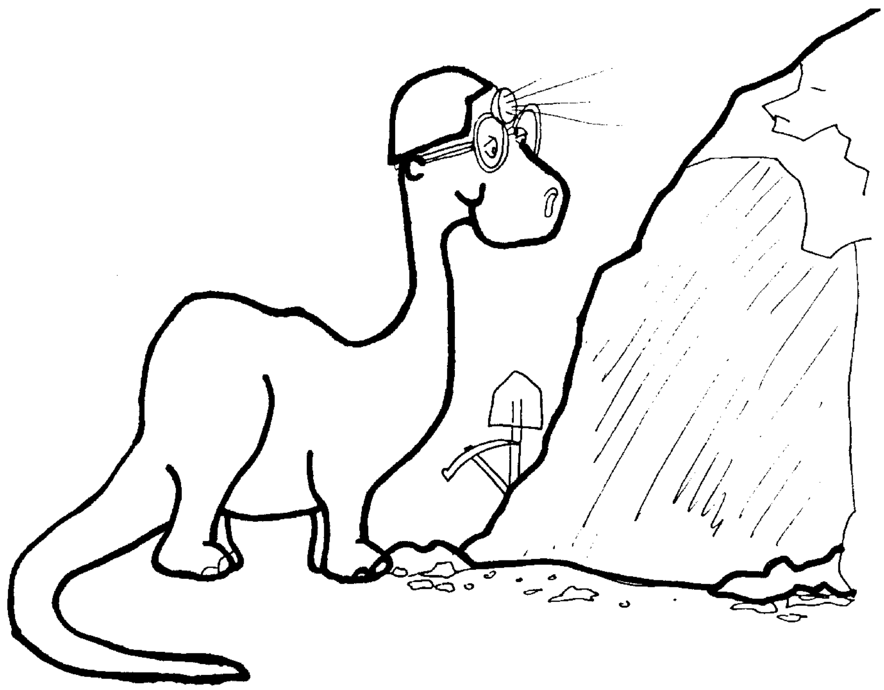
Rock Cycle

Understanding the Earth's Crust

FOURTH GRADE

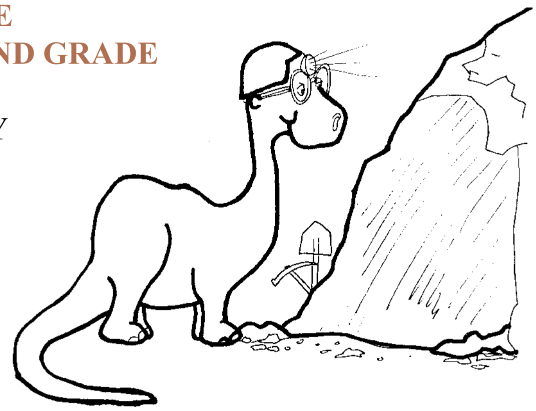
PAST LIFE



1 WEEK

LESSON PLANS AND ACTIVITIES

ROCK CYCLE
OVERVIEW OF SECOND GRADE



CHEMISTRY

WEEK 1.
PRE: *Analyzing the structure of the elements.*
LAB: *Investigating the chemical bonding of salt.*
POST: *Exploring the historical uses of salt.*

MINERALS

WEEK 2.
PRE: *Observing and describing key characteristics.*
LAB: *Exploring the characteristics of minerals.*
POST: *Comparing and contrasting mineral properties.*

WEEK 3.
PRE: *Exploring the different shapes of minerals.*
LAB: *Analyzing mineral shapes.*
POST: *Examining minerals that are gemstones.*

ROCKS

WEEK 4.
PRE: *Developing criteria to distinguish rocks.*
LAB: *Analyzing how different types of rocks are formed.*
POST: *Exploring the uses of rocks in the Indian culture.*

WEEK 5.
PRE: *Exploring parts of the rock cycle.*
LAB: *Analyzing and interpreting the shape of sand particles.*
POST: *Developing a story about rocks.*

PAST LIFE

WEEK 6.
PRE: *Reconstructing fossil organisms.*
LAB: *Discovering that "the present is the key to the past."*
POST: *Recognizing fossil bones.*

