STEM EARTH SCIENCE

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Chapter 2: Plate Tectonics

BIG QUESTION: How does the Earth's surface move and what evidence of this movement do we experience in our everyday lives?

Scenario: In 1883, on the island of Krakatoa in the East Indies, one of the most violent eruptions of recorded time took place. Half of the island was blown away by a volcanic eruption. Over a cubic mile of rock was hurled into the air. The sound of the explosion was heard in Australia, over 3200 km away.

Chapter Challenge: Students will build structures and then place them on the shake table, move it to simulate an earthquake, and test which structures are most stable. For building the structures, students can use Legos, wooden blocks, sugar cubes, popsicle sticks, toothpicks, marshmallows, plastic straws, pipe cleaners, paper clips, playing cards, or any other common materials. Students can experiment with the height of the structures and how different construction methods affect stability. Your goal is to build a structure to with stand an earthquake equivalent to a magnitude 7 for 10 seconds.

Activities We Did	Patterns or observations/What happened	What do you think caused these patterns or observations?	How do these patterns help us answer our Big Question?
Section 1			
Section 2			
Section 3			
Section 5			

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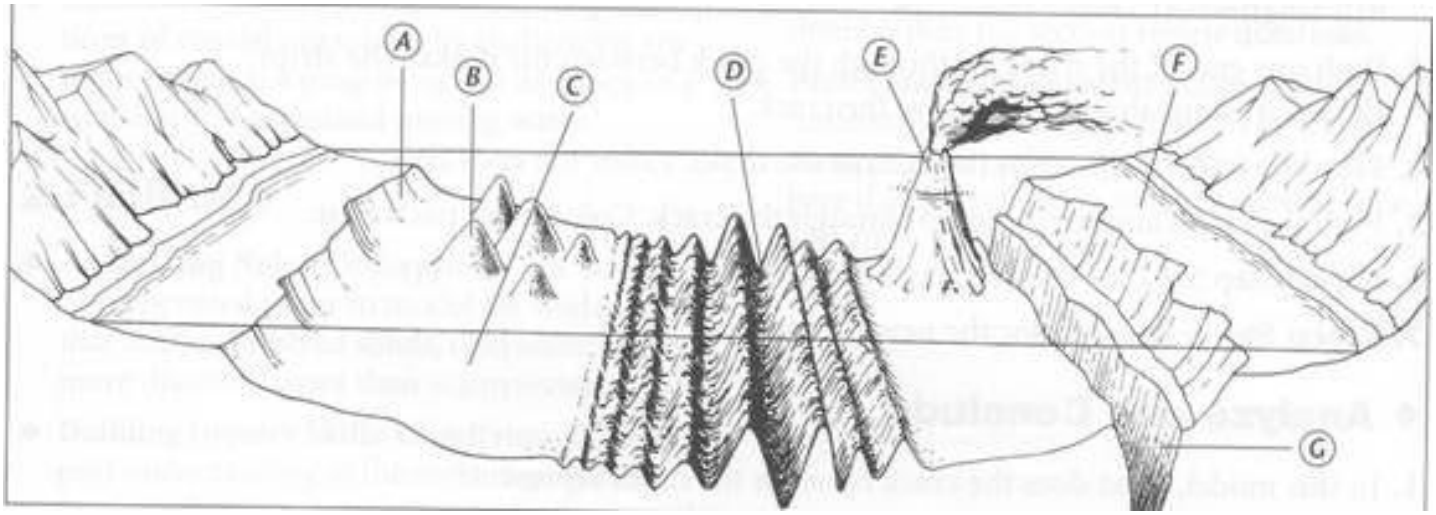
Section 6			
Section 10			
Section 11			
Section 12			

Section 1: Volcanoes and Earthquakes



Section 1 Question: Where are volcanoes and earthquakes located and what does this tell us about the surface of Earth?

What Do You See?

(Video)

What Do You Think?

Two students are debating the locations of plate boundaries around North America.

Student 1: *Both the West and East coasts are plate boundaries because for each coast the ocean crust is touching the continental crust.*

Student 2: *I think the West coast is on a plate boundary, but the East coast is not. There are almost no earthquakes that occur on the East coast.*

Student 1: *What about the divergent boundary in the middle of the Atlantic? The East coast is on that plate boundary.*

Student 2: *That divergent boundary separates the eastern half of the Atlantic Ocean from the western half. It does not separate the ocean crust of the Atlantic from the continental crust of North America.*

Do you agree with one or both students? Why?

