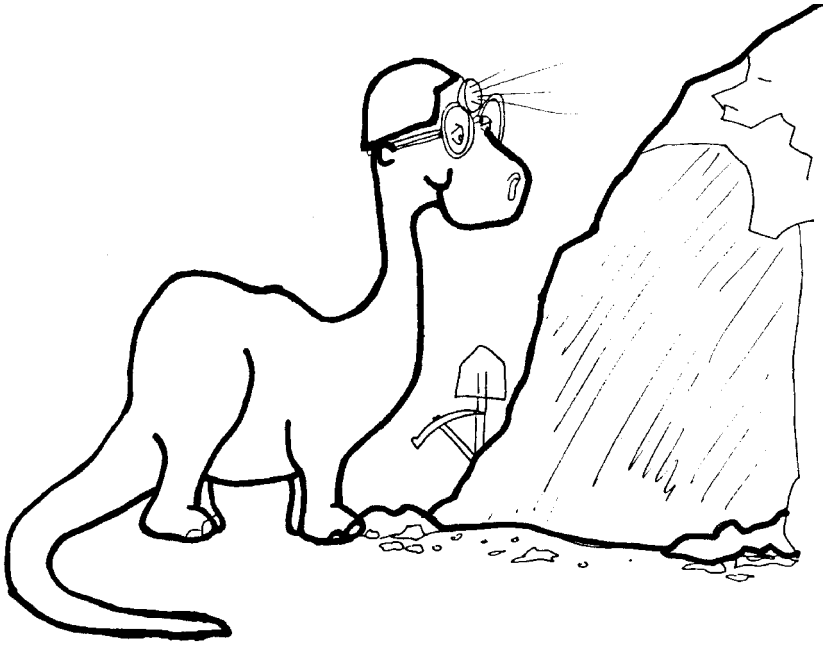
Rock Cycle

Understanding the Earth's Crust

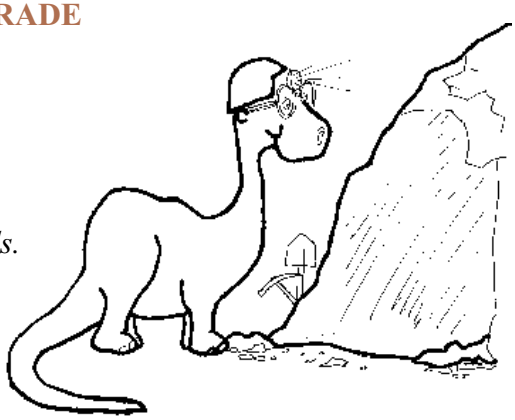
SIXTH GRADE

PAST LIFE



1 WEEK
LESSON PLANS AND
ACTIVITIES

ROCK CYCLE
OVERVIEW OF SIXTH GRADE



CHEMISTRY

WEEK 1.
PRE: *Comparing different solutions.*
LAB: *Exploring how elements can be released from compounds.*
POST: *Analyzing the periodic table.*

MINERALS

WEEK 2.
PRE: *Exploring the composition of minerals.*
LAB: *Exploring the varieties of quartz.*
POST: *Exploring minerals made from silicon and oxygen.*

WEEK 3.
PRE: *Determining specific gravity.*
LAB: *Predicting the use of minerals.*
POST: *Comparing an ore with a mineral.*

ROCKS

WEEK 4.
PRE: *Discovering how rocks are formed by plate tectonics.*
LAB: *Distinguishing where rocks are located within the rock cycle.*
POST: *Writing a creative essay on rocks.*

WEEK 5.
PRE: *Discussing decorative uses of rocks.*
LAB: *Distinguishing between adhesives and cements.*
POST: *Comparing mined resources in the United States.*

PAST LIFE

WEEK 6.
PRE: *Exploring the importance of fossils.*
LAB: *Interpreting cores to understand stratigraphy.*
POST: *Discovering how paleontologists document evolution.*

PROCK CYCLE - PAST LIFE (6)

PRE LAB

Student discuss geologic time.

