

March 8, 2021

More on Volcanoes as a Geohazard



Figure 1 - Mt. Sinabung, March 2, 2021 ¹

After last week's posting, two more volcanoes were in the news: Mt. Sinabung in Indonesia erupted ¹ and geologists warned that Keilir Volcano in Iceland will soon erupt ². With that in mind, I thought that it would be worthwhile to look further into the dangers from volcanoes.

The Nature of Lava

Erupting volcanoes spew out hot gases, molten rock, rock fragments and dust, so there are some pretty obvious dangers. Just how dangerous depends on the nature of the lava produced by the eruption. Lava varies in viscosity from fairly fluid to very viscous. Fluid lava will simply flow out of the volcano's pipe while viscous lava may explode. The presence or absence of water will also affect the eruption.

The viscosity of lava depends in large part its chemical composition, especially its silica content. The best way to describe this composition is by way of the minerals that will crystallise out of the melt. Figure 2 shows a general classification of igneous rocks, volcanic rocks are considered extrusive igneous rocks.

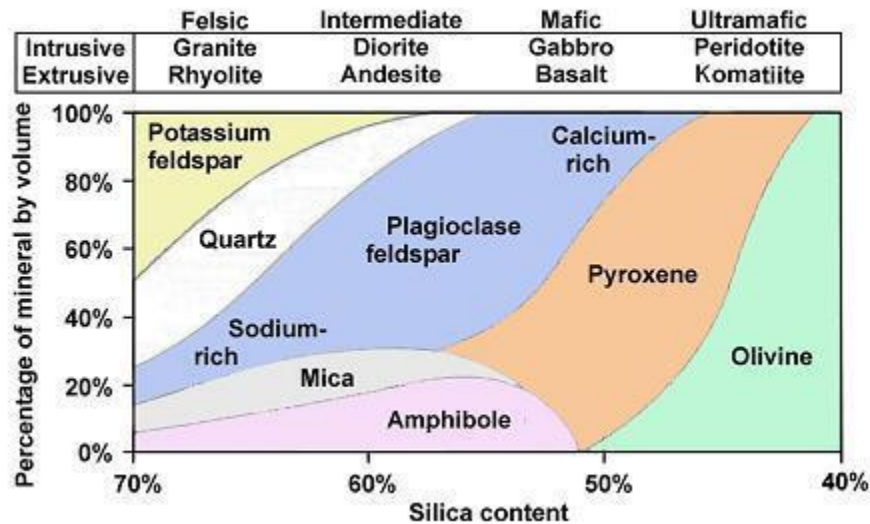


Figure 2 - General Classification Igneous Rocks ³

In general, the most fluid lavas will be those that form mafic and ultramafic rocks. The term "mafic" refers to the dark colour of rock dominated by minerals such as olivine, pyroxene and calcium rich plagioclase feldspar. At the other end of the spectrum, lavas that produce felsic rock will tend to very viscous; the term "felsic" refers to the lighter colour of the rock dominated by minerals such as orthoclase (potassium feldspar), quartz, and sodium rich plagioclase.

Hazards from Volcanic Eruptions

Lava flows



Figure 3 - Eruption of Kilauea ⁴

Molten rock flowing directly from a volcanic pipe or vent is probably the safest kind of volcanic eruption to be around. An example of a lava flow are the ongoing eruptions at Kilauea, Hawaii.

