

Guided Notes

Plate Tectonics

KEY

Earth's Interior
Continental Crust
Oceanic Crust
Evidence of Plate Tectonics
Pangaea
Convection Currents
Divergent Boundary
Seafloor Spreading
Magnetic Polarity Patterns
Convergent Boundary
Transform Boundary

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<https://www.teacherspayteachers.com/Store/Nys-Earth-Science-And-Living-Environment-Regents>

1) How are we able to study Earth's interior?

- Analyzing [earthquake waves](#), [volcanoes](#), and [meteorites](#).

2) What is the Earth's interior composed of?

- The Earth's interior is made up of four layers (see diagram below & ESRT page 10)

1. **Lithosphere:** Solid, outer layer of the Earth

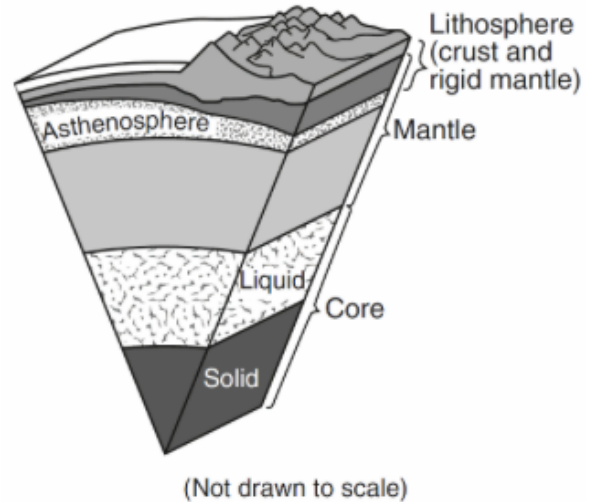
- a. Crust
- b. Rigid mantle

2. **Mantle:** Part solid, part liquid layer

- a. Asthenosphere
- b. Stiffer mantle

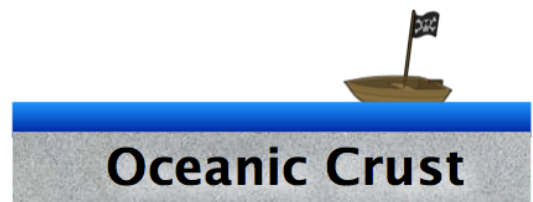
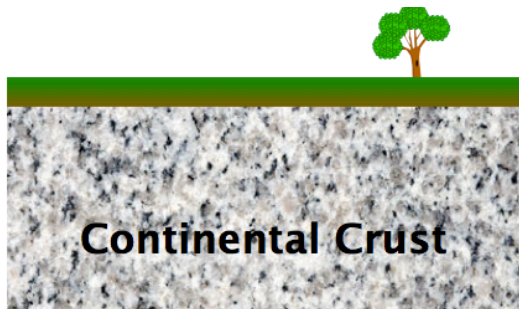
3. **Outer Core:** Liquid, metallic layer

4. **Inner Core:** Solid, metallic layer



3) What are the two types of crust?

- Two Types of Crust (See ESRT page 10)



Thickness	Very thick Thickest under mountains	Thin layer Drilling for oil is easier here
Composition	Granite (felsic)	Basalt (mafic)
Density	Less dense (2.7g/cm ³)	More dense (3.0g/cm ³)

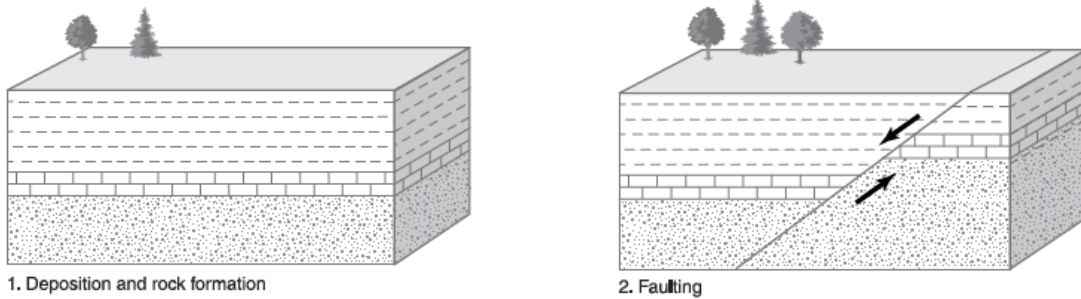
4) How have the continents of Earth changed over time?

- **Continental Drift:** continental landmasses have been moving across Earth's surface for millions of years.

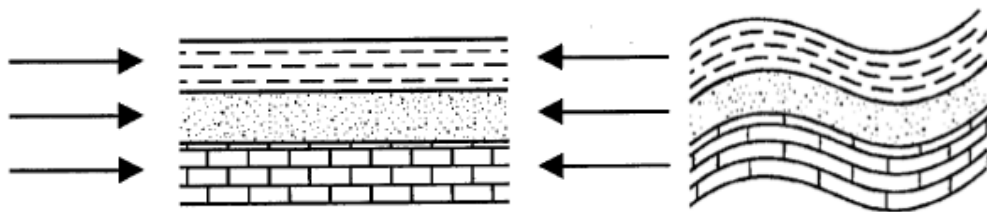
5) What geologic features prove that the plates have moved?

