Fossil Kit Laboratory Investigation 1: How Fossils Form

Investigation Summary: Students will examine several fossil and non-fossil specimens, record observations in their notebooks, and identify the type of fossil preservation. Students will learn the difference between a body and a trace fossil and will examine common methods of fossilization that preserve shell, bone, and wood.

Enduring Understandings	**Essential Questions**
• Fossils provide evidence that life existed in the distant past and that Earth's life forms have changed through time or evolved.	• How do fossils form? • What are the different kinds of fossil preservation? • What special conditions are necessary in order for something to become a fossil?
Students will know…	**Students will be able to…**
• The difference between a body fossil and a trace fossil. • Different types of fossil preservation including: unaltered, recrystallization, mold, permineralization/petrification, compression. • That the type of organism and its environment influence how it will be preserved.	• Predict and infer how fossils are formed from previously living organisms. • Compare and contrast molds, casts and permineralized fossils. • Describe observations in terms of appearance and texture. • Record data in a data table.

Assessment Evidence

Completion of Investigation Worksheet
Science Notebook Entries (as applicable)

Evidence Outcomes
Students will be able to:

a. Use evidence to develop a scientific explanation for:
    1. What fossils tell us about a prehistoric environment
    2. What conclusions can be drawn from similarities between fossil evidence and living organisms
b. Analyze and interpret data to generate evidence about the prehistoric environment
c. Evaluate whether reasoning and conclusions about given fossils are supported by evidence

Vocabulary:

Body fossil	Unaltered hard parts	Recrystallization
Molds	Permineralization	Petrification
Compression	Trace fossil	

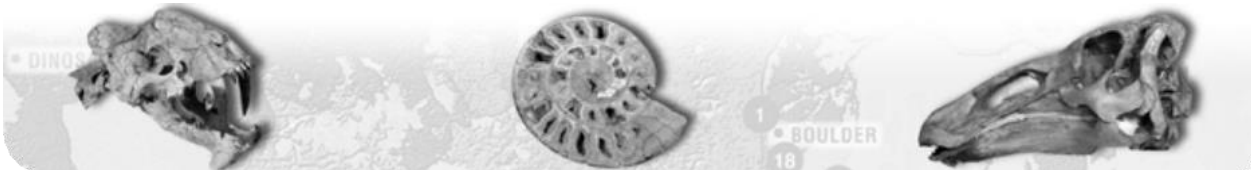
Before You Teach

What are fossils?

- Fossils are the tangible remains of ancient organisms found in the rock record. The simplest definition is that fossils are any evidence of past life.
- Fossils can tell us lots of information about what life was like millions of years ago, what the environment was like, and how old the rocks are. Fossils are THE primary evidence that life has changed (or evolved) over time.

How do fossils form?

- Organisms that are made up of lots of hard parts (e.g., clam shells and dinosaur bones) have a much better chance of becoming a fossil than an organism made up entirely of soft parts (e.g., jellyfish, worms). This is because when an organism dies, most of the soft parts rot away much faster than the hard parts.
- In very rare cases, completely soft bodied organisms are preserved in the fossil record.
- Another important factor in becoming a fossil is for an organism to be buried rapidly by sediment after it dies. This helps to protect the organism from decay and scavengers that might eat it.
- The sediment then gets compacted and eventually hardens into rock, preserving the organism for millions of years.



- Seafloors, lake bottoms, and rivers are excellent environments for rapid burial in sediment. Mountain tops are bad, because sediment is being eroded and not deposited.
- Once an organism has been buried, it can still be altered by groundwater, heat, pressure, etc. This can change the original composition of the organism and how it is fossilized.

Additional Teacher Resources

Vocabulary:

Body fossil – The remains of part (or all) of an actual organism. Body fossils are different from trace fossils, which preserve evidence of the behavior of an organism (e.g., dinosaur footprint; see definition below). Types of fossilization for body fossils include:

Unaltered hard parts- The body fossil is made up of exactly the same material as when it entered the rock record. Teeth are a good example as they are the hardest part in a vertebrate body, and they typically have the same composition in fossils as they do when they are in your mouth. Also, mummified fossils are essentially unaltered.

