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Discover Plate Tectonics

Grand Tour of the Ocean Basins

Created by Angela Daneshmand to complement Declan G. De Paor's Google Earth files and user guide

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Before you begin:

- Download KMZ/KML files and double click to open up Google Earth Pro
- Download Grand Tour of the Ocean Basins User Guide and reference when needed

1. Tour Stop #2 (uncheck #3 to get a better view): What is rift volcanism?

2. Tour Stop #11: What is a hotspot trail? Why are they of interest to us?

3. Tour Stop #13: Calculate the rate of spreading in the South Atlantic Ocean. Then, calculate the rate of spreading in the North Atlantic Ocean (between the US and Africa). How do they compare? What do you think that means?

4. Tour Stop #24: What is unique about Iceland? Which direction is the Greenland-Faroe moving? How do you know?

5. Tour Stop #28: Here you can see the dark blue trench. Which side do you think is subducting- the plate with the yellow tour stop pin or the plate with the islands?

6. Tour Stop #34: Which plate is subducting here (oceanic or continental) and how do you know?

7. Tour Stop #35: Use the path tool to draw a line across the subduction zone and over the Andes mountains. You can name the path if you want and then press okay. Then find your path in the places box, right click and select show elevation profile. Take a screenshot and paste your image below.

8. Tour Stop #36: Create an elevation profile across this tour stop and paste the screenshot below. Are there any differences from Tour Stop #35? Why do you think this is?

9. Tour Stop #37: Zoom in on the East Pacific Rise (shown on the user guide) and calculate the rate of spreading. How does this compare to the Atlantic?

10. Tour Stop #40: What is the visual evidence that this is a subduction zone?

11. Tour Stop #43 & 44: What happened to the Farallon Plate? Why should we know this?

12. Tour Stop #52: Which side is subducting here (left or right)? How do you know?

13. Tour Stop #58: Which side is subducting here (left or right)? How do you know?

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Plate Tectonics Transect Creation

Modified from McConnell et al., 2021 https://serc.carleton.edu/4937.1291

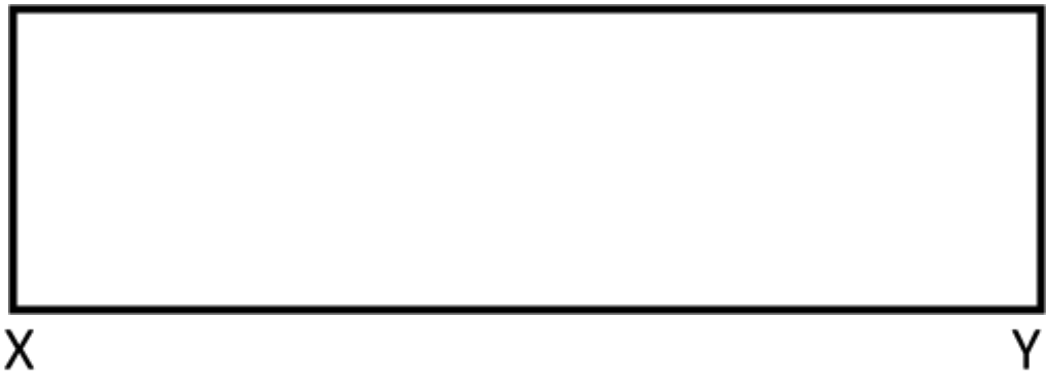
Using Figure 1 on the next page to answer the associated questions.

1. How many tectonic plates are shown?

2. For each plate, list the rock type that might comprise the plate.

3. Find a location on the map for each type of plate boundary (Hint: there are 3 types.)

4. Double click on the box to draw a simple cross section from X-Y in Figure 1 showing the configuration of tectonic plates.



