Fossil Formation Fun

Standard IV:

Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Objective 1:

Describe Utah fossils and explain how they were formed.

Intended Learning Outcomes:

1. Use science process and thinking skills.
2. Manifest scientific attitudes and interests.
3. Understand science concepts and principals.
4. Communicate effectively using science language and reasoning.

Content Connections:

Language Arts VII-2; Understanding informational text

Science Standard IV

Objective 1

Connections

Background Information

The three fossil types that are dealt with in this lesson are those specifically required by the Utah State Core for this grade level, the first being preserved organisms. In preserved organisms, the actual organism is basically unaltered and stays intact, e.g., mammoths that have been found in ice and frozen ground. The soft body parts are preserved as well as the hard parts. Preserved organisms have been found in tar pits and amber. Amber is formed when the soft resin from conifers and tropical flowering plants hardens. Organisms, e.g., insects, spiders, leaves, flowers, mosses, and even frogs, have been found in amber. Organisms trapped in this resin may experience a degree of decomposition, but because resin has a strong antibiotic component the decay of the organism is minimal.

The next type of fossils is mineral replacement. In this type of fossil the organism is buried in sediment, and the soft parts decay quickly. Bones, teeth, claws, and other hard parts decay more slowly. Water seeps through the sediment and passes through the bone. The seeping water dissolves the bone, and minerals in the water replace the bone one cell at a time. This eventually becomes stone. The same process happens in wood; except that wood is often covered with volcanic ash instead of sediments. The ash prevents the wood from rotting, and as rainwater falls on the ash over many years it seeps through the ash into the wood. The mineral replacement makes an exact replica of the original organism.

The last fossil type is impression fossils. These fossils may show detailed outlines of thin plants or small animals, e.g., leaves, feathers, and fish, which die in sediment. As they decay, they leave a carbon

deposit which shows as a dark print of the organism. Impression fossils also include tracks, tail prints, body outlines, teeth marks, and burrows. Mold and cast are impression fossils made by larger organisms. When the organism dies it is covered by sediment. The organism decomposes slowly and leaves a mold (hole) in its place. If the mold is later filled with sediment, it produces a cast that will physically look like the outside of the original organism.

Be aware that students may become confused by pseudofossils when examining rock specimens. These are rock structures that resemble fossils in external form, but lack the detailed structure of true fossils. Sometimes concretions that are harder than the rock in which they occur are found on the surface of the rock, and resemble fossil material.

Research Basis

House, J. D. (2006).The Effects of Classroom Instructional Strategies on Science Achievement of Elementary-School Students in Japan: Findings from the Third International Mathematical and Science Study (TIMSS). ***Academic Search Premier*** (EBSCO HOST). Retrieved 11/21/2006, from http://search.ebscohost.com/login.aspx?direct=true&db=aph &AN=21408846&site=ehost

This article addresses how cooperative learning activities and active learning strategies have helped to improve student interest and achievement in science. The purpose of the study was to investigate the relationship between instructional strategies and student achievement. It was found that students who were frequently involved in cooperative learning and who frequently performed experiments in class earned higher scores.

Mercier, S., & Ostlund, K. (1999). Rising to the Challenge of the National Science Education Standards: The Process of Science Inquiry. California, Squaw Valley: S & K Associates

The beginning of this book gives a practical introduction to inquiry and implementing the National Science Education Standards. It also includes an overview to the process skills which are the key to success in science. There is a section on cooperative and collaborative learning groups and guidelines for helping students learn cluster, task, and camaraderie skills. Help with assessing social skills is also provided.

Puntambekar, S. (2006). Analyzing Collaborative Interactions: Divergence, Shared Understanding and Construction of Knowledge. *Academic Search Premier* (EBSCO HOST). Retrieved 11/21/2006, from http://search.ebscohost.com/login.aspx?direct=true &db=eric&AN=EJ738994&site=ehost-li

This article discusses the interaction between individuals during collaborative learning, sharing divergent perspectives, and shared knowledge bases. Learners move from divergent perspectives to collaborative knowledge building. Students create understanding

from the discussions that they have. The purpose of the study was to understand how collaborative interactions develop over time.

