The August 2019 Eruption of Volcano 0403-091: timescales of pumice raft formation and evolution during dispersal

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A new eruption of Volcano 0403-091 (30 km NW of Vava’u, northern Tonga) occurred without warning on the 7th August 2019 following 18 years of dormancy. The eruption produced a >200 km2 pumice raft that was intercepted by two boats, causing navigational problems and hull abrasion. Rafts pose a range of potential hazards for marine traffic and infrastructure, yet their formation processes and evolution during dispersal are poorly understood. The 7th August raft was imaged by satellites almost daily, so its source and path are well-constrained. This eruption therefore provides a unique opportunity to sample both rafted pumice with known float times and sunken pumice at the vent, as well as a rare chance to study vent structure, hydrothermal activity and marine life interactions immediately following an explosive, shallow marine eruption.

Here we present the first results from a rapid response survey of the submarine vent site, conducted 6 months after the eruption. The vent was investigated using a small Remotely Operated Vehicle (ROV), a small Autonomous Underwater Vehicle (AUV) and a surface glider, alongside a grab sampler and mini-dredge designed for operation from a small vessel. Video transects, bathymetry and sampling together enable characterisation of the seafloor eruption products, post-eruptive vent morphology, and the recovery of seafloor ecosystems 6 months after an explosive shallow submarine volcanic eruption.

In addition, we compare the proximal seafloor deposits with a suite of samples from the floating pumice raft that experienced different float times, enabling us to compare the change in physical characteristics of pumice during its lifetime in the raft. These samples include pumice collected by a boat that intersected the raft shortly after eruption (floated for 1 week), and pumice subsequently collected from the shores of some Fijian Islands (floated for > 1 month). Physical, geochemical and textural (including high resolution X-ray computed tomography) analyses of these different pumice types from a single well-constrained eruption will help to determine the controls on pumice raft formation and their potential hazards for marine shipping and infrastructure.

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