



## Genesis of high Mg and SO<sub>4</sub> hydrothermal fluids in the Terceira Rift

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Typical Mid-Oceanic ridge hydrothermal systems are in general significantly enriched in Ca due to leaching from the magmatic basement (albitization of anorthite), while Mg and SO<sub>4</sub> are quantitatively removed because of Mg-rich smectite and anhydrite formation and further processes.

In the Terceira Rift (TR), a hyper-slow spreading center in the Central North Atlantic Ocean, hydrothermal fluid venting is known to occur only at shallow intertidal water depths around the volcanogenic Azores Archipelago. Here, we show for the first time that hydrothermal fluid venting is active in the eastern TR at water depths of 2800 m.

Pore fluids of a sediment core taken close to a volcanic cone, however, show that the fluid composition is significantly different from typical Mid-Oceanic hydrothermal systems. Pore water Mg, SO<sub>4</sub>, and total alkalinity (TA) concentrations are significantly higher compared to seawater and a nearby reference core.

The most straightforward way of interpreting these excursions is the re-dissolution of the metastable mineral caminite (MgSO<sub>4</sub> 0.4Mg(OH)<sub>2</sub> 0.2H<sub>2</sub>O). Caminite is known from mineral assemblages with e.g. anhydrite and forms only under specific conditions such as high fluid temperatures and in altered oceanic crust with only few fresh basaltic glass present, which are generally met at the TR. Isotope measurements of  $\delta^{34}\text{S}$ ,  $\delta^{26}\text{Mg}$ ,  $^{87}\text{Sr}/^{86}\text{Sr}$ ,  $\delta^{88/86}\text{Sr}$ ,  $\delta^{44/42}\text{Ca}$  and  $\delta^{30}\text{Si}$  provide additional evidence for caminite as a source for Mg, SO<sub>4</sub> and TA. The re-dissolution of the caminite is interpreted as a sign of cooling temperatures, which may indicate a waning state of the hydrothermal system. To date, no signs of extensive caminite formation and/or dissolution have been reported. Our study implies that element recycling through caminite might play a presently unrecognized role in element budgets of hydrothermal systems.