# Title Information

Ishika Patel

Earthquakes and Volcanoes Lab

July 14, 2020

N/A

Table of Contents

[Title Information 1](#_Toc45650166)

[Data and Observations / Calculations 2](#_Toc45650167)

[Exercise 1: Mapping Volcano and Earthquake Data 2](#_Toc45650168)

[Data Table 1: Active Earthquake and Volcano Locations 2](#_Toc45650169)

[Data Table 2: Pinned Map (Photo Requirement) 2](#_Toc45650170)

[Exercise 2: Determining Earthquake Epicenters 4](#_Toc45650171)

[Data Table 3: Time Intervals and Distances of Seismic Waves 4](#_Toc45650172)

[Data Table 4: Africa Map Epicenter Plot (Photo Requirement) 4](#_Toc45650173)

[Exercise 3: Modeling Soil Influences on Earthquake Shaking Hazards 5](#_Toc45650174)

[Data Table 5: Soil Type Hypothesis 5](#_Toc45650175)

[Data Table 6: Soil Shaking Results 5](#_Toc45650176)

[Photo Requirement: Exercise 3, Step 6 & 7 (Gravel-Dry) 6](#_Toc45650177)

[Photo Requirement: Exercise 3, Step 6 & 7 & 23 (Sand-Dry) 7](#_Toc45650178)

[Lab Question Answers 8](#_Toc45650179)

[Exercise 1 Questions 8](#_Toc45650180)

[Exercise 2 Questions 9](#_Toc45650181)

[Exercise 3 Questions 9](#_Toc45650182)

[Conclusion 10](#_Toc45650183)

[References 10](#_Toc45650184)

# Data and Observations / Calculations

## Exercise 1: Mapping Volcano and Earthquake Data

### Data Table 1: Active Earthquake and Volcano Locations

|  |  |  |
| --- | --- | --- |
| **Event** | **Plate Boundary** | **Within Plate** |
| **Volcanic Eruption** | 12 | 5 |
| **Earthquake (4.5+)** | 68 | 22 |

### Data Table 2: Pinned Map (Photo Requirement)

|  |
| --- |
| **Map Photograph** |
| Ishika Patel, GEY 111 Lab 9 July 14, 2020  A graffiti covered wall  Description automatically generated  Volcano (Smithsonian USGS, 2020)  A screenshot of a cell phone  Description automatically generated  Earthquake (USGS Earthquakes, 2020)A close up of a map  Description automatically generated |

## Exercise 2: Determining Earthquake Epicenters

### Data Table 3: Time Intervals and Distances of Seismic Waves

|  |  |  |  |
| --- | --- | --- | --- |
| **Station** | **Interval (min)** | **Distance (x 10^3 km)** | **Calculation** |
| **A** | 0:04:40 | 3.2 | 6:28:40 – 6:24:00 = 0:04:40 |
| **B** | 0:06:10 | 4.6 | 6:31:10 – 6:25:00 = 0:06:10 |
| **C** | 0:04:20 | 3.0 | 6:28:20 – 6:24:00 = 0:04:20 |

### Data Table 4: Africa Map Epicenter Plot (Photo Requirement)

|  |
| --- |
| **Map Photograph** |
| **A close up of text on a white background  Description automatically generated** |

## Exercise 3: Modeling Soil Influences on Earthquake Shaking Hazards

### Data Table 5: Soil Type Hypothesis

|  |
| --- |
| **Hypothesis** |
| If there was a simulated earthquake in various soil types and moisture levels, then the soil type that will best resist the effects of shaking would be the clay in moist conditions because clay is a part of Earth’s crust composition and gets sticky when whereas gravel and sand are more moveable grains and do not condense as greatly when moist. |