5. Where would you expect earthquakes to occur? Volcanoes?

6. What direction will Point A move over time?

7. Can you determine (generally) which direction each plate is moving?

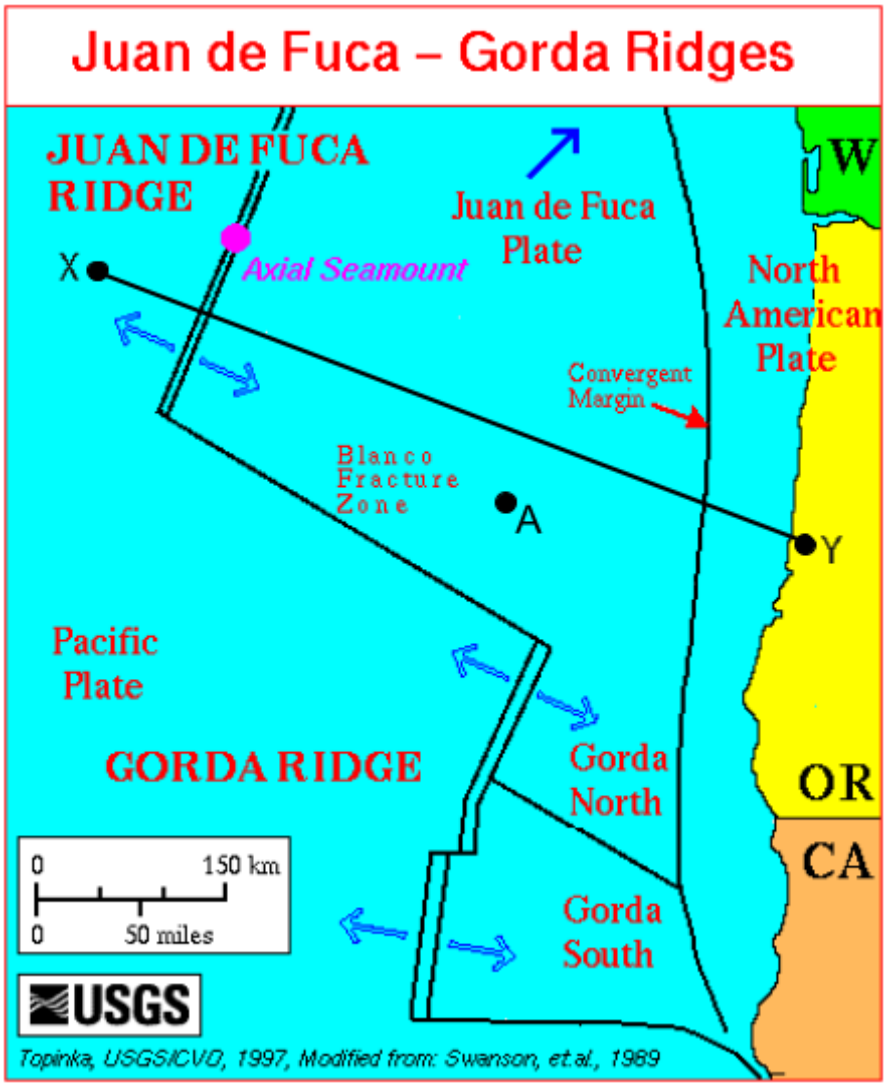


Figure 1: Simplified plate tectonic boundaries along the Pacific Northwest. Modified from Lyn Topinka for USGS, Public domain, via Wikimedia Commons

8. Find another plate boundary and draw a cross section across the plate boundary (Similar to #4 but with a plate boundary of your choosing)! List plate boundary:

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Hawaiian Islands Plate Motion

Modified from Heather Gingerich, Department of Earth Sciences, The University of Western Ontario

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Using Figure 2, answer the following questions.

1. Figure 2 shows various seamount chains in the Pacific Ocean. Explain how the Hawaiian Island chain formed.

2. The volcanoes of the Emperor Seamount Chain are older than those of the Hawaiian Island chain. What can you infer about the movement of the Pacific plate from the locations of the Emperor Seamount Chain in relation to the Hawaiian Islands? Is there any other evidence to support this hypothesis?

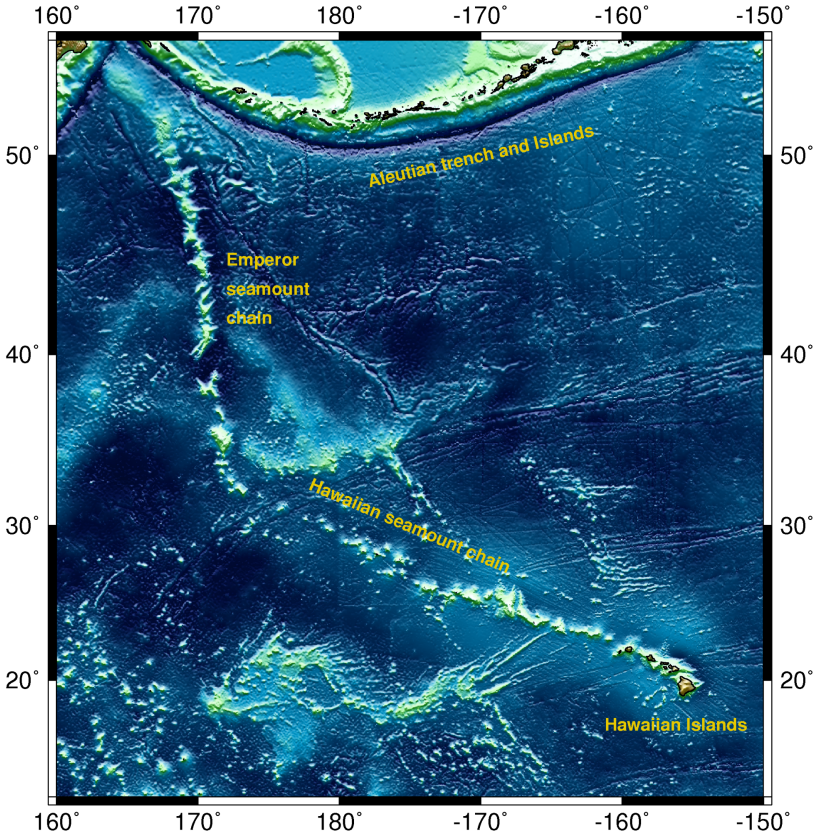

Figure 2: Digital Elevation Model of the Emperor-Hawaiian seamount chain. Ingo Wölbern, Public domain, via Wikimedia Commons

3. Using the age data on Figure 3, calculate the average rate of movement (in mm/yr) for the Pacific plate. Has it been consistent over time? How long ago did the direction of plate movement change?

