

## **Earthquakes, Plate Boundaries, and Depth**

### **Indiana Standard Indicators:**

**ES.1.23** – Explain motions, transformations, and locations of materials in Earth’s lithosphere and interior. For example, describe the movement of the plates that make up the crust of the earth and the resulting formation of earthquakes, volcanoes, trenches, and mountains.

**ES.1.24** – Understand and discuss continental drift, sea-floor spreading, and plate tectonics. Include evidence that supports the movement of the plates, such as magnetic stripes on the ocean floor, fossil evidence on separate continents, and the continuity of geological features.

**Purpose or goals:** Students will use data from Indiana Pepp station and the global map tool, the “Jules Verne Voyager, Jr.” to correlate and assess the location of earthquakes and plate boundaries, the age of the ocean and continental crust and the depth of earthquakes, and types of plate boundaries where earthquakes occur.

**Description of activity:** Students will use downloaded data sent from Indiana Pepp stations to Wilber II from various teleseismic earthquakes which have taken place in the past year, and using the longitude and latitude listed, will mark the earthquake’s location on a world map. As students mark the location of the earthquake a different color of mark will indicate the general depth of the earthquake. Blue marks will indicate a shallow earthquake depth of <75 km, green marks will indicate an intermediate earthquake depth of 75-300 km, and red marks will indicate a deep depth of >300 km. Students will then log on to the internet address:

<http://jules.unavco.ucar.edu/VoyagerJr/Earth>.

Students will use the world map with ocean floor age and plate tectonic overlays to assess and correlate earthquake data.

### **Assignments and/or questions for Review:**

- Is there any relationship between earthquake depth and ocean floor age? If so explain the relationship.
- Do any of the earthquakes documented on your map coincide to plate boundaries? If so what type of plate boundaries do they coincide with? What type of plate boundaries do the majority of the earthquakes occur at?
- Is there any relationship between the type of plate boundary and the depth of the earthquakes which occur at those boundaries? Explain this relationship.
- What is the relationship between the depth of an earthquake and the age of the ocean floor or continental crust?
- What is the explanation behind the earthquakes that do not occur at plate boundaries?

**Making ideas accessible for all students:**

Allow students with special needs to work on this activity with a partner.

Read directions for the activity to the students orally along with their written directions.

**Suggestions for Extensions:** Using the global map tool “Jules Verne Voyage, Jr.” have students correlate the location of earthquakes and volcanoes focusing on plate boundaries. Allow students to explore the global map tool and make their own discoveries – directional movement of the plates, stress axes, etc.

**Teacher resources:** [www.iris.washington.edu](http://www.iris.washington.edu)  
[www.indiana.edu/~pepp](http://www.indiana.edu/~pepp)

**Teacher Notes:**

Prior to this activity log onto the internet at [www.indiana.edu/~pepp](http://www.indiana.edu/~pepp) and click on the earthquakes tab on left hand side. Scroll down to Wilber II and below that heading, click on A short Walkthrough for Wilber. It will help in gathering data from the Indiana Pepp stations for this activity. (If unfamiliar with Indiana Pepp browse through the website to learn about it.) Following the procedure gather 40 teleseismic earthquakes from an Indiana Pepp station and print them off for the students to use during this activity.

Name \_\_\_\_\_

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**Materials:** Computer with internet access; activity worksheet; blue, green, and red colored pencils or markers; blank map of the world.

### Procedure:

- Take the list of earthquakes, which have been downloaded by the instructor, and using latitude and longitude, find each of their locations on a blank world map.
- Mark the location of the earthquake based on its depth as follows:

Blue marks	shallow earthquake depth	<75 km
Green marks	intermediate earthquake depth	75-300 km
Red marks	deep earthquake depth	>300 km.
- Log on to the internet address on the computer:  
<http://jules.unavco.ucar.edu/VoyagerJr/Earth>
- Observe and familiarize yourself with the tool bar at the top of the page and note that the map which has appeared is that of the face of the earth and relief, no features added, and no plate velocities.
- Click on “ocean floor age” under the tool bar tab select a base map.
- Click on “make changes” on the left side of the tool bar.
- Look at the legend of the ocean floor age in millions of years and refer to it throughout this activity.
- Taking the earthquake-marked world map correlate the location of the earthquakes and the age of the ocean floor. Record observations and correlation in the data section of this activity worksheet.
- Focus on the depth of the earthquakes and the age of the ocean floor. Record observations and correlation in the data section of this activity worksheet.
- Return to the tool bar and create a new map.
- Select face of the earth and relief under select a base map and the tectonic plate feature under add features.
- Click on “make changes” on the left side of the tool bar.
- Taking the earthquake-marked world map correlate the location of the earthquakes and plate boundaries. Record observations and correlation in the data section of this activity worksheet.
- Focus on the depth of the earthquakes and the location of the plate boundaries. Record observations and correlation in the data section of this activity worksheet.

- Click on age of the ocean floor under select a base map, followed by a click on “make changes.”
- Make observations between the plate boundaries, the location of the earthquakes, and the depth of the earthquake. Record observations in the data section of this activity sheet.

**Data:**

<b>Map Comparisons</b>	<b>Observations</b>
Earthquake location and Ocean floor age	
Earthquake depth and Ocean floor age	
Earth quake location and plate boundaries	
Earthquake depth and plate boundaries	
Earthquake location, depth and plate boundaries	

**Conclusions:**

**Questions for Review:**

1. Is there any relationship between earthquake depth and ocean floor age? If so explain the relationship.
2. Do any of the earthquakes documented on your map coincide to plate boundaries? If so what type of plate boundaries do they coincide with? What type of plate boundaries do the majority of the earthquakes occur at?
3. Is there any relationship between the type of plate boundary and the depth of the earthquakes which occur at those boundaries? Explain this relationship.
4. What is the relationship between the depth of an earthquake and the age of the ocean floor or continental crust?
5. What is the explanation behind the earthquakes that do not occur at plate boundaries?