Lesson Plan, Oceanography Spring 2020 – Natasha Gownaris, OOI Data Labs Fellow 2020

OOI 1: Tectonics and Volcanoes

Audience:

100-level Oceanography class, non-major students (mostly juniors and seniors); Gettysburg College

Learning Goals:

- Link concepts from class to current events
- Build confidence in reading graphs
- Understand how scientists use oceanographic data to predict natural disasters
- Build connections between the concepts of tectonic activity, volcanoes, and earthquakes

Prior Knowledge:

Before completing this activity, students will have learned about the earth's structure, plate tectonics, seafloor spreading, and earthquakes and volcanoes. During the first week of class we also discussed the new technologies used to study the ocean and global observing systems (with a brief intro to OOI).

Invitation:

Before class, have students read the long-form New Yorker article "The Really Big One". I assigned very little reading otherwise, given the length of this article. Students can also listen to the article for free (40 minutes). This article helps to set the scene for a tectonically active PNW. We will start the activity with a brief discussion of this article.

Link: https://www.newyorker.com/magazine/2015/07/20/the-really-big-one

Exploration:

Phase 1: Present students with information on how scientists predict volcanic eruptions. This information will include a description of deformation and how it is measured (helpful website here: http://www.mshslc.org/activity/volcano-deformation/) and a description of the Cabled Axial Seamount Array. Students will be asked a few basic questions to ensure they understand these concepts before moving forward.

Phase 2:

Show students "Monitoring Axial" video.
https://www.youtube.com/watch?v=_chP9yb73Ck&feature=youtu.be

Remind students that there were eruptions at the Axial Seamount in January 1998, April 2011, and April 2015. Have students predict inflation/deflation using OOI exploration activity "Seamount Diking-Eruption Event Science".

Activity: https://datalab.marine.rutgers.edu/explorations/geology/activity3.php?level=exploration

Concept Invention

Ask students to consider why volcanic eruptions might result in earthquake activity and talk with them about these earthquakes.

Show students IRIS Earthquake Browser, zooming in on Axial and the time range of the last eruption.

http://ds.iris.edu/ieb/

Application:

Have students use earthquake data from the Application activity "Seismic Features at a Seamount" to predict precisely when the diking-eruptive event occurred.

Activity: https://datalab.marine.rutgers.edu/explorations/geology/activity4.php?level=application

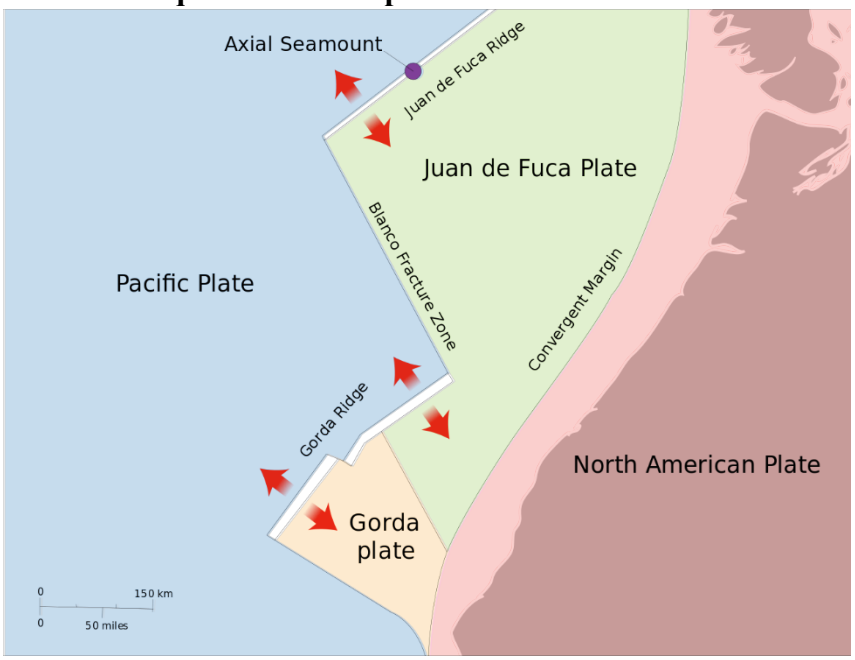
Reflection

Discussion of activities. Any additional questions?

Oceanography (ES 128)
Spring 2020

Name:

Earthquakes and Eruptions: The Axial Seamount



Public domain image of the Axial Seamount provided by Lyn Topinka.
https://commons.wikimedia.org/wiki/File:WestcoastSeaplates.svg

1. **Locate the Axial Seamount on the image above.**
    a. What type of plate interaction is occurring here?

    b. Which plates are involved?

    c. What type of crust is involved?

    d. Why would you expect active volcanoes here?

2. **Choose one of the techniques that scientists use to measure volcano deformation and describe it in your own words.**

***Wait for instruction before moving onto Question 3.**

3. **Go to the link below to explore the graph of seafloor elevation over time**
   https://datalab.marine.rutgers.edu/explorations/geology/activity3.php?level=exploration

   a. Which dates does this graph start and end? (Hint: put your cursor on the actual line of the graph and move left to right, the dates will be shown in the upper right corner)

   b. What variable appears on the y-axis? What are the units?

   c. What are the trends in seafloor elevation over time?

   d. Click the box next to Show Estimated Threshold. What does this line mean? (Hint: read the Data Tips below the graph)

   e. Click and drag your cursor on the graph to make a prediction for what will happen to seafloor elevation leading up to the 2015 eruption. Do the actual observations match your predictions?

***Wait for instruction before moving onto Question 4.**

4. **Go to the link below to explore earthquake magnitude at the Axial Seamount during April, 2015.**
   https://datalab.marine.rutgers.edu/explorations/geology/activity4.php?level=application

   a. What variables are shown on the graph?

   b. What is the range of earthquake magnitudes in these data?

   c. When do you see the largest earthquakes along this time series across the diking-eruptive event?

d. When do you see the deepest earthquakes along this time series across the diking-eruptive event?

e. How does what you see support what you previously knew about seismic activity at seamounts?