OBJECTIVES:

1. Understanding how rocks record geologic time.
2. Exploring the importance of fossils.

VOCABULARY:

evolution
fossil
geologic time
paleontology
stratigraphy

MATERIALS:

worksheet

Ammonites are not found in the Cenozoic

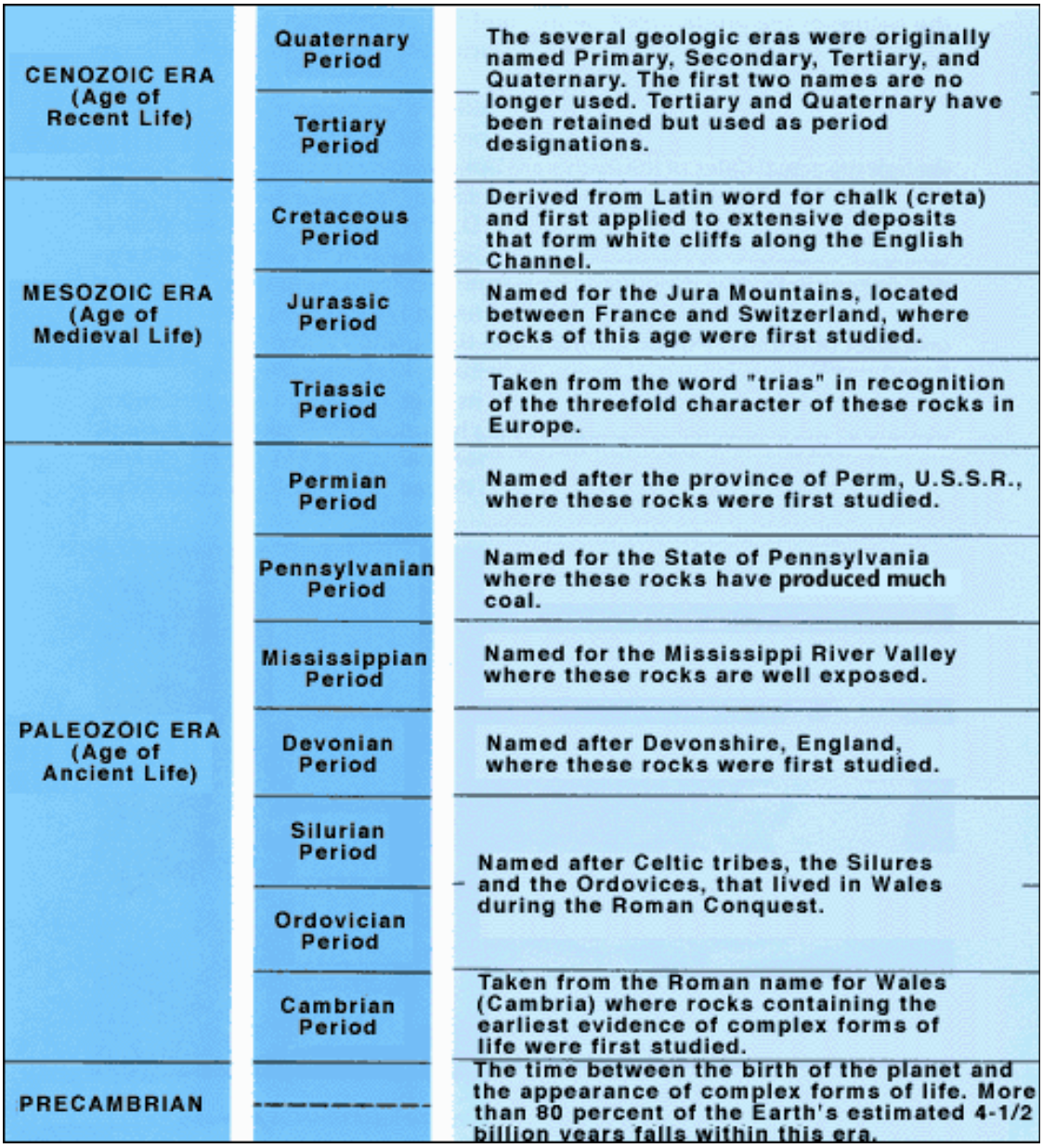
BACKGROUND:

Students are familiar with dinosaurs and other fossils, but the idea that certain organisms lived at certain times is very difficult for them to comprehend. The oldest unmistakable fossils are about 3.8 billion years old. However, multicellular organisms did not appear in the fossil record until approximately 650 million years ago. Animals with hard body parts (skeletons) did not appear until about 580 million years ago.

