Plate Boundaries and Patterns of Activity Name _____

Introduction: The Earth's crust is divided into several "plates". Some plates consist of mainly ocean crust, some are mostly continental crust, and some plates are made up of both ocean and continental crust. The plates, which together make up Earth's lithosphere, "float" on top of the mantle and move due to convection cells in the mantle. Movement of these plates causes earthquakes, volcanoes, and the building of mountain ranges. In this lab you will investigate patterns of earthquakes, volcanoes, and mountain ranges and determine the type of motion that takes place between earth's plates.

Materials

- Access to the World Wide Web to obtain data and maps at the sites listed below.
- Class notes (esp on History of Plate Tectonics)
- World relief map including ocean relief
- World map (to plot on) 8.5 x 11 inches
- Colored pencils (orange, green, blue) and highlighter (red fine point markers helpful)

Crustal Activity Patterns

Directions:

1. Obtain the latitude and longitude coordinates of the 10 most recent earthquake epicenters (*of magnitude 4.0 or greater*) in the world at http://earthquake.usgs.gov/eqcenter/recenteqssw **(link on class blog).** Fill in the table and plot the location of the epicenters on your world map using a ● and the following color key:

Depth (km)	**Color**
0 – 33	orange
34 - 71	orange
72 - 151	green
152 - 301	green
302 - 501	red
502 - 800	red

2. Obtain the latitude and longitude coordinates of the **10 most recent volcanic eruptions** in the world at http://www.volcano.si.edu/world/find_eruptions.cfm (**also on class blog**). Place each on the table and then plot the location of the volcanoes on your world map with red ▲'s. Do your best when you have to describe volcano type.

3. Observe the **world volcano map** at CVO Website - Plate Tectonics, Hot Spots, and Ring of Fire - World Map (http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/Maps/map_plate_tectonics_world.html) Plot the general areas where volcanoes are found using smaller red ▲'s. (**see class blog).**

4. Observe a **large laminated world relief map** (available at front of room in box) to locate the main mountain ranges of the world, including ocean mountain ranges. Outline (carefully) the areas of the world where the mountain ranges are found using a highlighter.

5. Answer **Conclusion Questions** 1 & 2.

Types of Plate Boundaries

Directions: The seismicity maps (**see blog**) listed below have earthquakes plotted from the last 20 years. Check the color key on the map to find out the depth of the earthquakes at various locations. Each set of questions below is based on a different region of the world. Choose the specific seismicity map when you are at the World Seismicity website.

Observe the South America seismicity map.

1. Describe the pattern of earthquake depth from **west to east** along the coast.

2. Use the **tectonic plates map and your notes** to find the type of plate boundary that exists along the western coast of South America.

   a) The type of plate boundary that exists along the western coast of South America?

   b) What are the names of the main plates on either side of this boundary?

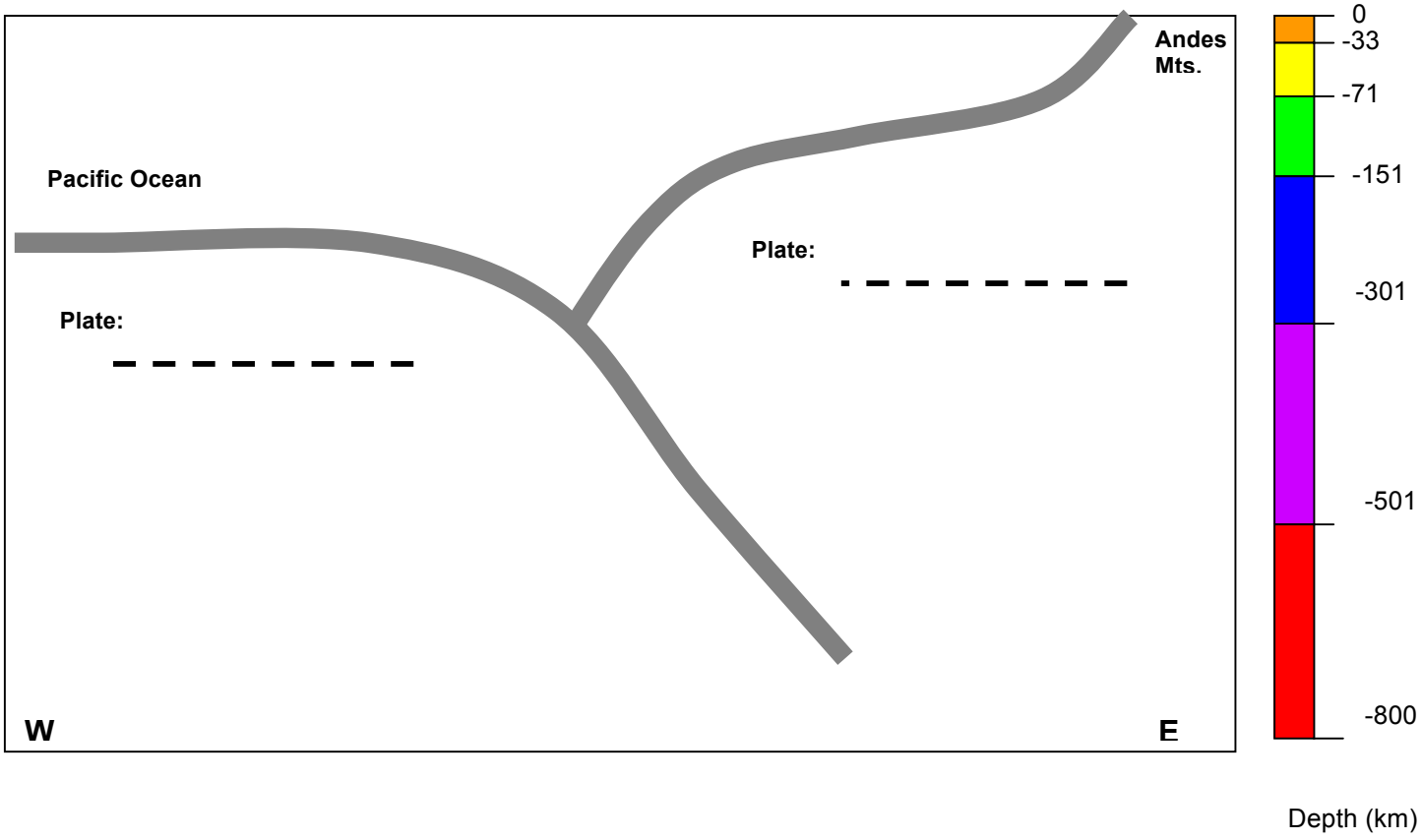
   c) Are the plates moving towards each other, away from each other, or sliding past each other?

