

The Last Frontier of Silicic Submarine Pyroclastic Volcanism

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Speaking personally, as I believe I'm entitled to do in this Keynote Address, it is clear we've come a long way in the past 40 years. As I will briefly recount, when Tokihiko Matsuda and I suggested back in the early 1960's that the large-volumes of silicic pumice in the Miocene Wadaira tuff member (Japan) were erupted from submarine volcanoes, the concept was greeted with mixed reactions. To some, the idea seemed plausible, even exciting; to others, it was suspect, because silicic magmas were thought to vesiculate significantly only at ocean depths of a few tens of meters or less. At that time, all of us were hampered by the fact that so little was known about sea-floor pyroclastic volcanoes in the present-day oceans. As recently as the early 1980's, manned submersible study of these volcanoes was not even a gleam in our eyes.

Much of what we know about silicic submarine pyroclastic volcanism has come from deposits preserved in ancient convergent margin settings. I will share with you some brief encounters I've had with the Archean of Canada, the Mississippian of Oklahoma, the Triassic of Oregon, the Cretaceous of Puerto Rico, and the Pliocene of Japan. Collectively, these areas show that freshly erupted pyroclastic debris can be deposited in the marine environment, but whether this debris was erupted directly into this environment by submarine volcanoes is often unclear.

Many of these uncertainties can be eliminated, or at least constrained, by study of the present-day sea floor along convergent margin environments, particularly along arc fronts and nearby back-arc settings. Here, in what I like to call the last frontier of silicic submarine pyroclastic volcanism, young volcanoes can be studied directly—proximal and distal deposits can be distinguished and characterized, eruption depths confidently estimated, and volcano structures better understood. We must find ways to get into these "field areas," but access is logistically difficult and extremely expensive. It is therefore imperative that we develop collaborative relationships with marine-science organizations and appropriate funding agencies.

I will close by briefly reviewing the current research situation along the Izu-Bonin arc south of Japan, where a wide variety of sea floor volcanological investigations are under way. I will emphasize the submarine silicic calderas at Myojin Knoll, Myojin-sho, and Sumisu, and I won't let you forget that six other little explored submarine silicic calderas lie along the same arc.