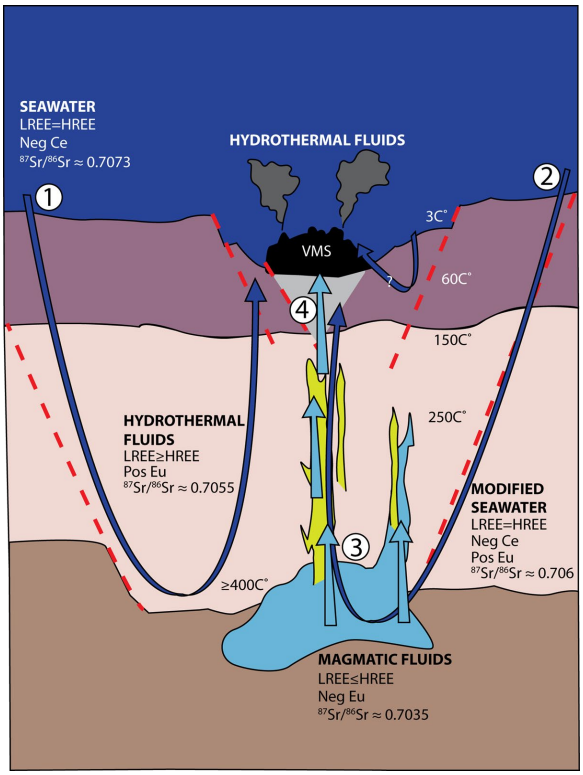
Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.12450

Magmatic volatiles episodically flush oceanic hydrothermal systems: Evidence from the Troodos Ophiolite, Cyprus

YARON KATZIR[1], STEPHEN FOX[2], WOLFGANG BACH[3], LUCY SCHLICHT[3] AND JUSTIN GLESSNER[4]

[1]Ben Gurion University of the Negev
[2]Weizmann Institute of Science
[3]University of Bremen
[4]University of California, Davis

Presenting Author: ykatzir@bgu.ac.il



Circulation of seawater at oceanic spreading centers extracts heat, drives rock alteration, and transport metals up to shallower levels of the crust where they precipitate in contact with fresh seawater and may form ore deposits. Crystallization of the lower crust may exsolve and introduce magmatic volatiles into the seawater-dominant system and contribute to the formation of ocean-floor sulfide deposits. However, the role of magmatic volatiles added to the hydrothermal system, including pathways of these fluids are lesser known. Favorable settings to test this hypothesis are Back Arc Basins (BAB) and their ancient analogs, supra-subduction zone ophiolites, because volatile-rich felsic magmas are much more common in back-arc settings than along mid-ocean ridges. Here we present coupled in-situ strontium isotope and rare earth element patterns of distinct domains in epidote, a common hydrothermal mineral throughout the Troodos ophiolite, to track magmatic fluid input and flow. Epidote crystal domains are characterized by three distinct strontium isotope-rare earth element signatures – suggesting sequential growth from magma-derived fluids (0.704, negative europium anomalies), rock-buffered fluids (0.7055, positive europium anomalies) and seawater-derived fluids (0.7065, negative cerium anomalies). The diversity of fluid endmembers flowing through on-axis hydrothermal systems and their chemical characteristics are presented in Fig.1: (1) seawater infiltrates the crust evolving to hydrothermal fluid, and is recirculated through upflow zones, while leaching metals from the sheeted diabase dikes and supplying them to VMS deposits; (2) seawater is drawn down fault planes along the axis, quick enough to retain a slightly modified seawater (MS-type) $^{87}Sr/^{86}Sr$ and REE signature; (3) emplaced plagiogranites exsolve magmatic volatiles (M-type), which flood the overlying hydrothermal system. MS-type and M-type fluids are funneled upwards in upflow zones, creating epidosite pipes. The precipitating epidote sequesters highly variable $^{87}Sr/^{86}Sr$ and REE values, pending on the most dominant fluid fluxing through the system at that particular time; (4) The fluid end-members are still partially unmixed even in the upper basalts hosting the VMS deposits, accounting for the highly variable fluids venting in black smokers of BAB.