Earthquakes – the most deadly natural catastrophes essay sample

Earthquakes are considered one of the most deadly natural catastrophes that can affect human life. Most often, a quake occurs in earthquake-prone zones where two tectonic plates meet, split, or slip by one another; the type of plate contact determines whether the earthquake will be shallow or deep. During the movement of these plates, intense forces overcome the friction between the plates. If the plates become “ locked together,” forces build up and eventually must give away – with the plates lurching into new positions and creating an earthquake. Other earthquakes form in association with volcanic regions, where the buildup of heat and pressure often triggers smaller tremors and localized quakes.

The focus is the point under the Earth’s surface where the earthquake energy is released. The point on the surface just above the focus is called the epicenter. Most earthquake foci occur no more than 62 miles (100 kilometers) below the surface.

Earthquake waves, or seismic waves, travel out from the focus of an earthquake in all directions. Primary waves (P-waves) move in a back-and-forth direction; they are the fastest seismic waves, reaching the far side of the globe in 20 minutes. The waves travel though the Earth’s molten core. Secondary waves (S-waves) move in a side-to-side direction; they are slower than P-waves and can move only through solids, stopping at the Earth’s central molten core. Love and Raleigh waves (both called L-waves) travel along the Earth’s surface, moving up, down, and sideways and creating much of the structural damage associated with earthquakes.

The Threat of Tsunamis

A tsunami (or seismic sea wave), from the Japanese words tsu (“ harbour”) and nami (“ wave”), is a very large wave caused by underwater earthquakes or volcanic eruptions. Often incorrectly called “ tidal waves,” tsunamis are not caused or influenced by the tides, though at high tide, the size of a tsunami may be significantly increased.

About 80 percent of these great waves occur in the Pacific Ocean, about 10 percent in the Atlantic Ocean, and 10 percent in other oceans. Tsunami wavelengths, or crest-to-crest measurements, often reach up to 600 miles (965 kilometres), but their amplitudes, or heights, range only from 1 to 2 feet, making them undetectable at sea. The destructive power of a tsunami occurs as the wave approaches a coastline, when the shallower bottom causes the wavelength to become shorter and the amplitude greater. A tsunami may be up to 200 feet (61 meters) high when it reaches shore. It can reach speeds of 150 miles (241 kilometres) per hour, destroying any structures in its path.

Modified Mercalli Scale

The Mercalli earthquake intensity scale, developed by Italian seismologist Giuseppe Mercalli in 1902, is a measure of an earthquake’s destructiveness. The scale was modified by American seismologists in the 1930s (called the modified Mercalli scale). Modern technology has made the Mercalli scale obsolete, though the method is often used to fill in “ seismic blanks” when there is an insufficient number of seismographs.

Richter Scale

Charles Richter developed The Richter scale, used to measure earthquake intensity, in 1935. It measures an earthquake’s magnitude (intensity) on a scale of 1 to 8. 8 which means that each successive whole number represents a 10-fold increase in power. Each magnitude number represents the maximum amplitude of a seismic wave at a distance of 100 miles (161 kilometres). The difference in time between the first and second (primary and secondary) waves is measured, and an empirical factor is added (which takes into account the fact that the waves become weaker as they travel away from the focus) to determine the magnitude of the quake.

Richter Number Increase in Magnitude by a Factor of 10

1 1 2 10 3 100 4 1, 000 5 10, 000 6 100, 000 7 1, 000, 000 8 10, 000, 000

Comparison of Richter Magnitude and Energy Released

Richter Number Approximate Energy Released (Amount of TNT)

1. 170 grams 2. 6 kilograms 3. 179 kilograms 4. 5 metric tons 5. 179 metric tons 6. 5, 643 metric tons 7. 179, 100 metric tons 8. 5, 643, 000 metric tons

Famous Earthquakes

Famous earthquakes are usually arranged by their magnitude on the Richter scale. To compare, the average tornado can rumble with a Richter scale magnitude of 4. 8, and a 1-megaton nuclear bomb can measure 7. 5 on the Richter scale. The highest magnitude earthquake recorded to date – at about 9. 6 (although the magnitude is debated) – was the 1960 Chilean earthquake, in which a fault 621 miles (1, 000 kilometers) long slipped 33

feet (10 meters); the largest deep quake on record was on June 9, 1994, beneath a remote area in the Amazon rain forest of northern Bolivia, with a Richter scale magnitude of 8. 3. Below are some of the more famous quakes of the last two centuries.

