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Snicker Science

Grade Level: Elementary

Purpose: An easy and tasty way to illustrate plate tectonics by using candy bars.

Objective: The student will be able to define what plate tectonics and faults are. The student will be able to illustrate one type of fault and describe what happens to the Earth when movement occurs there.

Nevada State Standards:
Earth and Space Sciences Content Standard 10.0: Earth Structures and Composition—Students understand that the Earth is composed of interrelated systems of rocks, water, air, and life.

Earth and Space Sciences Content Standard 11.0: Earth Models—Students understand that the Earth may be represented by a variety of maps and models.

Materials:
Snickers or Milky Way candy bars (one per student, slightly warm or at room temperature)

Anticipatory Set: Tell students that there is a fault line in California called the San Andreas Fault. Ask if anyone knows what happens at this fault line? (earthquakes) What causes these to occur? (movement of the Earth's plates) Discuss earthquakes to assess students' background knowledge about this topic, supplementing additional information if necessary.

Developing the Lesson: Tell students that the Earth is made up of interlocking pieces of land called *tectonic plates* (tectonic plates can be illustrated by showing students the peels of an orange—the peel is the Earth's crust, the pieces of peel the plates). These plates are constantly in motion. When plates collide or separate, the results can be earthquakes, the creation of mountains, and volcanic activity. Plates come into contact at places called *faults*. There are three types of faults:

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- **Normal faults** are distinguished by fault blocks that slide in such a way that one block is down-dropped (lowered) relative to the other block. This happens when the crust extends, or stretches. The Basin and Range in the western United States is a geographic province dominated by normal faults. It encompasses all of Nevada and portions of surrounding states. The Basin and Range is a region with rows of mountains and valleys trending north and south formed by normal faults.
- **Thrust faults**- are distinguished by a package of rock (fault block) that pushes up and over another rock package resulting in crustal thickening. This fault movement happens when plates collide or push together, such as regions where one plate is being subducted under another as in Japan.
- **Transform faults** (also called strike-slip faults) are distinguished by side to side sliding of fault blocks. Think of a transform fault as two cars, moving in opposite directions, passing on the road. A well known example of a transform fault is the San Andreas Fault in California. They occur where ever the crust is being stretched or pulled in opposite directions.

Pass out candy bars to students (students should wash their hands prior to this activity). Tell students that they are going to use candy bars to simulate the three types of faults to see what happens to the Earth when this movement occurs. In order to do this, tell students that they will have to imagine that their candy bar is the Earth. Using their fingernails, they should make a few breaks in the "Earth's crust" or the top of the candy bar. To illustrate **normal faults**, have students gently pull on edges of the candy bar. They will notice that the "plates" move apart to reveal the caramel/nuts, or the "Earth's mantle." Record students' observations on the board. To illustrate the force of **transform faults**, have the students push the pieces of chocolate, or "plates," back together then slide one half of the candy bar forward and the other piece backwards. Record students' observations on the board. To illustrate **thrust faults**, have the students push on both ends of the candy bar to squeeze it together. They should notice the plates colliding and possibly see one slide over the top of another. Record observations. Enjoy the chocolaty treat!

Closure/Extension: Review what tectonic plates and faults are. Review what happened to their candy bars at the three types of faults. Have students choose one of the three faults to illustrate on a piece of paper. They should include a description of what happened at the fault using the classes' recorded observations.

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Walker Lane

Walker Lane is a linear north-northwest trending depression extending some 800 km (500 miles) north from the Garlock Fault-Las Vegas area to south-central Oregon. Within it are Walker, Goose, and Pyramid Lakes. This trough is part of the Walker Lane Fault Zone, a major tectonic system that includes Owens and Death Valleys and several prominent faults, and is the site of many contemporary earthquakes. Located at the juncture of two contrasting tectonic styles, the Sierra Nevada and the Basin and Range, the Walker Lane region is deforming in a complex way by both extensional and transcurrent (sliding) fault movements.

