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The Logatchev Field at 15°N Mid-Atlantic Ridge: Geochemistry of hydrothermal fluids

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The investigation of the fluid geochemistry in the Logatchev hydrothermal field and its variability over a period of 6 years is part of the priority program 1144 "From Mantle to Ocean: Material-, Energy,- and Life-cycles at spreading axes funded by the German Science Foundation DFG. The geochemistry of hydrothermal fluids is mainly controlled by the source rock composition and phase separation processes (first-order effect on the composition of hydrothermal fluids) and has a direct influence on the organisms living in and from the vents (e.g. concentrations on dissolved gases and metals, redox speciation of S and metals, complexation of metals). Hydrothermal systems, in which phase separation takes place, are subject to significant changes with time. The fluids in the Logatchev Field were sampled during cruise M60/3 in 2004 as a first part of a 5-years time series study. The setting of the Logatchev Field at 15°N Mid-Atlantic Ridge is characterized by exposed mantle rocks. Due to serpentinization processes during the hydrothermal alteration of these ultramafic rocks the Logatchev fluids show extremely high concentrations of methane and hydrogen. Determination of the ?2H for the dissolved hydrogen in fluids allowed an estimation of fluid temperatures at first intensive mixing with cold sea water (outlet temperatures). Phase separation and the emanation of a vapor-dominated fluid is indicated by lowered chloride concentrations compared to ambient seawater. Because of the location of the Logatchev field in water depth of around 3000 m phase separation must happen in the supercritical region. Another main focus is on the organic complexation of

metals in hydrothermal fluids. Until now only little is known about the concentration and the type of organic substances in these fluids. Because organic metal complexes have a different geochemical behavior than free ions and are very stable, they should influence the bioavailability and mineral precipitation of heavy metals in the mixing zone of hydrothermal fluids and seawater. The first results of organic complexation of metals in the mixed hydrothermal fluid-seawater samples from M60/3 cruise show, that a large part of the metals is probably complexed by organic ligands. These organic metal binding substances seems to be produced in the hydrothermal fluid itself, as indicated by the correlations between organic ligand concentrations and hydrothermal fluid percentage in the samples. The high concentrations of reactive gases should support abiogenic generation of organic compounds from CO and CO2 leading to saturated hydrocarbons and, in the presence of H2S, of thiols. Especially the latter are probable candidates for a complexation and stabilization of trace metals within the hydrothermal fluids. Results from stable carbon isotopes support the abiogenic build up of organic compounds.