Geologic time is often very difficult to understand. Most students have trouble understanding the impact of 10 years, not to mention the 4.5 billion years that have passed since the formation of the Earth. It is difficult to date exactly how old the Earth is because no one was there to record the event. There are many lines of evidence for the age of the Earth, within your students' lifetimes this number will probably change slightly as new technology helps us to better date the past.

An accurate sense of geologic time and Earth history was very difficult for scientists to construct. It was not until the mid 1700's that James Hutton, who developed some of the modern principles of stratigraphy, realized that the history of the Earth was of unimaginable length of time, and that the "present was the key to the past." Hutton tried to develop methods that used present rates of sediment deposition to interpolate how much time had passed since the deposition of a particular rock layer.

In this lab, students will begin to put rocks and fossils in the context of geologic time. Organisms have evolved over the course of the Earth's evolution. Since paleontologists have recorded and study these changes, geologists can use the type of



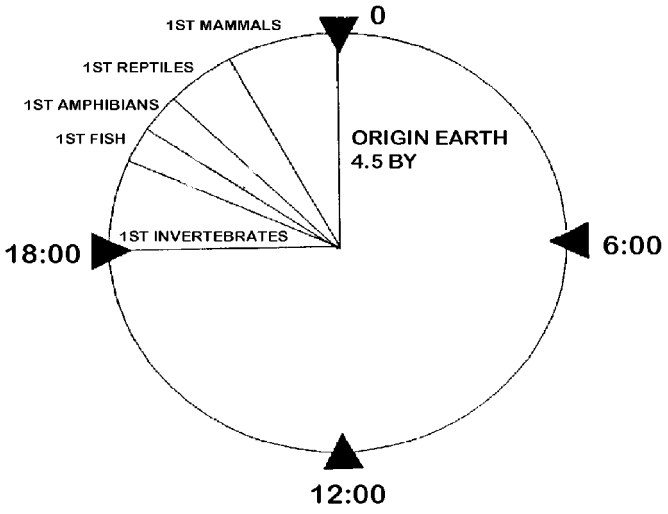
CENOZOIC ERA (Age of Recent Life)	Quaternary Period	The several geologic eras were originally named Primary, Secondary, Tertiary, and Quaternary. The first two names are no longer used. Tertiary and Quaternary have been retained but used as period designations.
	Tertiary Period	
MESOZOIC ERA (Age of Medieval Life)	Cretaceous Period	Derived from Latin word for chalk (creta) and first applied to extensive deposits that form white cliffs along the English Channel.
	Jurassic Period	Named for the Jura Mountains, located between France and Switzerland, where rocks of this age were first studied.
	Triassic Period	Taken from the word "trias" in recognition of the threefold character of these rocks in Europe.
PALEOZOIC ERA (Age of Ancient Life)	Permian Period	Named after the province of Perm, U.S.S.R., where these rocks were first studied.
	Pennsylvanian Period	Named for the State of Pennsylvania where these rocks have produced much coal.
	Mississippian Period	Named for the Mississippi River Valley where these rocks are well exposed.
	Devonian Period	Named after Devonshire, England, where these rocks were first studied.
	Silurian Period	Named after Celtic tribes, the Silures and the Ordovices, that lived in Wales during the Roman Conquest.
	Ordovician Period	
	Cambrian Period	Taken from the Roman name for Wales (Cambria) where rocks containing the earliest evidence of complex forms of life were first studied.
PRECAMBRIAN	----------	The time between the birth of the planet and the appearance of complex forms of life. More than 80 percent of the Earth's estimated 4-1/2 billion years falls within this era.

fossils in a rock to tell estimate its age relative to other rocks. For example, the dinosaurs lived and became extinct long before human ancestors evolved. Therefore, a rock containing dinosaur fossils would be much older than one containing hominid remains. This type of geologic time telling is called relative geologic time; it gives the order of events, fossils, and rocks from oldest to youngest, without reference to numerical ages.

