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Hydrothermal processes at the Pompeii hydrothermal field: insights from the association of a large sulfide deposit and talc-rich hydrothermal mounds (Mid-Atlantic Ridge)

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The Pompeii hydrothermal field was discovered in July 2022 during the HERMINE2 cruise [1]. It is located on an inside corner high (21°20 N) at the northern end of a “doomed” ridge segment [2] located just south of the TAMMAR propagating rift. The inside corner high is a domal bathymetric high with gentle slope ridgewards and spreading-parallel lineations (corrugations) characteristic of an oceanic core complex (OCC). The OCC is dissected by several faults including a ridge-perpedicular fault and a series of smaller ridge-parallel faults.

The main Pompeii hydrothermal site is located on the corrugated surface atop a spreading-perpendicular rubble ridge. The mound is about 150 m in diameter and 30-40 m high and mainly composed of sulfide-bearing rocks partly covered by Fe-Mn hydrothermal crusts. Sulfide-bearing mineralization mainly consist of quartz and pyrite and are characterized by low copper and zinc concentrations (i.e. <0.1 wt.%). At least three smaller satellite mounds (< 40m in diameter) located north, south and west of the main site are composed of silica-rich slabs and/or talc-rich mineralizations. Talc-dominated mineralizations are composed of talc with variable amount of microcistalline silica and rare fully-oxidized sulfides. Mineralogy and chemistry of the talc-rich mineralization is similar to that described for the deep active Van Damm hydrothermal field [3]. The main hydrothermal still exhibit a very weak hydrothermal activity (up to 4.25 °C) with H_2 concentrations ranging from 45 to 90 nmol/L indicating interaction with a gabbro-peridotite basement. While sulfide-rich mineralization suggest high-temperature interaction in the reaction zone, talc-rich hydrohtermal deposits point out moderate-temperature interaction with mafic/ultramafic rocks [3]. The tight spatial association between these two different types of deposits (i.e. talc-rich and sulfide-bearing deposits) within the Pompeii hydrothermal field raises the question of the evolution and dynamics of hydrothermal circulation over time in an OCC setting.

[1] Pelleter and Cathalot (2022),

https://doi.org/10.17600/18001851

[2] Dannowski et al., (2018) *J. Geophys. Res. 123, 941-956*

[3] Hodgkinson et al. (2015) *Nat. Commun 6:10150*

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