

# Dante's Peak - Fact and Fiction

## Enjoy the movie, but know the Geology!

- Read the following facts about volcanic eruptions and volcanoes in general.
- Watch the movie Dante's Peak, keeping these facts in mind as you view it.
- As you notice something in the movie that either supports a fact or departs from it in order to create more drama in the movie, then list it in the correct space on the worksheet.

### **FACT 1: VOLCANIC ERUPTIONS - EXPLOSIVE STRATOVOLCANO VERSUS GENTLE SHIELD VOLCANO**

The fictitious volcano in the movie, Dante's Peak, is located in the *Cascade Range* in the United States Pacific Northwest, a mountain range noted for the famous eruption of Mt. St. Helen's, a *stratovolcano*.

When a **Stratovolcano** (AKA Composite Volcano) erupts, the lava which flows from the volcano is very thick (viscous) due to a high silica (quartz) content. Therefore, the "sticky" lava tends to remain near and build up around the cone of the volcano and NOT flow great distance from the volcano itself.

Stratovolcanoes are famous for their destructive ash clouds and pyroclastic debris (see definitions below) which travel great distances in the air, finally falling to the ground while still very hot, often fusing into a rock called tuff and setting fire to objects they come in contact with. Their eruptions are definitely the most violent and explosive.

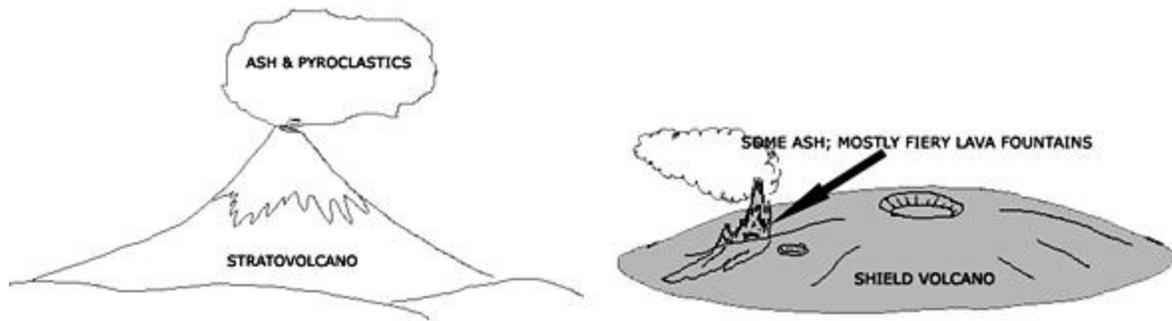
Also, pyroclastics and lava are normally not emitted during the *same eruption*. Stratovolcanoes alternate between pyroclastic flows and lava flows in successive eruptions which is what builds (cements) their ejecta allowing the construction of a cone shape that reaches great heights.

A **Shield Volcano**, on the other hand, such as those that built the Hawaiian Island chain, emits fluid basaltic lava that is low in silica and which flows quite easily and quickly and which travels a considerable distance from the actual crater from which it erupted.

Shield volcanoes may be high in elevation, but are not cone-shaped. Rather, because their lava is so fluid and tends to flow away from the crater, they are more gently sloped and wide across the volcano.

Shield volcanoes are not famous for ash clouds but rather "fire fountains", glowing streams of red hot lava that eject from the volcano's crater upward like water from a statue in a fountain.

Look for the type of lava flow in the movie. Are there ash and pyroclastics present during the eruption? Is their fluid lava (as from a Shield Volcano) that moves far and fast or sticky lava (as from a Stratovolcano) that stays close to the volcano? Does Dante's Peak stick to the facts for a typical Stratovolcano?



### **FACT 2: LAVA IS VERY HOT!**

Lava flows reach temperatures of over 1500 degrees Fahrenheit. That is hot enough to immediately set on fire any object the lava comes into contact with. In fact, the heat alone that incandesces from the lava is enough to cause surrounding objects to burst into flames!

Notice when the main characters (the geologist, the mayor and her son) are escaping from the eruption in a car.

### **FACT 3: ASH IS DENSE AND FAIRLY HEAVY IN WEIGHT**

Ash and pyroclastics are not light in weight, nor do they fall like confetti as they fly through the air then fall to the ground, landing on objects and *people*.

What is the falling ash like in the movie? What does it look like they used to simulate falling ash?

### **FACT 4: LAKES AROUND A STRATOVOLCANO CAN BE MORE ACIDIC**

Sulfur Dioxide is a gas common to volcanic eruptions. This gas, when dissolved in water, produces sulfuric acid, one of the worst known acids and one a person would definitely not want to come in contact with.

Other gases dissolved in magma, hydrogen sulfide, hydrogen fluoride, hydrogen chloride and carbon dioxide, also contribute to the acidity of surrounding bodies of water.

A pH of 0-2 (where 7 is neutral, and any number lower than that is acidic) is not impossible and the water can be quite corrosive to metal. If you think that the juice from a lemon is acidic, imagine water thousands of times more acidic than that! One definitely would not want to swim in water that is very close to an active stratovolcano.

In a period of perhaps several hours, a thin metal wire could corrode away.

Notice what happens to Grandma in the movie and also to the metal boat the actors try to escape in. Would you say that the events stay in line with the facts?

