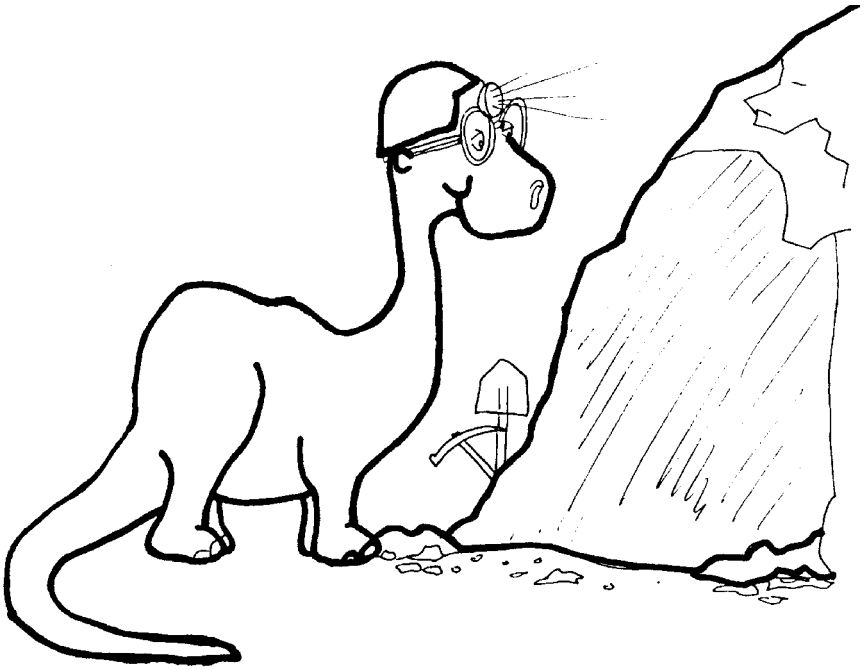
Rock Cycle

Understanding the Earth's Crust

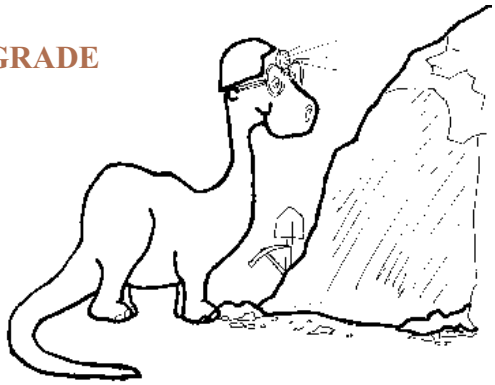
THIRD GRADE

PAST LIFE



1 WEEK
LESSON PLANS AND
ACTIVITIES

ROCK CYCLE
OVERVIEW OF THIRD GRADE



CHEMISTRY

WEEK 1.
PRE: *Comparing elements of the periodic table.*
LAB: *Discovering properties of compounds.*
POST: *Exploring why elements combine.*

MINERALS

WEEK 2.
PRE: *Exploring the shapes of gems.*
LAB: *Comparing mineral shapes.*
POST: *Distinguishing the geometric shapes of minerals.*

WEEK 3.
PRE: *Distinguishing between crystalline and amorphous substances.*
LAB: *Discovering that all minerals are not crystalline.*
POST: *Exploring crystals.*

ROCKS

WEEK 4.
PRE: *Exploring the etymology of sedimentary, igneous, and metamorphic rocks.*
LAB: *Contrasting different types of rocks.*
POST: *Writing a creative essay on rocks.*

WEEK 5.
PRE: *Exploring agents of erosion.*
LAB: *Analyzing different types of sands.*
POST: *Comparing sand formed by wind and water.*

PAST LIFE

WEEK 6.
PRE: *Comparing different modes of fossilization.*
LAB: *Discovering information derived from organisms.*
POST: *Observing fossil and living organisms.*

ROCK CYCLE - PAST LIFE (3)

PRE LAB

Students compare and distinguish different types of fossil preservation.

