Hotspot Model

LESSON SUMMARY

In this lesson, students will model how a magma plume creates a hotspot on the Earth's crust.

LESSON OBJECTIVE(S)

- Students will create a model to demonstrate a hotspot.
- Students will explain how heat from the mantel in the form of a mantle plume can affect the crust within a tectonic plate, not just at the boundaries.

FOCUS QUESTION

How does heat from Earth's mantle affect Earth's crust away from tectonic plate boundaries?

LEARNING TARGET (I CAN STATEMENT)

I can model how heat from Earth's mantle can affect Earth's crust not just at tectonic plate boundaries but within tectonic plates.

STANDARDS ADDRESSED

AR: 7-ESS2-2
MS: E.8.9A.1
TN: 8.ESS2.4/ 8.ESS2.5/ 8.ESS3.2/ EVSC.ESS2.1

MATERIALS

- Disposable Aluminum Pan (shape does not matter)
- Water
- Cornstarch
- Spoon
- Lighter
- Candle (tealight are the best)
- Student Worksheet

PROCEDURES

1. Determine how much of the cornstarch-water mixture you will need for the pan size you chose. The mixture is 2 parts cornstarch to 1 part water (students may point out this is Oobleck or non-Newtonian fluid, which is true).
2. Insert the measurements in the student lab sheet before you print them.
3. Divide students into groups of 2-4 students.
4. While doing the lab, use the time while you wait for volcanoes to form (2-4 minutes) to review concepts you have already taught about the layers of the Earth and plate tectonics.
5. Once the students have created a volcano have them model plate movement and have another student in the group hold the pan to create another volcano.
6. Be sure students are writing their observations down on their worksheet.
7. Once students have created 2-4 volcanoes, move to the closure.

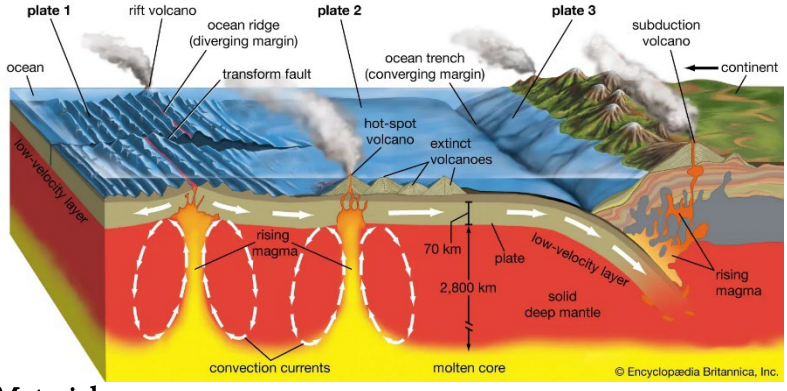
CLOSURE

- Once students have modeled hotspots, have the complete the conclusion section of their worksheet.
- Have students straighten up their workspace for the next class. Oobleck can dry out quickly, but adding water will fix it.

Name: _____ Period:_____

Hotspot Lab Worksheet

Background



Many volcanoes happen at the boundary of two tectonic plates, but hundreds or thousands of miles from the boundary between tectonic plates. In this lab you will be modeling volcanoes that happen away from a plate boundary.

Figure 1: Volcanoes and Plate Tectonics
credit: Encyclopædia Britannica

Materials

- Cornstarch
- Water
- Aluminum Pan
- Candle
- Lighter
- Spoon

Procedure

1. If not already done, mix 1 cup cornstarch with ½ cup of water with the spoon in the aluminum pan. The mixture should look runny but be semi firm to the touch. If it is too runny, add more cornstarch. If it is too firm, add more water. You should have enough mixture to cover the bottom of the pan.
2. Light the candle. Be sure to keep hair and clothing away from the open flame.
3. Hold the pan in one spot over the candle. You may hear crackling noise, which is normal. Hold in one spot until your "volcano" forms. This will take a couple of minutes. Once the "volcano" forms, switch to a new person holding the pan, and move the pan to a new spot.
4. Repeat this till everyone in the group has created a volcano. Draw and write your observations.