- **Crustal Deformations That Indicate Movement of Plates:**

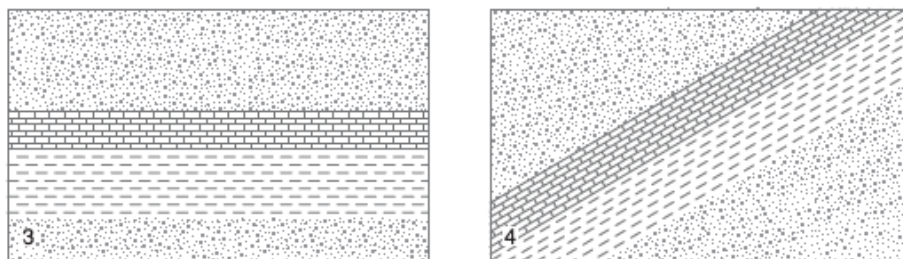
1. **Faulting:** A crack or weakness in Earth's crust along which movement occurs during earthquakes



2. **Folding:** Layers of sedimentary rock that have been bent by crustal forces



3. **Tilting:** Formally horizontal rock layers that have been tilted at an angle by crustal activity



6) How else do we know plates have moved?

1. **Continental “fit”**: the continents would fit together like puzzle pieces if they were connected.

Pangaea: Evidence suggests that all continents were joined in one giant supercontinent 200 million years ago.

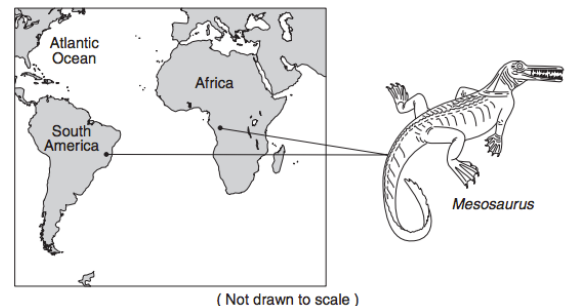


2. Correlation of rock & minerals on different continents:

- a. Similar rocks and minerals are found in widely separated locations along coastal regions of different continents.
- b. Similar mountain systems in North America, Greenland, and Europe.
- c. Evidence of the same glacier on South America, Africa, India, Madagascar, Australia, and Antarctica.
 - Most of these places are too warm for glaciers so they must have been located closer to the South Pole in the past.

3. Finding of fossils:

- a. On different continents: same species of land animals and plants on continents far from each other.

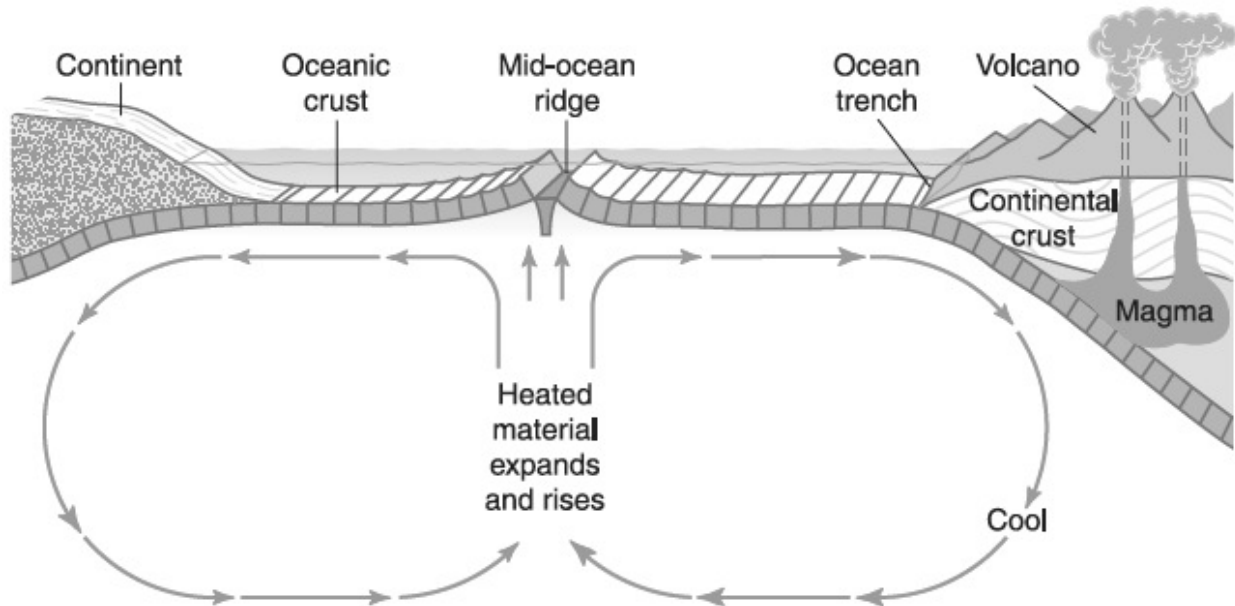


b. In unusual locations:

- i. Fossils of tropical plants are found in Antarctica and Alaska.
- ii. Fossils of shallow marine organisms found on the tops of mountain ranges means land has been uplifted.
- iii. Fossils of land animals in deep oceans means land has moved deep under water.

7) How do the plates move?

- **Convection currents:** Driving force behind plate movements caused by the uneven heating of mantle fluids by the Earth's interior.