OBJECTIVE:

1. Comparing different ways a fossil can be preserved.
2. Distinguishing modes of preservation.

VOCABULARY:

alteration
preservation

MATERIALS:

leaf
chicken bone
bark
shell
Fossils by P. Taylor

Permineralization of dinosaur bone

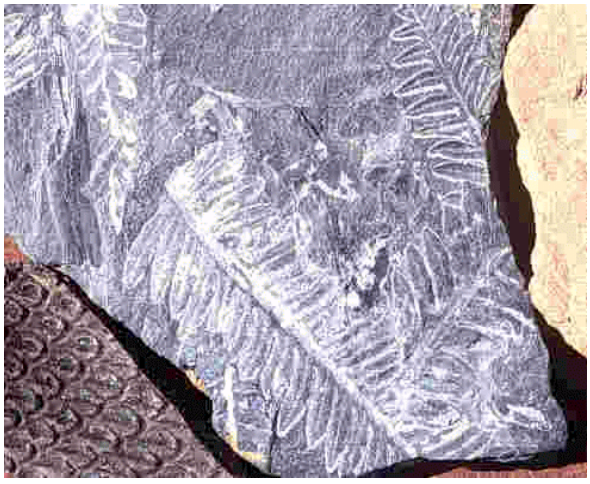
BACKGROUND:

Fossils are the remains of plants and animals that lived long ago. The probability that an organism will be preserved as a fossil is very low. Geological processes such as erosion, weathering, sedimentation, and leaching constantly "attack" the fossil, and may destroy it before anyone sees it.

There are two main types of fossil preservation. Most common is fossil preservation with alteration; the original organic material is partially to fully changed into new material. There are several types of preservation with alteration:

A) carbonization, a chemical reaction where water transforms the organic material of plant or animal to a thin film of carbon. Nitrogen, hydrogen, and oxygen are driven off as gases, leaving an outline of the organism. Organisms often preserved by carbonization include fish, leaves and the woody tissues of plants.

B) permineralization or petrifaction takes place in porous materials such as



Carbonization

bones, plants and shells. The material is buried; later, groundwater percolates through its pore spaces. A solution, commonly supersaturated in either calcium carbonate or silica, precipitates minerals in the spaces. The original wood or shell like material preserved.

Recrystallization

C) recrystallization occurs when a solution or precipitate changes the internal physical structure of a fossil. Recrystallization changes the microstructure of the original minerals; they often reform as larger crystals. The composition of the mineral does not change, only the crystal structure. For example, many shells originally composed of calcium carbonate in the form of the mineral aragonite recrystallize into the more stable form of calcium carbonate called calcite.

D) replacement involves the complete removal of original hard parts by solution and deposition of a new mineral in its place. The Petrified Forest in Arizona is an excellent example of this type of preservation. Here the original organic material (wood) has been wholly replaced by silica.

The second type of fossil creation is direct preservation, the preservation of original organic materials as fossils. The most common directly preserved fossils are unaltered hard parts of a living organism, like shells, teeth, and bones. This material is unchanged, except for the removal of less stable organic matter. Other examples of this type of preservation include fossil corals, shells, sponges, microscopic fossils and a host of other organisms with hard parts. In rare circumstances, preservation of the soft parts of an organism may occur. An example is an insect which has become "stuck" in tree resin. When the resin fossilizes to form amber, it preserves the insect. This was the whole premise for the movie Jurassic Park.

PROCEDURE:

1. Show the students different examples of living material, such as chicken bones, leaves, or tree bark. If you have a live animal in the classroom, you may also want to use it as an example. Ask the students what will remain after the organism dies. Lead them into a discussion about why hard parts such as shells or bones are more likely to be found in the fossil record then are the soft parts of an organism.

2. The *Eyewitness Book on Fossils* by P. Taylor has wonderful pictures of fossils for the students to examine. They will see examples of many of the modes of preservation presented above.

ROCK CYCLE -PAST LIFE (3)

LAB

Students examine how organisms become fossils.

OBJECTIVE:

1. Exploring the present is the key to the past.
2. Discovering trace fossils.

VOCABULARY:

carbon
coprolite
trace fossil
tracks

Trilobite

MATERIALS:

Rock Cycle - Past Life (3)
model of lion and giraffe (optional)

BACKGROUND:

The pre lab exercise introduced different types of fossil preservation. All of these are direct evidence of past life. Paleontologists can also study past life using indirect evidence about how the organisms lived. Types of indirect evidence include molds and casts, tracks and trails, burrows and borings, and coprolites.

The formation of a mold and cast is a very common type of indirect preservation. After the remains of an organism have been buried and cemented within sediment, water percolating through the sediment dissolves or leaches out the fossil. This leaves a cavity in the rock, called a mold. A cast forms when the mold is filled up with another substance. In some cases minerals such as calcite or quartz precipitate in the mold; elsewhere loose sediment may fill it. The formation of a cast is similar to putting jello in a mold. When you remove the mold, you are looking at the cast of the mold.

