Making a Model of Magma – Slip Sliding Away

Using models helps us understand things that we can’t observe directly. In this activity you will be making a material that can be used as a model for magma. Observe its properties carefully. After investigating be ready to tell if you think it is a good model and why or why not.

Caution: DO NOT eat or drink any of the materials being used. You should wash your hands after this activity. Food coloring may stain your clothes, use it with care.

Teacher procedure to make the magma ingredients:
- Combine an 8 oz bottle of Elmer’s Glue-ALL, \textit{not School Glue}, with 8 oz of water.
- Combine $\frac{1}{2}$ cup warm water with a teaspoon of Borax powder (found in the laundry soap isle at grocery store).

Student procedure to make the magma model material:
1. Put 30 ml of the glue solution into a sandwich size ziplock bag.
2. Add 1 to 2 drops of food coloring (if desired) and mix well by kneading the bag gently.
3. Add 10 ml of Borax solution and knead the bag until all the liquid is absorbed.
4. Remove the material from the bag and answer the questions below.

Answer in complete sentences:
1. What happened as you kneaded the ingredients together?
2. Is this material a solid or a liquid? How do you know?
3. Describe how this substance might be similar to Earth’s magma.
4. What inside the mantle keeps the rocky material in a semi-solid state?
5. Describe how this substance might be different from Earth’s magma.

Use the hand outlines below to draw how the mixture looks like a liquid, and how the mixture looks like a solid in your hand.

Model mixture as a \textbf{LIQUID} \hspace{5cm} Model mixture as a \textbf{SOLID}

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In 1915, a weather scientist named Alfred Wegener noticed that the continents of South America and Africa looked like puzzle pieces that might fit together. After many years of research that took him to all continents of the world searching for evidence of plant and animal fossils, rock formations, mineral deposits, glacial erosion, and climate changes, he concluded that the continents had moved over time and were sliding on plates which are always moving. Because he could not fully explain how large pieces of land could slide or what force below the surface could cause them to do so, his theories were not taken seriously by the scientists of the time. After World War II, as we were exploring the ocean floor, new evidence surfaced which served to explain the unanswered questions posed by Wegener’s critics. The crust of the Earth is not one solid piece but 7 or more large plates and many smaller ones. These plates are floating on the semi-solid mantle, which acts like silly putty sliding slowly around and changing shape. When mantle material moves, so do the plates on top of them. The plates move anywhere from 2 to 4 cm per year.

In this activity you will use a model of magma material and Earth’s plates to investigate and measure the amount of movement during a simulated “continental drift.”

Materials per student:
- Piece of waxed paper
- Ziplock bag of model material (representing magma)
- 7 pennies (representing Earth’s plates)
- Centimeter ruler
- Timer, stopwatch or clock with second hand

Procedure:
1. Place the waxed paper on your desk for a work surface.
2. Take your magma model material out of the bag and place it in a pile on the waxed paper.
3. Place seven pennies close together (touching) in the center of the magma material.
4. Observe how the pennies drift apart as the continents have over the last 230 million years.
5. Decide upon a way to measure the distance the pennies drift apart during a fixed time using the ruler and timer.
6. Do at least 4 trials, measuring the distance in mm during a specified time period. Record your measurements.
7. Divide the distance in each trial by the time to get speed. Speed = distance in mm / time in seconds
8. Average the 4 speeds to get a final result for your moving plates.
9. Record your trial measurements, answer questions, and make sketches on the data sheet.
## Making a Model of Magma – Slip Sliding Away Data Sheet

<table>
<thead>
<tr>
<th>Trial</th>
<th>Distance pennies move in mm</th>
<th>Time in seconds</th>
<th>Speed of “continental drift”</th>
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Average speed in mm per second of 4 trials =

How does your speed compare to the average amount the plates are really moving per year?_______

How do you think the results would change if you heated the magma model material?________________

How do you think the results would change if you froze the magma model material?________________

Make a sketch below of your drifting plates on the magma model material in one of your trials.

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