VOLCANOLOGY

Electric eruption

On the morning of 24 August, AD 79, Mount Vesuvius in the Bay of Naples, Italy, exploded into activity. The eruption caught the roman occupants of Pompeii and Herculaneum utterly unawares. The cities were rapidly buried by thick ash fall and pyroclastic surges, killing thousands of people. In a letter to the historian Tacitus, Pliny the Younger, an eyewitness and survivor of the eruption, described "frightening dark clouds, rent by lightning twisted and hurled" (http://go.nature.com/gkcLgn).

Volcanic lightning has since been documented during many historical eruptions. More recently, spectacular lightning was observed during the eruptions of Mount Redoubt in Alaska, USA, in 2009 and Eyjafjallajökull Volcano in Iceland in 2010. The lightning generally occurs within the volcanic plume — a spreading column of ash, rock and hot gases blasted from the volcano vent. Although the details of the processes are poorly understood, volcanic lightning is thought to be triggered by the fragmentation of, and high-speed collisions between, volcanic rocks and ash as they exit the vent, as well as by the interactions between super-cooled water droplets and ice particles in higher, cooler parts of the column. The collisions create positive and negative electrically charged regions within the volcanic plume that are equalized by an electrical discharge that creates a lightning flash.

Lightning can generate temperatures of tens of thousands of degrees, yet the silicate minerals and glasses that comprise volcanic ash can melt at temperatures of only one or two thousand degrees. This prompted Kimberly Genareau and colleagues to question whether volcanic lightning could melt the ash in a volcanic plume (*Geology* **43,** 319–322; 2015). They analysed ash deposits collected from the Mount Redoubt and Eyjafjallajökull eruptions and found tiny glass spherules (less than 100 μm across), which could have been formed when lightning melted the volcanic ash. To test this hypothesis, they exposed samples of pseudo-ash — an artificial analogue that replicates the chemical, physical and electrical properties of volcanic ash — to electrical discharge in the laboratory. The simulated lightning bolts created glass beads similar to those spherules observed in the deposits from Alaska and Iceland.

The glass spherules mostly formed from melting of the smallest individual ash grains or from the fusion of several melted ash grains. After formation inside the volcanic plume, the glass droplets fall out of the volcanic cloud to be deposited on the ground. Although rare, identification of these tiny spherules in ancient volcanic deposits can now be used to infer the occurrence of volcanic lightning in past eruptions for which there are no eyewitness accounts.

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