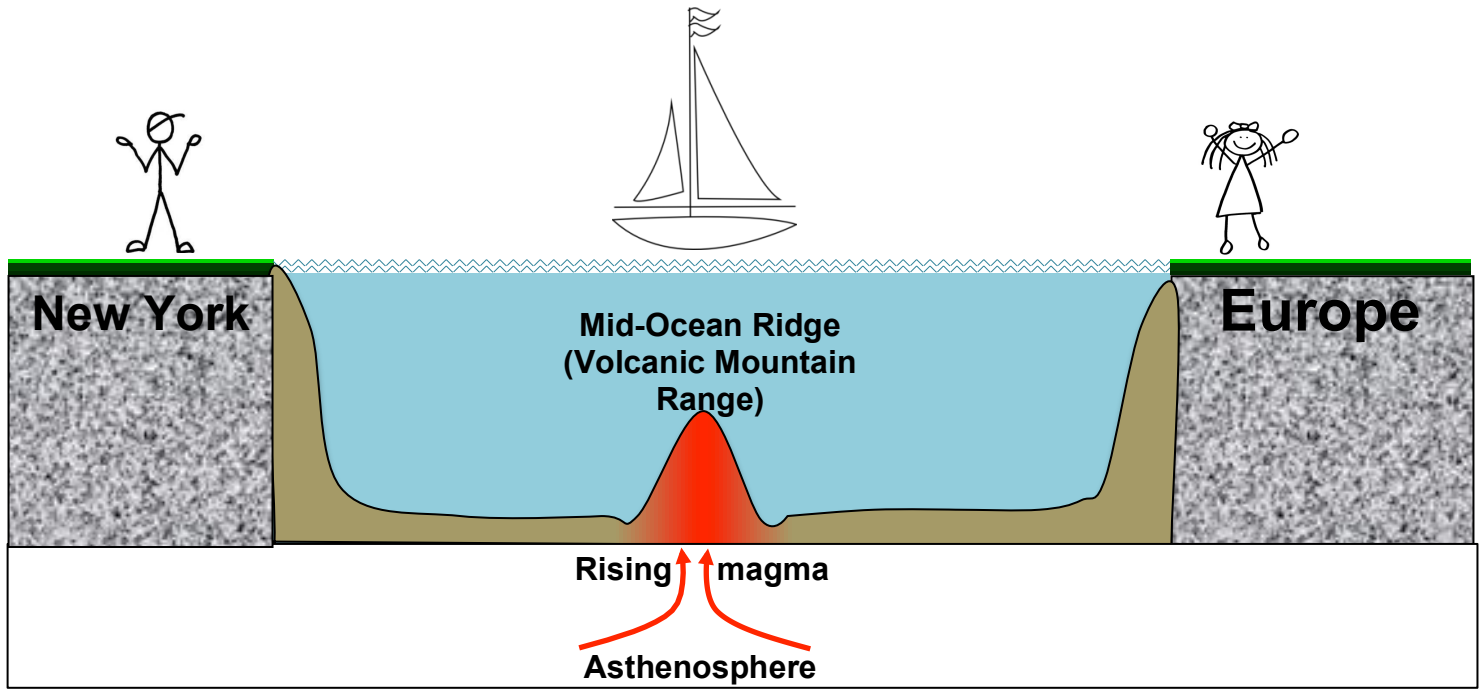


8) What are the different ways plates interact?

1. **Divergent plate boundaries:** 2 plates are moving away from one another due to rising convection currents
 2. **Convergent plate boundary:** 2 plates are moving towards each other due to sinking convection currents.
 3. **Transform plate boundary:** 2 plates are sliding past one another
- See ESRT page 5 – Tectonic Plates for locations of each plate boundary around the world.

9) What does the bottom of the Atlantic Ocean floor look like?

- ★ **Making Predictions:** The cross section below shows the east coast of North America, the Atlantic Ocean, and the west coast of Europe. Using a pencil, draw what you think the ocean floor looks like as you travel from one continent to the other.



Explanation:

- In the middle of the Atlantic Ocean there is a **divergent plate boundary**. (See ESRT p5)
 - At the plate boundary, there is a **volcanic mountain range called a mid-ocean ridge**.
 - **New seafloor forms here when magma solidifies and causes the seafloor to spread. This means North America and Europe are slowly moving away from each other.**
- ✓ **Checkpoint:** Use ESRT page 5 to find another example of a mid-ocean ridge. What is the name of this ridge? What are the two plates that are diverging at this ridge?

East Pacific Ridge; Pacific Plate & Antarctic Plate

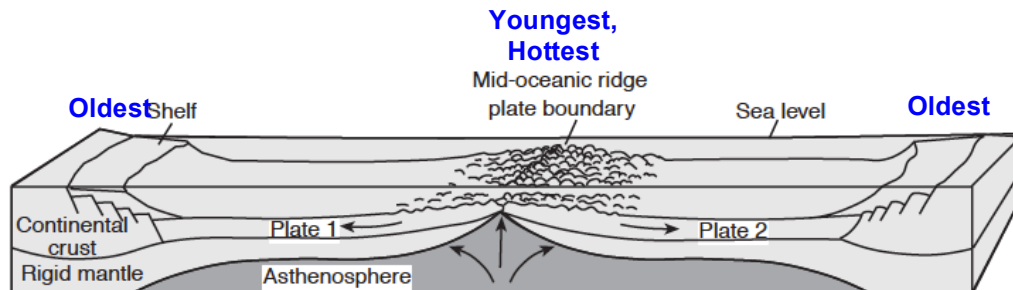
Southeast Indian Ridge; Indian-Australian Plate & Antarctic Plate

10) How do we know the seafloor is spreading at mid-ocean ridges?

