

Edible Rock Activity

Grade: 6-12

Subject: Earth Science

Purpose: To introduce students to relative age dating.

Objective:

Students will understand the concept of relative age dating, the Principle of Original Horizontality, the Principle of Superposition, cross cutting relationships, and the principle of inclusions.

Supplies:

- 1 or 2 bags of “bite-size” Snickers Bars
- Knife (for cutting the Snickers in half)
- Clean surface to cut the Snickers on
- Class handouts
- Wooden geologic models for discussing relative age dating (or some other means of demonstration such as layers of clay) can be helpful, especially with younger students.

Procedures:

The main purpose of this exercise is to introduce students to the geologically fundamental concept of relative age dating. Typically, student motivation is not a concern during this exercise. As soon as the students see the edible rocks (i.e. Snickers bars), they are immediately intrigued. However, the process of defining the concepts associated with relative age dating can be dull for many of the students. A handout containing the relative age dating definitions will be provided but the technique for teaching the definitions is completely up to you. Some people like to draw diagrams on the board and others like to use layers of clay. Either way, the main purpose of the handout is to serve as reference material.

I. Introduction to relative age dating.

- a. Give each student the handout that defines the basic principles of relative age dating. Use the appropriate diagrams/models to help explain each point on the handout. The key point is to make sure that the students understand what layers of rock are older or younger in a given stratigraphic sequence. The complexity of the stratigraphic sequence can vary with the experience of the group that you are working with. For example, a high school or introductory level college group can be introduced to structural features such as anticlines and synclines.
- b. To help relate this topic to space science, it may be helpful to explain the studies conducted by Treiman *et al* who used relative age dating to show

that a Martian meteorite was altered on Mars not Earth. This example is only effective if the students know what a fusion crust is (see the meteorite activity for further information).

II. Examining the edible rocks.

- a. For this exercise, it is easiest to use the “bite-size” version of Snickers Bars. Before class, cut the Snickers Bars in half and give one half to each student. It is very important to tell the students not to eat the “rock” until they are told to do so.
- b. In general, the goal of this exercise is to have the students do the following (see the class handout):
 - i. Draw the cross section (profile) of the Snickers bar. The students should be using their observational skills to determine how many components there are to the edible rock. As they are drawing the “rock” encourage the students to be thinking about which layers or features may have formed first. Remind them that some of the concepts on the relative age dating worksheet will help them to determine which layers came first. It is also important to let the students know that their sketch of the edible rock does NOT need to be a masterpiece. Many students appear to be afraid that people are going to make fun of their sketch if it is not perfect. It may be helpful to begin an example sketch on the board. Hopefully each student will draw the chocolate, the nougat, the caramel and the peanuts.
 - ii. Have the students answer questions 2-4 on the hand out and make sure that they give specific reasons why they answered the way they did. This is a perfect opportunity to discuss the scientific method (e.g. making observations, making a hypothesis, and making sure that the observations support the hypothesis). Once again, remind the students that there are clues on the relative age dating handout.
 - iii. As is the case with any of these activities, go around to each student and make sure that they are doing the activity correctly. Ask them what they are thinking and try not to tell them that they are wrong without having any discussion on the topic. Let them know that there are several possibilities, however, suggest that some possibilities make more sense than others.
 - iv. Step 5 is always tricky, so if you are short on time you might want to skip it or find another way to discuss the topic. Even though it might seem straightforward to draw a step-by-step process of how the edible rock formed, it is usually difficult for the students to grasp. Every student will have a different idea about how the rock formed, however, based on the available evidence, only a few scenarios are possible. So in short, this is what we are looking for:
 1. Draw the oldest layer first, which in most cases is the bottom chocolate layer.
 2. Draw the next oldest layer, which is usually the nougat.