### Data Table 6: Soil Shaking Results

|  |  |  |  |
| --- | --- | --- | --- |
| **Soil Type** | **Trial 1** | **Trial 2** | **Average** |
| **Gravel-Dry** | Upright:3  Toppled:0  Leaning:0  Sunken:0 | Upright:2  Toppled:0  Leaning:1  Sunken:0 | Upright:2.5  Toppled:0  Leaning:0.5  Sunken:0 |
| **Gravel-Moist** | Upright:1  Toppled:0  Leaning:2  Sunken:0 | Upright:2  Toppled:0  Leaning:1  Sunken:0 | Upright:1.5  Toppled:0  Leaning:1.5  Sunken:0 |
| **Gravel-Saturated** | Upright:0  Toppled:2  Leaning:0  Sunken:1 | Upright:0  Toppled:2  Leaning:  Sunken:1 | Upright:0  Toppled:2  Leaning:0  Sunken:1 |
| **Sand-Dry** | Upright:1  Toppled:0  Leaning:0  Sunken:2 | Upright:1  Toppled:0  Leaning:1  Sunken:1 | Upright:1  Toppled:0  Leaning:0.5  Sunken:1.5 |
| **Sand-Moist** | Upright:2  Toppled:0  Leaning:1  Sunken:0 | Upright:1  Toppled:0  Leaning:1  Sunken:1 | Upright:1.5  Toppled:0  Leaning:1  Sunken:0.5 |
| **Sand-Saturated** | Upright:0  Toppled:0  Leaning:0  Sunken:3 | Upright:0  Toppled:0  Leaning:0  Sunken:3 | Upright:0  Toppled:0  Leaning:0  Sunken:3 |
| **Clay-Dry** | Upright:0  Toppled:0  Leaning:0  Sunken:3 | Upright:0  Toppled:0  Leaning:0  Sunken:3 | Upright:0  Toppled:0  Leaning:0  Sunken:3 |
| **Clay-Moist** | Upright:0  Toppled:1  Leaning:2  Sunken:0 | Upright:1  Toppled:0  Leaning:2  Sunken:0 | Upright:0.5  Toppled:0.5  Leaning:2  Sunken:0 |
| **Clay-Saturated** | Upright:3  Toppled:0  Leaning:0  Sunken:0 | Upright:3  Toppled:0  Leaning:0  Sunken:0 | Upright:3  Toppled:0  Leaning:0  Sunken:0 |

### Photo Requirement: Exercise 3, Step 6 & 7 (Gravel-Dry)

Trial 1

A close up of a sign

Description automatically generated

Trial 2

A picture containing table, indoor, sitting, food

Description automatically generated

### Photo Requirement: Exercise 3, Step 6 & 7 & 23 (Sand-Dry)

Trial 1

A close up of a sign

Description automatically generated

Trial 2

A close up of a sign

Description automatically generated

# Lab Question Answers

## Exercise 1 Questions

1. **What percentage of weekly volcanic activity occurred on plate boundaries? What is likely the cause of volcanic activity occurring within tectonic plates?**

Approximately 71% (12/17) of weekly volcanic activity occurred on plate boundaries, according to Data Table 1. The cause of volcanic activity within tectonic plates might be their position in relation to volcanic hot spots (HOL Lab, 2020). According to the HOL Lab, “. Hot spots are isolated plumes of magma that may occur within plates”. Volcanic activity can also be geysers and ocean vents erupting which are more often in the middle of oceanic plates as opposed to along boundaries.

1. **The report you used in this exercise, provided by the Smithsonian Institute, only records volcanic eruptions. How would your map plot differ if the report also included geyser and ocean vent activity?**

There would be more volcanic activities recorded if the report included geyser and ocean vent activity. Geysers would be more on the Earth surface (i.e. the Yellowstone geyser in the middle of the North American Plate). Ocean vents might also be in the middle oceanic plates. Both would also be located near hotspots (HOL Lab, 2020).

1. **What percentage of weekly earthquake activity occurred on plate boundaries? What is likely the cause of earthquake activity occurring within tectonic plates?**

Approximately 24% (22/90) of weekly earthquake activity occurred on plate boundaries, according to Data Table 1. According to the HOL Lab, “Earthquakes originating in the middle of tectonic plates are rare and often attributed to the reactivation of ancient faults and human activities”. Earthquake activity could also be caused by the differing temperatures under earths curst and rising and falling of minerals based on temperature and even explosions.