Anderson, K.L., Martin, D.M., & Faszewski, E.E. (Sept 2006). Unlocking the Power of Observations. *Science and Children* (pp. 32-3).

This article discusses how observation is the cornerstone of the inquiry process which lays the groundwork for future scientific learning. Suggestions are given on how to help students make good observations and how to help students communicate those observations. Also given is an assessment checklist and rubric for assessing students' observation abilities.

Invitation to Learn

Fossil Questions

Read each statement carefully. If you believe it is true, place a check in the "Agree" column. If you believe the statement is false, place a check in the "Disagree" column. After learning more about fossils, you may go back and change any of your answers using a different color of pencil.

	Agree	Disagree
1. Scientists learn about Earth's history by studying fossils.		
2. Fossils are usually found in igneous rocks.		
3. Only the soft part of an organism can become a fossil.		
4. Impression fossils are also called track fossils.		
5. An organism can be preserved without changing by being frozen in ice.		
6. Amber is an insect found fossilized in rocks.		
7. Minerals that fill tiny holes in an imprint form mineral replacement fossils.		
8. Replacement fossils are all the same color.		

Instructional Procedures

Fossil Observations

In this activity, students will work in cooperative groups of five to six students (depending on class size) to use the process skills of

Materials

- ❑ Science notebook
- ❑ Pencil
- ❑ Five different fossils
- ❑ Timer
- ❑ *Fossil Chart*

observing, comparing, and inferring. When doing this activity it helps to use a timer; typically, about five to seven minutes allows them enough time to observe their fossil and record the information.

1. Students in each group should count off from one to five. Then students assemble with students from other groups who have the same number. Each numbered group will examine a different fossil, discussing the characteristics they observe.
2. Students will record their fossil observations in their own science notebook, along with a detailed drawing of the fossil. Their written observations should include such things as size, color, shape, texture, and any defining features.
3. Students go back to their original group to share what they have observed and learned about their fossil. Use the *Fossil Chart* to organize the group's information.
4. Students can then use their observations to ascertain similarities and differences among the fossils. They should use logical thought processes to show relationships and make inferences as to the fossil organism's original environment. It is also important that students use the identified features to compare the fossils to living organisms that are familiar.
5. Each group can then share with the class as a whole.

Preserved Organisms- Model of Amber

Materials

- ❑ 3 x 5 index cards
- ❑ Crayons
- ❑ Hot glue gun and glue sticks
- ❑ Brown pipe cleaners or actual insects

Begin by discussing with students what a fossil is and how scientists use fossils to help explain Earth's past. Since there are currently no living dinosaurs, the only evidence we have about dinosaurs and other prehistoric organisms is what can be inferred from fossilized remains. Physical models that correspond to real objects and events can be used to explain and understand things and how they work. Using the process skill of formulating models, students will develop a physical representation of a preserved organism:

1. Give each student a 3 x 5 index card. Have each student draw about a one inch circle on the left hand side of the index card. Have them color it the color that they think is closest the color of real amber.
2. Students should place the item representing the insect on the colored circle.
3. Students will bring the index card and insect to you to encase in hot glue, covering the colored circle and insect.

4. Discuss how this represents the resin which fossilized into amber over a period of millions of years, preserving the insect.
5. On the right hand side of the card, have them write the process which preserved the insect.

Mineral Replacement- Sponge Fossil

Using the process skill of formulating models, students will develop a physical representation of a mineral replacement fossil:

1. Each group will place their sponge shapes into a container holding sand, covering the sponge shapes completely. There should be a layer of sand below and above the sponges.
2. Mix two parts salt to 5 parts water in another container. Make sure that the salt is dissolved into the water.
3. Slowly poor the salt water on top of the sand until it completely soaks the sand.
4. Leave the container of sand in a warm, dry place until it completely dries. You can expedite the process by putting it in the oven at 250 degrees F for a few hours, but you will need to use a container that can go into the oven.
5. When it is dry, excavate the sponges with a spoon. Have students use a grid to record where each "bone" was found.
6. See how the sponges turned "bonelike." Discuss with students how when the salt water was added to the sand, it filled the pores in the sponge. When the water evaporated, the salt remained in those pores. This simulates how dissolved minerals replaced the cells in bones, wood, etc. Fossils are found in sedimentary rocks which are formed by cementation and compression.