What Do You Think Now?

Focus Question A: What patterns can be found when charting volcano and earthquake data?

Data:

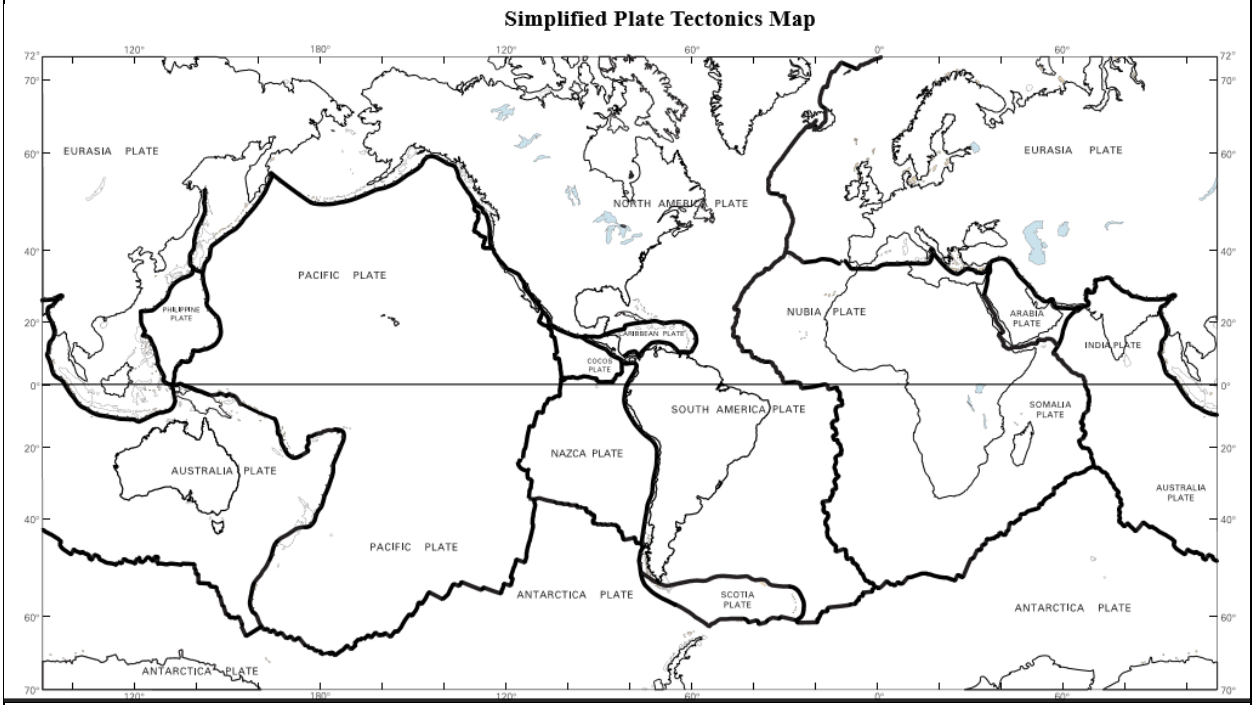
Table 1: Global Volcanic Activity Over a One-Month Period

Latitude	Longitude	Region
1°S	29°E	DR Congo, Eastern Africa
38°N	15°E	Aeolian Islands, Italy
37°N	15°E	Sicily, Italy
15°S	71°W	Peru
0°	78°W	Ecuador
12°N	87°W	Nicaragua
0°	91°W	Galapagos, Ecuador
19°N	103°W	Western Mexico
19°N	155°W	Hawaii, United States
56°N	161°E	Kamchatka, Russia
54°N	159°E	Kamchatka, Russia
43°N	144°E	Hokkaido, Japan
39°N	141°E	Honshu, Japan
42°N	140°E	Hokkaido, Japan
1°S	101°E	Sumatra, Indonesia
4°S	145°E	Papua New Guinea
5°S	148°E	Papua New Guinea
15°S	167°E	Vanuatu
16°N	62°W	Montserrat, West Indies
12°N	86°W	Nicaragua
37°N	25°W	Azores

