

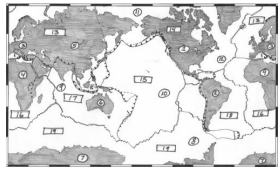
Volcanoes & Earthquakes

December 5, 2014


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First let's review where we've been...


- Earth's crust is broken up into plates




- The places where these plates interact are called boundaries.
Three Types:



Divergent



Convergent



Transform

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Everyone Gets a Card....

(Latitude, Longitude)

Earthquake 40° N, 120° W	Earthquake 7° N, 34° E	Volcano 60° N, 150° W	Volcano 0°, 75° W
Earthquake 5° S, 110° E	Earthquake 44° N, 74° W	Volcano 35° S, 70° W	Volcano 40° N, 122° W
Earthquake 4° S, 77° W	Earthquake 30° S, 70° W	Volcano 45° N, 120° W	Volcano 40° N, 30° E
Earthquake 23° N, 88° E	Earthquake 45° N, 10° E	Volcano 15° N, 61° W	Volcano 30° N, 60° E
Earthquake 14° S, 121° E	Earthquake 13° N, 85° W	Volcano 20° N, 105° W	Volcano 55° N, 160° E

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Everyone Gets a Card....

(Latitude, Longitude)

Earthquake 23° N, 125° E	Earthquake 61° N, 150° W	Volcano 3° S, 37° E	Volcano 15° N, 35° E
Earthquake 35° N, 30° E	Earthquake 47° S, 68° W	Volcano 40° N, 145° E	Volcano 30° S, 70° W
Earthquake 35° N, 140° E		Volcano 10° S, 120° E	
Earthquake 46° N, 12° E		Volcano 41° N, 14° E	
Earthquake 28° N, 75° E		Volcano 5° S, 105° E	

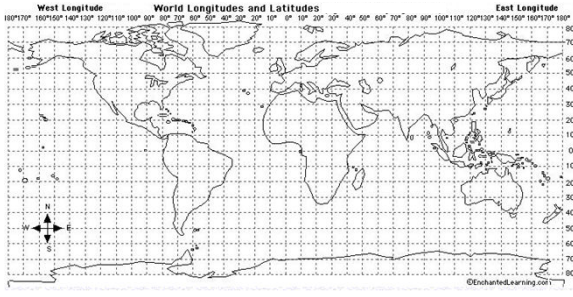
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Come on up to the board and map your point!

▲ Volcano

● Earthquake

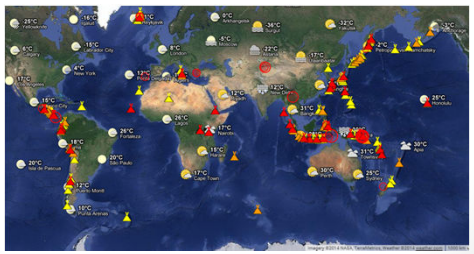
(Latitude, Longitude)



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Where are Volcanoes?

- Most volcanoes form at plate boundaries.
- **80%** are found along convergent boundaries
- **15%** are found along divergent boundaries
- **5%** are found far away from plate boundaries



<http://earthquakes.volcanodiscovery.com/>

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Where are Earthquakes?

- Most earthquakes occur at plate boundaries.
- 80% occur in the Circum-Pacific Belt.
- 15% occur in the Mediterranean-Asia Belt (Southern Europe & Asia)
- The rest occur along the crests of ocean ridges or randomly scattered away from plate boundaries.

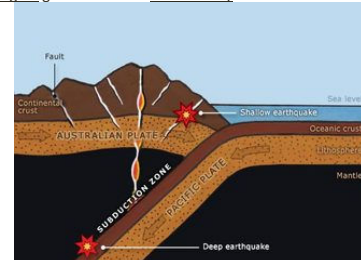


<http://earthquakes.volcanodiscovery.com/>

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How are volcanoes formed?

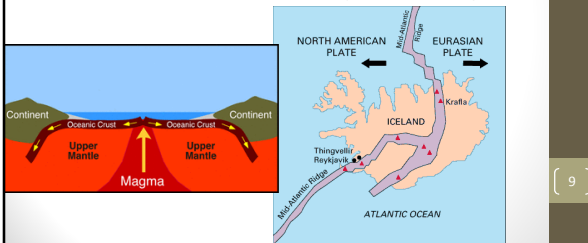
- (1) Converging Plates:
 - Called a subduction volcano
 - Most explosive!
 - Magma generated from sedimentary rock in the subduction zone



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How are volcanoes formed?