## **FACT 5: CARBON DIOXIDE GAS CAN BE RELEASED FROM ACTIVE UNDERGROUND MAGMA CHAMBERS**

As carbon dioxide, a component of magma, leaves underground magma chambers, travels up through soil, and is emitted into the air, it is possible that living things (birds, small animals and trees) can be affected by this high carbon dioxide gas concentration. In fact, it is one of the early warning signs of a volcano's increasing activity and possible future eruption. However, these signs do not necessarily indicate an eruption that will take place any moment.

Around Mammoth Mountain, California, trees have been dying since 1989 due to higher carbon dioxide emissions coming from deeply buried magma, emissions which are coming through the soil towards the surface (thus affecting tree roots). Yet, the mountain has not yet erupted.

In the movie, is Pierce Brosnan (the geologist) immediately alarmed by animals in the area dying from carbon dioxide?

## **FACT 6: OBSERVATIONS CAN PROVIDE EARLY WARNING OF A POSSIBLE VOLCANIC ERUPTION**

Unlike earthquakes, volcanic eruptions can often be predicted using several methods of observation. However, the exact time of a volcanic event cannot be so easily foretold. Noticing changes in the area around a volcano, or with the actual volcano itself, can tell us that the volcano is now active, but not whether an eruption will happen the next day, two weeks in the future or several months or more.

Scientists use several instruments in order to observe changes in volcanos:

- Seismographs: Magma moving through the ground causes earthquake tremors that can be recorded by seismographs.
- Observation of increased acidity in surrounding water.
- Observation of increased carbon dioxide levels in soil and air with the aid of gas sensors.
- Temperature Probes to detect rising temperatures in the ground.
- Tiltmeters: Instruments that detect changes in shapes and angles of land structures. A change in the tilt of a volcano could be caused by magma building and shifting within the mountain.
- Satellites (example: NASA's robot space explorers) are used to observe changes in the size and tilt of a volcanic mountain.

## **FACT 7: ROBOTS ARE USED TO EXPLORE VOLCANOES FOR EARLY WARNING SIGNS OF A VOLCANIC ERUPTION**

In Antarctica a NASA robot *was* used to explore the inside of a volcano (Mount Erebus). Ironically, the robot used in Antarctica was named: **Dante**.

**"Dante II** is an multi-legged frame walking robot that was designed by NASA and Carnegie Mellon University to investigate live volcanoes and help test robotic technology for NASA. The robot is a framewalker with eight pantographic legs arranged in two groups of four, on inner and outer frames.

Dante II is connected by a tension-controlled tether to maintain stability and to allow rappelling on steep slopes. In 1994 Dante II was adopted to explore the Mount Spurr volcano in Alaska." [1]

As you watch the movie, does this description of Dante II seem familiar at some point?

It should be pointed out that the use of robots is not considered common practice to predict volcanic eruptions. The other instruments listed above are more reliable and more commonly used.

In the movie, notice if any of the instruments and supporting data were used to predict the eruption of Dante's Peak.

### **ONE LAST THOUGHT:**

Pierce Brosnan's alarm based on the readings from his instruments and his observations may or may not have been warranted.

For example, earthquakes increasing in intensity, were recorded for 3 months preceding the eruption of Mount St. Helens.

A measurable bulge, caused by magma forcing its way through a side vent, extended 450 feet outward on the volcano's north side. It grew over a period of months before the actual eruption.

First indications of trouble and a possible concern over an impending eruption occurred on March 16, 1980.

Mount St. Helens actually erupted on May 17, 1980. [2]

Scientists may have indications of impending disaster, but the actual time an event will take place is still an unknown.

However, in this author's opinion: evacuation is in order if the signs point to the possibility of impending disaster. Better safe than sorry.

### **DEFINITIONS**

**Active Volcano:** A volcano that is erupting. Also, a volcano that is not presently erupting, but that has erupted within historical time and is considered likely to do so in the future.

**Ash:** Fine particles of pulverized rock blown from an explosion vent. Measuring less than 1/10 inch in diameter, ash may be either solid or molten when first erupted. By far the most common variety is vitric ash (glassy particles formed by gas bubbles bursting through liquid magma).

**Ashfall (Airfall):** Volcanic ash that has fallen through the air from an eruption cloud. A deposit so formed is usually well sorted and layered.

**Composite Volcano:** A steep volcanic cone built by both lava flows and pyroclastic eruptions.

**Lava:** Magma which has reached the surface through a volcanic eruption. The term is most commonly applied to streams of liquid rock that flow from a crater or fissure. It also refers to cooled and solidified rock.

**Lava Flow:** An outpouring of lava onto the land surface from a vent or fissure. Also, a solidified tongue like or sheet-like body formed by outpouring lava.

**Lava Fountain:** A rhythmic vertical fountainlike eruption of lava.

**Magma:** Molten rock beneath the surface of the earth.

**Pyroclastic:** Pertaining to fragmented (clastic) rock material formed by a volcanic explosion or ejection from a volcanic vent.

**Shield Volcano:** A gently sloping volcano in the shape of a flattened dome and built almost exclusively of lava flows.

**Silica:** A chemical combination of silicon and oxygen.

**Tuff:** Rock formed of pyroclastic material. [3]