Lab Handout

Lab 6. Plate Interactions: How Is the Nature of the Geologic Activity That Is Observed Near a Plate Boundary Related to the Type of Plate Interaction That Occurs at That 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

FIGURE L6.1

Earth's layers

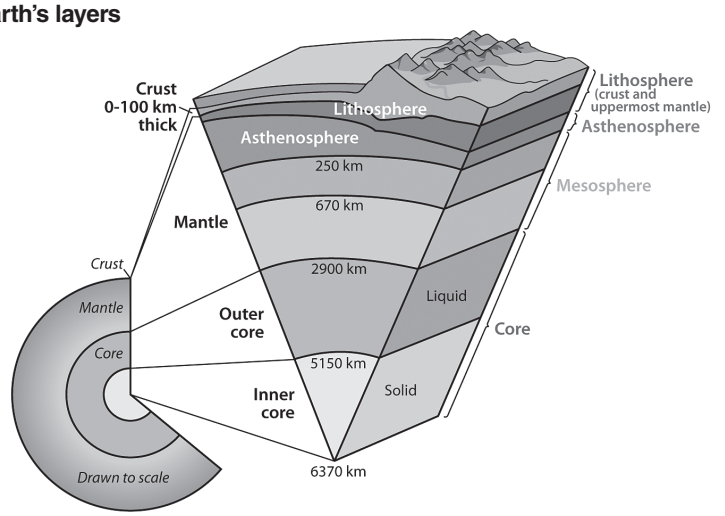
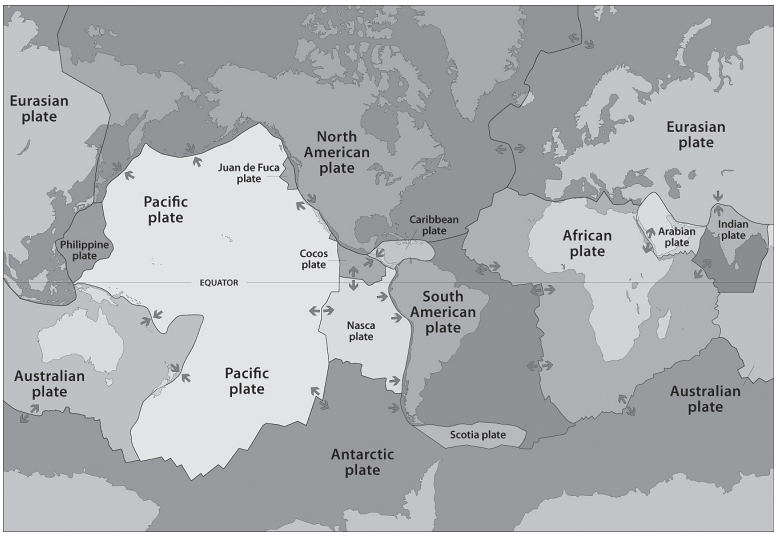


FIGURE L6.2

The major tectonic plates



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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. You 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 earthquake 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 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 nature of the geologic activity that is observed near a plate boundary related to the type of plate interaction that occurs at that 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.*

Safety Precautions

Be sure to follow all normal lab safety rules.

Investigation Proposal Required? ☐ Yes ☐ No

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 or scales should 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 will decide what to include?
- 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 could you create to help make sense of your data?

Connections to the Nature of Scientific Knowledge and Scientific Inquiry

As you work through your investigation, be sure to think about

- the difference between observations and inferences in science, and
- how the culture of science, societal needs, and current events influence the work of scientists.

Initial Argument

Once your group has finished collecting and analyzing your data, your group will need to develop an initial argument. Your initial argument needs to include a claim, evidence to support your claim, and a justification of the evidence. The *claim* is your group's answer to the guiding question. The *evidence* is an analysis and interpretation of your data. Finally, the *justification* of the evidence is why your group thinks the evidence matters. The justification of the evidence is important because scientists can use different kinds of evidence to support their claims. Your group will create your initial argument on a whiteboard. Your whiteboard should include all the information shown in Figure L6.3 (p. 160).

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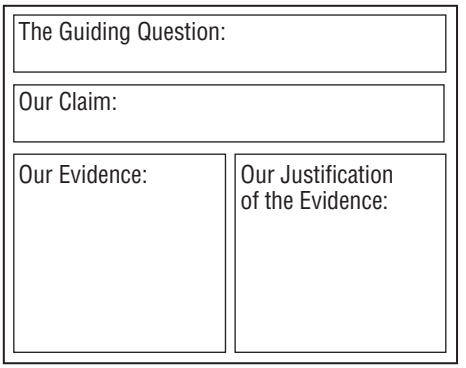
FIGURE L6.3

Argument presentation on a whiteboard



Argumentation Session

The argumentation session allows all of the groups to share their arguments. One or two members of each group will stay at the lab station to share that group's argument, while the other members of the group go to the other lab stations to listen to and critique the other arguments. This is similar to what scientists do when they propose, support, evaluate, and refine new ideas during a poster session at a conference. If you are presenting your group's argument, your goal is to share your ideas and answer questions. You should also keep a record of the critiques and suggestions made by your classmates so you can use this feedback to make your initial argument stronger. You can keep track of specific critiques and suggestions for improvement that your classmates mention in the space below.

Critiques of our initial argument and suggestions for improvement:

If you are critiquing your classmates' arguments, your goal is to look for mistakes in their arguments and offer suggestions for improvement so these mistakes can be fixed. You should look for ways to make your initial argument stronger by looking for things that the other groups did well. You can keep track of interesting ideas that you see and hear during the argumentation in the space below. You can also use this space to keep track of any questions that you will need to discuss with your team.

Interesting ideas from other groups or questions to take back to my group:

Once the argumentation session is complete, you will have a chance to meet with your group and revise your initial argument. Your group might need to gather more data or design a way to test one or more alternative claims as part of this process. Remember, your goal at this stage of the investigation is to develop the best argument possible.

Report

Once you have completed your research, you will need to prepare an investigation report that consists of three sections. Each section should provide an answer for the following questions:

1. What question were you trying to answer and why?
2. What did you do to answer your question and why?
3. What is your argument?

Your report should answer these questions in two pages or less. You should write your report using a word processing application (such as Word, Pages, or Google Docs), if possible, to make it easier for you to edit and revise it later. You should embed any diagrams, figures, or tables into the document. Be sure to write in a persuasive style; you are trying to convince others that your claim is acceptable or valid.