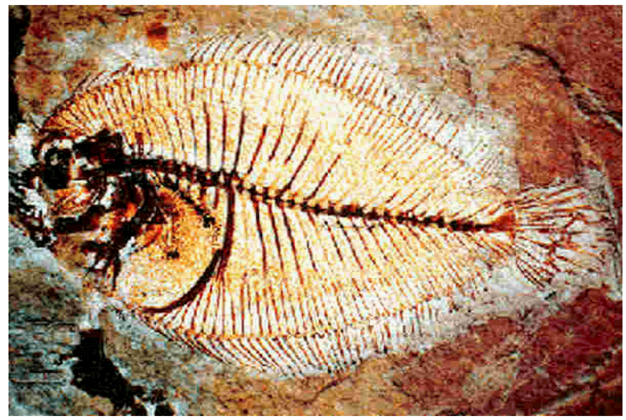
ROCK CYCLE - PAST LIFE (4)

PRE LAB

Students use skeletal remains to reconstruct fossil organisms.

OBJECTIVE:

1. Exploring the meaning of fossils.
2. Reconstructing fossil organisms.



A fossilized fish

VOCABULARY:

fossil
reconstruction
sedimentary

MATERIALS:

worksheet

BACKGROUND:

Evolution is the documented change in organisms, leading to the creation of new species, through time. Evolution is a non-reversible process. For example, dinosaurs will never exist again. Present day evolutionary theories are based not only from biochemical data from living organisms, but also from the remains of organisms preserved as fossils in rocks. Discoveries about the details of the evolutionary process continue, but the basic accuracy of the theory is not in doubt.

The chance that an organism will be preserved as a fossil is low. Geological processes such as erosion, weathering, sedimentation, and leaching constantly "attack" the fossil, which may destroy the fossil 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 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.

C) recrystallization 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 fossils without alteration. 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.

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 withing sediment, water percolating through the sediment leaches out the fossil. This leaves a cavity in the rock, called a mold. A cast then 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 up. The formation of a cast is similar to putting jello in a mold; when you remove the mold, you are actually eating the cast of the mold.

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 excrements. They give some indication of the structure of the animal's gut, and sometimes provide clues to its diet.

PROCEDURE:

1. Discuss with students what fossils tell us about that organism. The remains of organisms tell us about what it was and how it lived. However, think about how organisms live today; they do not live in isolation, but interact with other organisms in their environment. The biological subdiscipline of ecology studies the relationships between communities of organisms, as well as interactions between organisms in their environment. Ecologists must answer a broad range of questions to document ecological relationships.

These include:

1) How does the physical and chemical environment influence the organisms?

2) How do individuals gather food?

3) How do individuals occupy living space, and what position of the food chain do they occupy?

4) How do organisms interact with each other?

5) How does the community evolve through time?

2. The physical, chemical and biological properties of communities can limit the distribution and abundance of species. Limiting factors can include parameters like temperature, salinity of water, oxygen, pH, sunlight, water turbulence, nutrients, substrate, and predator/prey interactions, to name a few.