Evidence of seafloor spreading:

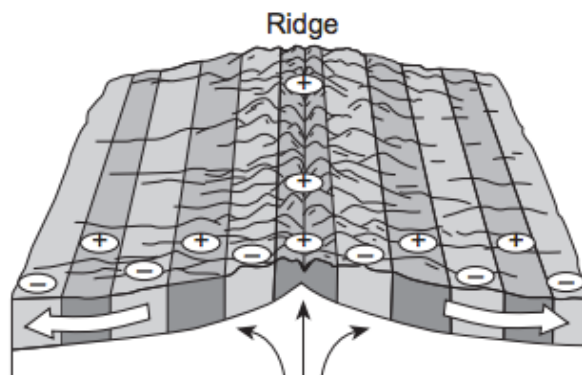
1. Age of bedrock:

- **Youngest bedrock is at the ridge. This is the hottest crustal location due to rising magma.**
- **Oldest bedrock is at either continent.**



2. Magnetic polarity pattern of bedrock

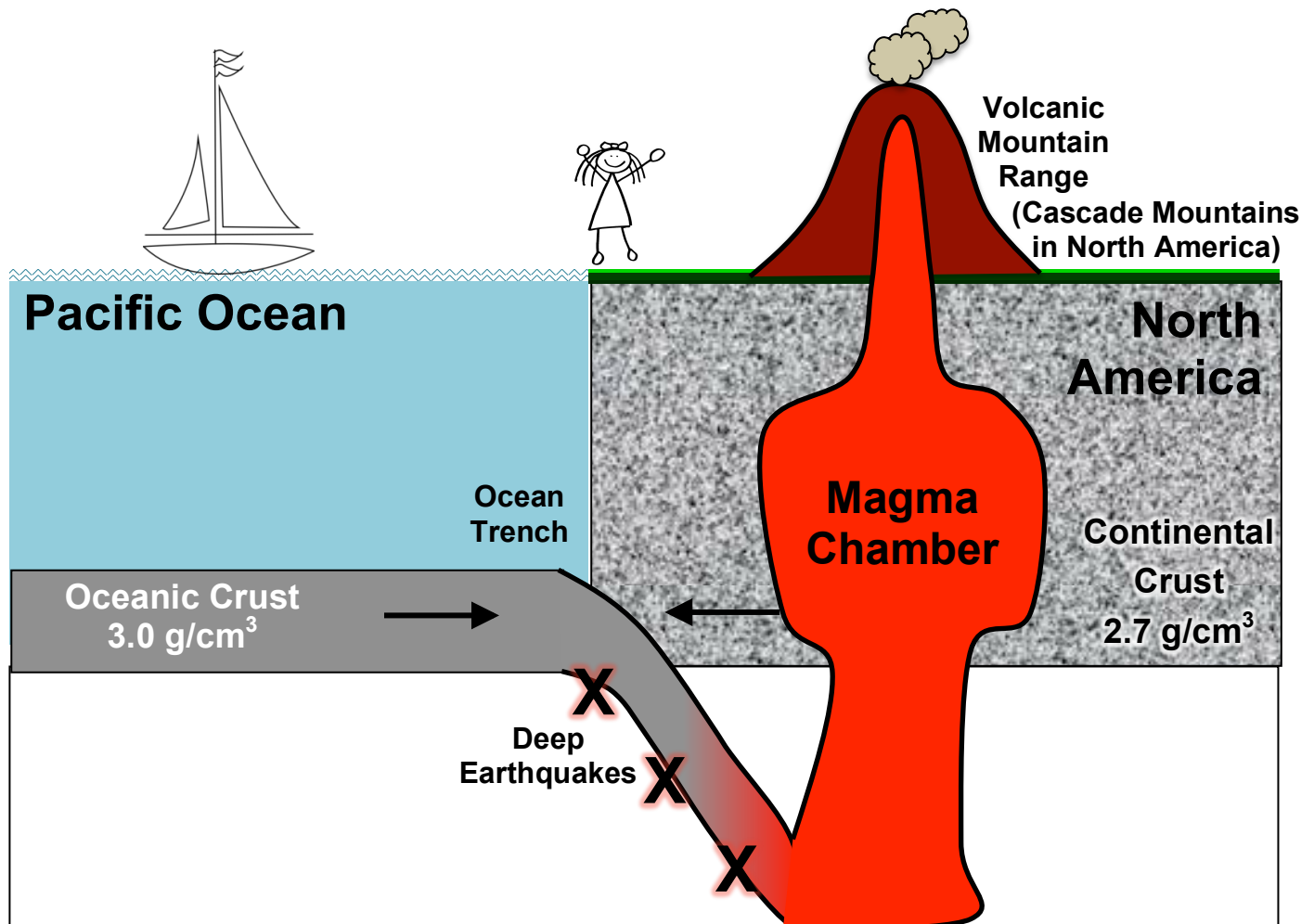
- Earth's magnetic North Pole is currently near the geographic North Pole. In the past, it seems to have been reversed for periods of time, meaning the magnetic North Pole was located near the geographic South Pole.
- As magma cools, magnetic elements like iron in the magma align to the Earth's magnetic North Pole of the time.
- Oceanic crust at equal distances on opposite sides of the ridge have the same magnetic polarity (normal + or reversed -). Meaning, the oceanic crust formed at the same time at the ridge and was pushed apart as new seafloor has been created.
- **Magnetic polarity pattern is a mirror image on opposite sides of the ridge.**



11) What geologic features occur when a continental plate collides with an oceanic plate?

★ **Making predictions – Convergent Plate Boundaries:** On the diagram below...

1. Label each type of crust.
2. Label the density of each type of crust.
3. Using a pencil, draw what you think will happen when these two plates collide.



