June 28, 2021

Comments and Opening Remarks

As usual now, I'll start this week's blog posting with a few comments before going on to my main posting, this week some more on volcanic rocks.

There were some interesting paper that came out recently. Have a read and make up your own mind:

- *A pulse of the Earth: A 27.5-Myr underlying cycle in coordinated geological events over the last 260 Myr* by Michael R. Rampino, Ken Caldeira and Yuhong Zhu. This paper postulates that there is a definite cyclical pattern to major geological events happening every 27.5 million years or so.

- A paper entitled *Nickel isotopes link Siberian Traps aerosol particles to the end-Permian mass extinction* by Menghan Li, Stephen E. Grasby, Shui-Jiong Wang, Xiaolin Zhang, Laura E. Wasylenki, Yilun Xu, Mingzhao Sun, Benoit Beauchamp, Dongping Hu, and Yanan Shen examines the geochemical evidence for worldwide environmental changes that led to the mass extinction event. Long story short: volcanic eruptions at the Siberian Traps led to catastrophic changes in ocean chemistry. Note: approximately 81% of marine species and 70% of terrestrial vertebrate species went extinct at the end of the Permian Period.

- Continuing on, the authors of Pesticides and Soil Invertebrates: A Hazard Assessment, Tari Gunstone, Tara Cornelisse, Kendra Klein, Aditi Dubey and Nathan Donley, warn of the dire consequences of our use of pesticides on the soil. We may be setting ourselves up for extinction.

- On less serious news, there have been 455,144 views, 340 shares, 11,136 reactions, and 652 comments to this posting on LinkedIn

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Extrusive Igneous Rocks: Obsidian, Tephra, Scoria and Pumice

Figure 1 - Explosive Volcanism, Tavurvur Volcano, Papua New Guinea
Credit: Taro Taylor, Creative Commons Attribution 2.0 Generic license

Obsidian is also called volcanic glass and is formed when lava rapidly cools without crystallization. Let's look at these rocks separately. Tephra is a general term for pyroclastic rocks and includes tuff, volcanic breccia, ignimbrite and lahar deposits. Tephra rocks originate with explosive volcanism. The gases in magma that create explosive volcanism can create scoria and pumice.

Let's look at them.

Obsidian

Figure 2 - Obsidian from Oregon
Credit: PAR~commonswiki, public domain

Obsidian is formed by the rapid cooling of volcanic lava, so rapid that there is no crystallization. It is mostly silica formed in the last stages of volcanic eruptions where mostly silica is left over after most of the other elements and water have been used up. The silica material is either ejected or flows out and is then rapidly chilled at surface temperatures.

In pre-historic times, obsidian was one of the most valuable stones for making tools such as knives and projectile points, as in Figure 3, below.

Figure 3 - Obsidian Blades and Cores From the Naxos, Greece
Credit: Zde, Creative Commons Attribution-Share Alike 4.0 International license

Tuff

Figure 4 - Tuff
Credit: Roll-Stone, public domain

Volcanic tuff is a rock that forms from the fall of volcanic ash, that is it is the result of an explosive volcanic eruption. The smaller volcanic ash particles that make up around 75% of the tuff are essentially volcanic glass. Larger particles, >2 mm in diameter, are lapilli and volcanic bombs.

Figure 5 - Ignimbrite in Cumbria, England
Credit: Graeme Churchard (GOC53), Creative Commons Attribution 2.0 Generic license

When the ash particles are welded together the rock is called a welded tuff. Ignimbrite is another form of welded tuff. Welded tuffs can be formed by a pyroclastic flow. The USGS site on pyroclastic flows states that "Pyroclastic flows move fast and destroy everything in their path".

Volcanic Breccia

Figure 6 - Volcanic Breccia from Jackson Hole, Wyoming USA
Credit: Daniel Mayer, Creative Commons Attribution-Share Alike 3.0 Unported license.

Volcanic breccia is a general term for coarse-grained rocks containing abundant (>10%) angular volcanic fragments. They can be divided into three main categories, based on how they form: autoclastic, pyroclastic, and epiclastic

When semisolid lava moves around and churns into chunks of lava, the result is called an autoclastic volcanic breccias. An example of autoclastic breccia goes by the Hawaiian name of

Aa or blocky basalt. Autoclastic volcanic breccias resemble tectonic breccias or fault breccias that form along tectonic faults.

Pyroclastic breccias are produced by explosive volcanism. Other names for pyroclastic breccias include vulcanian breccia, pyroclastic flow breccia, and hydrovolcanic breccia.

Lahars, or volcanic mudflows, can deposit epiclastic volcanic breccias. Water from rainfall or melting glaciers mix with volcanic ash, lapilli and volcanic bombs to make include laharic breccia, water-laid volcanic breccia, and volcanic talus breccia.

Scoria and Pumice

Figure 7 - Pumice
Credit: Amcyrus2012, Creative Commons Attribution-Share Alike 4.0 International license

The volcanic gases in magma can create vesicles or small cavities in the rock. When these vesicles form the greater volume of a rock the result is scoria or pumice. The difference between scoria and pumice is gradational: scoria tends to have larger vesicles and pumice usually has fine cavities in the rock. Also, there is enough air entrained in to allow it to float in water. Many people are familiar with pumice as an abrasive.

Standard Caveat

The purpose of my weblog postings is to spark people's curiosity in geology. Don't entirely believe me until you've done your own research and checked the evidence. If I have sparked your curiosity in the subject of this posting, follow up with some of the links provided here. If you want to, go out into the field and examine some rocks on your own with the help of a good field guide. Follow the evidence and make up your own mind.

In science, the only authority is the evidence.