

Weird Magmas All Over the Place: Young Boninite-Dacite-Basalt Occurrences in the NE Lau Basin

KEN H. RUBIN¹, ROBERT W. EMBLEY², ERIC G.
HELLEBRAND¹ WILLIAM W. CHADWICK²,

¹ Department of Geology & Geophysics, SOEST
Univ. of Hawaii. Honolulu, HI 96822, krubin@hawaii.edu

² NOAA-PMEL/OSU/CIMRS, Newport, OR 97365

One of Earth's most active submarine volcanic provinces is in the fastest opening backarc, adjacent to Tonga's northern Tofua arc, the fastest converging subduction zone. Microplate extensional tectonics and a lithosphere tear promote extensive regional modern rear arc and backarc volcanism, distributed across many closely-spaced volcanic centers. Regional subdomains erupt exclusively boninite and related ultramafic magmas, dacite magmas (including the world's largest modern dacite lava flows), or enriched basalts. Backarc dacites are most likely boninite differentiates and differ from Tofua arc dacites. The diversity of magma types, variations in source compositional signatures, ranges of phenocryst compositions, and generally high initial magmatic gas contents all suggest poorly mixed magmas drawn from distributed sources, and what we interpret to be a loosely interconnected distributed storage network in a "magmatically spongy" crust. We will tie together observations with implications for the modes of magma formation, delivery and storage to interoceanic arcs from 3 ROV expeditions by our group in the area, including a Nov.-Dec. 2017 expedition with Schmidt Ocean Institute on R/V Falkor and 3 other expeditions over the past decade using ship-based remote observational tools. These provide information on the rate, composition, structures, eruptive styles, and relative rock unit ages at many of these volcanoes, including common occurrences of deep submarine explosive, gas-driven pyroclastic volcanism and the eruption of highly vesicular and crystal-rich lavas. Some of these edifices, which we consider to be "submarine stratocones", have substantial portions (>50%) of pyroclastic and volcanoclastic sediment interlayered between lava flows erupted over 1 km to 3 km water depth and are structurally similar to composite volcanoes on land. These include recently erupting West Mata volcano. The range of magma compositions, eruption styles and regional partitioning of magma types suggest spatially variable melting regimes, magma storage, degassing histories, and eruption conditions at arcs. These magmas are sampled in high fidelity in the NE Lau because of the active regional tectonics, and might otherwise be obscured by mixing at tectonically and magmatically more stable systems.