

Plate Tectonics: How Is the Type of Plate Interaction Related to the Nature of the Geologic Activity That Is Observed Near a Plate Boundary?

Introduction

The interior structure of the Earth is composed of several layers (see Figure L6.1). At the center of the Earth is the inner core. The inner core is a solid sphere and consists of mostly iron. It has a radius of about 1,120 km. The next layer is the outer core. The outer core is liquid and extends beyond the inner core another 2,270 km. The next, and thickest, layer is the mantle. The mantle is often divided into three sublayers: the lower mesosphere, the upper mesosphere, and the asthenosphere. The outermost layer of the Earth is the lithosphere. The lithosphere includes the crust and the uppermost mantle.

The theory of plate tectonics states that the lithosphere is broken into several plates that move over time (see Figure L6.2). The plates move in different directions and at different speeds in relationship to each other. Plate boundaries are found where one plate interacts with another plate. These boundaries are classified into three different categories: (a) *convergent boundaries* result when two plates collide with each other, (b) *divergent boundaries* result when two plates move away from each other, and (c) *transform boundaries* form when two plates slide past each other. Volcanic eruptions and earthquakes often occur along or near plate boundaries.

In this investigation, you will explore where volcanic eruptions and earthquakes tend to happen. Your goal is to determine if volcanic eruptions and earthquakes happen more often near a specific type of plate boundary. This type of investigation is important because natural processes, such as the gradual movement of tectonic plates over time, can result in natural hazards. Although it is impossible to prevent volcanic eruptions and earthquakes from happening, we can take steps to reduce their impacts. It is therefore useful for us to understand where these types of hazards are likely to occur because we can prepare for them and respond quickly when they happen. We can, for example, build better buildings, develop warning systems, and increase the response capabilities of cities to help reduce the loss of life and economic costs when we know where volcanic eruptions and earthquakes tend to happen.

Your Task

Use an online interactive map to collect data about how often volcanic eruptions and earthquakes happen near the three different types of plate boundaries. Your goal is to use what you know about plate tectonics, patterns, and the use of different scales, proportional

FIGURE L6.1
Earth's layers

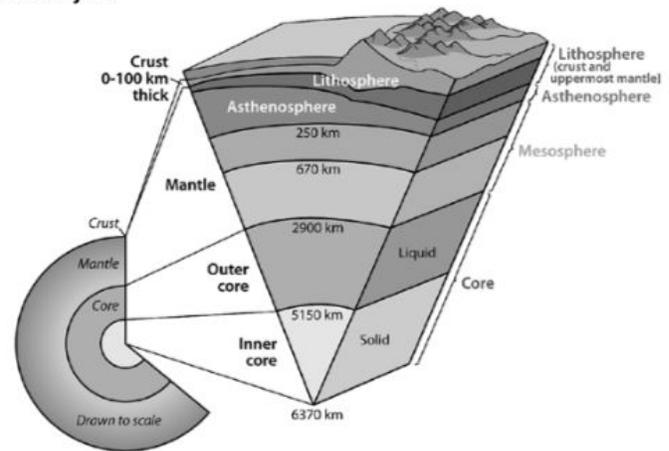
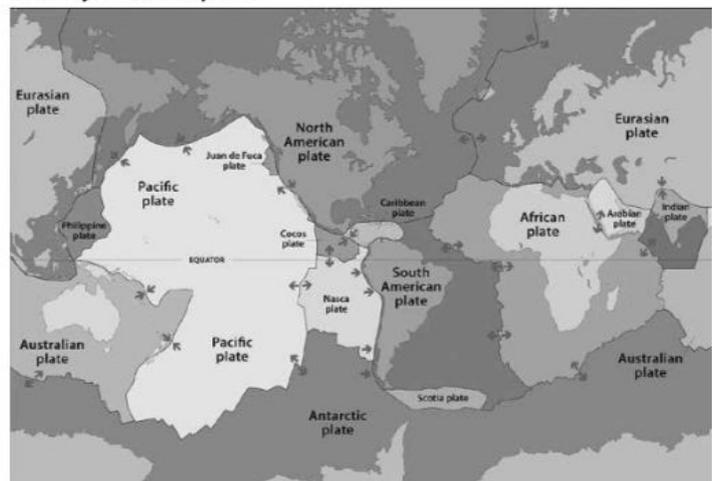


FIGURE L6.2
The major tectonic plates



relationships, and quantities during an investigation to determine if the way plates interact with each other at a specific location is related to the occurrence of volcanic eruptions and earthquakes at that location.

The guiding question of this investigation is: **How Is the Type of Plate Interaction Related to the Nature of the Geologic Activity That Is Observed Near a Plate Boundary?**

Materials

You will use an online interactive map called *Natural Hazards Viewer* to conduct your investigation; the interactive map can be accessed at <http://maps.ngdc.noaa.gov/viewers/hazards>.

Getting Started

Given the nature of this investigation, you must determine what type of data you need to collect, how you will collect the data, and how will you analyze the data to answer the research question.

To determine what type of data you need to collect, think about the following questions:

- How will you identify the location of different types of plate boundary?
- How can you describe an earthquake and a volcanic eruption quantitatively?
- What are the limitations of the available data set?

To determine how you will collect the data, think about the following questions:

- What parts of the world will you need to include in your study?
- What scale could you use to quantify the size of an earthquake or a volcanic eruption?
- Will you need to limit the number of samples you include? If so, how?
- What concessions will you need to make to collect the data you need?
- How will you keep track of the data you collect and how will you organize it?

To determine how you will analyze the data, think about the following questions:

- What types of comparisons will you need to make?
- What types of patterns might you look for as you analyze the data?
- What potential proportional relationships can you find in the data?
- How could you use mathematics to determine if there are differences between the groups?
- What type of diagram or graph could you create to help make sense of your data?

Report

Once you have completed your research, you will need to prepare an investigation report that consists of four sections (be sure to have section headings):

1. Introduction: Give some background information on the topic. Explain what question were you trying to answer and include a hypothesis. (Background info, research question and hypothesis)
2. Procedure: What did you do during your investigation and why did you conduct your investigation in this way? (How you collected and analyzed data)
3. Data: Include a data table and/or graph to show your results. Be sure to include a title for your table or graph with labels for the variables.
4. Conclusion: What is your argument? (Claim - Evidence - Reasoning)

Your report should answer these questions in two pages or less. The report must be typed, and any diagrams, figures, or tables should be embedded into the document. Type your report on Google Docs (12 point font, double-spaced) and share it with your teacher. Your report will be graded based on the rubric in the class syllabus.