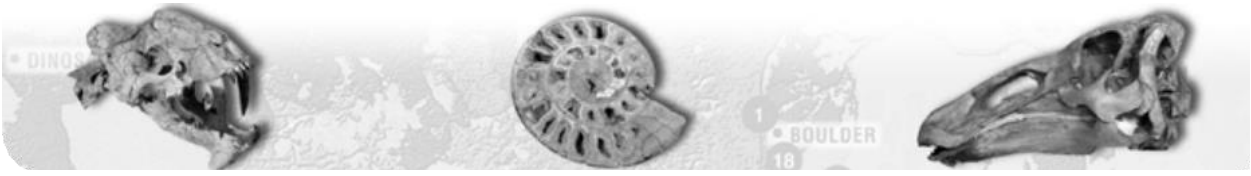
Recrystallization- The process by which the original material of the body fossil has had its chemical structure changed. The fossil is usually identical in shape to the original unaltered hard parts, but the internal crystal structure has been changed.

Molds- Sometimes after an organism gets buried in rock, its original material can be completely dissolved by the groundwater flowing through it. What is left behind is a hole (or cavity) in the exact shape of the organism, which is called a *Mold*.

Permineralization/Petrification- This type of preservation normally happens with bone and wood, which have many tiny pore spaces inside. If you have ever looked inside a beef bone, you probably saw the marrow cavity, which is bubbly- looking, filled with tiny holes. These holes are the pore spaces. When groundwater percolates (or flows) through the organism, it deposits minerals into these pore spaces. The minerals crystallize, hardening and preserving the organism. Permineralized wood and bone are much heavier in weight compared to the original organism, and they're often discolored by the minerals carried in the water.

Compression- These fossils are usually totally flattened (or squished) and two-dimensional, but still show most of the original shape of the organism. Leaves, stems, and soft-bodied organisms are often preserved as compressions.

Trace fossil – Trace fossils are traces or marks left behind by an organism. They record the behavior or activities of an organism, but are not the actual organism itself (which would be a body fossil). Dinosaur footprints and worm burrows are examples of trace fossils, as are coprolites (fossilized dung or feces)

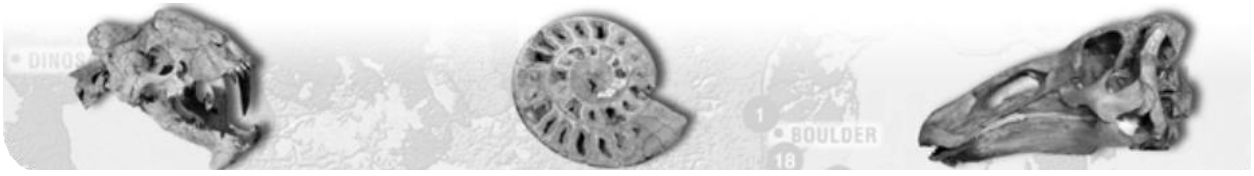


Online Resources

http://www.ucmp.berkeley.edu/education/teachers.php is a website that features valuable and easy to understand paleontology resources for teachers.

http://www.newyorkscienceteacher.com/sci/esl/es/spanish-es.pdf is a website that lists Spanish translations of Earth Science Terms.

http://puzzlemaker.discoveryeducation.com/ is a website where you can easily create your own crossword puzzles or word searches using the listed vocabulary words.



Laboratory Investigation 1, Part 1:
Sorting, Measuring, and Recording Observations about Fossils

Materials:

1 set of fossils

Trilobite, Petrified Wood, Brachiopod, Fern, Coprolite, Dinosaur Bone

1 set of non-fossils/unaltered remains

Unaltered Bone, Unaltered Shell

1 set of fossil labels

10 hand lenses

10 rulers

Investigation Worksheets

Conducting the Investigation:

1. Introduce the science of Paleontology.

Introduce paleontology to students by defining the word *paleontology*. "Paleo" means ancient, "onto" means creature, and "ology" means study. Thus, *paleontology* is the study of ancient creatures, or the study of past life on Earth.

Paleontologists use many kinds of evidence to tell them what life was like on Earth throughout its history, including the study of fossils. Tell students that they will be paleontologists as they explore ancient life.

