The August 2019 Eruption of Volcano 0403-091: a well-constrained pumice raft forming eruption

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Without warning, a new eruption of Volcano 0403-091 (30 km NW of Vava'u, northern Tonga) occurred on the 7th August 2019 producing a >200 km^2 pumice raft. Pumice raft formation and evolution is poorly understood, yet rafts pose a range of potential hazards for marine traffic and infrastructure. 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 eruption.

Here we present the first results from a rapid response survey of the submarine vent site, conducted 6 months post eruption. The vent was investigated using a small Remotely Operated Vehicle (ROV), a small Autonomous Underwater Vehicle (AUV) and a surface glider, alongside a mini-dredge designed for operation from a small vessel. Video, bathymetry and sampling together enable characterisation of the eruption products, post-eruptive vent morphology, and recovery of seafloor ecosystems. In addition, we compare seafloor deposits with a suite of samples from the pumice raft with different float times. These include pumice collected by a boat that intersected the raft (floated for 1 week), and pumice subsequently collected from the shores of two 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.