Materials

- ❑ Sponges
- ❑ Scissors
- ❑ Sand
- ❑ Salt
- ❑ Water
- ❑ Large container with pouring spout
- ❑ Large Cool Whip containers
- ❑ Measuring cups
- ❑ Long handled spoon

Impression Fossils- Making Traces

In this model, Plaster of Paris represents the soft sediment that an organism would fall into before it becomes a fossil. Using the process skill of formulating models, students will develop a physical representation of an impression fossil:

1. Mix up Plaster of Paris to about the consistency of thick cream.
2. Pour approximately an inch into each student's cup, or have students mix their own in a margarine tub or their school milk carton that has been opened completely and rinsed out. Have them measure ½ cup of Plaster of Paris dry, then add

Materials

- ❑ Bag of Plaster of Paris
- ❑ Bowl and spoon
- ❑ Water
- ❑ 8 oz. paper cup
- ❑ Measuring cups
- ❑ Plastic fossils
- ❑ Petroleum jelly

approximately 1/4 cup water, and stir. Let it sit for a couple of minutes to start setting up.

3. Place their leaf, feather, shell, or other small item vein side down, gently into the Plaster of Paris until it makes complete contact with the surface. (I've had better results in getting the object out, if they have put a thin layer of petroleum jelly on the surface of it before putting it into the plaster.)
4. Allow this to cure for several hours.
5. After the object making the impression is removed, have students in different groups trade and match fossils with the objects that made the fossil.
6. Students should respond to these questions in their journals: How are your fossil models like a real fossil? How are your fossil models different from a real fossil? How can your fossil models help us to understand real fossils? What can real fossils tell us about the world at the time they were formed?
7. Follow the journal writing with a class discussion sharing their journal responses.

Assessment Suggestions

- Pre-Assessment- See the *Fossil Questions* blackline used as the Invitation to Learn.
- 3-2-1 Assessment: Have students write three facts that they have learned about fossils, two terms they want to remember, and one question that they have about fossils.
- Using a tri-fold piece of paper, have students label and draw a different picture in each section that shows the formation of: a preserved organism, mineral replacement fossil, and an impression fossil.
- Use the *Fossil Assessment* which is included.

Curriculum Extensions/Adaptations/ Integration

- Extend student learning by having students create a model which shows a dinosaur trackway. This can be done with various mediums such as clay or sand dough. Use different dinosaur models to make the tracks. Have students evaluate what information might be learned from the dinosaur trackway, such as: Does the dinosaur walk on two or four legs? Do you

see evidence of a tail? Is there more than one type of dinosaur track? Can you see evidence of change of direction or increase in the speed of movement? What story is indicated from these tracks?

- Use the book, *Fossils Tell of Long Ago*, by Aliki, as a read aloud. Then have students create a chart listing the different types of fossils described and how they were formed.
- Vocabulary is often a stumbling block in science. Focus on vocabulary by creating a vocabulary study guide or by working with a group to illustrate the meaning of each important vocabulary word.
- If accommodations are needed for students who may be in pull-out programs or absent on the day of the fossil observation activity, it can be done as a center activity. Students can record their information on the fossils and compile it in booklet form instead of using their notebooks. The drawback of this approach is that it doesn't allow for the use of comparing and inferring with classmates. This can also be used with students who have completed the group activity to focus a second time on making a better observation. Students will almost always increase the length and complexity of their responses.
- If Plaster of Paris is too messy for students to use, Play- Doh also works well for making an impression or track fossil. It dries completely in two days.
- Using the fossils from the observation activity, students can write a riddle about their fossil. Students can then share their riddles with classmates. Classmates can try and match the fossil with the riddle.
- Integrating with Language Arts:

Introduce the Student Content Reading

1. Each student will individually read the *Fossils* article to themselves silently.
2. Assign each student a partner. (Assign partners carefully, allowing the best reader to read aloud first. This will give the slower reader a second time through the material before their turn, and allow for better performance on the task.) Partner #1 reads the article aloud to their partner. When finished with the reading, partner #1 retells the article information to partner #2, who uses the *Fossil Retell* report form to record the retell.
3. Partner #2 then reads the article aloud to their partner. When finished with the reading, partner #2 retells the article

information to partner #1, who uses the *Fossil Retell* report form to record the retell.