Relative time is based on several principles of stratigraphy (the arrangement of sedimentary rock layers. These are the principles of **Original Horizontality, Superposition,** and **Faunal Succession**. The principle of Original Horizontality, first proposed by William Smith in the late 1700's, states that sedimentary layers formed in a

horizontal position. If mountain building took place and the layers were tilted or moved, this event must have occurred after the layers were laid down.

The Principle of Superposition states that in a sequence of sedimentary rock layers, the bottom layers are older than the top layers. The bottom layers were deposited first. The principle of Faunal Succession is similar to Superposition; it states that the oldest fossils in a series sedimentary rock layers will be in the lowest layer. Progressively younger fossils occur in higher layers.

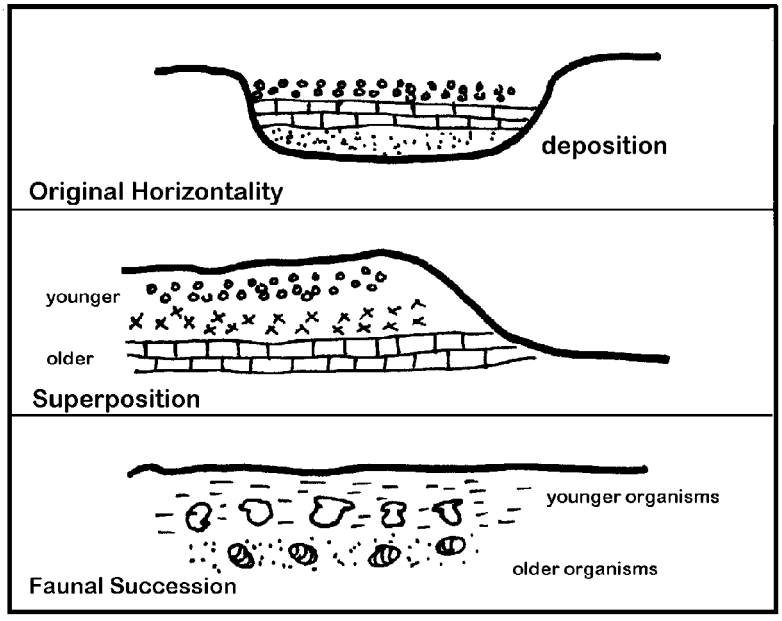


PROCEDURE:

1. Illustrate geologic time using the analogy of a 24 hour clock representing the 4.5 billion years of earth history. Draw the clock (shown below) on your blackboard. The creation of the major types of animals was not until 20:00, and humans were not around until 30 seconds before 24:00! Humans have only been on this Earth for a very short period. Dinosaurs were on this planet for much longer than we have been.

2. The students should use the worksheet to follow your presentation. This worksheet will help the student remember this very simple but difficult concept.

3. Emphasize that the history of geologic time was very difficult for scientists to construct. Explain how relative time is based on stratigraphic principles. You may wish to use the diagram below to help illustrate these principles.



ROCK CYCLE -PAST LIFE (6)

LAB

Students make sediment cores and learn the information they record.

OBJECTIVES:

1. Learning that fossils can be found in layers below the Earth.
2. Interpreting cores to understand stratigraphy.

Sediment layers in an excavation

VOCABULARY:

correlate
evolution
fossil
stratigraphy

MATERIALS:

Plaster of Paris
wax paper
small pieces of “fossils”
worksheet

BACKGROUND:

Stratigraphy is the study of the physical and time order of rock layers. In this lab the students will look at sediment cores from wells. They will learn how geologists "correlate" or match up the different rock layers from well to well.

The sediment layers in the well cores contain fossils. The fossils change upward through the cores. These changes occurred as the organisms evolved. The fossils thus uniquely record the passage of time, because evolution goes in only one direction. This is called “the Principle of Faunal Succession”. When a paleontologist see certain fossils in a sample, he or she can deduce the age of the sample.

Fossils and the Principle of Faunal Succession can also be used to correlate isolated rock outcrops or well cores. If the same fossils or succession of fossils are seen in different cores, a geologist can deduce that the cores are the same age.

