Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29972

Alteration of the depleted mantle and gabbro crust drilled at Atlantis Massif: insights from mineralogy, elemental and B and Sr isotope variations in rocks and fluids from IODP Hole U1601C

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We will present lithology and mineral chemistry results for the depleted serpentinized peridotites and gabbros recovered from recently drilled (IODP Expedition 399, Mid-Atlantic Ridge 30N) Hole U1601C on the south wall of the Atlantis Massif (AM). These samples represent the deepest in situ gabbro/peridotite drill cores ever recovered from the ocean floor [1]. The downhole variation in alteration minerals, fluid mobile element enrichments and the vast Sr and B isotope fractionations highlight the important role of seawater infiltration and seawater-peridotite/gabbro interactions taking place at shallow depths. However, it appears that the chemical fingerprint of seawater-driven alteration diminishes with depth and away from the large scale detachment fault responsible for the emplacement of the AM. The Sr isotope ratios of the fluids [87/86Sr = 0.706] recovered from Hole U1601C at depth > 1km resemble the composition of the fluids emitted from the Lost City Hydrothermal System (located only 800m to the south). They are also similar to the pervasively altered gabbro [87/86Sr = 0.705] samples from the same site. It appears that active metamorphic (hydration) reactions involving unaltered basement rocks may still occur near the drill core bottom (at 1268 mbsf). We will attempt to evaluate the importance of variously hydrated oceanic mantle and crust as a volumetrically important carriers of volatiles from the ocean floor to the deep mantle and back via slab recycling.

REFERENCE:

[1] Lissenberg CJ, et al., 2024. A long section of serpentinized depleted mantle peridotite. Science 385, 623-629. DOI:10.1126/science.adp1058