Table 2: Global Earthquake Activity Over a One-Week Period

Latitude	Longitude	Region
47°N	151°E	Kuril Islands
28°S	178°W	Kermadec Islands
30°N	52°E	Iran
36°N	140°E	Honshu, Japan
34°N	103°E	Gansu, China
40°S	177°E	New Zealand
0°	36°E	Kenya, Africa
38°N	21°E	Ionian Sea
16°N	47°W	North Mid-Atlantic Ridge
6°S	147°E	New Guinea
55°N	164°W	Unimak Island, Alaska
24°S	67°W	Argentina
13°N	91°W	Guatemala coast
4°N	76°W	Colombia
40°N	125°W	North California coast
5°S	102°E	South Sumatra, Indonesia
44°S	16°W	South Mid-Atlantic Ridge
51°N	179°E	Aleutian Islands
15°S	71°W	Peru
49°N	128°W	Vancouver, Canada
35°N	103°E	Gansu, China

Explore:



Observe: Describe any patterns or trends in your data.

Explain:

Extension:
Smithsonian Institution's National Museum of Natural History Global Volcanism Program
http://www.volcano.si.edu/
This Dynamic Planet

Observe the map legend and interpret the meaning of the various symbols on the map.

Find the latitude and longitude of the 3 nearest volcanoes to our community.

Find the latitude and longitude of the 3 nearest earthquakes to our community.

Suppose that tomorrow an earthquake or volcano forms somewhere in the US. Could it form in or near NYS?

We claim…

We believe this because…

RETURN TO WDYTN

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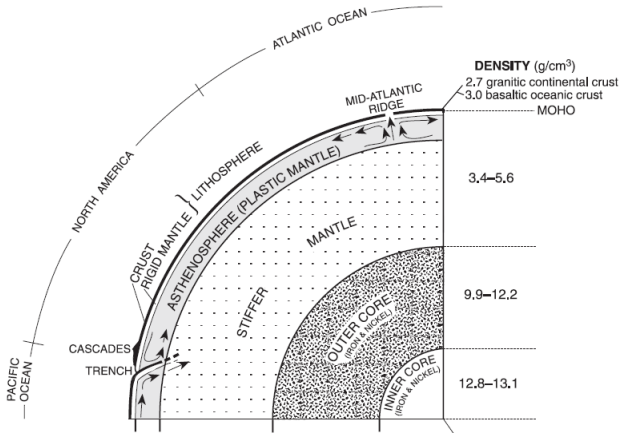
DIGGING DEEPER

Layers of the Earth

- Geologists divided up the layers of the Earth using two methods.
- The first division is based on the chemical properties of Earth.
  - Crust
  - Mantle
  - Core
- The second is based on the physical properties of Earth.
  - Lithosphere
  - Asthenosphere
  - Mantle
  - Outer Core
  - Inner Core
- Geologists are scientists that study the Earth, its resources, and the processes that affect those resources.

