales at around 700 pounds. Fundamental differences between it and the lion are evidenced by the skull and dentition (tooth shape and distribution), and a relatively small brain size for its massive bulk. *Smilodon* (Saber Tooth's scientific name) is presumed to have been a more vicious carnivore than the modern cats.



The skull was uniquely adapted for the dagger-like canine (sabers) teeth in the upper jaw, so that the mouth could open 90 degrees to clear the sabers for their plunging action. It is for these long, narrow, curved fangs that *Smilodon* (Saber Tooth's scientific name) is named. An adult's sabers grew to over 6 inches in length and had edges that were serrated like a steak knife. The sabers gradually elongated (became longer) as the cat's killing bite was extended to ever larger prey, including elephants, mastodons and giant ground sloths. It was the serrated edge of the saber tooth that enabled the predator to cut through the thick hide of elephants and mastodons.

In attacking, the Saber Tooth Tiger ambushed its victim, stunning the prey by throwing one paw over the shoulders and the other over the nose. In these first critical seconds, *Smilodon*, dug its claws into the immobilized beast, pushing the victim's head into the best position for inflicting the deadly wound. Instantaneously, the sabers did their lethal work, severing the neck artery or jugular vein of the prey. The backward position of the Saber Tooth Tiger's nasal (nose) opening probably allowed the cat to breath with its head plunged deeply into the side of its prey. A corrugated gum covering the ridges of the hard palate (top of the mouth) may have aided bloodsucking.

A Saber Tooth Tiger had to be enormously powerful to kill in a single-bite attack. What is more astounding is that this animal could only inflict this fatal wound by standing on its hind legs. With its powerful forelegs and flatfooted posture, the Saber Tooth Tiger was designed to instantaneously attack and kill, not to pursue

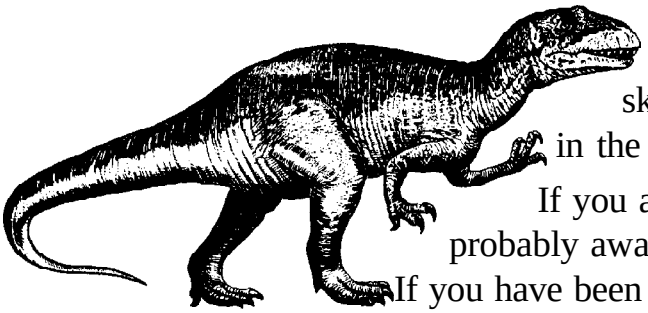
its prey in open country.

Because the Saber Tooth Tiger contained an internal spinal column, it is considered a vertebrate. This fact was plainly exhibited by the fossil record, which showed *Smilodon* suffered back problems. This probably was caused by an upright attack position that would be stressful to the vertebrae of a quadruped (four legged animal). Fusion (attachment) of the vertebrae is the one striking disability of the Saber Tooth Tiger. When too crippled to hunt big game in the open, they probably prowled the edges of the Ice Age tar pits where the prey was slower and the catch was easier.

This Saber Tooth Tiger Tooth cast was made from an original specimen found in the La Brea Tarpits in Los Angeles, California. The tiger was most probably in the process of attacking an animal near the tarpits, when it ventured too close and got caught itself.

ALLOSAURUS FRAGILIS

This North American carnosaur was the largest predator from the Jurassic Period of geologic time. The Jurassic Period lasted about 67 million years, from about 205 million to 138 million years ago. The first specimen of *Allosaurus* (strange reptile) was found in 1869. The remains were scanty, so not much was known about this dinosaur until better material was found 14 years later. Beginning in 1927, with a spectacular discovery in Utah, many complete *Allosaurus* skeletons were recovered from a quarry in the Morrison Formation.