Skinprint

The other types of indirect evidence are collectively called trace fossils. A trace fossil gives a paleontologist some evidence of the organism's behavior. There are three main types of trace fossils. Tracks and trails are produced by an organism walking, crawling, foraging, or resting. For example, dinosaur tracks provide information

about how large the dinosaur was, how fast it walked, and whether it walked alone or in a group. Burrows and borings are the tunnels or burrows left by organism digging into the ground, either on land or underwater. This may indicate whether the animal was feeding, dwelling, or just foraging. Finally, coprolites are fossilized animal excrement. They give some indication of the structure of the animal's gut, and sometimes provide clues to its diet.

PROCEDURE:

1. Before lab, prepare sample collections for each student group, using the specimens in the Rock Cycle - Past Life (3) or other materials that you may have available.

2. Show the plastic lion and giraffe to the students. Ask them to name differences between the two animals, for example, the lion is a carnivore, while the giraffe is a herbivore. Tell the students that both animals presently live on the African Savannah. Have them then imagine that both creatures are no longer living; all that remains are their trace fossils.

3 Have the students predict what the fossil tracks of both animals would look like. Have them consider both running and walking tracks. The giraffe would leave hoof like impressions, compared to the paw prints of the lion. In general, the giraffe's prints would be further apart than the lion's tracks, because it is a bigger animal. Likewise, for both creatures, running tracks would have wider spacing than walking tracks.

4. Next ask the students to consider the coprolites of the two animals. How would they differ? You may wish to have them consider the "coprolites" of everyday animals, like cows and cats, as analogues. Note that the lion coprolite would probably have bone fragments, and the giraffe coprolite would not.

5. Have the students consider the skeletons of the lion and giraffe. How would they differ? For example, the giraffe, compared to the lion, would have longer neck bones (although the same number of bones as a lion), and larger bones in general.

6. Have students examine the fossils in the Rock Cycle - Past Life (3) kit. Introduce each of the specimens using the information below. Be sure to give them some information to guide their answers, but leave a great deal for them to determine.

TRILOBITE - (from Morocco) These arthropods are now extinct, but the individual segments make it an obvious "bug." Trilobites are found in marine sedimentary rocks; they thus lived on the sea floor. The organisms were probably buried in mud after they died. The fossils are replacements of the original organism.

AMMONITE (from Morocco). This is related to the present day nautilus (Mollusca). Ammonites were squid-like animals that appear to have been predators. The animal lived in the outermost chamber of its shell.

CRINOID STEM (from Morocco) - Crinoids belong to the same family of marine animals as do seastars and sand dollars. Crinoids were animals, but they lived attached to the sea floor. The top part of the organism had feathery tentacles, which trapped food. The fossil in the kit is actually part of the stem which connected this feathery top to the sea floor. Like the trilobite, this crinoid fossil is an example of replacement.

IRREGULAR ECHINODERM (from Morocco). This is a "fat" sand dollar which would be related to sea biscuits. They like warm, shallow water. They burrow in the sandy mud, and tend to be preserved where they die. This is an example of replacement.

SHARK TEETH (from Morocco). These are from several species of sharks that lived in the ancient Mediterranean Sea. Compare this with the present day shark jaw that is included in the kit. Sharks' teeth will fall out as soon as the shark eats something, so there are always rows and rows of teeth to take the place of the fallen ones. You can see this within the shark jaw.

ORTHOCERAS (from Morocco) Is an extinct organism related to the Ammonites and the present day nautilus (Mollusca). Unlike these creatures, Orthoceras had straight or linear chambers instead of a spiral shape. This organism swam in the water, much like an octopus or squid.

7. Have the students look at the coprolite and fossil fish samples. Have them try to determine how they became fossils. The coprolite is fossil dung from either a sloth or turtle (the sloth looks more like grapes, the turtle looks more like a swirl on an ice cream cone.) The coprolite is from a locality in the state of Washington. The coprolite was quickly buried by sand. It then slowly fossilized by replacement; the organic material was replaced by a variety of minerals. Ask students to name a modern animal today that is probably producing coprolites. A cat (in kitty litter) is a good example.

The fossil fish is from an old lake bed near Green River, Wyoming. The fish died and settled to bottom of the lake. It was then buried with a layer of mud, and preserved by carbonization, especially the scales. Note that the impression of the backbone of the fish is also visible; this is a type of cast.

