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Volcanology
Article 1

An article entitled *The Eruption of Krakatau* by Peter Francis and Stephen Self, published in *Scientific American* in 1983, shed a new light on the apocalyptic eruption that occurred in 1883. 100 years later, they uncovered new compelling evidence that gives us a deeper understanding of what happened that day.

On August 27, 1883, a stratovolcano off the coast of Indonesia on the small island of Krakatau erupted in a violent paroxysmal blast that leveled the island itself. This blast was so powerful that it could even be heard in places like Sri Lanka and Australia and in low inaudible wave frequencies worldwide. Tidal waves ripped through both the Atlantic and Pacific oceans and killed over 30,000 people globally. The aftermath of the eruption had an impact worldwide as the high quantities of ash that entered the atmosphere reduced sunlight and lowered the average global temperature. Krakatau proved to be a very infamous eruption because it was the first of its kind to be heavily scientifically investigated.

Though Francis and Self were certainly not the first scientists to study this eruption, they did make some very important discoveries largely based on volcanic deposits and timing of air and sea waves. One of their biggest discoveries was in the construction of the volcano itself. After the eruption destroyed most of the island, only the bisected volcanic cone remained standing. Francis and Self were able to determine after a closer look and this bisection that Krakatau composed of 3 volcanic cones, not 1 as previously presumed. These cones are roughly aligned northwest to southeast, the top and largest of these cones (813 m) known as Rakata lies at the southern end. The middle cone was named Danan and the bottom cone Perbuwatan. Perbuwatan was particularly interesting because they determined that it had been recently geologically active and was responsible for a pumice eruption in 1680.

Francis and Self were able to determine the sequence of eruptions from sampling ash deposits. They were able to find that the start of the eruption began when Perbuwatan first erupted on May 20, 1883 after being dormant for about 200 years. This activity was very minor with only small explosions that continued all the way through August. An associate of Francis and Self who was a Dutch surveyor by the name of Captain Ferzenaar visited the island on August 11. His reports stated that only about 50 cm of fine to medium grained ash (mostly dacitic pumice) had accumulated and that most trees were still standing but without foliage due to ash. It was not until August 27, 1883 that the massive explosion heard around the world got our attention towards the eruption. Based on Francis and Self's instrument data and ash deposits from this time. Nobody within close range of the island could have survived this explosion.

There is an interesting theory both Francis and Self proposed in this article on the cause of the massive eruption. This theory is that there was a mixing of different types of magmas led to the violent August eruption. They note that although most of the deposits appear to be light dacitic pumice however, some of them look very different. They say that there is darker mafic pumice containing mineral crystals with different composition than that of the lighter silicic pumice. There are whole bands of this dark basaltic pumice as well as mixed deposits of the light and dark. Francis and Self believe an intrusion of this fresh basaltic magma into the base of the Krakatau's dacitic magma chamber caused a violent convective movement. They state that most dacitic magma chambers are stable and stratified with the more dense magma at the bottom and lighter more silicic magma on top. A pulse of hot basaltic magma injected into this chamber could cause superheating in the chamber leading to a catastrophic explosion. This is a fairly common occurrence in pyroclastic deposits such as that of Krakatau so Francis and Self certainly have a sound argument.

Some historical evidence supporting the theory of Francis and Self is that a small group of scientists who studied the eruption of Perbuwatan in May 1883 noted that there was 60 cm of dark ash that overlay 30 cm of lighter pumice. These scientists also took samples of this ejecta and found that the dark ash seemed to have a basaltic

composition and the lighter pumice had a dacitic composition. Seems to me that Francis and Self knew what they were talking about.