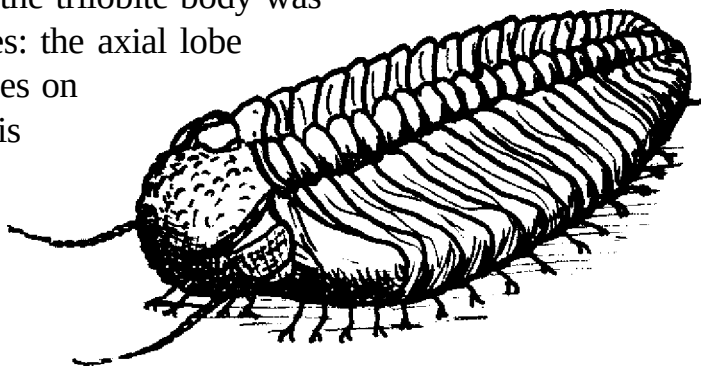
If you are familiar with dinosaurs, you are probably aware that they are considered vertebrates. If you have been to a natural history museum or seen pictures of dinosaur displays, you probably could not help but notice that dinosaurs possessed rather large skeletons. The spinal columns of most dinosaurs are huge, and as with most vertebrates, provide the main support structure for the remaining sections of the skeleton, i.e. the bones of the skull, arms, legs, ribs, tail, etc. The *Allosaurus*, as well as all other dinosaurs, are members of the vertebrate family.

Easily identified as a flesh-eater by its strong jaws and sharp teeth, *Allosaurus* grew to a maximum of 40 feet. Its huge body supported a skull that was very large relative to its body size - up to 3 feet in length. The massive jaws were lined with many long, curved, dagger-like teeth with serrated edges that were able to pierce and cut even the toughest of skin and tissue. The rest of the skull was lightened by several openings (like holes or windows), which enabled the bones to move on one another so that the jaws could maneuver around a chunk of food as large as 12 inches across. Supporting this impressive skull were very powerful muscles of the neck and back, which aided the jaws in tearing large pieces of flesh from its victims.

Another set of tools *Allosaurus* used in disabling its prey was the large claws on its “hands” and “feet.” These claws could reach lengths of over 7 inches. With three fingers on each hand, and four toes on each foot, *Allosaurus* had an impressive arsenal of claws to help control and subdue any attacker or prey. Your claw fragment is reproduced from the hand of a specimen housed in the collections of the National Museum of Natural History at the Smithsonian Institution in Washington, DC.

TRILOBITE

Trilobites were ancient sea creatures that roamed the ocean's depths from the beginning of the Cambrian Period (570 million years ago) to the end of the Permian Period (245 million years ago). They belong to the most abundant and diverse phylum of all time, Arthropoda. Among the arthropods that exist today are insects, lobsters and crabs, spiders, and scorpions.



The word "trilobite" reminds us that the trilobite body was divided longitudinally into three lobes: the axial lobe down the middle and two pleural lobes on either side. The front of the trilobite is called the "cephalon," or head; the rear is called the "pygidium," or tail; and in between lies the "thorax," or chest, to which were attached its numerous legs. An exoskeleton, or skeletal shell, covered the entire body and supported and protected the muscles and internal organs.

To protect its underside, a trilobite could roll itself up; many are found fossilized in this state. As it grew, a trilobite shed its exoskeleton many times. Thus, a single trilobite could have left many such exoskeletons behind for fossilization.

Trilobites were among the earliest life forms to possess vision. A trilobite usually had two crescent-shaped eyes that gave it a 360-degree visual field on the ocean floor. The amazing preservation of the eyes in some specimens has enabled scientists to dissect these ancient sensory organs and study their structure.

