WHO LET THE BONES OUT?: TEACHER GUIDE

Subject: Earth Science
Grade Level: Middle School
Last Updated: October 2, 2008

Case Summary

A mysterious find in a Madagascar may shake up everything we know about ancient human life! A group of paleontologists has discovered an ancient human skull in proximity to a dinosaur fossil, prompting some in the public to ask if dinosaurs and humans coexisted. To prepare for their upcoming appearance on the Oprah show, the scientists need to get their data in order and decide whether or not the two specimens are from the same time period.

Credits

This case was adapted by Elizabeth Sheehan (PhD student, Psychology, Emory University, Atlanta, GA) and Antione L. Ford (teacher, Bethune Middle School, Decatur, GA) fellows of the Emory University PRISM program (http://www.prism.emory.edu). Authors may be contacted at elewis2@emory.edu

This case was adapted from:
Turner, B. L., & Shamsid-Deen, K. K. (2005). *Dinosaur find*. Retrieved July 12, 2006 from Emory University, CASES Online Web site: http://www.cse.emory.edu/cases/casedisplay.cfm?case_id=170

The student evaluation sheet in the student materials is from:
DeLoney, D. Y. (2006). *Out of breath*. Retrieved October 03, 2006 from Emory University, CASES Online Web site: http://www.cse.emory.edu/cases/casedisplay.cfm?case_id=543

Learning Objectives

At the end of the case, students will be able to:

1. Examine and interpret primary data, examining the validity of their own and others' interpretations and formulating a scientific argument.
2. Describe the principles of uniformitarianism and relate them to stratigraphic layering and geological age.
3. Distinguish relative from absolute dating.
4. Describe the process of radioactive decay and how it permits radiocarbon dating and potassium-argon dating of fossil material.
5. Describe the process of radioactive decay and radioisotope dating.
6. Construct stratigraphic models showing how fossils of different ages can be near each other but in different stratigraphic layers.
7. Differentiate between different rock types found in stratigraphic profiles and how they typically form.
8. Create an original dinosaur and fossil and describe its characteristics.

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Georgia Performance Standards

SCSh1. Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science. (NSES Content Standard A)

S6E5. Students will investigate the scientific view of how the Earth's surface is formed. (NSES Content Standard D)

c. Describe processes that change rocks and the surface of the Earth

f. Describe how fossils show evidence of the changing surface and climate of the Earth

g. Describe soil as consisting of weathered rocks and decomposed organic material.

Assessment

At the end of the case, each group must turn in the box chart from each scene, observations from their mock dig (explained below), and a poster describing their fossil. Each group creates an original dinosaur and fossil using a model or illustration. Students must describe the characteristics of this unknown animal (eating habits, habitat, size, and etc.).

In addition, the students participate in a constructed "dig." Each group is given a small replica of a dig site. This replica was constructed in a shoebox-sized bin and included small toys buried under different rock types, dirt, and sand. The students will need to grid off the area using string and conduct an excavation. They are given tools (plastic spoons and forks) and brushes to help them on their "dig." They will need to uncover the techniques to use during their case research and are given a worksheet with tips for their dig (see ***Student Materials***). Soil, screen, and string were purchased at the hardware store. Students created a grid by taping the sting to the sides of the bin. Toys (poker chips for "money", toy soldiers and animals, and jewelry) were purchased from the dollar store. Small clear beads were mixed in with the soil to be found by the "sifter".

The rubric students are given is located in the ***Student Materials***.

Implementation Strategy

Day 1 (120 minutes total)

- Read Scene 1; complete box charts; share and discuss as a class (40 minutes)
- Divide Scene 1 Learning Issues (20 minutes); Begin in-class library research (45 minutes), finish for homework
- Homework: Research Scene 1 Learning Issues

Day 2 (60 minutes total)

- Guest speaker – Darby Proctor a graduate student from the Anthropology Department at Georgia State

Day 3 (120 minutes total)

- Share Learning Issues research; catch-up (20 minutes)
- Read Scene 2; Complete box charts (20 minutes)
- Share and discuss Scene 2 box charts (15 minutes)
- Divide Scene 2 learning issues (20 minutes); Research learning issues (45 minutes)
- Homework: Finish researching learning issues

Day 4 (120 minutes total)

- Activity – The mock archaeological dig; students properly uncover, describe, measure and take the mass of each "artifact" that they find (120 minutes).
- In groups work on poster and create an original dinosaur and fossil
- Homework: Finish individual poster component and unknown dinosaur(s)

Day 5 (60 minutes total)

- Finish poster/fossil replica
- Presentations
- Case evaluation; wrap-up

Facilitator Guide
Boxchart for Scene 1: Items provided to students are in **bold.**

Facts	Hypotheses
• **Drs. Krunk and Tee are paleontologists** • **They are excavating for dinosaurs** • They are in in Mahajanga • There is a grid on the site • They have been carefully brushing away dirt for hours • They had been there for about a month • There had been interesting finds in the region before • Dr. Krunk found a Homo sapiens • Dr. Krunk thinks it is from the Late Plaistocene or Early Recent Period • There are stone tools lying next to it • They have also found an unknown fossil	• The Homo Sapiens and the unknown fossil lived during the same time period. • The Homo Sapiens and the unknown fossil did not live during the same time period.
Learning Issues	**Questions**
• **What is paleontology?** • **What is Homo sapiens?** • **How do paleontologists excavate a site?** • **Where is Mahajanga?** • What is an excavation square? • Why are they carefully brushing away dirt? • What is a grid for? • What other interesting finds had been made?	• **Why is Dr. Krunk surprised?**

Boxchart for Scene 1: Items provided to students are in **bold.**

Facts	Hypotheses
• A reporter is asking the scientists questions • They will present their findings on the Oprah Show • They are like celebrities	
Learning Issues	**Questions**
• **What are radiocarbon dates?** • **What are potassium argon dates?** • **What are stratigraphic maps?** • What do you do in a paleontology lab? • What does refute mean?	

Case Notes:

What went well:

1. The students were excited about the archeological dig. It was a very hands-on assignment. They had fun digging in the dirt but stayed on task and took their "jobs" seriously.
2. Students enjoyed having the guest speaker. We had some last minute scheduling issues, half of the students were able to hear the speaker. During this time they also got to see some fossils, which they liked. The speaker brought some fossil replicas and the middle school also had some fossils that Mr. Ford obtained for class that day.

What could be changed:

1. Because we ended up giving them more research time in the library, they needed more time to create their posters and fossils. This could be avoided by limiting their time in the library. We had some issues with students completing their research at home but it would help if we enforced our in-class research time more strongly.
2. We had trouble finding references/links to the "early recent period" for the students to use. I would suggest changing this to a different time period.
3. It was important to discuss theories of evolution with our speaker. She came from the Anthropology department at Georgia State and talked a lot about human ancestors. Mr. Ford had some concerns about the information that would be covered but she accommodated his wishes very well.

Resources

Exline, J. D., Pasachoff, J. M., Simons, B. B., Vogel, C. G., Wellnitz, T. R. (2001). *Science Explorer: Earth Science.* Needham: Prentice Hall.