Explanation:

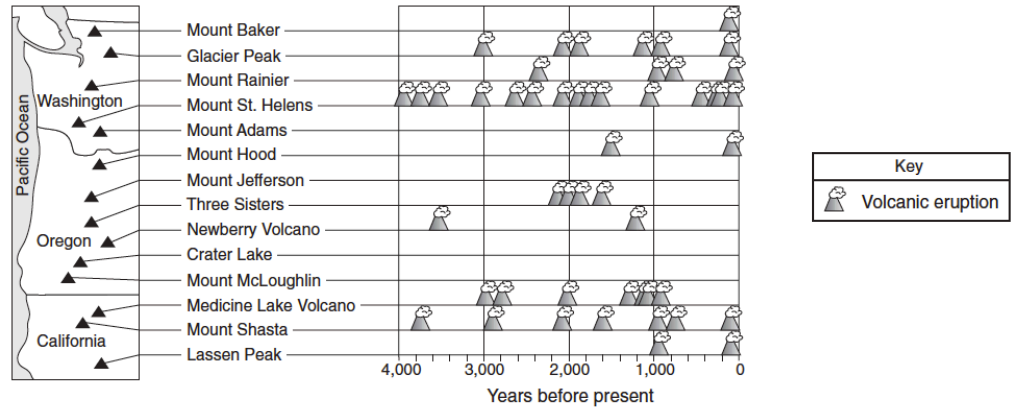
- **Continental-Oceanic Convergent Boundary:** This is called a subduction zone caused by the collision of an oceanic and continental plate
 - Because the oceanic crust is more dense, it will always subduct (move under) the less dense continental crust which destroys crust, causes deep earthquakes, forms ocean trenches, and forms continental volcanic mountains.

✓ **Checkpoint – Continental-Oceanic Convergent Boundaries:**

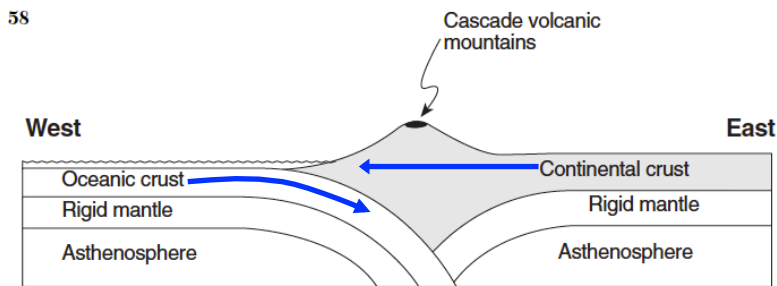
1. Use ESRT page 5 to find the continental-oceanic plate boundary on the west coast of South America. Which two plates are converging at this boundary? What is the name of the trench formed at this boundary?

South American Plate & Nazca Plate; Peru-Chile Trench

Base your answers to questions 2 through 5 on the map below which shows locations of the volcanic peaks of the Cascade Mountain Range of the northwestern United States. The table shows the major eruptions of each peak over the past 4,000 years.



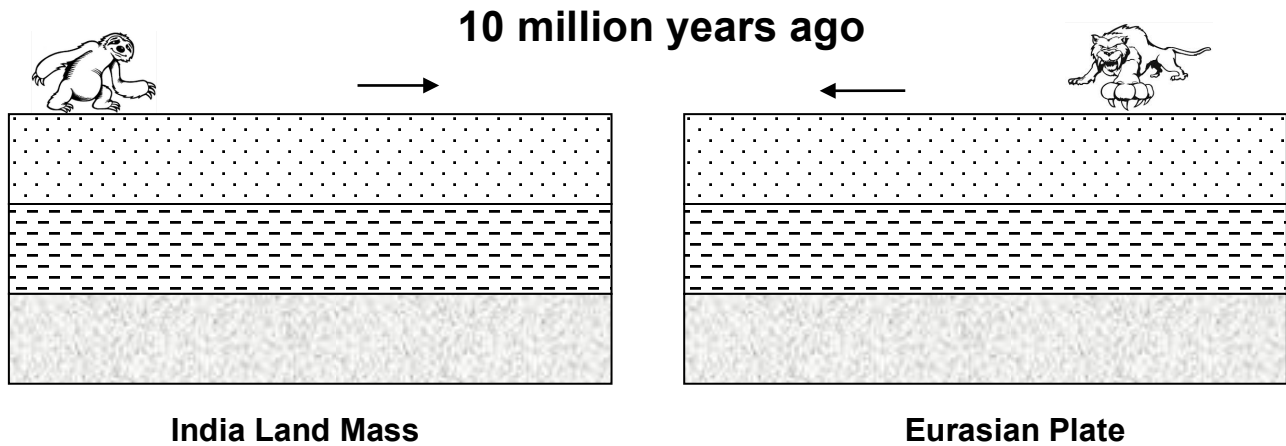
2. Which volcano of the Cascade Mountain Range has erupted most frequently in the past 4,000 years? **Mount St. Helens**
3. What type of plate boundary formed the Cascade volcanic mountains? **Convergent**
4. What are the names of the two plates found on either side of this plate boundary? **North American Plate & Juan de Fuca Plate**
5. On the cross section below, place an arrow in the continental crust and an arrow in the oceanic crust to show the relative directions of plate movement.



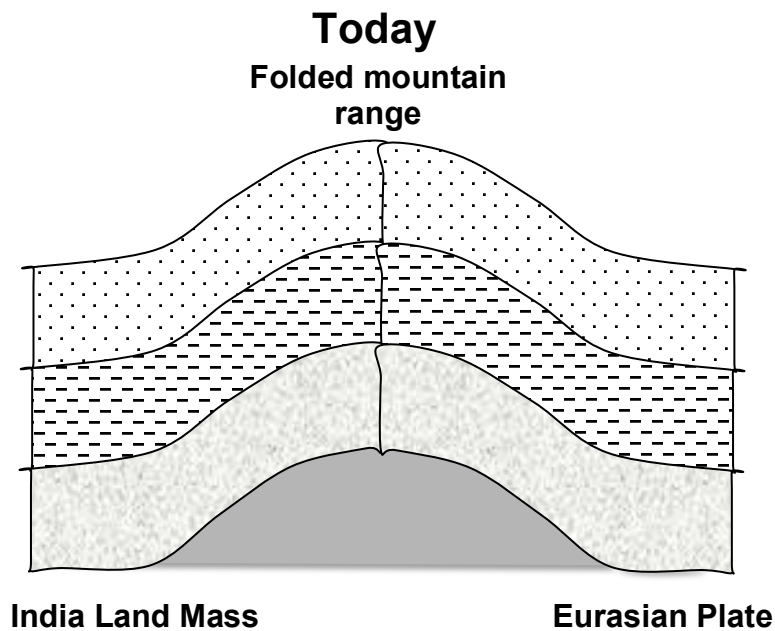
(Not drawn to scale)

12) What geologic features occur when two continental plates collide?