Source: http://nationalatlas.gov/articles/geology/features/walkerlane.html

History of Plate Tectonics

The plate tectonics theory suggests that Earth's crust is broken into many small pieces that move, and that the plate interactions result in earthquakes, mountain ranges, volcanoes, and the separation of continents. It took many years before this theory was accepted as a valid concept. Geologists used a variety of evidence to support their ideas. The following is a history of how scientists developed the theory of plate tectonics.

A French scientist Antonio Snider-Pellegrini (1859) first proposed that all the continents were once connected together during the Pennsylvanian Period (314-280 million years ago). He used identical plant fossils found in coal beds of Europe and the US to support his idea. He attributed the super continent break up to be the great flood of the bible. Scientists of the day were very religious. Most of their research was directed toward explaining how God did things on Earth, so finding biblical reasons for landforms seemed logical to them. Some people today still rely on biblical texts to explain the world around them.

Another Frenchman, Elisee Reclus (1972), attributed continental movement to random drifting of the continents. His proposal gave no explanation for why the continents floated around, but stated that their collision resulted in mountain ranges and earthquakes and formed voids for oceans.

An Australian scientist, Edward Seuss (1885) described how plants in Late Paleozoic coal beds of India, Australia, and South America were all similar, and differed from plants found in northern continents. He proposed a large southern super continent called Gondwanaland, where the plants were transported by animals over one large landmass.

An American, Frank B. Tailor, proposed that gravitational or tidal forces caused by the moon moved continents around. Even though his ideas concerning the causes of plate movement were on the edges of contemporary scientific thought, he is credited with the discovery of the Mid-Atlantic Ridge. This ridge or submarine mountain range is a spreading point

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between two continental plates and allowed the Atlantic Ocean to form between Europe and North America. Scientists today believe that spread at the Mid-Atlantic Ridge caused America to separate from Europe, dissolving a large super-continent called Pangaea.

Alfred Wegner, in 1915, is credited with the modern theory of continental drift. He based his theory on several pieces of evidence including geological, paleontological, and climatological factors. He noticed similar rock sequences of the same ages found on separated continents. He also noticed how mountain ranges and glacial deposits match up when continents are pushed together forming a continental jigsaw puzzle. Similar extinct plant and animal fossils are found on continents separated by large distances. All this suggests that the continents were once connected or close together. This large connecting landmass was named Pangaea.

A supported of Wegner named Alexander du Toit found further evidence supporting continental drift by comparing coral bed fossils. He discovered northern continents once formed a large super continent called Laurasia. His evidence includes large fresh water reptiles (Mesosaurus), two land reptiles (Cynognathus and Lystsaurus), and a Permian plant (Glossopteris). He determined that it would be physically impossible for any of these creatures to be on the different continents unless the continents were in close proximity to each other.

Scientists of the past supported the idea of moving continents, but could not explain the cause of the movement. The theory remained relatively stagnant until the mid 1950's. A boom in paleomagnetic research reignited interest in and generated massive support for the theory of plate tectonics.

Paleomagnetism is a magnetic direction (polar magnetism) recorded in igneous rock at the time the rock solidified. When lava and magma is in its fluid state, small iron minerals in the flow align with the polar magnetism of the Earth. When molten rock solidifies, those minerals stay pointing toward the magnetic north. If the rocks moved after the magnetic direction has been locked in, the rock compass does not align with the poles and scientists can determine the original position of the igneous rock along with the amount it has moved over time.

> Scientists found that the magnetism in young rocks is aligned with the current north. Ancient rocks vary in orientation and in direction. Scientists determined that instead of magnetic poles wobbling around in different

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Evaluation: Formally assess students' knowledge of one type of fault by evaluating their illustrations and descriptions of a fault. Informally assess students by observing their ability to follow directions and make fault movements using a candy bar during this lesson. Also, students can be informally assessed by their ability to answer questions and contribute to the class discussion.