Fossils: Evidence of Change

STANDARD COURSE OF STUDY CORRELATIONS:

Science, Grade 6, Goal 7: The learner will conduct investigations and use technologies and information systems to build an understanding of population dynamics.

7.06 Investigate processes which, operating over long periods of time, have resulted in the diversity of plant and animal life present today (natural selection and adaptation).

Science, Grade 8, Goal 5: The learner will conduct investigations and utilize appropriate technologies and information systems to build an understanding of evidence of evolution in organisms and landforms.

5.01 Interpret ways in which rocks, fossils, and ice cores record Earth's geologic history and the evolution of life including: geologic time scale, index fossils, law of superposition, unconformity, evidence for climate change, extinction of species, catastrophic events.

5.02 Correlate evolutionary theories and processes: biological, geological, technological.

Biology, Goal 3: The learner will develop an understanding of the continuity of life and the changes of organisms over time.

3.05 Examine the development of the theory of evolution by natural selection including: development of the theory; the origin and history of life; fossil and biochemical evidence; mechanisms of evolution.

INTRODUCTION TO LESSON: Students will examine real fossils or photos of fossils. They will hypothesize how the fossils were formed, what types of organisms the fossils represent and what the environment was like during the life of the organisms.

BACKGROUND FOR TEACHER: Studying fossils is an excellent way to engage students in learning about how organisms have changed over time. A nice explanation of the possible ways that fossils can form is found at http://www.fossil museum.net/fossil-record/fossilization/fossilization.htm.

MATERIALS

- Fossils or photos of fossils
- Question cards for fossil stations

PREPARATION

- Prior to class, set up the fossil stations around the room using fossils or photos of fossils. (See *Additional Resources* for sources of fossils; color photos of North Carolina fossils can be found at http://www.ncfossilclub.org/fossilsgallery.htm.)
- Place a card next to each fossil or photo bearing an open-ended, thought-provoking question. You may use your own questions or the sample cards provided here.

engage ➢ Have students spend two or three minutes at each fossil station and discuss their answers with each other. Emphasize that they will not be graded on "right" or "wrong" answers. Ask students to make a note of any questions they have.

explore ➢ Show Chapters 1 and 2 of the video. Divide students into small groups and have each group choose a specimen from the fossil station to investigate. Some suggested guiding questions for this exploration:

- What kind of organism does this fossil represent?
- How did this fossil form?
- What are the living relatives of this fossil?
- In what type of environment would this organism have lived?
- What other organisms would have lived at the same time as this one?

explain ➢ Have student groups present their findings to the class. Allow each group five to 10 minutes to share highlights of their explorations. Encourage them to use pictures and diagrams. Ask them to be sure all members of the group participate. Encourage a dialogue between the students through questions and answers, keeping in mind that some questions may have multiple answers or be subject to opinion.

For a follow-along viewing guide for students, see Viewing Guide 4.

Pogonias *pharyngeal photograph courtesy of Richard Chandler.*

elaborate➢ Show Chapters 3 and 4 of the video. Have students research how landmasses have changed over time. Ask them how it is possible that some of the same fossils that are found in North Carolina are also present in China. (*North Carolina and China were once joined in a single landmass.*) Ask them to describe how landmasses were configured at the time their fossil was formed. Another option is for students to explore in more depth what types of abiotic and biotic conditions existed during a particular fossil organism's lifetime.

evaluate➢ Have students write a summary of what they learned from their fossil explorations and the video. Evaluate these summaries and the presentations and/or assess through testing how well students comprehend the significance of fossil evidence in understanding evolution.

Teacher's Notes:

BEYOND THE CLASSROOM

- The Aurora Fossil Museum in Aurora http://www.aurorafossilmuseum.com/ has exhibits on the geology and paleontology of North Carolina's Coastal Plain, including the display of a wide variety of Pleistocene, Pliocene and Miocene marine fossils. It also has an on-site fossil digging pile where students may find the remains of ancient sharks, whales and bony fish alongside corals, shells and other invertebrates.
- The N.C. Museum of Natural Sciences in Raleigh has a comprehensive, student-friendly exhibit on geologic time, fossils and evolutionary processes. Visit the museum Web site, www.naturalsciences.org, to explore the logistics of a field trip.
- Many other museums can be found at: http://www.unc.edu/depts/cmse/museums.html.

Additional Resources:

Online auctions and other Internet stores are good sources of fossils. Science museum gift shops often sell fossil specimens.