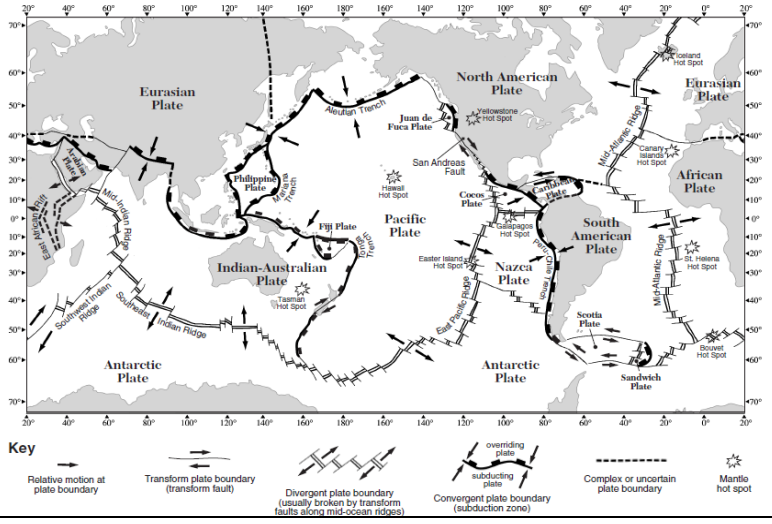
Page 10 in your ESRT



Earth's Tectonic Plates

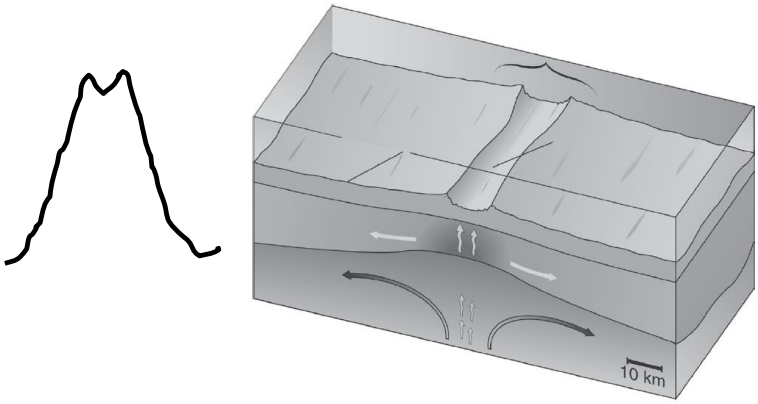
- Plate boundaries are defined by the relative movement of two adjacent plates.
  1. Convergent plate boundary
  2. Divergent plate boundary
  3. Transform plate boundary
- Most of Earth's volcanoes and earthquakes are found along these boundaries.
- There are currently 15 major tectonic plates on Earth.
- Velocities of plates can vary from 1 to 10 cm per year.
- The theory of plate tectonics explains the large-scale movement of earth's lithospheric plates.

Page 5 in your ESRT



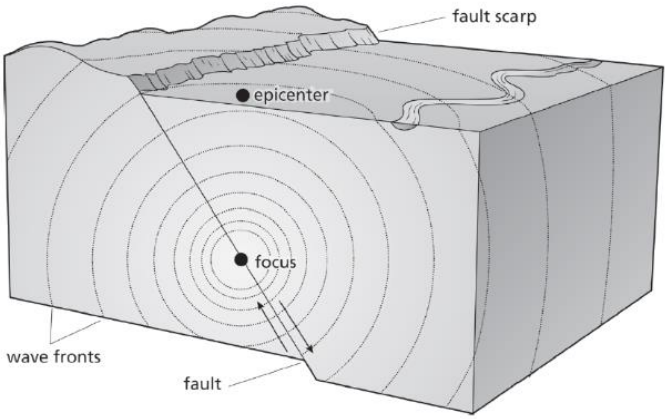
Volcanoes and Earthquakes

- Volcanoes occur where large fissures or cracks in the lithosphere allow molten material to rise to the surface.
- Volcanoes can occur on land or underwater.
- Most of Earth's volcanoes are found underwater at midocean ridges located in every ocean basin. (a type of divergent boundary)
- Volcanoes can also be found at convergent plate boundaries where one plate is subducted under the other.



Describe the events that lead to a volcanic eruption.

- Earthquakes occur when rocks break and release large amounts of energy into the surrounding rock.
- The origin point of an earthquake below the surface is called the focus.
- The point directly above the focus on Earth's surface is called the epicenter.
- Earthquakes occur along transform and convergent boundaries.



Why are earthquakes more likely than volcanos to occur away from plate boundaries?

Chapter 2, Section 1 E.B.C.
Volcanoes and Earthquakes

Name:_____
Period:_____

Question (2)		
Claim 1 (2)		
A. Supporting Evidence (3)	B. Supporting Evidence (3)	
Claim 2 (2)		
A. Supporting Evidence (3)	B. Supporting Evidence (3)	
Analysis (6)		

	Claim *A statement or conclusion that answers the original question/problem.*	**Evidence** *Scientific data that supports the claim. The data needs to be appropriate and sufficient to support the claim.*	**Analysis** *A justification that connects the evidence to the claims. It shows why the data counts as evidence by using appropriate and sufficient scientific principles and vocabulary*.
0	Does not make a claim, or makes an inaccurate claim.	Does not provide evidence, or only provides inaccurate or vague evidence.	Does not provide an analysis, or only provides an irrelevant analysis.
1	Makes an accurate but vague or incomplete claim.	Provides vague evidence and does not include specific data.	Repeats evidence and links it to claim, but does not include specific scientific principles.
2	Makes accurate and complete claim.	Provides correct evidence but does not include specific data.	Connects all evidence to the claims using scientific principles or vocabulary but not both.
3		Provides correct evidence and includes specific data.	Connects all evidence to both claims using scientific principles and vocabulary.

CHECKING UP: Page 145, 1 through 10 (2 points each)

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25

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Compare the cause of earthquakes in California with those in Indonesia. (5 points)