4. Partners should then discuss the information they learned from the article.
5. Randomly select students in the classroom to share with the class what they discussed with their partners.
6. Allow students to go back to their pre-assessments and change any responses that they now think were incorrect.

Family Connections

- Students can take home the Fossil background reading and read to parents, discussing what they learned from the article.
- As a family, take a trip to an Earth Science Museum or a dinosaur exhibit in your area. (See the website listed for more information.)

Additional Resources

Books

Adventures in Paleontology: 36 Classroom Fossil Activities, by Thor Hansen and Irwin Slesnick; ISBN- 13: 978-0-87355-272-1

A Golden Guide from St. Martin's Press: Fossils, by Frank H.T. Rhodes, Herbert S. Zim, and Paul R. Shaffer; ISBN 1-58238-142-9

Boy, Were We Wrong About Dinosaurs!; ISBN 0-525-46978-8

Fossils Tell of Long Ago, by Aliki; ISBN-13: 1978-0-06-445093-5

Linking Science & Literacy in the K-8 Classroom, Edited by Rowena Douglas, Michael P. Klentschy, and Karen Worth, with Wendy Binder; ISBN-13: 978-1-933531-01-4

New Dinos, by Shelley Tanaka; ISBN 0-689-85138-9

Reader's Digest Pathfinders: Dinosaurs; ISBN 1-57584-288-2

The Complete Book of Dinosaurs; ISBN 0-681-37578-7

Web-linked, Online: Dinosaurs; ISBN 0-7566-2228-X

Media

Reading Rainbow: Digging Up Dinosaurs; ASIN 6302033365

Eyewitness: Dinosaurs; ISBN 0-7894-0038-3

Articles

Science and Children (Nov 2006), NSTA.

Web sites

http://www.utah.com/dinosaurs/index.htm

Fossil Chart

	Size	Color	Shape	Texture	Defining features
Fossil #1					
Fossil #2					
Fossil #3					
Fossil #4					
Fossil #5					

Fossil Questions

Read each statement carefully. If you believe it is true, place a check in the "Agree" column. If you believe the statement is false, place a check in the "Disagree" column. After learning more about fossils, you may go back and change any of your answers using a different color of pencil.

	Agree	Disagree
1. Scientists learn about Earth's history by studying fossils.		
2. Fossils are usually found in igneous rocks.		
3. Only the soft part of an organism can become a fossil.		
4. Track fossils are one type of impression fossil.		
5. An organism can be preserved by being frozen in ice.		
6. Amber is an insect found fossilized in rocks.		
7. Minerals that fill tiny holes in an imprint form mineral replacement fossils.		
8. Mineral replacement fossils are all the same color.		

Fossil Questions

Read each statement carefully. If you believe it is true, place a check in the "Agree" column. If you believe the statement is false, place a check in the "Disagree" column. After learning more about fossils, you may go back and change any of your answers using a different color of pencil.

	Agree	Disagree
1. Scientists learn about Earth's history by studying fossils.		
2. Fossils are usually found in igneous rocks.		
3. Only the soft part of an organism can become a fossil.		
4. Track fossils are one type of impression fossil.		
5. An organism can be preserved by being frozen in ice.		
6. Amber is an insect found fossilized in rocks.		
7. Minerals that fill tiny holes in an imprint form mineral replacement fossils.		
8. Mineral replacement fossils are all the same color.		

Fossil Assessment

In each box below, write the name of a different category of fossil.	Identify at least three key details about how that category of fossil is formed.
	1. 2. 3.
	1. 2. 3.
	1. 2. 3.

Fossil Assessment

In each box below, write the name of a different category of fossil.	Identify at least three key details about how that category of fossil is formed.
	1. 2. 3.
	1. 2. 3.
	1. 2. 3.