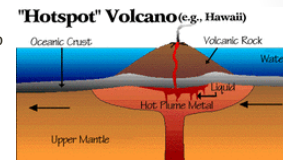
- (2) Diverging Plates:
 - Called a rift volcano
 - Less explosive
 - Usually occurs under water... creates new ocean floor!
 - Iceland has a rift volcano on land which is responsible for making the island



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Hot Spot Volcano

- (3) Hot Spots
- Volcanoes located far from plate boundaries form due to hot spots
- Unusually hot regions of Earth's mantle where high-temperature plumes of mantle material rise toward the surface
- The Hawaiian islands were formed and are changing due to hot spot



<https://www.youtube.com/watch?v=AhSaE0omw9o>

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Circum-Pacific Belt (“Ring of Fire”)

- The Ring of Fire is a band of volcanoes and fault lines circling the edges of the Pacific Ocean.
- It is horseshoe-shaped, and 25,000 miles long.
- Of the world's 1,500 active volcanos, almost 90% are in the Ring of Fire
- Remember... 80% of earthquakes also occur at the Ring of Fire



<https://www.youtube.com/watch?v=gITf-xoWgfc>

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ANATOMY OF AN EARTHQUAKE

An earthquake is the shaking of the ground caused by sudden motions along faults, or fractures in the Earth's crust.

Fault

A fracture in the rocks that make up the Earth's crust

Epicenter

The point at the surface of the Earth directly above the focus

Focus

The point within the Earth where an earthquake rupture starts

Plates

Massive rocks that make up the outer layer of the Earth's surface, and whose movement along faults triggers earthquakes

Seismic Waves

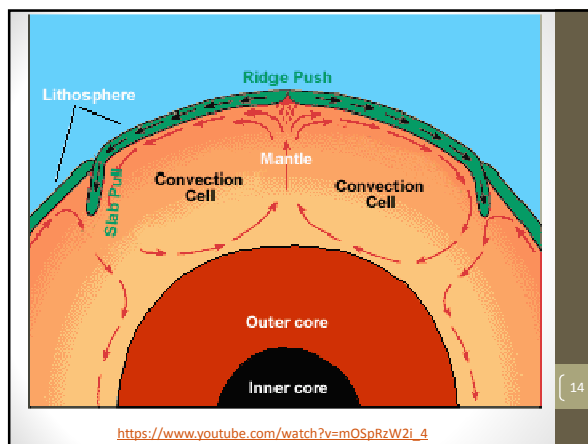
Waves that transmit the energy released by an earthquake

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Origin of Earthquakes

- The underlying origin for earthquakes is movement of the plates
- Earth's plates can move due to three different methods:
 - Mantle Convection:** The slow creeping motion of Earth's solid mantle caused by convection currents carrying heat from the interior of the Earth to the surface.
 - Ridge Push:** Weight of an elevated ridge pushes an oceanic plate toward a subduction zone.
 - Gravity/Slab Pull:** Cooled plates become dense and sink into the mantle due to its own weight.

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Faults

- As plates move past each other, along **fault zones**, they sometimes get caught and pressure builds up.
- When the plates finally give and slip due to the increased pressure, energy is **released** as seismic waves, causing the ground to shake. This is an **earthquake**.

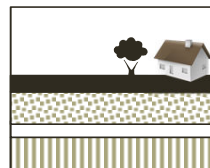
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Paper & Scissors

- Group 1: On your paper draw a bird's eye view of a road. Add railroad tracks, tops of buildings... Etc. as you wish



- Groups 2 and 3: Draw a cross section of the Earth showing different layers in the crust:



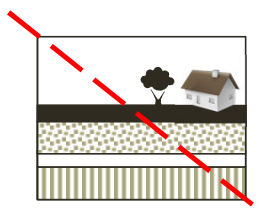
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Paper & Scissors

- Group 1: Cut your drawing vertically in half



- Groups 2 and 3: Cut your drawing along a 45° angle. Corner to corner!



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Drawing	Has the crust Shortened? Lengthened? Neither?	Fault Type	Type of Plate Boundary
	<u>Neither</u>	<u>Strike-Slip Fault</u>	<u>Transform</u>
	<u>Lengthened</u>	<u>Normal Fault</u>	<u>Divergent</u>
	<u>Shortened</u>	<u>Reverse Fault</u>	<u>Convergent</u>

<http://www.iris.washington.edu/gifs/animations/faults.htm>

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Helpful Textbook Pages: [460-463;498](#).

Today's Main Idea

- Most volcanoes and earthquakes occur at plate boundaries.

Explore Question

2. Explore today's main idea with this question:
What are the relationships among mantle convection, ocean ridges, and subduction zones?

Vocabulary

- Primary Wave (P Wave)
- Secondary Wave (S Wave)
- Surface Wave