Spectacular phenomenae of disaster: tsunamis, earthquakes and volcanoes

History

Tsunamis, Volcanoes, and Earthquakes: The Dangers They Present

Dr. Kusky writes in the introduction of his book, “ Volcanic eruptions provide one of the most spectacular of all natural phenomena, yet they also rank among the most dangerous of geological hazards” (xv). It is always hard to tell when the next natural disaster will happen, and what hazards it will wreak on our environment. There is little to none warning system in place for these three natural disasters, which in turn makes it difficult to judge which environments will be in danger. Ever since the beginning of the earth, natural disasters have wreaked havoc on many countries, but what other harms do they bring to our environment? Volcanic eruptions can bring glass, rock, and gasses into the environment, earthquakes can devastate and level towns or cities, and tsunamis can also devastate towns or cities but can bring in and move materials that do not belong in the area.

Volcanic eruptions are rare events that sometimes have little warning, but scientists are learning and working on how to predict the next big explosion. There are many hazards to look at when volcanoes erupt; for example, one can look at the basalt flow and the pyroclastic flow. The pyroclastic flow contains ash, which can be shards of glass, rock, and gasses. As seen above the ash particles are very fine pieces of material, measuring about 105 micrometers. The gasses that are released travel along with the ash cloud and may cause acid rain, or a slight cooling in the earth’s atmosphere due to the sulphate aerosols. The aerosols, “ reflect solar radiation and absorb heat, thereby cooling the earth. Sulphate aerosols also take part in chemical reactions, forming ozone destructive material” (“ Water”). Along with the pyroclastic flow, we cannot forget about the basalt flow. The basalt flow consists of lava that has a low-silica percentage, this means that it will contain more magnesium and iron. In turn, this means these flows are less liquid and more viscous, meaning having a think consistency between a solid and a liquid. Since the flow is so thick and slow moving, it cools rapidly creating what are commonly called basalt columns.

While there are many small volcanic eruptions happening around the globe, the most recent one that made the news was the Calbuco Volcano of Chile. According to Payne, “ In a twenty-four hour time span it erupted twice, and deposited up to twenty-four inches of ash in surrounding areas” (See Fig 1). According to the United States Geological Services (USGS), “ Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive, and conducts electricity when wet” (“ Properties of”). Since this ash is not from a fire, it is very heavy and will crush a house under its weight. This means that the people in the surrounding area of the ash cloud are in extreme danger, because even a couple of inches of the ash on one’s roof can bring the little shack to the ground injuring and or killing those inside.

Figure 2. Photograph of Chile’s Calbuco Volcano spewing ash. Photo taken by Helen Rodgers (used in Payne)

Related to, but not always causing volcanic eruptions, are earthquakes. These natural disasters are untimed and always unpredictable. While there are some earthquake warnings, they can still hit in an unpredicted spot at any given time. Going back in time to the middle of the Chinese dynasties, roughly 132 AD, the first seismograph was invented. Before that time, earthquakes could never be predicted, but the scientists knew when one happened. How it works is there are eight dragons attached to the side of a vase and a brass ball was placed inside of the mouth, represented by the figure below.

Figure 3. First seismograph invented by Chinese scientist Chang Heng (“ How Are”)

When an earthquake happened, either the ball would roll or fallout of the mouth indicating what direction it came from. This was the first time an attempt was made to study and try to determine out how earthquakes work or happen.

In today’s time, scientists are busy looking at data collected from an earthquake from 1700. In the Cascadia Subduction Zone, off the coast of Washington, Oregon, and northern California, a magnitude 9. 0 earthquake devastated the coast with a tsunami that spread across the Pacific Ocean. Studies are being done to see when the next quake from this zone will happen. Research shows that a big quake has happened in this area every 234 years, the last was 315 years ago. We are not only overdue for the next earthquake in this zone, but technology nowadays cannot predict when it will happen. Scientists say that there will be a solid four minutes of shaking; after the shaking has stopped people on the coast have 15 minutes to move to safety before the tsunami hits. That is not enough time to react when the tsunami will affect almost 200 miles inland (Spitz).

Lastly are tsunamis, one of the few natural disasters to happen directly after another natural disaster. Only a big earthquake can trigger tsunamis, that is if the quake is a magnitude 7. 5 or higher. Even then the tsunami will not be that devastating, to have a devastating tsunami look back at the most recent one that hit Japan in 2011. The earthquake that caused this devestating tsunami was a magnitude 9. 0, and hit forty-five miles off the coast, and fifteen miles below sea level. This in turn produced a thirty-foot tsunami that Japan is still having troubles recovering from (Oskin). For example, the Fukushima Nuclear Power Plant had a level 7 nuclear melt down, small amounts of radioactive material made it out into the ocean that are still present today. A level 7 melt down ranks how serious the melt down is, and 7 is the worst on the scale. The figure below represents where the earthquake hit in Japan, represented by the star, and how fast the tsunami traveled, represented by the hour markers. The yellow dots represent tsunami tide gages that are used to alert scientists where the tsunami is and how tall it is at the given time.

Figure 4. Representation of the 2011 Earthquake and Tsunami the hit Japan, travel times are represented for how far and fast the tsunami traveled (Oskin)

The environmental effects that tsunamis have vary from not only area to area, but also what belongs in that area. For example, the Indian Ocean 2004 tsunami did not hit any nuclear reactors like the Japanese tsunami, which they named Tohoku Tsunami, but it brought thousands of gallons of seawater inland contaminating what drinking water was available. As mentioned in the above paragraph, the Tohuku Tsunami hit nuclear reactors that then spilt into the water, which still radiates today. From what the news and scientists say only a small amount of leakage happened, but that small amount can do damage to a school of fish swimming in the area, or hurt the surrounding ecosystem itself.

To finish there have been many volcanic eruptions, earthquakes, and tsunamis that have devastated the earth's surface for many years. However, we may not be able to tell when the next natural disaster will hit, but we can at least learn from the past and try to predict the next and have a better understanding of how they work. Stated in the introduction of Roy Chester's book,

If we needed an event to remind us of the great danger that could arise from natural disasters, then the Indian Ocean tsunami of 2004 played the role well… there was one single underlying thread that controlled the way the surface of our planet had evolved; a thread that underpinned the way volcanoes, earthquakes, and tsunamis were generated. That thread was the theory of plate tectonics. (1)

Maybe that is the key to unlocking the knowledge of the natural disasters, tectonic plates. If we learn about how natural disasters work then maybe, we can have an advanced warning system to fully predict the next major earthquake, volcanic eruption or tsunami.