Name:_____

SOS Explorer Student Exploration: Plate Tectonics

Objective:
Plot and ponder the location of the 10 most powerful earthquakes of all time. Compare the locations of these to volcanoes and different types of plate boundaries. Express your understanding by answering a few questions in complete sentences.

Directions:

1. Open SOS Explorer
2. Play around with the program to get acquainted. Zoom in and out of the Earth. Spin the sphere around, etc. Take the help tour if you have time.
3. Move your cursor on the sphere and notice the latitude and longitude value at the middle bottom of the screen.
4. Plot the Top 10 Historical Earthquakes (table on page 3) onto the sphere. To do this go to *Tools > Draw > Icons*. Choose an icon, drag and place on the sphere at the correct latitude and longitude coordinates. Repeat for each.
5. Double-click the icon and click the pencil to edit. Name each earthquake by location and magnitude.
6. Find *Datasets>Layer – Earthquakes 2011 (KML)* and *Load* on top of the Top 10 icons that you just made.

    - What do the size of the dots mean?

    - What do the different colors mean?

    - Do you see any patterns? How do the top 10 earthquakes and earthquakes of 2011 compare?

7. Find *Datasets>Layer - Volcanoes (KML)* and *Load* on top of everything. Click a few volcanoes to learn more about them.

    - What do you notice about the location of the earthquakes and volcanoes?

- What kind of geographical features do you see where the volcanoes are? (to see them better, reduce the transparency of the Earthquake Layers)

8. Find *Datasets>Layer – Geographical Overlays > Plate Boundaries* and *Load*. If needed, lower the transparency of other layers in order to see the different boundary types well. Answer these questions about what you see.

    - One type of plate boundary is highlighted in purple on the plate boundary overlay. Which type of boundary is this? What else do you notice about the purple boundaries?

9. Read Page 4: Plate Tectonics Boundaries. Answer the following questions.

    - If a 9.0 earthquake were to happen tomorrow, what type of boundary would it most likely be on? Why do you think?

    - Using SOS Explorer, name a specific geographical example of a divergent, convergent and transform boundary (example: The long ocean ridge in the middle of the Atlantic is a divergent boundary)

      Divergent –

      Convergent –

      Transform -

    - So if the Earth's crust is broken into pieces and these pieces crash into each other and move around, what do you think has happened to the Earth's surface over time?

Top Ten Historical Earthquakes

Use the latitude and longitude of each to plot them on the sphere in SOS Explorer.

Place Name	Lat/Long	Date	Magnitude
1. Chile	38S, 73W	05/22/1960	9.5
2. Prince William Sound, AK	61N, 148W	03/28/1964	9.2
3. Sumatra-Andaman Islands	3N, 96E	12/26/2004	9.1
4. Honshu, Japan	38N, 142E	03/11/2011	9.0
5. Kamchatka	53N, 160E	11/04/1952	9.0
6. Arica, Peru (now Chile)	17S, 73W	08/13/1868	9.0
7. Cascadia Subduction Zone	49N, 125W	01/26/1700	9.0
8. Bio-Bio, Chile	36S, 73W	02/27/2010	8.8
9. Esmeraldas, Ecuador	1N, 82W	01/31/1906	8.8
10. Rat Islands, AK	51N, 179W	02/04/1965	8.7

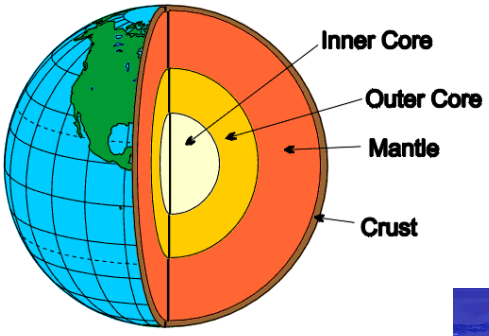
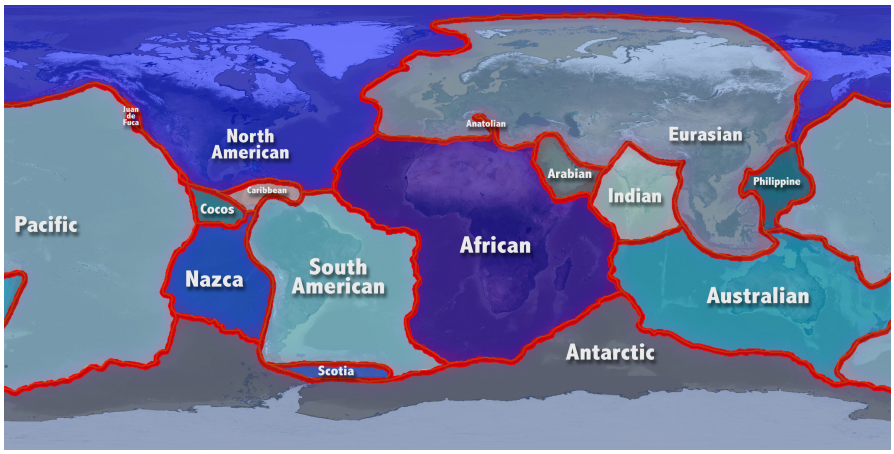


Plate Tectonics Boundaries

The Earth is made has many layers of material underneath the surface, where we stand. Look at the diagram to the left to see the different layers. The outside layer is known as the crust. Earth's crust is broken up into pieces called tectonic plates. Where these plates meet we call plate boundaries, the red lines in the picture below.



There are three types of plate boundaries. **Divergent plates boundaries** are where two plates pull apart. ←→ At divergent boundaries on the seafloor you will find mid-ocean ridges, where the seafloor is uplifted into a long mountain range, like the mid-Atlantic ridge. On the continents you will find a rift valley, where the land is lower due to the spreading and can often form lakes, like the East African Rift. Many weak earthquakes happen at divergent boundaries. This is also where new crust is formed. The youngest rock on Earth is found at these boundaries where the seafloor is spreading and filling in from the magma pushing up from the mantle.

Convergent plate boundaries are where two plates collide into eachother →← also called a subduction zone – because one plate is subducting (going) under the other. At these boundaries you will find rugged mountain ranges, deep seafloor trenches, chains of islands as well as chains of volcanoes and powerful earthquakes. Examples of these boundaries include: the Aleutian Islands in Alaska, the Andes Mountains in Chile and the Mariana Trench in the Pacific Ocean southeast of Japan. This is also where old crust is destroyed and recycled back into the hot molten magma in the mantle layer (see diagram above to located the mantle).

Transform plate boundaries are where two plates slide past eachother.↓↑ Natural or manmade structures that cross transform boundaries are offset – split into pieces and carried in opposite direction. Medium magnitude earthquakes can happen at these boundaries. A well-known example is the San Andreas Fault in California.