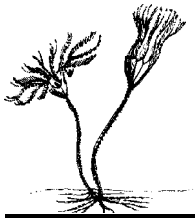
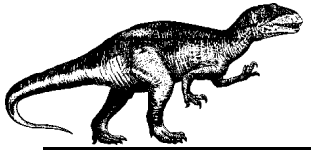
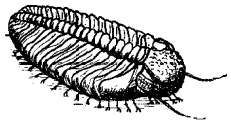
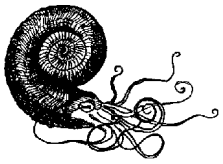
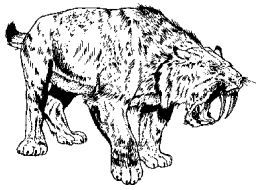
Trilobites existed for more than 300 million years, during which time they evolved into over 10,000 species. Their fossils come in a multitude of interesting shapes and sizes, from the tiny *Shumardia,* less than 5mm long, to the giant *Uralichas,* more than 700mm long. Some were spiny and rough, whereas others were almost perfectly smooth.

EXERCISES TO ACCOMPANY EACH FOSSIL CAST

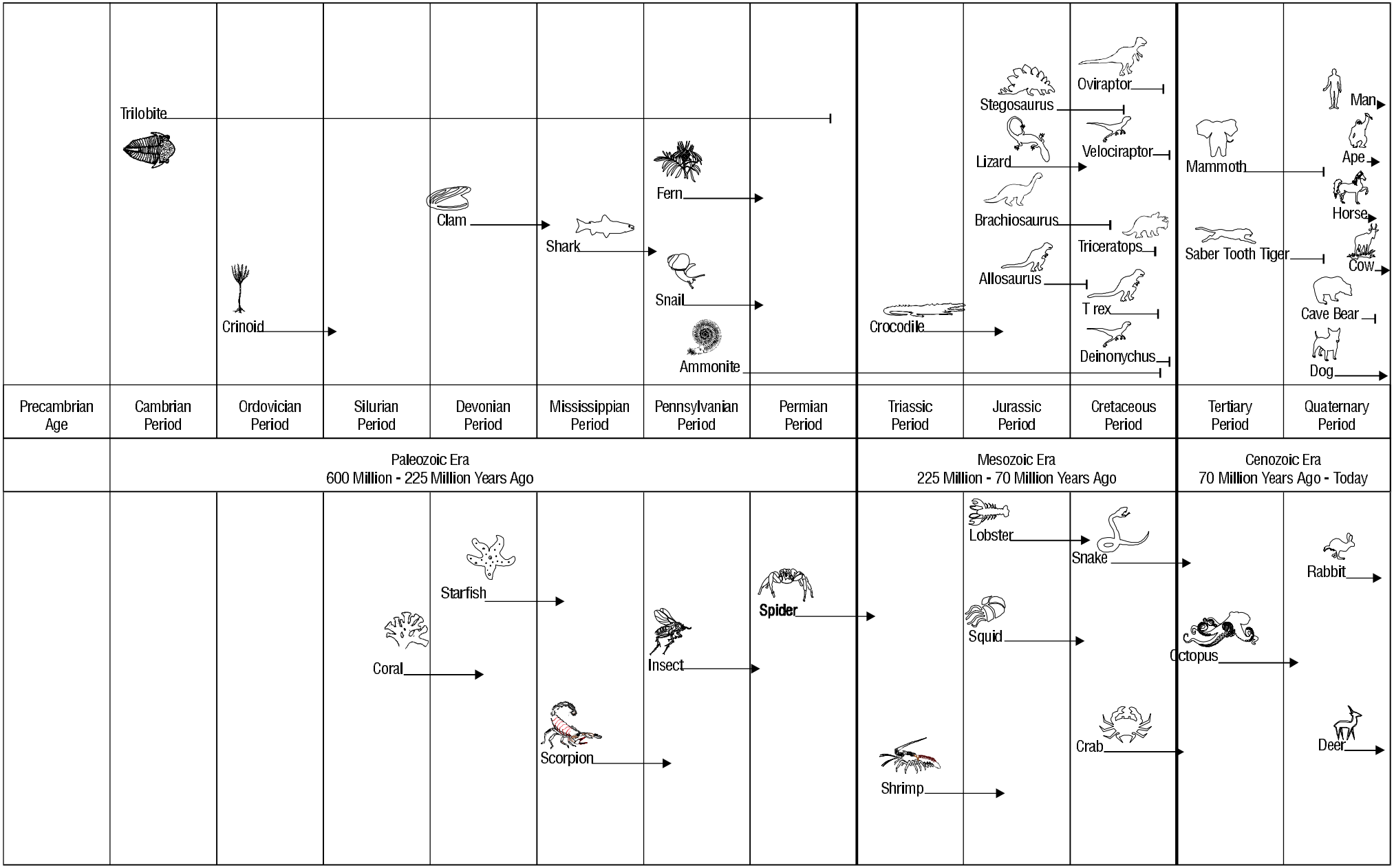
A. Split your class into 6 paleontology groups
   1. Pass out a fossil cast to each group.
   2. Ask each group if they can identify the piece you just gave them just by sight and touch.
   3. Pass out a set of fossil reading material, the timeline and the fossil exercise sheet to each group.
   4. Instruct each group to read through the fossil information and correctly identify the fossil currently in their possession. Have them write the correct name next to the corresponding diagram on the exercise sheet.
   5. From the information included on their fossil and the information on the timeline, have them determine in which time period(s) their fossil existed. Instruct each group to write the period on their exercise sheet.
   6. Instruct them to write whether the fossil is an invertebrate or vertebrate on the exercise sheet.
   7. From the timeline, ask them to determine 2 other animals and/or plants that were alive during the same time period(s) as their fossil. Have each group write their answers on their exercise sheet.
   8. Instruct each member of the group to draw a picture that shows what life was like during the time period that their fossil existed. Have them use other plants and animals from this time period to illustrate their picture. Have them look on their timeline for other fossils in the appropriate time period.
   9. Have each group contemplate whether their fossil exists in any form today.
   10. Ask if they can name any animals alive today that would have anything in common with their fossil cast. Have them list their answers on their exercist sheet.

