Influence of water-rock interaction on the sulfur geochemistry at the Atlantis Massif, MAR 30°N

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Tectonic activity along slow-spreading mid-ocean ridges often leads to the exposure of ultramafic rocks. Hydrothermal alteration and serpentinization of these rocks are associated with extensive element exchange between fluid and rock and involve a wide range of biogeochemical processes. These processes significantly influence the global sulfur cycle due to both biogenic and abiogenic removal of seawater sulfate. Hence, ocean floor serpentinization couples the hydro-, bio- and lithosphere.

Here we present a study of the sulfur geochemistry of oceanic serpentinites from the Atlantis Massif located at 30°N at the intersection of the slow-spreading Mid-Atlantic Ridge and the Atlantis Transform Fault. The analyzed samples are either from drill cores recovered during IODP Expedition 357 or were collected during *Alvin* dives in 2000 and 2003.

The studied samples are overall dominated by sulfate over sulfide. Multiple sulfur isotope analyses of sulfide and sulfate phases indicate that several processes took place during progressive hydrothermal alteration: 1) Incorporation of seawater-sulfate, 2) thermochemical sulfate reduction (TSR) under the presence of high temperature, low-pH fluids and possibly interaction with black smoker type fluids, and 3) microbial sulfate reduction (MSR). TSR resulted in positive $\delta^{34}S$ and $\Delta^{33}S$ values between -0.026 and +0.043‰ of sulfide phases. TSR is most likely associated with the development of the detachment fault during initial formation of the Atlantis Massif. In contrast, MSR was supported by late-stage, low temperature, alkaline fluids, which induced elevated sulfide-sulfur contents with typically negative $\delta^{34}S$ and positive $\Delta^{33}S$ values. The aim of this study is to distinguish between the distinct stages of hydrothermal alteration, to reconstruct the evolution of this hydrothermal system and to provide new insights into the extent of the subsurface biosphere near the Lost City hydrothermal field on the southern wall of the Atlantis Massif.