4. Using your knowledge of plate movement on Earth, what will eventually happen to the Meiji seamount?

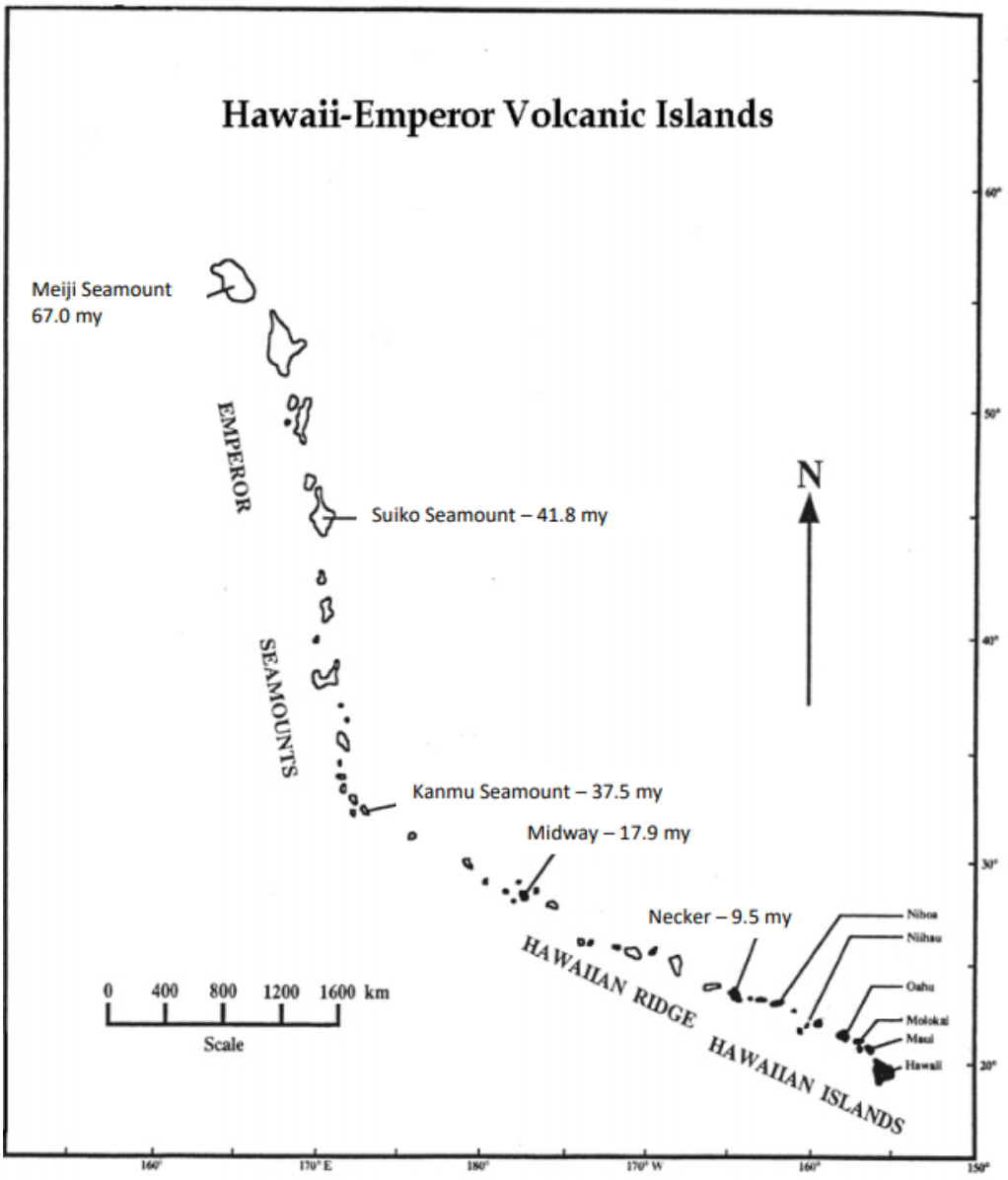

Figure 3: Simple schematic of the Hawaiian-Emperor Seamount Chain with approximated ages. Modified from Heather Gingerich, Dept. of Earth Sciences, The University of Western Ontario, http://www.ontariogeoscience.net/lessonplans/hawaiian-islands.jpg