Although relatively fluid, molten lava moves slowly and is easily avoided. However, there are distinct dangers from flowing lava. Hot flowing lava will cause any flammable item in the vicinity to catch on fire including vegetation and wooden structures. Also, flowing lava can bury anything that gets in the way its way including cars, roads and buildings. ⁵

Pyroclastic Flows



Figure 4 - Pyroclastic Flow, Mt. Merapi, Indonesia. ⁶

Moving downhill at 80 km/hr; you really want avoid these hellishly hot (200 - 700 degrees C)avalanches of volcanic dust, gases and steam. Be prepared to run far, pyroclastic flows can travel five to fifteen km from the volcanic eruption. Pyroclastic flows are associated with explosive eruptions such as at Mt. Pinatubo, Philippines, El Chicon, Mexico and Mt. Merapi, Indonesia (Fig. 4, above).⁵

Debris Flows and Lahar



Figure 5 - Lahar at Mt. St. Helens⁷

Another hazard from volcanic are debris flows, sometimes called lahars. Mixtures of volcanic ash, soil, rocks, water, and any other debris the lahar pick up along the way (trees, dead bodies), lahars travel down the steep slopes of volcanoes, during or after volcanic eruptions. The water often comes from melted ice. The debris flow has the consistency of cement, and will often travel long distances along river valleys downstream from the volcano. Lahars from Mt. St. Helens, in Washington State, traveled up to 97 km from the volcano. ⁵

Landslides

Volcanic landslides occur when the structure of the main body of a volcano fails before, during or after an eruption ⁵. There was a landslide immediately before the main eruption of Mt. St. Helens. [See this video from the USGS](#); the landslide is discussed beginning at 4:08.

I'll discuss more about landslides in an upcoming posting.

Volcanic Ash and Tephra

Explosively erupting volcanoes discharge various sizes of material ranging from very fine silt to cobbles and boulders. The fine grained material is usually called "volcanic ash" and the larger material is often called "tephra" ⁵. Tephra cobbles and boulders are sometimes called "volcanic bombs".

The obvious hazard from volcanic ash and tephra is burial. So, unless you want to become a future exhibit in a museum, like the unfortunate inhabitant of Pompeii below, you would be wise to vacate areas suffering volcanic ash falls.



Figure 6 - Cast of Pompeii Resident ⁸

You may have to travel far, though; volcanic ash can travel hundreds of miles from the volcanic eruption ⁵.

Another danger from volcanic ash is inhalation. Volcanic ash is made up of fine particles of volcanic glass ⁵; inhaling volcanic glass can lead to respiratory failure. Volcanic ash, carried aloft, high into the atmosphere, can also cause damage to jet engines. It can be a major hazard for airline travel, such as when the [Eyjafjallajokull](#) Volcano in Iceland erupted in 2010 ⁹.

Eyjafjallajokull is on the Reykjanes Peninsula in SW Iceland. Also on the Reykjanes Peninsula is the Keilir Volcano, which, as we noted at the beginning of this post, may be ready to erupt ². Due to the earthquakes and likely volcanic activity, the Iceland civil defence authorities are warning people of the dangers of landslides and rock falls ¹⁰. Icelanders, known to be fairly common sense about these things, refer to the volcanic activity on Reykjanes Peninsula as "tourist eruptions" ¹⁰, i.e. good for the tourist business.

Volcanic Gases

Volcanic eruptions usually include emissions of various gases such as steam, carbon dioxide, sulphur dioxide and hydrogen sulphide. Sometimes the gaseous emissions alone are sufficient to cause great harm. Sulphur dioxide and hydrogen sulphide are both poisonous gases and high concentrations of carbon dioxide present an asphyxiation hazard. ⁵

The release of carbon dioxide from Lake Nyos, a lake in a volcanic crater in Cameroon, killed approximately 1700 people August 26, 1986 ¹¹.

Pay Your Money and Take Your Chances

Volcanoes are both dangerous and beautiful. If you live in the vicinity of an active volcano, familiarise yourself with its eruption history and characteristics. If you plan to visit an active volcano, enjoy the spectacle but keep the risks in mind. Try not to be like these tourists at [Eyjafjallajokull](#).

Notes on Grain Size

When referring to the grain size of material, I use the Wentworth Scale ¹², as shown in Table 1, below.