Data

Draw your observations:	Write your observations:

Name: _____ Period:_____

Conclusions

What is a hotspot?
What is a mantle plume?
How do hotspots provide evidence of continental drift?

Claim Evidence Reasoning

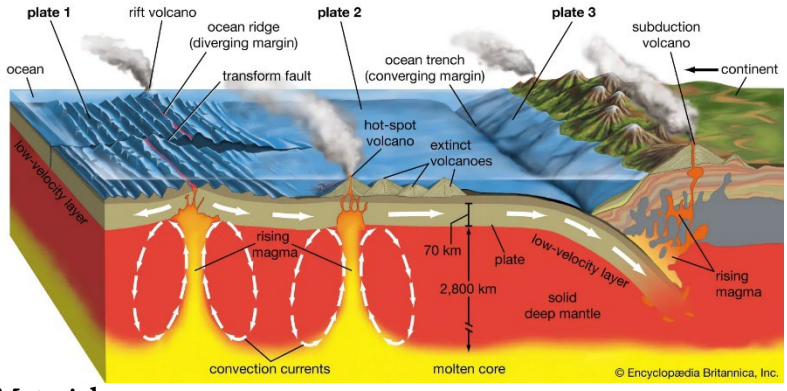
How does heat from Earth's mantle affect Earth's crust within tectonic plates?

Claim (statement that answers the question):
Evidence (scientific data and detail from the lab that supports your claim):
Reasoning (explains the how or why the evidence supports your claim):

Name: _____ Period:_____

Hotspot Lab Worksheet ANSWER KEY

Background



Many volcanoes happen at the boundary of two tectonic plates, but hundreds or thousands of miles from the boundary between tectonic plates. In this lab you will be modeling volcanoes that happen away from a plate boundary.

Figure 2: Volcanoes and Plate Tectonics
credit: Encyclopædia Britannica

Materials

- Cornstarch
- Water
- Aluminum Pan
- Candle
- Lighter
- Spoon

Procedure

5. If not already done, mix 1 cup cornstarch with ½ cup of water with the spoon in the aluminum pan. The mixture should look runny but be semi firm to the touch. If it is too runny, add more cornstarch. If it is too firm, add more water. You should have enough mixture to cover the bottom of the pan.
6. Light the candle. Be sure to keep hair and clothing away from the open flame.
7. Hold the pan in one spot over the candle. You may hear crackling noise, which is normal. Hold in one spot until your "volcano" forms. This will take a couple of minutes. Once the "volcano" forms, switch to a new person holding the pan, and move the pan to a new spot.
8. Repeat this till everyone in the group has created a volcano. Draw and write your observations.

Data

Draw your observations:	Write your observations:
Answer varies per student	Answer varies per student

Name: _____ Period:_____

Conclusions

What is a hotspot? A hotspot is an area above a mantle plume. The excess heat causes melting and thinning of the crust, which can create uplift and/or volcanoes.
What is a mantle plume? A mantle plume is a pipelike upwelling of hotter than usual material in the mantle that goes up towards the crust due to the buoyancy of the hotter material.
How do hotspots provide evidence of continental drift? The hotspots are creating volcanoes. Since the hotspot is mostly stationary when the tectonic plate moves it creates a new volcano. The action of the plates moving creates a chain of volcanoes showing the path of movement which is evidence for continental drift.

Claim Evidence Reasoning

How does heat from Earth's mantle affect Earth's crust away from tectonic plate boundaries?

Claim (statement that answers the question): The Earth's mantle has mantle plumes which creates hot spots near the crust.
Evidence (scientific data and detail from the lab that supports your claim): The excess heat at the hot spots causes melting and thinning of the crust. This can create uplift and/or volcanoes.
Reasoning (explains the how or why the evidence supports your claim): These volcanoes happen far from a tectonic plate boundary. If it were not for the mantle plumes carry unusually hot material from closer to the core to the crust, these volcanoes would not exist.