Fossils

Fossils teach us about plants and animals that lived on Earth long ago. Scientists study these fossils to learn about what happened on Earth millions of years ago. Fossils are usually found in sedimentary rocks. Hard parts of an organism such as bones or shells can become a fossil, but soft parts rot too quickly. The plant or animal must be buried quickly by sediments and stay untouched for a long period of time.

Sometimes a fossil is just a mark left behind by an organism when it was alive such as a footprint or a burrow. Sometimes a dead plant or animal sinks into mud leaving its shape when it decays. When the sediment hardens, it becomes an **impression or track fossil**.

Some organisms are preserved without changing. This might happen when an animal falls through ice and is frozen. An animal might also be trapped in a tar pit. Some organisms have been preserved in amber (the fossilized resin from ancient trees and plants). These are called **preserved organisms**.

Mineral replacement fossils are made when water dissolves part of the dead plant or animal and washes it away. Minerals fill in the tiny holes left in the imprint of the plant or animal. These minerals harden into stone. The fossil is the same shape and size as the original plant or animal. Sometimes you can see very detailed parts of the once living organism. Replacement fossils can be very colorful because the minerals which fill in the holes may be different colors.

Fossils

Fossils teach us about plants and animals that lived on Earth long ago. Scientists study these fossils to learn about what happened on Earth millions of years ago. Fossils are usually found in sedimentary rocks. Hard parts of an organism such as bones or shells can become a fossil, but soft parts rot too quickly. The plant or animal must be buried quickly by sediments and stay untouched for a long period of time.

Sometimes a fossil is just a mark left behind by an organism when it was alive such as a footprint or a burrow. Sometimes a dead plant or animal sinks into mud leaving its shape when it decays. When the sediment hardens, it becomes an **impression or track fossil**.

Some organisms are preserved without changing. This might happen when an animal falls through ice and is frozen. An animal might also be trapped in a tar pit. Some organisms have been preserved in amber (the fossilized resin from ancient trees and plants). These are called **preserved organisms**.

Mineral replacement fossils are made when water dissolves part of the dead plant or animal and washes it away. Minerals fill in the tiny holes left in the imprint of the plant or animal. These minerals harden into stone. The fossil is the same shape and size as the original plant or animal. Sometimes you can see very detailed parts of the once living organism. Replacement fossils can be very colorful because the minerals which fill in the holes may be different colors.

Sorting and Sifting the Fossil Data

The words and phrases in the following cards have been taken from the selected text in the activity. Similar activities could be used with the students literacy pieces in the Teacher Resource Book.

Before reading:

1. Cut the cards on the page apart into rectangles that can easily be moved or shifted.

2. Have partners decide which words or phrases seem to go together. Write a sentence that makes a statement and uses the target vocabulary.

3. As students do activities, they gain greater understanding and can group words and phrases into threes and again make statements.

4. Students are now ready to read the informational text. While they read, they should be looking for the words and phrases they used for the vocabulary activity. Have them try to match up the words or phrases they have with those in the text. Pay attention to how they are used in the writing. Did the student created sentences match or are they similar to the passage?

Words sorted together: Sentences:

Bones or shells can make *impressions* in soil.

Trilobites are a kind of *fossil.*

Fossil Word Sort

impression	track fossil	hard parts of an organism	preserved organism
mineral replacement fossil	sedimentary rocks	infer	water dissolves
bones or shells	fossilized resin from ancient trees and plants	minerals harden into stone	footprint
amber	trilobite	dead plant or animal	imprint in the mud

Fossil Retell

Free Retell	Cued Retell	Main Ideas
		1. Fossils teach us about plants and animals from long ago.
		2. Fossils are found in sedimentary rock.
		3. Dinosaur footprints are impression or track fossils.
		4. Some organisms are preserved without changing.
		5. Amber is an example of a preserved organism.
		6. Water dissolves part of the dead plant or animal in a mineral replacement fossil.
		7. Minerals can fill in the tiny holes of an imprint and turn to stone.

Date: _____

Free Retell: _____

Cued Retell: _____

. . . . . .

Student Pair: _____ (1st Retell)

_____ (2nd Retell)