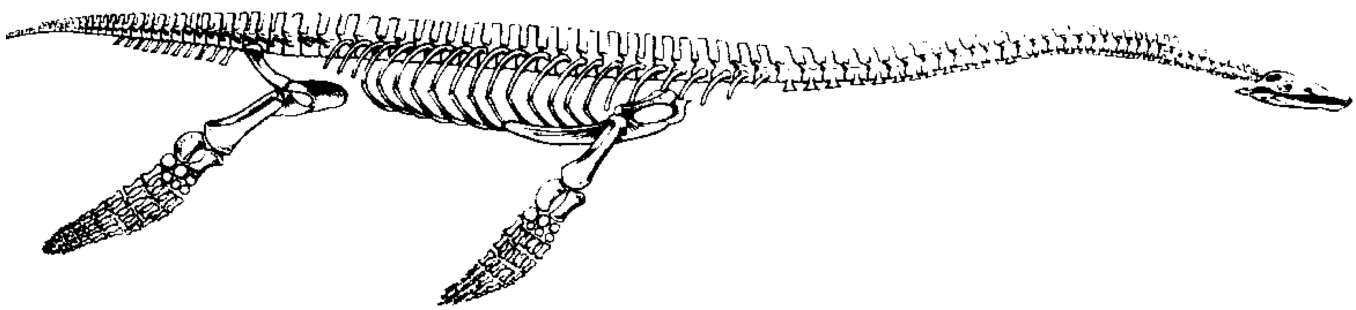
Note that this list of factors includes very few items that are recorded in the fossil record. You can illustrate this point by using a fish tank. You might go home and find a few dead fish in your tank. You can then check the temperature of the water, the pH, or other factors and probably determine what caused the fish to die. However, in the fossil record you cannot check many of these parameters. You must rely on the remains of the organisms and from them determine the overall ecology of the community. This is difficult. It would be as if you went on vacation and came home to an empty fish tank. Maybe your fish died while you were gone, and your maid disposed of the fish and drained and cleaned the tank. How would you find out what killed those fish? Was it the temperature, pH, the cat, or was the maid hungry?

The only source for ecological information on fossil organisms is the rock surrounding the fossil. Sometimes the rock records the environment where the organism lived. This is not always the case, as dead organisms may be transported before they are fossilized. However, if the fossil formed in rocks reflecting its "living" environment, the rocks can be used to make ecological inferences. These include the type of environment, i.e., land vs. ocean, the energy of the environment, and sometimes basic environmental chemistry.

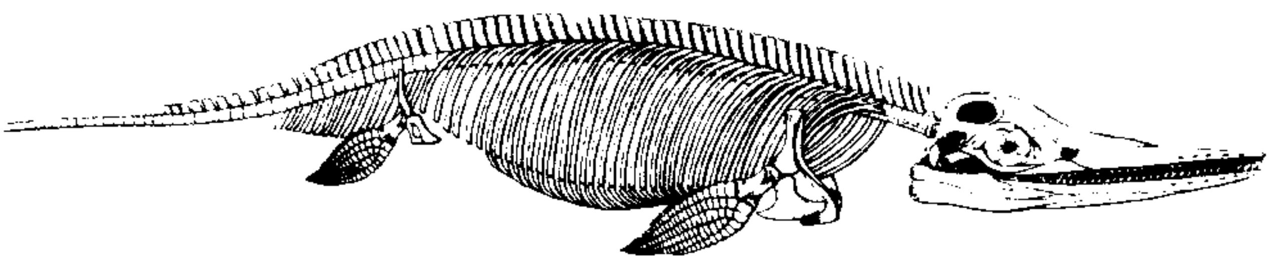
3. Use the worksheet to have students reinact what the fossil might have looked like as a living organisms. Both of them lived in the ocean, because the legs are modified as fins. Color should be similar to organisms that presently live in the oceans so they would be gray to black.

ROCK CYCLE - PAST LIFE (4) PRE LAB

Can you guess what kind of animal this used to be? Draw a picture of what you think it looked like when it was alive. Did it have feathers, skin, or fur? Was it red, yellow or green?



Pleiosaurus dolichodeirus



Ichthyosaurus communis

ROCK CYCLE - PAST LIFE (4)

LAB

Students compare living coral, gastropod and bivalves with fossils.

OBJECTIVE:

1. Discovering that "the present is the key to the past."
2. Comparing recent organisms with fossils.

A bivalve shell - notice preservation of shell features

VOCABULARY:

fossil
living
past
recent

MATERIALS:

Rock Cycle - Past Life (4)
hand lens or Swift GH

BACKGROUND:

One meaning of the statement "the present is the key to the past," is that knowing about present day organisms can help to identify fossils and to explain their behavior and ecology. The remains of present day organisms are often better preserved than are fossils, so the former contain much more scientific information.

In this lab, students will compare recent and fossil remains, and distinguish their differences.

PROCEDURE:

1. Explain to the students that the remains of once-living modern organisms have distinct key characteristics. These key characteristics can help you identify fossil examples of the same kind of organism.