Year Location Richter Number

1811-1812 New Madrid earthquake, Missouri 8. 0-8. 3 (a series of quakes from December 1811 to March 1812)

1899 Yakutat Bay earthquake, Alaska 8. 3-8. 6 (estimate)

1906 San Francisco earthquake, California 7. 7-8. 25 (estimate)

1960 Chilean earthquake, Chile 9. 6 (disagreement on magnitude)

1964 Alaskan earthquake, Alaska 8. 5

1971 San Fernando earthquake, California 6. 5

1976 Tangshan earthquake, China 8. 2

1985 Mexico City earthquake, Mexico 8. 1

1988 Armenian earthquake, Armenia 6. 9

1989 Loma Prieta earthquake, California 7. 1

1990 Northwest Iran earthquake, Iran 7. 7

1994 Bolivian earthquake, South America 8. 3 (largest deep quake on record)

1994 Northridge earthquake, California 6. 8

1995 Kobe earthquake, Japan 6. 8

Volcanoes

Volcanoes form when magma, the hot, molten rock under the Earth’s surface, upwells between tectonic plate boundaries (Iceland formed in this way) or at hot spots (Yellowstone National Park). A magma chamber holds the hot material, and weaker areas of solid rock above the magma chamber allow the magma to rise. When the surface can no longer hold back the pressure of the magma and the dissolved gases associated with it, an eruption occurs at the surface. Volcanoes can remain dormant for hundreds to thousands of years, then erupt violently.

Most of the world’s active volcanoes (and earthquakes) occur in specific zones. The volcanoes of the Pacific Ocean form the Ring of Fire (Circle of Fire), in which many tectonic plates undergo subduction. Hot spots also produce volcanoes but are not associated with plate boundaries. They form from the upwelling of magma though weak spots in the crust; the Hawaiian Islands resulted from hot spot activity.

There are four types of volcanoes:

Shield volcanoes form by layers of lava flows. The Hawaiian Islands are shield volcanoes.

Composite volcanoes form by alternating layers of ash and lava. Mount St. Helens in Washington State is a composite volcano.

Cinder volcanoes are composed of small lava fragments and form slopes of 30 to 40 . Sunset Crater in Arizona is a cinder volcano.

Lava domes are thick, pasty layers of lava. Lassen Peak, California is a lava dome.

Aftermath of a Modern Volcano

From June 14 to 16, 1991, on the Philippine island of Luzon, Mount Pinatubo erupted, resulting in a stratospheric cloud that contained roughly twice as much sulfur dioxide as the one produced by Mexico’s El Chichï¿½ in 1982. But even more amazing was the fact that the cloud circled the Earth within the short span of 3 weeks. The potential effect was evident for months after the eruption: Mount Pinatubo’s release of sulfur dioxide resulted in unusually brilliant sunsets in different parts of the world.

Scientists predicted even greater effects from this eruption – that the volcanic particles in the air would reflect radiation from the Sun and cause a reduction in surface temperatures. As a result, the Northern Hemisphere would have colder than normal weather. The decrease in solar energy would decrease the wind strength along the equatorial belt. If the winds died down, the surface temperature of the Pacific Ocean would rise – contributing to the development of El Niï¿½, the anomalous current of warm water that flows north along the west coast of South America.

Did the volcano create such problems? Scientists do not totally agree. But in the years following the eruption of Mount Pinatubo, El Niï¿½ conditions persisted longer than usual; there was a major blizzard in March 1993 – one

of the worst of the century – along the East Coast of the United States, and other weather oddities occurred.