3. Draw next oldest layer, which is usually the caramel-peanut mix. This is always a difficult concept but remind the students that one of the examples on the relative age dating worksheet helps to explain how this layer might have formed.
 4. Finally, the overlying chocolate layer is added. The evidence for this can be found by looking in the bottom corners where the bottom layer of chocolate meets the overlying layer of chocolate. As long as the sample isn't melted, it should be possible to see that the two layer of chocolate are separated by a line, showing that they are not the same unit (only point out this feature at the end of the activity, unless one of the students finds it first). Now this scenario is still up for discussion, so proceed with your own ideas. For example someone suggested that all of the chocolate is one layer (e.g. a chocolate shell) and that all of the other components are stuffed into the shell. In any event, remind the students that they must be able to provide evidence for their hypothesis.
- c. With the teacher or someone else in the room, propose at least two different scenarios for how the rock formed. Draw the step-by-step process describing how the rock might have formed, but try not to give the "correct" answer, leave that for the students (see previous section for ideas). Then have the students vote on which scenario they think is the best. Most likely some of the students won't like either option, so suggest that some of the students get up in front of the class and discuss their hypothesis (remind them that they must provide evidence). Once a suitable hypothesis has been proposed, confirm its validity and tell the students that they can eat their rock!

National Science Education Standards addressed:

Grades 5-8, Earth and Space Science, Content Standard D, Structure of the Earth system: Landforms are the result of a combination of constructive and destructive forces.

Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destructive forces include weathering and erosion.

Grades 9-12, Earth and Space Science, Content Standard D, The Origin and Evolution of the Earth System: Geologic time can be estimated by observing rock sequences and using fossils to correlate the sequences at various location.

New Mexico Science Standards addressed:

Grades 5-8, Earth and Space Science, Strand II, Standard III, Benchmark II: Describe the structure of Earth and its atmosphere and explain how energy, matter, and forces shape Earth's systems. Grade 6, #7: Know that landforms are created and change through a

combination of constructive and destructive forces, including weathering of rock and soil, transportation, deposition of sediment, and tectonic activity.

Grades 9-12, Strand II, Standard III, Benchmark II: Examine the scientific theories of the origin, structure, energy, and evolution of Earth and its atmosphere, and their interconnections. Grade 9-12, #4: Understand the changes in Earth's past and the investigative methods used to determine geologic time, including rock sequences, relative dating, fossil correlation, and radiometric dating.

Relative Age Dating

1. Relative dating – Using layers of rock to find out if one layer rock is older or younger than another layer of rock. This type of age dating does **NOT** give a specific numerical age like 3.8 billion years old.
2. Principle of superposition – If you see a bunch of layers of rock on top of each other, then the layer on the bottom is the oldest and the layer on the top is the youngest (for example, the layers of chocolate, nougat, and caramel in the Snickers).
3. Principle of original horizontality – Dirt and rock carried by water or wind (sediment) is always deposited first in flat layers. So, if you see layers of rock that have been folded or tilted, then there must have been a something pushing or pulling those layers (maybe the same forces that cause earthquakes).
4. Cross cutting relationships – If many layers of rock are crossed or “cut” by a fault, then the fault will be younger than the layers of rock (for example, the fusion crust on a Martian meteorite can cut across a vein).
5. Principle of inclusions – When pieces of one type of rock are inside a layer of another type of rock, then the pieces of the first type of rock will be older than the layer of rock that they are in (for example, the peanuts in the caramel are older than the caramel itself. The peanuts had to be formed before they were placed in the caramel therefore they are older).
6. Unconformity – This is a rough/wavy surface that represents “missing” time, separating young rock from old rock. An unconformity can be produced when rock on the surface of the earth is eroded and then more dirt and rock are piled on top of that. We don’t see evidence of the rock that was eroded away.
7. How can we tell if a Martian meteorite experienced alteration while it was on the Earth or while it was on Mars?
 - If the alteration happened while the meteorite was on Mars, then the fusion crust would not be cut by a vein. Instead, the fusion crust will cut across the vein.
 - If the alteration happened while the meteorite has been on the Earth, then the fusion crust would be broken, letting water and wind into the meteorite. The fusion crust itself might even be altered.