- ★ **Making Predictions – Convergent Plate Boundaries #2:** The diagram below represents the bedrock of the India landmass moving towards the bedrock Eurasian Plate 10 million years ago.



Using a pencil, draw what you think happened to the bedrock when these two plates collided to represent this area today.

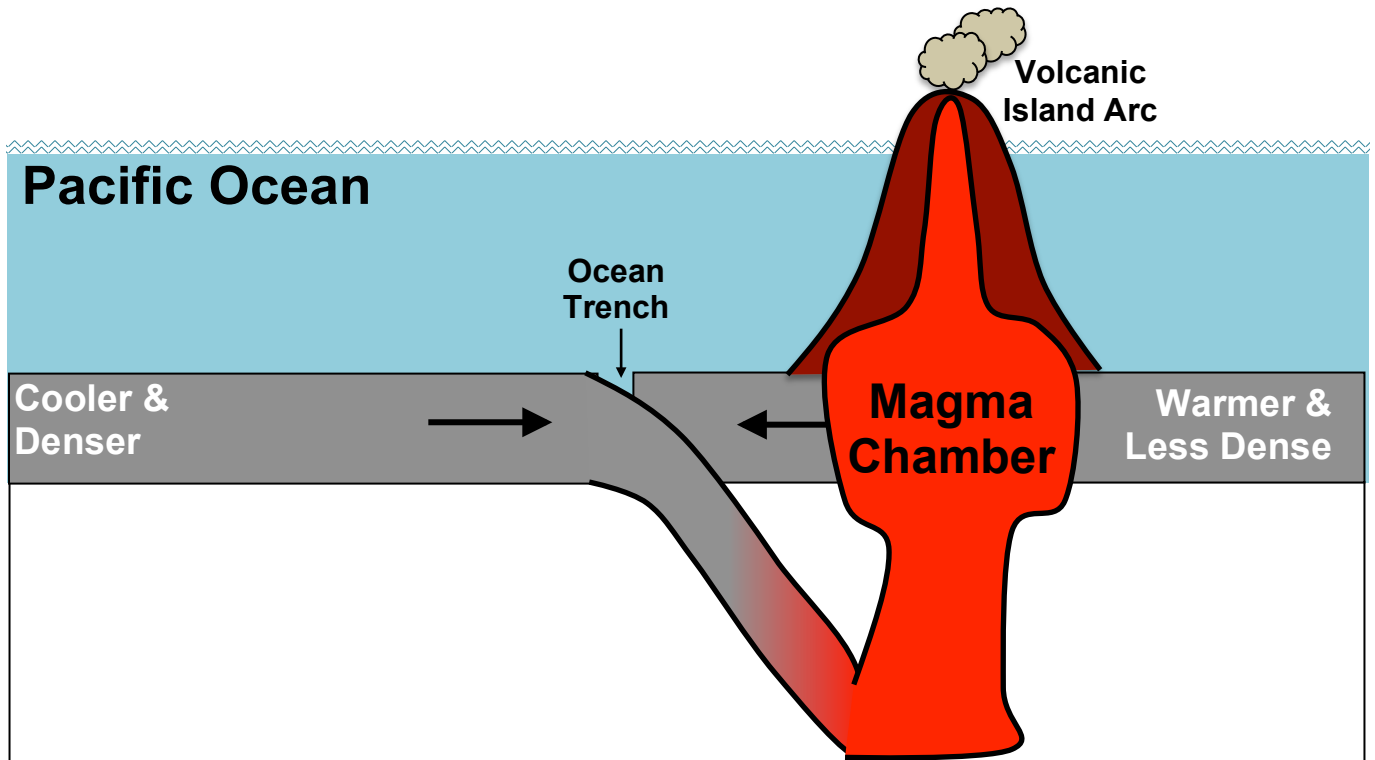


Explanation:

- **Continental-Continental Convergent Boundary:** The collision of two continental plates forms folded mountain ranges, such as the Himalayan Mountains between the India land mass and the Eurasian Plate shown above.

13) What geologic features occur when two oceanic plates collide?

- ★ **Making Predictions – Convergent Plate Boundaries #3:** On the diagram below, use a pencil to draw what you think will happen when these two plates collide. The oceanic plate on the left is cooler and denser than the oceanic plate on the right.



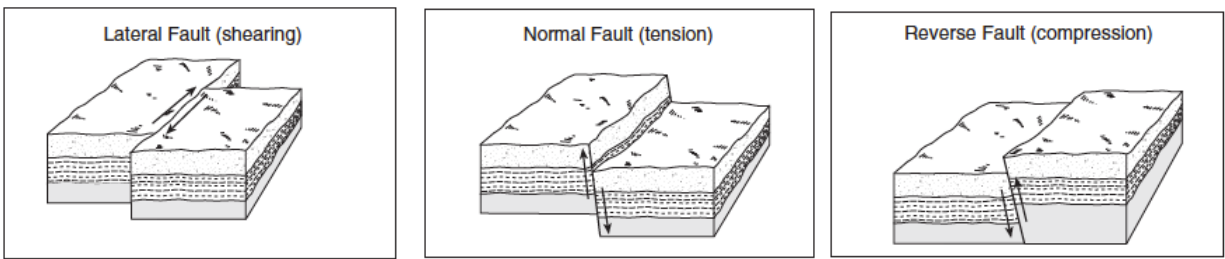
Explanation:

- **Oceanic-Oceanic Convergent Boundary:** The collision of two oceanic plates form deep ocean trenches and island arcs.
 - **Commonly known island arcs include the islands of Japan and the Aleutian Islands off the coast of Alaska.**
- ✓ **Checkpoint – Oceanic-Oceanic Convergent Boundaries:** Use ESRT page 5 to find two ocean trenches formed by an oceanic-oceanic convergence.