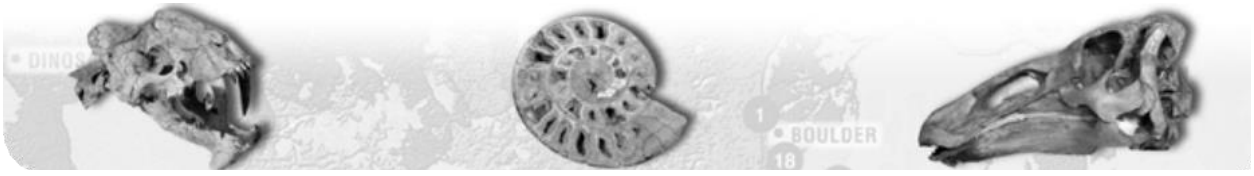
2. Introduce fossils.

Show students the fossils and explain that they are the remains of organisms that once lived on Earth. Explain that paleontologists make detailed observations of the fossils they study.

They start with *general observations* and then make more *specific observations*.

General observations help paleontologists to determine what kind of organism they are examining, and what part of that organism is preserved in the fossil.

More specific observations can tell what properties make that fossil unique as a species or even as an individual.



3. Introduce the tools.

Show and demonstrate the use of the hand lens and rulers. Ask students what kind of measurements should be taken and where measurements should be taken on a fossil.

Paleontologists often use landmarks, or special features, on a fossil to make clear which distances are being measured, and to make sure the fossils are measured in a uniform way.

Ask students to determine where to measure each fossil to get its length, width, height, and any other measurement they think is important. They should measure each fossil, sketch each fossil on their Investigation Worksheets, and record their measurements and the location of each measurement.

4. Measure and make detailed observations of fossils.

Have students make initial observations. Students can work in groups to make initial observations.

Students should have the opportunity to handle each of the specimens and observe the differences in kind, size, shape, texture, etc.

Have students make measurements of each fossil's length, width, height, and other features.

Have them record these measurements and all observations on the Investigation Worksheets.

5. Discuss and compare detailed observations.

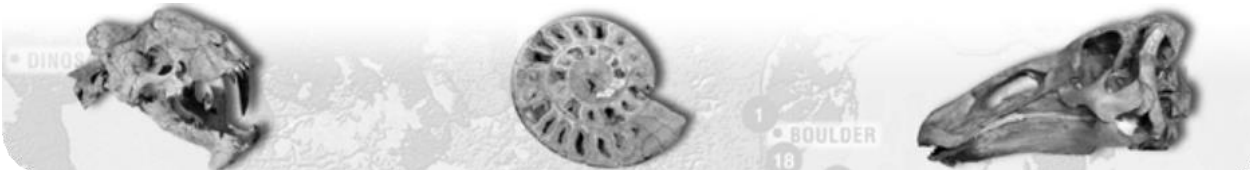
Review some of the features of the fossils that students observed.

What are some of the detailed observations they recorded?

What are some of the things that they saw using the hand lens that they didn't see when just looking with the naked eye?

What are some of the landmarks, or special features that they used to make measurements?

Share some of their sketches with the rest of the class.



Laboratory Investigation 1, Part 2:
Investigating Types of Fossil Preservation

Materials:

1 set of fossils

Trilobite, Petrified Wood, Brachiopod, Fern, Coprolite, Dinosaur Bone

1 set of non-fossils/unaltered remains

Unaltered Bone, Unaltered Shell

1 set of fossil labels

Investigation Worksheets

Conducting the Investigation:

1. Introduce how fossils form.

Show students the fossils from Part I again and explain that they are the remains of once-living organisms. Explain to them that while the organisms once had soft body parts, such as muscles and organs, those parts were not preserved as part of the fossil.

Explain that fossils can be generally divided into body fossils and trace fossils. Show examples of each type of fossil. Then introduce the different types of fossilization: unaltered hard parts, recrystallization, molds, permineralization/petrification, and compression.

Tell students that their challenge is to make observations about the fossils and unaltered remains, determine if they are body or trace fossils, and identify the type of fossil preservation for the body fossils.

2. Review what the students will be recording on Part 2 of their data collection sheets.

3. Recording Data.

Students should identify whether the fossil is a body fossil or trace fossil. If the fossil is a body fossil, they should then try to identify the type of fossil preservation. Ask them to use their vocabulary lists for this part of the exercise.

