

Earth's Last Frontier of Pyroclastic Volcanism

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A vast and virtually untouched frontier of pyroclastic volcanism lies along submarine convergent margin systems. The area along the Izu-Ogasawara Arc south of Japan is a good example and is dotted with many dozens of recently active volcanoes. However, surprisingly little is known about these volcanoes-- how they erupt, and the nature of the seafloor deposits they produce. Submarine pyroclastic deposits are also abundant in green-tuff terrains on the Japanese mainland and in ancient convergent margins all over the world. This topic is made more relevant when we realize that these terrains are host to some of the world's most important mineral deposits, many of which are thought to be genetically related to the submarine volcanic deposits with which they are associated. A few recent volcanological findings along the Izu-Ogasawara Arc in the vicinity of latitude 32° N include:

- 1) Myojin Knoll caldera was the site of a caldera-forming submarine eruption of about 36 km³ of rhyolitic pumice.
- 2) Submarine pyroclastic flows, consisting largely of caldera-related pumice that became water-saturated at the time of the eruption, probably traveled down the slopes of the Myojin Knoll edifice and ponded in nearby areas of the sea floor.
- 3) Myojinsho, a submarine volcano about 20 km south of Myojin Knoll, is a remarkably symmetrical cone having proximal slopes of almost exactly 21=9A. This symmetry can be interpreted to reflect the importance of pyroclastic gravity flows that traveled down the volcano's slopes along all azimuths.
- 4) Convective upwelling of heated water at Myojinsho (and at other active submarine volcanoes as well) swept fine tephra from the rubbly material making up the volcano's summit, carried it to near the sea surface, where ocean currents carried it to distal locations. Thin layers of fine tephra found in deep-sea sediment cores might therefore be the result of "slow-and-steady" deposition from drifting plumes rather than from the "instantaneous" deposition of airfall tephra from distant explosive eruptions.