Cross-Section of Plate Boundary

a) The diagram below shows a cross-section of the plate boundary along the west coast of S. America. Label each plate on the matching diagram on your **answer sheet**.

b) Put arrows on the ends of the dotted lines on each plate to show the direction each plate is moving.

c) Plot earthquakes with an X along the edge of the Nazca Plate to show the general earthquake depth from west to east. (Refer to your answer to question #2 or observe the South America seismicity map again.) Use the depth scale at the right to determine the depth at which to plot the earthquakes on the diagram.



Observe the Alaska seismicity map.

3. Describe the pattern of earthquake depth from **south to north** along the curved arc (the Aleutian Islands).

4. a) Use the tectonic plates map and your notes to name the type of plate boundary that exists in this region.

b) What are the names of the main plates on either side of this boundary?

c) Are the plates moving towards each other, away from each other, or sliding past each other?

Observe the Japan and Kuril Islands seismicity map.

5. Describe the pattern of earthquake depth from **east to west** along Japan.

6. a) Use the tectonic plates map and your notes to name the type of plate boundary that exists in this region.

   b) What are the names of the main plates on either side of this boundary?

   c) Are the plates moving towards each other, away from each other, or sliding past each other?

7. Think about what you discovered in steps 1 – 7. What can you say about convergent plate boundaries (subduction zones) and earthquake depth along these plate boundaries?

Observe the South Atlantic Ocean seismicity map.

8. Describe the pattern of earthquake depth you see along the Mid-Atlantic Ridge. (The Mid-Atlantic Ridge runs from the top edge of the map south down the middle of the map.)

9. a) Use the tectonic plates map and your notes to name the type of plate boundary that exists along the Mid-Atlantic Ridge.

   b) What are the names of the main plates on either side of this boundary?

   c) Are the plates moving towards each other, away from each other, or sliding past each other?

Observe the Indian Ocean seismicity map.

10. Describe the pattern of earthquake depth you see along the Mid-Indian Ridge. See the tectonic plates map in your reference tables for help finding where this ridge is located.)

11. a) Use the tectonic plates map and your notes to name the type of plate boundary that exists along this ridge.

b) Are the plates moving towards each other, away from each other, or sliding past each other?

12. Think about what you discovered in steps 9 - 12. What can you say about divergent plate boundaries and earthquake depth along these plate boundaries?

Observe the Western United States seismicity map.

13. Is the earthquake depth along the **west** coast of the U.S. in California deep or shallow?

14. a) Use the tectonic plates map and your notes to name the type of plate boundary that exists along the west coast of the U.S. in California.

b) What are the names of the main plates on either side of this boundary?

c) Are the plates moving towards each other, away from each other, or sliding past each other?

15. Think about what you discovered in steps 14 – 15. What can you say about transform plate boundaries and earthquake depth?

Observe the Eastern United States seismicity map.

Answer **Conclusion Question #**7.

16. Observe the map you plotted earthquakes on in part one of this lab. **Compare the earthquake depth patterns you plotted on your map to the different types of plate boundaries where they are found**. Use the tectonic plates map and your notes to determine the type of plate boundary. (You may also want to look back at the answers to the previous questions to help you.)

a) Name one other area of the world (not already mentioned in the lab above) that shows the same relationship between earthquake depth and a **convergent** boundary as you described above. When describing the location, name the two plates that are on either side of the boundary and the ocean and/or land that it is located near.

b) Name one other area of the world (not already mentioned in the lab above) that shows the same relationship between earthquake depth and a **divergent** boundary as you described above. When describing the location, name the two plates that are on either side of the boundary and the ocean and/or land that it is located near.

Conclusion Questions (you should have already done 1,2, and 7)

1. What can you conclude about the patterns of earthquakes and volcanoes and plate boundaries?

2. Why are most of the world's earthquakes and volcanic mountains located along plate boundaries?

3. Why do plates move? Be as thorough and specific as possible.

4. Explain **why** the earthquake depth goes from shallow to deep along convergent plate boundaries that are subduction zones.

5. Why are many of the world's volcanoes and mountain ranges located along subduction zones?

6. Why are the earthquakes located along divergent and transform boundaries not as deep as those located along convergent boundaries?

7. Why do you suppose there are far fewer earthquakes in the Eastern United States region than in the other regions you observed?