Aleutian Trench; Mariana Trench

14) What geologic features form at a transform boundary?

- Transform boundary: one plate slides past another plate causing shallow earthquakes



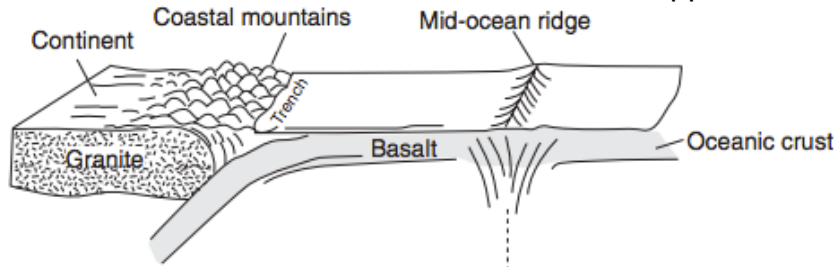
- ✓ **Checkpoint – Transform Boundaries:** Using ESRT page 5, find the transform boundary located in the continental United States. What is the name of this boundary? Which two plates are sliding past each other at this boundary?

San Andreas Fault; North American Plate & Pacific Plate

✓ **Checkpoint – Plate Boundaries:** Use your knowledge of Earth Science and the Earth Science Reference Tables to answer the questions below.

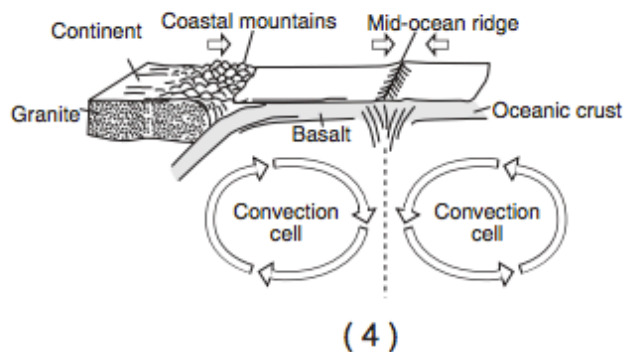
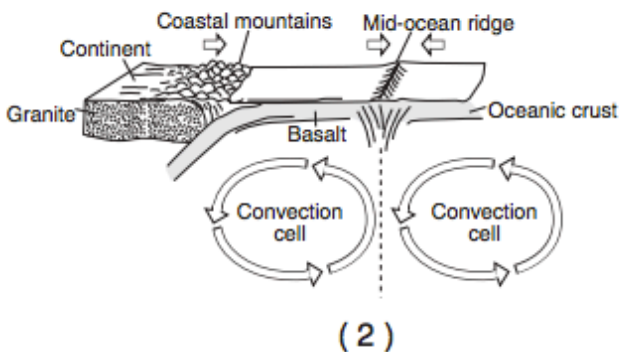
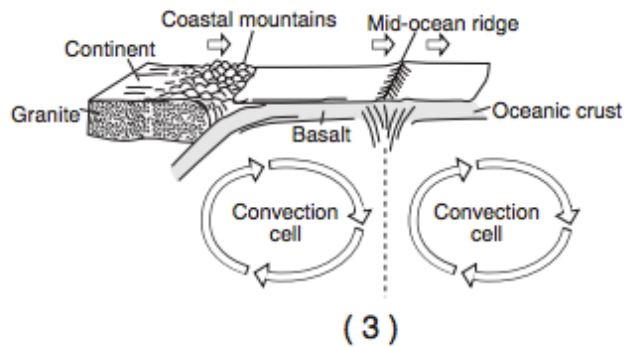
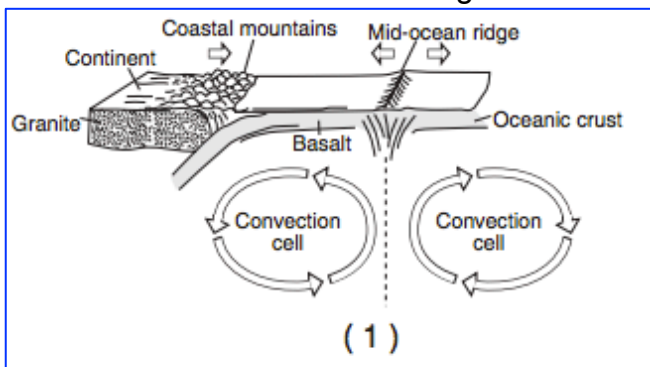
1. The movement of tectonic plates is inferred by many scientists to be driven by
 - a. tidal motions in the hydrosphere
 - b. density differences in the troposphere
 - c. convection currents in the asthenosphere
 - d. solidification in the lithosphere

2. The diagram below shows some features of Earth's crust and upper mantle.



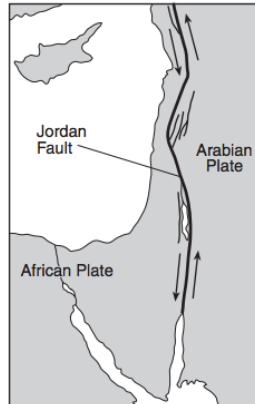
(Not drawn to scale)

Which model most accurately shows the movements (arrows) associated with the surface features shown in the diagram?



