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Hydrothermal Inputs to Biogeochemical Cycling at the Volcanically Active Vailulu'u Seamount, American Samoa

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Hydrothermal fluids were collected from two seafloor hydrothermal vents at the Vailulu'u Seamount in American Samoa in September 2024, 24 years after the discovery of hydrothermal activity at the site [1]. A volcanically active seamount located at the end of the Samoan hotspot chain, Vailulu'u is one of a few places in the world that is known to host high-temperature hotspot-driven hydrothermal venting. Evidence of venting within the summit crater was obtained in 2000 with the discovery of a manganese-enriched turbid plume, yet venting source fluids were not sampled or characterized until now [1, 2]. Maximum exit temperatures measured from sites "Pagoda" and "Bubble Spire" were 218°C and 240°C, at depths of 681m and 680m, respectively. Gas bubbles were seen at Bubble Spire but not at Pagoda.

Vent fluids were collected with ROV *Hercules* during NA165 using isobaric gas-tight samplers [3]. The pH of the vent fluids ranged from 4.8-4.9 at Pagoda and 4.7-4.9 at Bubble Spire. All fluid samples had high salinities relative to seawater. Measured [ΣH_2S] ($\Sigma H_2S = H_2S + HS^- + S^{2-}$) ranged from 0.94-1.00 mmol/L at Pagoda and 0.31-1.03 mmol/L at Bubble Spire. Sample alkalinities range from 1.64-1.88 mM at Pagoda and 1.38-2.64 mM at Bubble Spire. Ongoing analyses include IC to determine major ion concentrations, ICP-MS to determine trace element abundance, GC to measure the abundance of inorganic carbon [ΣCO_2] ($\Sigma CO_2 = CO_2 + HCO_3^- + CO_3^{2-}$), and UV-Vis spectrophotometry for [SiO_2] and nutrients. These data will provide insights into potential carbon and energy sources for microbial communities and determine the input of biologically important transition metals to the water column. Findings from this study will inform how hotspot dynamics influence hydrothermal systems. The fluids from Vailulu'u will provide a valuable contrast to the well-studied hydrothermal system at Kama'ehuakanaloa Seamount (previously known as Lō'ihi) in Hawai'i.

[1] Hart et al. (2000), *G3* 1, DOI: 10.1029/2000GC000108. [2] Staudigel et al. (2004), *G3* 5, DOI: 10.1029/2003GC000626 [3] Seewald et al. (2002), *Deep Sea Research Part I: Oceanographic Research Papers* 49, 189-196.