B. Rotate the fossils between groups so that each group gets a fossil they have yet to study. Repeat steps A1 - A10 for each remaining fossil cast.

EXERCISE SHEET

	Name	Time Period	Vertebrate Invertebrate	Names of other plants & animals alive during same period
				
				
				
				
				
				

Time Line



Still Exists

Extinct

Origin and extinction dates are approximate and should only be used for general estimates.

SUGGESTED READING LIST

Alexander, R. McNeill (1989) *Dynamics of Dinosaurs and other Extinct Giants*. New York: Crown Publishers, Inc.

Arduini, P.; Teruzzi, G. (1986) *Guide to Fossils*. New York: Simon & Schuster.

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Norman, David (1985) *The Illustrated Encyclopedia of Dinosaurs*. New York, NY: Crescent Books.

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Turek, T.; Marek, J. & Benes, J. (1988) *Fossils of the World*. New York: Crown Publishers, Inc.

EDUCATIONAL KITS AND SUPPLIES

0275-3 Fossil Kit I	$75.00	Shipping $8.00
0250-3 Fossil Kit II	$75.00	Shipping $8.00
0400-3 Fossilworks (6 fossil molds)	$50.00	Shipping $8.00
0470-3 Animal Tracks	$50.00	Shipping $8.00
0930-3 Dino Traces, Velociraptor	$55.00	Shipping $8.00
0931-3 Dino Traces, Triceratops	$55.00	Shipping $8.00
0932-3 Dino Traces, Tyrannosaurus rex	$55.00	Shipping $8.00
0950-3 Human Traces	$55.00	Shipping $8.00
0960-3 Animal Bites	$95.00	Shipping $8.00
1001-3 Hydrostone (10 lbs.)	$10.00	Shipping $8.00
1310-3 Clay (10#, 40 sticks)	$13.00	Shipping $6.00

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