Discuss the key characteristics of "present" day organisms compared to those of the "past." Include items like teeth, bones, bark, and shells. Emphasize to your students that items like blood, skin, hair, and clothes are not found from the "past" (unless mummified).

2. Instruct the students to observe and draw the specimens of recent organisms. Help them observe details, so that they will be able to compare the fossils and recent specimens. Use a hand lens or Swift GH microscope to observe the specimens.

3. Have the students examine the fossils, and match each fossil with its recent counterpart. After they make a correct match, have them again draw the fossil.

Different fossil specimens have gone through different types of fossilization. The characteristics listed below may be slightly different from your specimens.

SHELL: Recent samples should have ridges, growth lines, and should be whitish, with a hint of color. Fossil samples should be white and embedded into rock; growth lines may be visible.

GASTROPOD: The recent samples are spiraled and colored. The students should be able to count the spirals. The fossil sample should be whitish, and often reveals the inside of the gastropod.

CORAL: The recent sample will be full of small holes, which were inhabited by the living coral organisms. Some samples may be colored. The fossils look very rocklike, and show only cross sections of the inside of the coral.

ROCK CYCLE - PAST LIFE (4) LAB

PROBLEM: Do present day organisms help us understand fossils?

PREDICTION:____

EXERCISE I. You have 3 samples of present day organisms in your packet. Draw each specimen in the space provided and try to figure out what the organism is. You may want to consult reference books to help identify them. Record what part of the organism you think each sample is, and why.

EXERCISE II. Try to figure out the fossil counterpart of the present day organism. Draw each specimen in the space provided next to the present-day counterpart.

EXERCISE 1 PRESENT	EXERCISE 2 FOSSIL COUNTERPART

CONCLUSION: How does a present day organism help us understand a fossil?
____

ROCK CYCLE -PAST LIFE (4)

POST LAB

> Students compare chicken and cow bones.

OBJECTIVE:

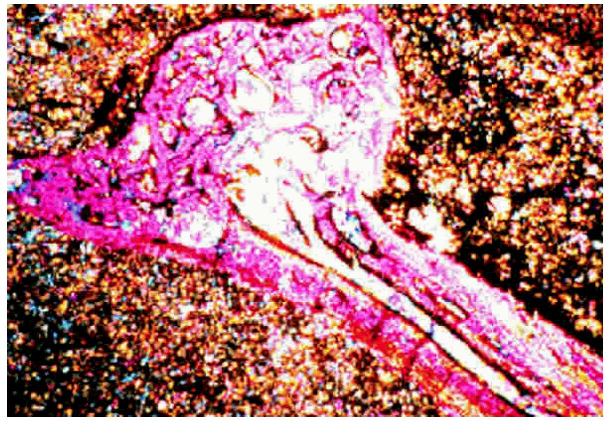
1. Recognizing bones.
2. Comparing chicken and cow bones.

VOCABULARY:

bone
cross section
preserved

MATERIALS:

chicken bone and steak bone
Swift-GH microscopes



A fossilized dinosaur bone

BACKGROUND:

The bones of different animals are very unique and can be distinguished easily. For example, a larger animal has proportionately larger bones than a small animal. The larger the animal, the greater the bone diameter needed to support the weight of the animal. Larger bones usually correspond to a lack of agility; a mouse is much quicker in its movements than is an elephant.

Students sometimes do not realize that bones are living parts of organisms. For example, the interior of a bone is porous. Some of these openings host blood vessels.

Dinosaur bones

PROCEDURE:

1. Ask the students to bring a chicken bone and a steak bone to school. Make sure the bones have been cleaned.

2. Instruct the students to carefully draw the bones. Make sure they look at cross-sections, not just the surfaces. They should discover that both types of bones have something in common - a porous interior. After they have discovered this, explain that the holes hosted blood vessels

that nourished the bones when they were part of a living organism.

3. Ask the students to list differences between the bones. They should note that the steak bone is more dense than the chicken bone; use this to lead a discussion about how the two organisms live. Bird bones tend to be light and hollow, because birds are small, and because they need lightweight bones to be able to fly.