ROCK CYCLE - PAST LIFE (3) LAB

PROBLEM: What information is available from fossil animals?
PREDICTION:_____
_____

EXERCISE 1. Look at the fossils. Try and figure out what type of animal it was (guess) and how it became a fossil. Your teacher will give you some hints.

Fossil	**Type of animal and fossilization**
trilobite	
ammonite	
shark teeth	
coral	
crinoid stem	
irregular echinoderm	
orthoceras	

EXERCISE 2. Look at the fossil that your teacher has on display. Draw them and try to guess how they became fossils.

	picture	how it became a fossil
coprolite		
fossil fish		

CONCLUSIONS: In how many ways can an organism become a fossil? _____
_____

ROCK CYCLE - PAST LIFE (3)

POST LAB

Students use the Internet to research.

OBJECTIVE:

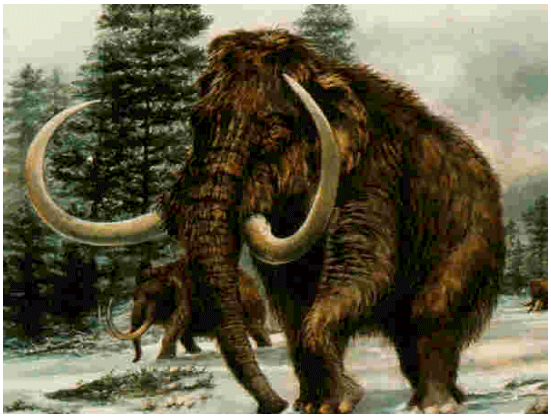
1. Interpreting evidence from fossils.
2. Comparing modern day elephants with their extinct ancestors.

VOCABULARY:

mastodon
mammoth
prehistoric

MATERIALS:

Internet



A wooly mammoth

BACKGROUND:

After the extinction of the dinosaurs 65 million years ago, prehistoric mammals dominated the Earth. Most of these animals are now extinct as well. Many of their descendants, however, can be easily recognized.

Arsisnoitherium lived about 35 million years ago. It resembles a mix between a rhinoceros and an elephant. *Zeuglodon* was a large sea mammal that was 80 feet long. Imagine a dolphin or porpoise with large, sharp teeth. *Hyracotherium* was a small mammal that is thought to be the direct ancestor of the horse. *Indricotherium,* which stood 18 feet tall, is a giant ancestor of the rhinoceros. *Smilodon,* better known as the saber-toothed tiger or cat, is likely related to most large cats that now prowl the earth. *Dinictis* was small and slender, and is also probably related to the cheetah and other large cats. *Moeritherium* was smaller than its ancestor, the present day elephant. *Platybelodon* and the Woolly Mammoth are also related to the elephant. The mammoth was adapted to live in colder climates.

Elephants are the largest living land mammals. Their ancestors included the Woolly Mammoth, the Columbia Mammoth, the Imperial Mammoth and the Mastodon. Today's elephants are adapted for warm climates, but their ancestors were adapted to both warm and cold climates.

Frozen mummified mammoths have been found in Siberia and Alaska. Dimo, the complete carcass of a six-month-old baby mammoth, was discovered in 1977. Another mummified baby mammoth, less than three months old, was found in Siberia in 1988.

Mastodons (*Mammut americanum*) are part of a group of extinct elephant-like mammals that first appeared during the early Miocene Epoch, about 20 million years ago.

They became extinct at the end of the Pleistocene Epoch, about 10,000 years ago. The Mastodons belong to same Order of mammals as the elephants, Order *Proboscidea*.

PROCEDURE:

1. Use the background information to remind students that there are many types of extinct mammals. Tell them that we know these extinct animals only through their fossils. Have the students imagine what the fossil organisms looked like, by giving them clues from the background section. You may want them to draw a picture of what they think the mammal looked like.

2. Mastodons and mammoths were not the same type of animal. They are both related to the elephant, but have a number of important differences. Instruct the students to search the World Wide Web for information on mastodons and mammoths. Have them try to learn differences between these creatures. You may wish to suggest that they find pictures of each creature, and use them as a guide.

Instruct students to make a list of the sites they searched, and to identify the sites that were most helpful.

Useful sites include:

1) http://www.geringia.com
2) http://www.calvin.edu/academic/geology/mastodon/about.htm
3) http://www.museum.state.il.us/exhibits/larson/mammut.html

mastodon