1. **Volcanic eruptions are one source of earthquakes. Describe the association between earthquakes and volcanoes on your pinned map.**

Earthquakes and Volcanos often happened near each other and more often than not occurred along plate boundaries. These phenomena occur at convergent, divergent and transform boundaries. Earthquakes were far more prevalent in my 7-day map as compared to volcanos. With regards to Volcanos, there were only 4 new volcanoes and the rest were ongoing (Smithsonian USGS, 2020).

## Exercise 2 Questions

1. **Why are at least three seismograph locations needed to determine the epicenter of an earthquake?**

At least three seismograph locations needed to determine the epicenter of an earthquake because “waves travel in all directions form the epicenter” (HOL Lab, 2020). With three distances we can devise a more specific epicenter – Afterall, more accurate data can often lead to more specificity.

1. **Describe the three types of seismic waves displayed on a seismogram. Which waves are used to determine the epicenter of an earthquake?**

The three types of seismic waves displayed on a seismogram are P waves, S waves and L waves. P waves are the primary push of the wave. These waves travel the fastest. S waves come after P waves and are a little slower. The S waves are the seconds, side to side, waves. The last set of waves are the L waves which are the surface or Love waves that are across the Earth’s surface. SOURCE: HOL Lab, 2020. The S and P waves are used to determine the epicenter of an earthquake. Specifically, the measurement between the time the P wave starts and the time the S wave starts.

## Exercise 3 Questions

1. **Did the experimental results support your hypothesis? Explain why or why not.**

The experiment results supported my hypothesis with the parameter of a certain moisture content. Clay in general is not the best soil to use, if we were looking at general soil to use, I would recommend gravel. Gravel had the most upright on average, as seen in Table 6 at 2.5 and 1.5 upright. However, when clay was saturated and frankly very doughy, the number of upright coins after a simulated earthquake was all 3 each time.

1. **Which soils demonstrated liquefaction?**

**Sand demonstrated liquification. Each time the coins were put in, the sand at dry and saturated moisture content acted as water and the coins sunk under the sand.**

1. **What was the effect of moistening the soil?**

Moistening the gravel over time made the coins more likely to lean and topple in the gravel. Moistening the sand at first made it a decent soil to keep coins upright. Then when the sand was saturated, we noticed liquefication. Moistening the clay made a MASSIVE mess. The clay however became thicker in consistency and the coins were more likely to lean and stay upright as compared to the original sinking.

# Conclusion

The premise of this lab was to discover the impact and frequency of volcanos and earthquakes.

Beginning with Exercise 1, I went on to graph and map the earthquakes and the volcanos in the past 7 days of recorded data. A trend that I have notices is the frequency of these events to occur near a plate boundary as opposed to inside a plate. That is to not d\say that neither occurs within a major plate. For example, a subsection of volcanos, Geysers, occur in Wyoming in the middle of the North American Plate. Also, Utah has frequency earthquakes this year already and is not near a plate boundary.

Moving to Exercise 2, I learned about the different types of seismic waves and how to estimate the epicenter of an earthquake. There are three types of waves we covered: P-waves, S-waves, and L-waves. In that order the waves decrease in speed. The P and S waves help with deciphering an epicenter. The Epicenter lies in the middle of often 3 graphed P and S waves converted to distance.

In Exercise 3, I looked into the impact of soil and moisture content to earthquake damage. The best type of soil would be saturated clay because unless given great pressure downwards, the coins were stagnant in the wet and mushy clay. Sand was the soil that had liquefication where all the coils started to sink as if they were in water! This experiment was fun, but the clean-up was a mess!

# References

Physical Science Department. (2020, Summer). GEY111 HOL lab manual.  Colorado: CCCOnline.  Retrieved from class website at:

<https://ccco.desire2learn.com/d2l/le/content/2768021/viewContent/29148171/View>

Physical Science Department. (2020, Summer). GEY111 Lab Report Assistant.  Colorado: CCCOnline.  Retrieved from class website at:

<https://ccco.desire2learn.com/d2l/le/content/2768021/viewContent/29148191/View>

Smithsonian / USGS Weekly Volcanic Activity Report. (2020). Retrieved July 14, 2020, from <https://volcano.si.edu/reports_weekly.cfm>

USGS Earthquakes. (2020). Retrieved July 14, 2020, from <https://earthquake.usgs.gov/earthquakes/map/>