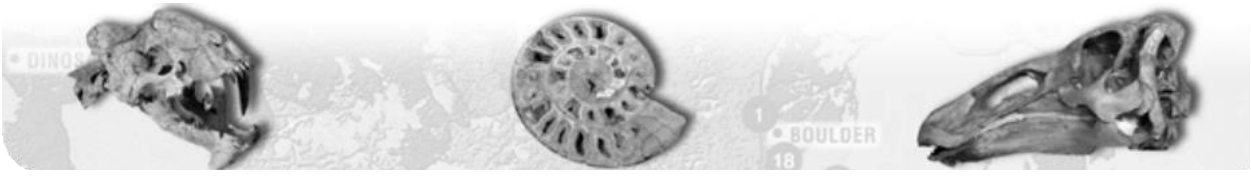
4. Discuss and compare initial observations.

What observations did you make?

Are these body fossils or trace fossils?

For the body fossils, can you identify the type of fossil preservation?

What characteristics did you use to identify the type of fossil preservation?



Name: _____

Laboratory Investigation 1, parts 1 and 2 – Investigation Worksheet

For this exercise, examine the eight specimens of fossils and non-fossils and do the following:

Part 1: Determine whether the specimen is a fossil or non-fossil. Carefully pick up and observe each specimen, noting any special features or characteristics. Measure the specimen. Sketch the specimen, including any special features, and note on the sketch where you measured it. Record your observations and measurements in the space below.

Part 2: If the specimen is a fossil, is it a body fossil or a trace fossil? If the specimen is a body fossil, determine the mode of preservation, or how it was preserved (unaltered hard part, recrystallization, mold, permineralization/petrified, or compression – Use your vocabulary list to help answer this question). Sort or classify this group of fossils, and record what criteria you used to sort them.

Specimen 1- Fossil _____ Non-Fossil _____

Part 1: Length:

Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?

Specimen 2- Fossil _____ Non-Fossil _____

Part 1: Length:

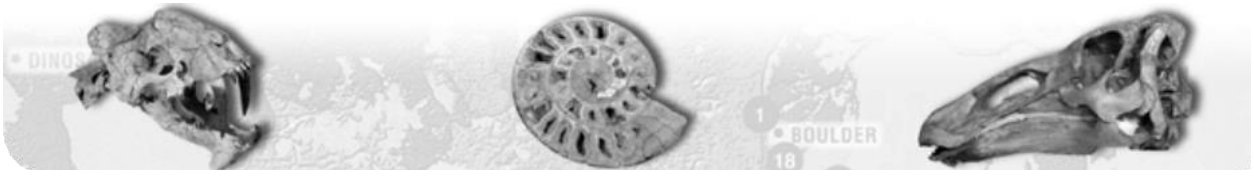
Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?



Specimen 3- Fossil _____ Non-Fossil _____

Part 1: Length:

Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?

Specimen 4- Fossil _____ Non-Fossil _____

Part 1: Length:

Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?

Specimen 6- Fossil _____ Non-Fossil _____

Part 1: Length:

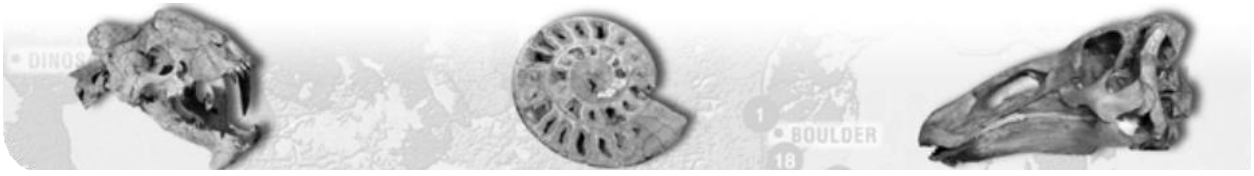
Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?



Specimen 13- Fossil _____ Non-Fossil _____

Part 1: Length:

Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?

Specimen 14- Fossil _____ Non-Fossil _____

Part 1: Length:

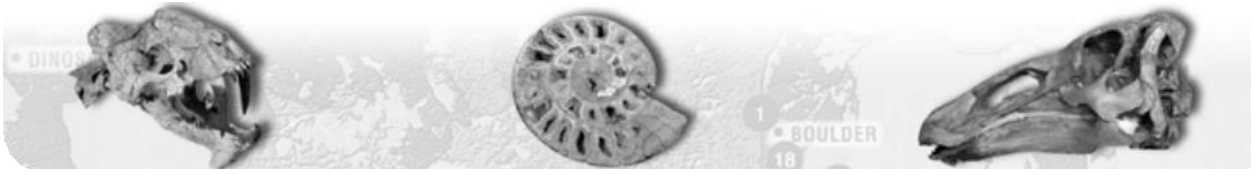
Width:

Height:

Other:

Special Features:

Part 2: Body or Trace? If body, what type of preservation?