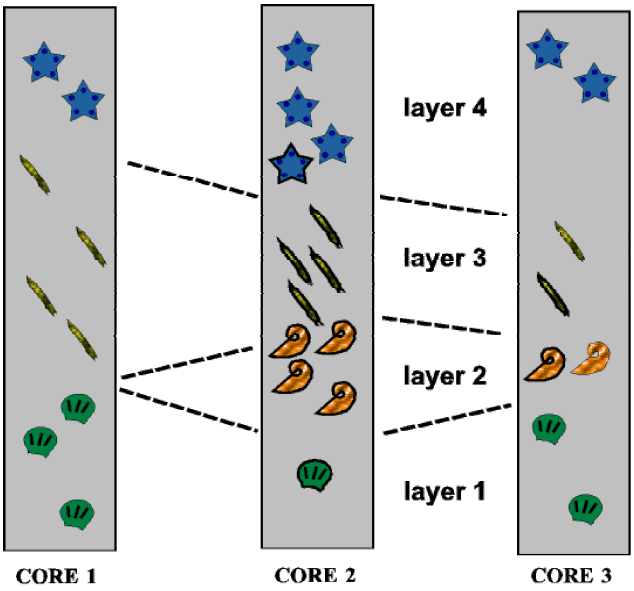
This lab will illustrate how geologists study strata to date and correlate rocks. Key characteristics of the fossils will help students recognize the strata that represent the same interval.

PROCEDURE:

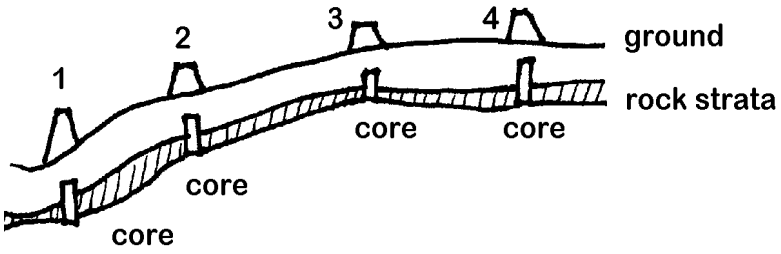
1. Before lab you can make a set of cores that resembles the diagram in exercise

1. However you should make at least 4 different sets of 4 cores, so the students can look and correlated different examples. You can make permanent cores by using plaster of Paris and embedding real or fake fossils or shells. Make sure the cores make sense if you line them next to each other. You also may want the students to make their own cores by using clay or styrofoam. There are many ways to illustration correlation of fossils.

2. Have the students complete Exercise 1. They should easily be able to correlate the fossils between the cartoon cores. Answers are to the right.



3. Draw the following diagram on the board so the students can visualize where the cores were drilled.



4. Begin Exercise 2. On their lab sheets, have the students describe the key characteristics the fossils in each well core. It is crucial that they be able to identify the fossils before they attempt the correlations.

5. Have the students compare the different sequences between wells and try to correlate them using the fossils. Each correlated layer represents the same time at a different place on the Earth's surface.

ROCK CYCLE - PAST LIFE (6) LAB

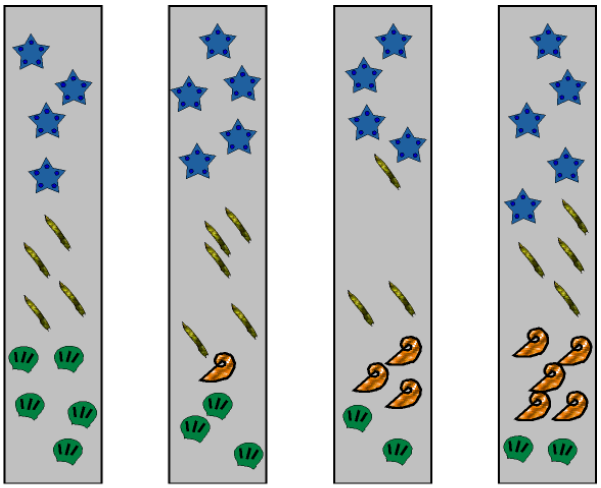
PROBLEM: How can fossils be useful?
PREDICTION:_____

EXERCISE I. Below are four different well cores. Correlate between the cores using the fossils.

EXERCISE II.

