

Geochemistry of deep seafloor hydrothermal fluids at Brothers volcano

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Due to their high magmatic volatile content, hydrothermal fluids venting from arc volcanoes extensively modify the crust via fluid-rock reaction. This chemical interaction culminates in alteration and mineralization in the lithosphere and impacts ocean budgets as fluids are expelled into the overlying water column. The sub-seafloor environment is inaccessible in most cases. Thus, processes occurring within the crust are inferred through the geochemical analysis of naturally venting hydrothermal fluids and mineral deposits at the seafloor, such as at the Upper Cone Site at Brothers volcano, Kermadec arc [1].

During IODP Expedition 376, we cored the Brothers Upper Cone to a depth of 359 mbsf, offering an unprecedented opportunity to sample buoyant fluids expelled at depth from an active arc volcano. Three high temperature (140-247°C) borehole fluid samples were collected from within the drill string at depths of 160, 279, and 313 mbsf using a mechanical-clock actuated flow-through sampler. We used dissolved inorganic and volatile chemistry, coupled to traditional and non-traditional stable isotopes (C, multiple S, Li, B, Mg) to infer a dominantly magmatic origin of these low pH (down to 1.8), high ΣSO_4 (up to 89 mM) fluids. This acidic, volatile-rich magmatic fluid mixes with seawater at temperatures of at least 350°C and ascends toward the seafloor. During ascent, fluids leach Mg and K from the host rock, while contributing ΣSO_4 , Ca, and Sr to form secondary minerals. In contrast to mid-ocean ridge systems, the primary source of salinity in acid sulfate fluids at arc systems may not be seawater-rock reaction, but instead may derive from the direct reaction of a low-salinity magmatic fluid into infiltrating seawater with volcanic rocks in the upflow zone.

[1] de Ronde et al. (2011) *Miner. Deposita* **46**, 541–584.