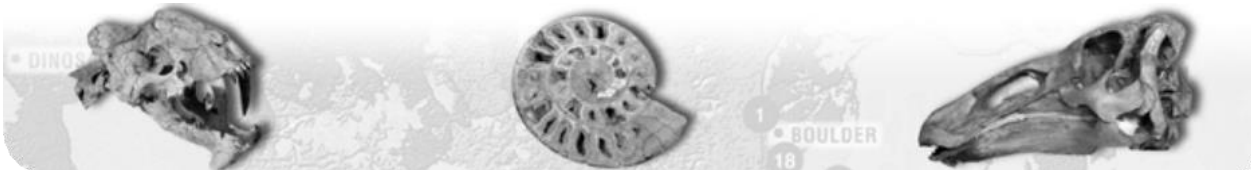


Laboratory Investigation 1: Vocabulary for How Fossils Form

Body fossil – The remains of all or part of an actual once-living organism. Examples of body fossils include: dinosaur bones, clam shells, and mammoth tusks. Different kinds of preservation for body fossils include:

> **Unaltered hard parts** – The body fossil is made up of exactly the same material as when it entered the rock record.
>
> **Recrystallization** – The process by which the original material of the body fossil has had its chemical structure changed. For example, the fossil clam shell looks identical in shape to the original (once living) clam shell, but if you look at it under a microscope, its texture or color probably looks different from the original clam shell because the internal crystal structure has been changed.
>
> **Molds** – Sometimes after an organism gets buried in rock, its original material can be completely dissolved (or removed) by the groundwater flowing through it. What is left behind is a hole in the exact shape of the organism, which is called a *mold.* Think of a Jell-O mold.
>
> **Permineralization/Petrification** – This type of preservation normally happens with bone and wood, which have many tiny pore spaces inside. If you have ever looked inside a beef bone, you probably saw the marrow cavity, which is bubbly-looking, filled with tiny holes. These holes are the pore spaces. When groundwater percolates (or flows) through the organism, it deposits minerals into these pore spaces. The minerals crystallize, hardening and preserving the organism. Permineralized wood and bone are much heavier in weight compared to the original organism, and they're often discolored by the minerals carried in the water.
>
> **Compression** – These fossils are usually totally flattened or squished like a pancake, but they still show most of the original shape of the organism.

Trace fossil – Trace fossils are traces or marks left behind by an organism that capture its behavior and activities, such as crawling along the sea floor, digging (or burrowing), feeding, and even pooping! Dinosaur footprints and worm burrows are examples of trace fossils, as are coprolites (fossil dung or feces).



Laboratory Investigation 1 – Investigation Worksheet – Answer Key

Specimen 1 – Coprolite (Fossil)
Part 1: Students fill in their
sheet Part 2: Trace fossil

Specimen 2 – Trilobite (Fossil)
Part 1: Students fill in their sheet
Part 2: Body fossil; Type of preservation: recrystallization

Specimen 3 – Brachiopod (Fossil)
Part 1: Students fill in their sheet
Part 2: Body fossil; Type of preservation: recrystallization

Specimen 4 – Dinosaur Bone (Fossil)
Part 1: Students fill in their sheet
Part 2: Body fossil; Type of preservation: permineralization

Specimen 6 – Petrified wood (Fossil)
Part 1: Students fill in their sheet
Part 2: Body fossil; Type of preservation: petrification

Specimen 11 – Fern (Fossil)
Part 1: Students fill in their sheet
Part 2: Body fossil; Type of preservation: compression

Specimen 13 – Unaltered bone (Non-
Fossil) Part 1: Students fill in their sheet
Part 2: Body fossil; type of preservation: unaltered

Specimen 14 – Unaltered Shell (Non-
Fossil) Part 1: Students fill in their sheet
Part 2: Body fossil; Type of preservation: unaltered