3. According to tectonic plate maps, New York State is presently located
 - a. at a convergent plate boundary
 - b. above a mantle hot spot
 - c. above a mid-ocean ridge
 - d. near the center of a large plate

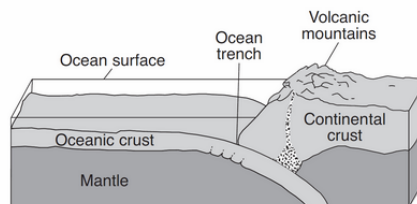
4. Which coastal area is most likely to experience a severe earthquake?
 a. east coast of North America
 b. east coast of Australia
 c. west coast of Africa
 d. west coast of South America
5. The map below shows the northern section of the boundary between the Arabian Plate and the African Plate. Arrows show the relative direction of plate motion.



- Which type of plate boundary is located at the Jordan Fault?
 a. divergent
 b. convergent
 c. transform
 d. complex

6. Which of the following locations is the site of a convergent plate boundary?
 a. the Mid-Atlantic ridge
 b. the Aleutian trench
 c. the Atlantic-Indian ridge
 d. the Pacific/North American plate boundary
7. Which tectonic feature is associated with a complex or uncertain plate boundary?
 a. Southwest Indian Ridge
 b. East African Rift
 c. Mariana Trench
 d. Galapagos Hot Spot

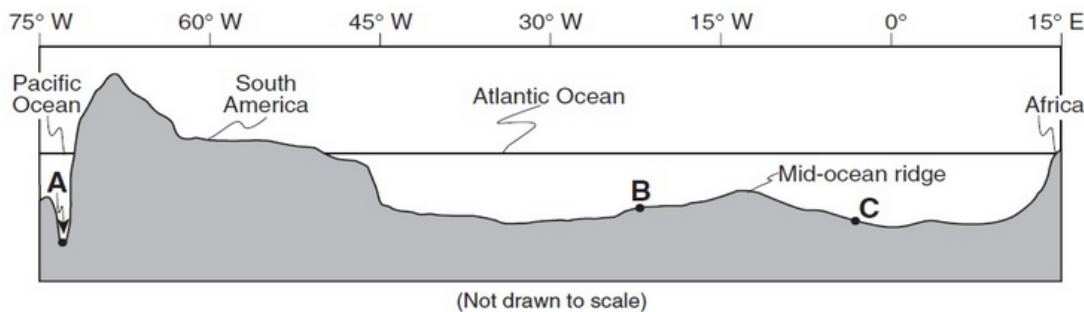
Base your answers to questions 8 and 9 on the block diagram below which shows the boundary between two tectonic plates.



(Not drawn to scale)

8. Which type of plate boundary is shown?
 a. divergent
 b. convergent
 c. transform
 d. complex
9. Which tectonic plate boundary is best represented by this diagram?
 a. Nazca Plate and Pacific Plate boundary
 b. Scotia Plate and South American Plate boundary
 c. Juan de Fuca Plate and North American Plate boundary
 d. Antarctic Plate and Indian-Australian Plate boundary

Base your answer to questions 10 through 12 on the cross section below, which shows the major surface features of Earth along 25° S latitude between 75° W and 15° E longitude. Points A, B, and C represent locations on Earth's crust.



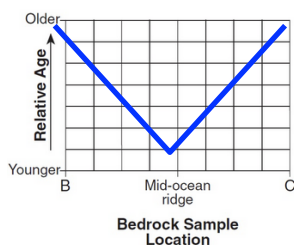
10. Identify the crustal feature located at point A.

Trench; subduction zone; convergent boundary

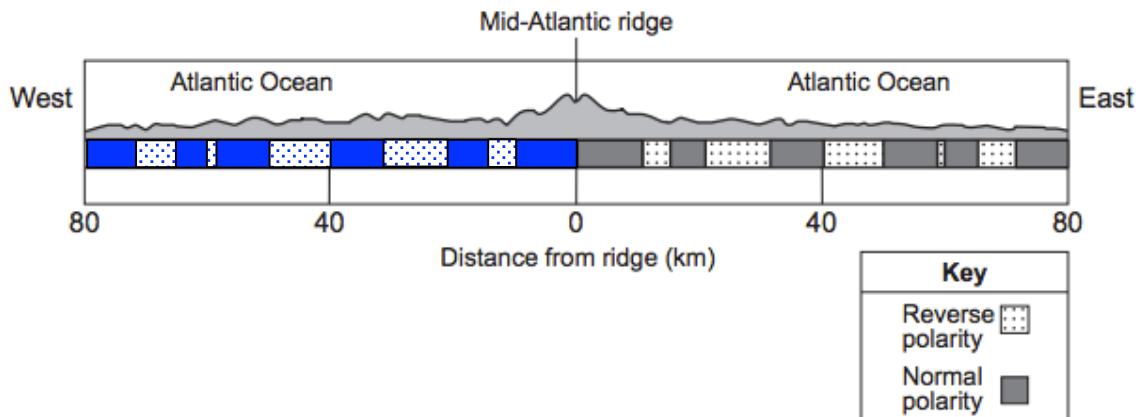
11. Identify the tectonic plate motion that is causing an increase in the distance between South America and Africa.

Divergence; seafloor spreading

12. Bedrock samples were taken at the mid-ocean ridge and points B and C. On the grid, draw a line to show the relative age of the bedrock samples between these locations.



13. The cross section below represents a pattern of magnetic field reversals preserved in the igneous bedrock of the oceanic crust east of the Mid-Atlantic ridge.



Complete the diagram above by shading the pattern of normal polarity on the west side of the ridge center. Assume the rate of plate movement was constant on both sides of the ridge center. Your answer must show the correct width and placement of each normal polarity section.