Geophysical Research Abstracts, Vol. 9, 03097, 2007
SRef-ID:

Influence of high fluid fluxes on sulfur and carbon speciation of serpentinites of the Atlantis Massif

A. Delacour (1), G. L. Früh-Green (1), S. M. Bernasconi (2), P. Schaeffer (3), M. Frank (4,5), M. Gutjahr (5) and D. S. Kelley (6)

(1) Institute for Mineralogy and Petrology, ETH Zurich, Switzerland, (2) Geological Institute, ETH Zurich, Switzerland, (3) Laboratoire de Géochimie Bioorganique, Université Louis Pasteur, Strasbourg, France, (4) IFM-Geomar, Leibniz Institute for Marine Sciences, Germany, (5) Institute of Isotope Geology and Mineral Resources, ETH Zurich, Switzerland, (6) School of Oceanography, University of Washington, USA (adelie.delacour@erdw.ethz.ch)

The influence of fluid-rock interaction on carbon and sulfur speciation has been investigated in serpentinites and gabbros of the Lost City Hydrothermal Field (LCHF). This peridotite-hosted hydrothermal system is located on a terrace of the southern Atlantis Massif, a 1.5 to 2 Myr old oceanic core complex located at 30˚N along the Mid-Atlantic Ridge (MAR). The LCHF is composed of numerous carbonate-brucite chimneys venting alkaline and low-temperature ($<$90˚C) fluids that are rich in methane and hydrogen. The presence of these volatiles in the hydrothermal fluids is related to the serpentinization of the mantle peridotites, which together with minor gabbroic bodies form the basement of the LCHF. Strontium and Nd isotopes were used to model fluid-rock interaction and indicate high seawater fluxes in the serpentinites. Extensive circulation of seawater has consequences on the chemical compositions of the serpentinites, in particular on carbon and sulfur speciation. Serpentinites contain low total sulfur contents and show ^{34}S-enriched sulfur isotope compositions. Sulfides have positive δ^{34}S values that are consistent with partial oxidation and loss of sulfides during progressive seawater circulation. Sulfates exhibit δ^{34}S values similar to that of seawater indicating that serpentinization conditions at the AM allow precipitation of seawater sulfate. The serpentinites show a wide range of total carbon contents and carbon isotope compositions, whereas analyses of total organic carbon shows a much smaller range of contents with negative δ^{13}C values. Organic geochemistry and compound specific carbon isotope analyses indicate the presence of marine organic compounds that have been transported by the high seawater fluxes into the serpentinites. Similar negative δ^{13}C values characterize the gabbros and may reflect the presence of volatile phases in fluid inclusions of the oceanic gabbros and serpentinites. In conclusion, our data indicates that the Atlantis Massif has undergone a long history of fluid-rock interaction and that serpentinization processes have important consequences for sulfur and carbon cycles in near-ridge environments.