Detailed geochemical investigation of hydrothermal fluids from the Logatchev field, 15°N, MAR

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As part of a time-series study detailed geochemical investigation of hydrothermal fluids from the ultramafic-hosted Logatchev field at 15°N Mid-Atlantic Ridge has been carried out. Fluids were sampled during two research cruises in 2004 and 2005. Exposed mantle rocks characteristic for the Logatchev field are common at slow-spreading ridges and their high-temperature alteration clearly influences the chemical composition of hydrothermal fluids in these settings. The only other known high-temperature hydrothermal system in ultramafic rocks at MAR (Rainbow) is strongly influenced by phase separation, which modifies the geochemical signatures caused by host rock composition and temperature.

The Logatchev field consists of six different vent sites near 3000 m water depth, emanating hot (up to 350°C), reducing and acidic fluids which are characterized by very high concentrations of dissolved hydrogen and methane (19 mM and 3.5 mM, respectively) and therefore clearly indicating the alteration of ultramafic rocks. A depletion of boron compared to seawater and lower Li concentrations than in basaltic-hosted systems are further signatures of fluids reacted with ultramafic rocks. Additional alteration of gabbroic rocks is indicated by relatively high Ca concentrations of 30 mM and the simple fact, that ultramafic rocks intergrown with gabbroic rocks commonly occur at the Logatchev field and other locations at the MAR (e.g. ODP Leg 209). There are only weak indications for phase separation (slightly lowered depletion of chlorinity compared to seawater), which is possibly caused by a separation near the critical point. A first evaluation of the temporal evolution in the Logatchev field shows a rather stable systems for 9 years (based on our own data and data from [1]). The fluid geochemistry differs only slightly between vent sites (smoking craters vs. massive chimney complex) and indicate a common source in the reaction zone. Spatial differences are related to conductive cooling and mixing with seawater benath the massive vent complex; emanating fluids are cooler and therefore elements with strong temperature-controlled solubility like Cu, Co, and Mo are strongly depleted, which is also expressed in chimney mineralogy and morphology.

References

[1] Douville, E. et al. (2002) *Chemical Geology* **184,** 37-48.