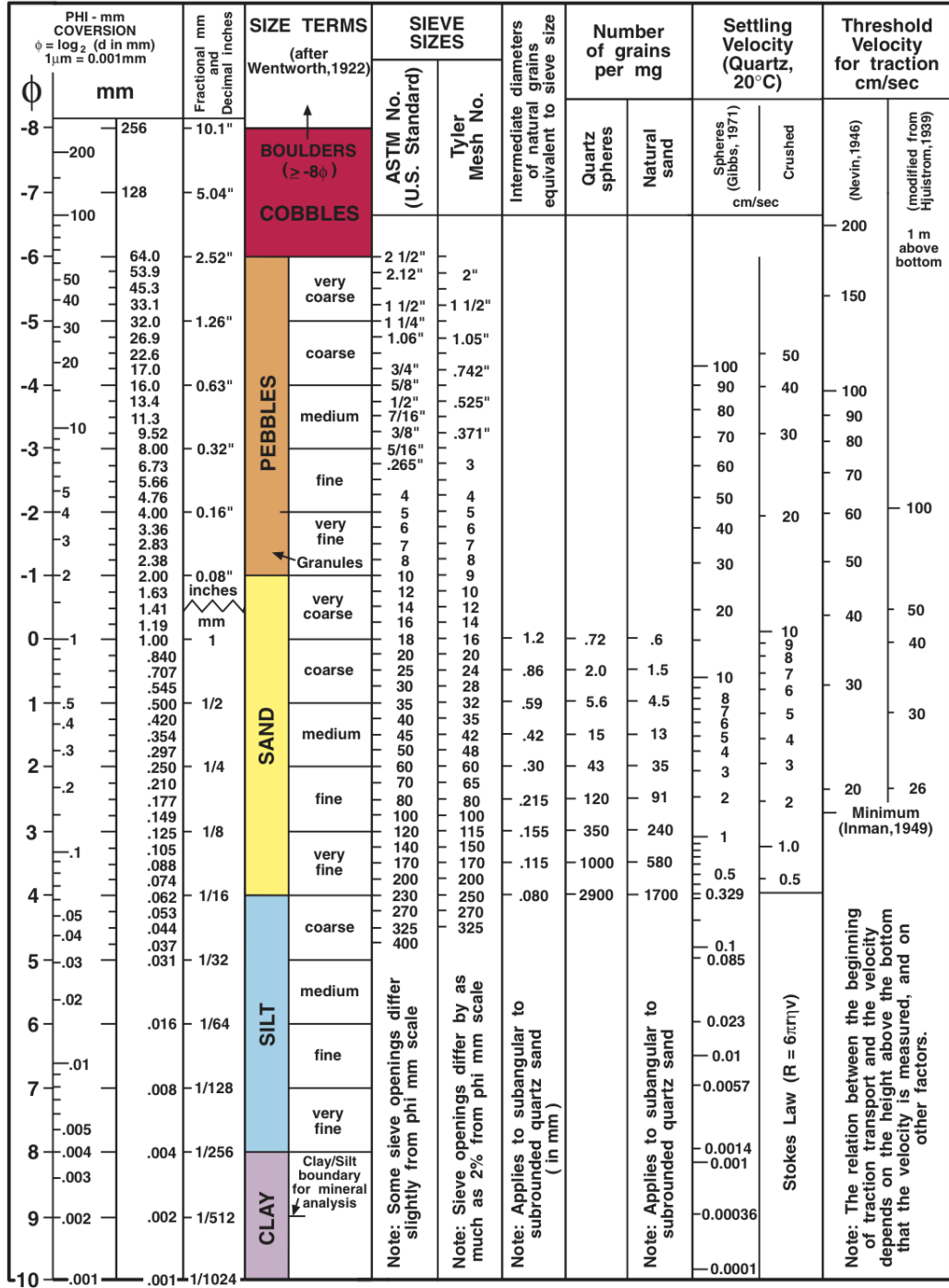


Table 1 - Wentworth Grain Size Scale ¹³

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