Lesson 1: Earth's Interior & Plate Tectonics

To learn why, where, and how earthquakes happen, you need to familiarize your students with the interior of the Earth and a model called plate tectonics. Plate tectonics is the engine behind the earthquake machine. The first step towards learning about plate tectonics is to learn about the Earth's interior structure. This lesson should address both of these topics.

This activity is designed for one 1-hour class period.

This lesson is modified from activity created by Laurie Molnar (University of Pittsburg, Johnstown) and the United States Geological Survey.

Materials

Copies of Handout No. 1 (one per student)
Hard-boiled egg (one per student)
Plastic knives, plates, and napkins (one per student)

Introduction

1. First, ask students what a globe represents. Explain to them that a globe is a model of the Earth. Scientists use models to represent objects.

2. Present a model of the Earth's interior (Handout No. 1). Ask students how they think scientists know what the Earth is made of. You may want to start with a simple example your students can relate to (guessing what is inside of a wrapped present by shaking, weighting, feeling, smelling, etc.). Explain that scientists study seismic waves generated by earthquakes, vibrating machines, or explosions to learn about the interior of the Earth. Seismic waves bend and reflect at the interfaces between different materials (see Lesson 6). Use an example your students can relate to (checking the ripeness of a watermelon by tapping on it). Tell students there are other ways that scientists study the interior of the Earth: drilling holes, studying material brought up to the surface by volcanic eruptions.

3. Explain that the Earth is made of three main layers: crust, mantle, and core. Draw them on the board using colored chalk. Explain that the core is divided into two layers: solid inner core, and liquid outer core. Ask students how scientists know about the liquid and solid nature of the two layers. Explain seismic waves travel at different velocities when they pass through different states of matter.

4. Tell your students that the crust is broken into pieces. Scientists refer to these pieces as plates. The plates move relative to each other. This is called plate tectonics. Tell them they will learn about the three different kinds of plate motion in this lesson.

5. Tell your students that now they are going to use an egg as a model of the Earth's interior.

Procedures

1. Provide each student with a hard-boiled egg, a plate, a plastic knife, and a napkin.

2. Ask students what part of the Earth the eggshell represents.

3. Ask students to gently tap the egg on the table to produce cracks all around the egg. Ask them what the shell pieces are referred to on the Earth.

4. Ask students what layer of the Earth is shown through the shell.

5. Now ask the students to squeeze their eggs gently until slight movement of the shell pieces occur. Ask students to look for places where pieces of the eggshell separate, come together, or pass one another. Ask them what they see (the shell buckles in some places, in other places it exposes the white part of the egg). This is how Earth's tectonic plates move. This results in formations of mountains, new ocean floor, and earthquakes. Introduce the term plate boundary. It is where the earth's plates approach each other (buckling of eggshells), move away from each other (exposing the white part of the egg), and pass one another.

6. Show students how to cut their eggs.

7. Ask students to name the different layers of the Earth's interior using the egg as a model that represents the Earth.

Caution! The egg analogy has some limitations. Eggshell pieces, for the most part, have the same density whereas the plates on earth vary in density. Oceanic plates are denser than the continental plates, for example. The eggshells do not move whereas the plates move. The egg has one inner section (yolk) whereas the earth's core is comprised of a solid inner core and a liquid outer core. It is worthy to mention these limitations to your students.

8. Eat the egg.

Useful Internet Resources

Surface and Interior of the Earth:
http://www.windows.ucar.edu/tour/link=/earth/Interior_Structure/overview.html&edu=elem