

First geochemical insights into newly discovered shallow hydrothermal vent fields near Milos, Greece

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Hydrothermal vent systems, commonly located along mid-ocean ridges and tectonically active regions, are predominantly found at considerable depths. These systems are characterized by the emission of geothermally altered fluids enriched in metals, sulphide, and silica, which play a crucial role in local geochemical processes and contribute to mineral deposition. During a research expedition aboard the German research vessel *Meteor* (cruise number M192) nearby Milos, a previously unrecorded shallow hydrothermal vent field was identified. Milos, a volcanic island situated in the Aegean Sea, exhibits a complex geological structure primarily influenced by extensive volcanic and tectonic activity. The island's geology is predominantly composed of volcanic lithologies, such as pumice, obsidian, and basalt, which have been formed through recurring eruptions associated with the Hellenic volcanic arc.

Hydrothermal fluid samples, with temperatures reaching up to 180°C, were collected using the pump system with Teflon tubing and bottles, deployed via the Remotely Operated Vehicle (ROV) MARUM-SQUID. Additional water column samples were obtained using the CTD Water sampler system aboard *Meteor*.

Geochemical analysis of fluids from a vent structure located southeast of Milos at a depth of 189 m with a temperature of up to 180°C, revealed a low pH (5.04 to 5.13), elevated hydrogen sulphide (H₂S) concentrations (1.19 to 1.65 mM), and increased chloride and reduced magnesium levels, suggesting phase separation with a brine phase discharging in the southeast of Milos. In contrast, a vent structure with fluid temperatures up to 100°C in a depth of 187 m, a pH of 6, and H₂S concentrations of 5.65 mM, showed a decrease in chloride and magnesium concentrations, indicating the presence of a vapor-phase fluid ascending northwest of Milos. Dissolved manganese concentrations were measured with ICP-OES for the fluids, revealing higher concentrations of dissolved manganese in the southeast (0.1 mM) compared to the northwest of Milos (0.01 mM). Additionally, onboard colorimetric measurements of dissolved manganese revealed elevated concentrations of manganese, mostly correlating with reduced Eh values, which extended into the water column above the vent structures. This confirms that the hydrothermal signals are dispersed by a