MATERIALS: prepared well cores

Look at the each core; notice that they contain fossils. Describe the key characteristics of each fossil. Match up the fossils between each core. Draw the four different cores and connect the "horizons" that are the same from one well core to another.



WELL CORE 1	WELL CORE 2	WELL CORE 3	WELL CORE 4

CONCLUSION: How do cores of the Earth help us to learn about the Earth?

_____

ROCK CYCLE - PAST LIFE (6)

POST LAB

Students use a worksheet to study extinct horses.

OBJECTIVE:

1. Discovering how paleontologists observe evolution.
2. Exploring how changes in fossil morphology help geologists to age date rocks.

VOCABULARY:

evolution
molar
ungulate

MATERIALS:

worksheet

A bee preserved by carbonization

BACKGROUND:

The "present is the key to the past," refers to an important principle in paleontology. Paleontologists infer that the way evolution works today is the same as it worked in the past history of the earth. Evolution, in paleontological terms, is the change in the morphology of fossils through time. The presence and extinction of small organisms, especially the invertebrates and protozoa, show many examples of evolution. The larger the organism, the harder it is to see evolution. For instance, complete invertebrate skeletons are frequently preserved, but complete dinosaur skeletons are virtually nonexistent. For this reason (among many others), human evolution is not as well documented as the many other organisms that lived on Earth.

One of the best known examples of change through time of a vertebrate is the evolution of the horse. The oldest known horse is found in both North American and Europe. According to the fossil record, the evolution to the modern horse consisted of a variety of changes, including an overall increase in size, development of a single hoof from several toes, development of large molar teeth for grazing, and an increase in brain size. Most of these changes were caused by changes in the environment where the ancestral horses lived. For example, the molar teeth grew larger in order to chew grass, which is a very tough plant food. Horse evolution was *not* a linear trend, but more like a branching tree; many types of horse evolved and went extinct before the appearance of modern horses.

PROCEDURE:

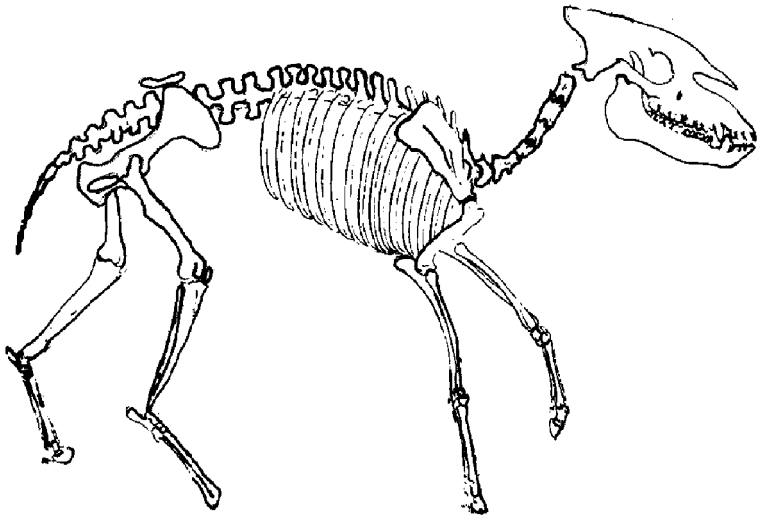
1. The worksheet shows the skeleton of a *Mesohippus*, an early form of horse that lived during Oligocene Epoch (about 38-26 million years ago). Have the students recreate what they think *Mesohippus* might have looked like, using the bones as a guide. Do not tell the students it is a horse, because they will not think about what the bones are telling them.

2. Paleontologist have found these fossils. The *Hyracotherium* is found below *Mesohippus*, below *Merychippus*, and so on. Point out to students the development of the brain and the hoofs. Paleontologists can only interpret the record of their fossils, which leads them to believe that horses have evolved through the last 50 million years.

3. Explain to the students that horses are just one of many fossil examples that paleontologists have used to demonstrate a slow, but constant change of life on the Earth. This change is called evolution.

ROCK CYCLE - PAST LIFE (6) POST LAB

WHAT DID I LOOK LIKE WHEN I WAS ALIVE?



I AM AN UNGULATE.