Article about new rauisuchian found in North Carolina in 1998, which predated the true dinosaurs • http://www.unc.edu/depts/cmse/science/dinosaur.html

Short guide about fossils in North Carolina • http://www.priweb.org/ed/TFGuide/SE/se_fossils/se_fossils_pdf/brpied_fossils_se.pdf

The Paleontology Portal • http:// www.paleoportal.org/index.php?globalnav=time_space&sectionnav=state&name=North%20Carolina

Article from the News and Observer about the work of paleontologist Vince Schneider of the N.C. Museum of Natural Sciences • http://www.newsobserver.com/689/story/369491.html

SAMPLE QUESTIONS FOR FOSSIL CARDS:

1. (shark teeth)
Q: Shark teeth are commonly found at the bottom of the ocean, but other parts of the shark are rarely found there. Suggest a reason for this.
A: Hard parts of an organism fossilize best. The soft parts, such as flesh and cartilage, tend to decompose.

2. (cast of a bivalve)
Q: How might this fossil have formed?
A: Sediment filled up the shells and hardened over time.

3. (barnacle)
Q: In what environment would these organisms have lived?
A: Ocean.

4. (fossilized wood)
Q: What does this sample have in common with wood? What does this sample have in common with rock?
A: The fossil has the grain of wood, but it is composed of the minerals of rock.

5. (fossil fern imprint)
Q: Fossil evidence suggests that much vegetation found in Canada today is similar to what was found 14,000 years ago in our area. Suggest an explanation for this.
A: Our area used to be as cold as Canada is today.

6. (insect in amber)
Q: How might this arthropod have been preserved so completely?
A: Sap trapped the insect and hardened over time.

7. (fossil coral)
Q: What is the common name of this fossilized organism? What used to live in the tiny holes?
A: Coral; a soft bodied organism much like a sea anemone.

8. (fossil copralite)
Q: Do you have any idea what this might be? Hint: It came from one end of a dinosaur.
A: The feces from a dinosaur.

9. (fish imprint fossil)
Q: This ocean fish was fossilized in Wyoming, which is nowhere near saltwater. How was this possible?
A: In early geologic time, the ocean actually cut through the middle of the United States, where Wyoming is now.

10. (ammonite and fossil fern)
Q: If the ammonite fossil was found in a deeper stratum of rock in the same general location as the fern fossil, which do you think is older?
A: The ammonite is probably older because sediment has continued to pile on top, meaning that the fossils closest to the surface are newer.

11. (whale vertebra)
Q: This is a preserved anatomical part from a large, ocean-dwelling organism. What kind of fossil is it?
A: Whale vertebra.

12. (Fossil tooth from a horse or pig)
Q: Was this animal a carnivore or herbivore? Explain.
A: A grinding molar suggests it was an herbivore.

13. (fossil scallop)
Q: Fossils of this type are very common. If a certain type of fossil is common, can we assume these organisms were more abundant than other organisms that lived at the same time?
A: No. Organisms with hard parts are more likely to fossilize. Organisms that are composed mainly of soft tissue do not fossilize well. Therefore, fossils such as sharks' teeth and scallop shells are common, while fossils of jellyfish are rare. The latter does not mean that jellyfish were not common in the ancient marine environment.

14. (Heavy fossil and light fossil of the same type)
Q: Lift both of these fossils. How do you explain the difference in weight? Which is probably oldest? Why?
A: The heavy fossil has more mineral replacement and therefore is probably older.

1. Shark teeth are commonly found at the bottom of the ocean, but other parts of the shark are rarely found there. Suggest a reason for this.

2. How might this fossil have formed?

3. In what environment would these organisms have lived?

4. What does this sample have in common with wood? What does this sample have in common with rock?

5. Fossil evidence suggests that much vegetation found in Canada today is similar to what was found 14,000 years ago in our area. Suggest an explanation for this.

6. How might this arthropod have been preserved so completely?

7. What is the common name of this fossilized organism? What used to live in the tiny holes?

8. Do you have any idea what this might be? *Hint: It came from one end of a dinosaur.*

9. This ocean fish was fossilized in Wyoming, which is nowhere near salt-water. How was this possible?

10. If the ammonite fossil was found in a deeper stratum of rock in the same general location as the fern fossil, which do you think is older?

11. This is a preserved anatomical part from a large, ocean-dwelling organism. What kind of fossil is it?

12. Was this animal a carnivore or herbivore? Explain.

13. Fossils of this type are very common. If a certain type of fossil is common, can we assume these organisms were more abundant than other organisms that lived at the same time?

14. Lift both of these fossils. How do you explain the difference in weight? Which is probably oldest? Why?

Cut along dotted lines.