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Preliminary Results on Mineralogy and Geochemistry of Loki's Castle Arctic Vents and Host Sediments

Fernando Barriga (1,2), Carlos Carvalho (1,2), M. Inês Cruz (1,2), Ágata Dias (1), Rita Fonseca (1,3), Jorge Relvas (1,2), and Rolf Pedersen (4)

(1) CREMINER/ISR - LA, (2) Department of Geology, Fac. Sciences University of Lisbon, Portugal, (3) Department of Goosciences, University of Évora, Portugal, (4) Department of Earth Science, Centre for Geobiology, University of Bergen, Norway

The Loki's Castle hydrothermal vent field was discovered in the summer of 2008, during a cruise led by the Centre of Geobiology of the University of Bergen, integrated in the H2Deep Project (Eurocores, ESF). Loki's Castle is the northernmost hydrothermal vent field discovered to date. It is located at the junction between the Mohns Ridge and the South Knipovich Ridge, in the Norwegian-Greenland Sea, at almost 74ºN. This junction shows unique features and apparently there is no transform fault to accommodate the deformation generated by the bending of the rift valley from WSW-ENE to almost N-S. The Knipovich Rigde, being a complex structure, is an ultra-slow spreading ridge, with an effective spreading rate of only $\sim$ 6 mm/y. It is partly masked by a substantial cover of glacial and post-glacial sediments, estimated to be between 12 and 20 ky old, derived from the nearby Bear Island fan, to the East of the ridge.

The Loki's Castle vent site is composed of several active, over 10 m tall chimneys, producing up to 320°C fluid, at the top of a very large sulphide mound, which is estimated to be around 200 m in diameter. About a dozen gravity cores were obtained in the overall area. From these we collected nearly 200 subsamples. Eh and pH were measured in all subsamples.

The Portuguese component of the H2Deep project is aimed at characterizing, chemically and mineralogically, the sulphide chimneys and the collected sediments around the vents (up to 5 meters long gravity cores). These studies are aimed at understanding the ore-forming system, and its implications for submarine mineral exploration, as well as the relation of the microbial population with the hydrothermal component of sediments.

Here we present an overview of preliminary data on the mineralogical assemblage found in the analyzed sediments and chimneys. The identification of the different mineral phases was obtained through petrographic observations of polished thin sections under the microscope (with both transmitted and reflected light, for a clear identification of the ore paragenesis), X-Ray diffraction and electron microprobe analyses. The analyses were conducted in the geology labs of the University of Lisbon.

The sulphide assemblage most commonly present in the samples consists of sphalerite (which seems also the most abundant), pyrite and pyrrhotite, with minor amounts of chalcopyrite.

Sulphide-poor selected samples collected at the base of chimneys are mostly composed of halite, anhydrite, gypsum and talc. In sediment cores clays are largely predominant, mainly smectite and ilite, as well as chlorite. Combinations of quartz, calcite, anhydrite, gypsum and barite were also found in some of the samples.