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The 71N vent fields at the Arctic Mid-Ocean Ridge

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Two vent fields were in 2005 located at 500-700m water depth at 71ºN on the Arctic Mid-Ocean Ridge (AMOR). The fields were revisited in 2006 when vent fluids, hydrothermal deposits and micro and macro fauna were sampled. A multi frequency scientific echo sounder system (Simrad EK60) was used to image the water column and to locate the vent sites. The exceptionally silent ship design of R/V “G.O. Sars” improves the signal to noise ratio by two orders of magnitude compared with traditional vessels, enabling an unparalleled imaging of the water column. Two distinct types of echo responses may be linked to seafloor hydrothermal activity. The most prominent feature is narrow, vertical and cone-shaped echoes present right above the fields. Multi-frequency recordings at 18, 38 and 70 kHz indicate that the main backscattering is related to microscopic bubbles in the emanating hydrothermal fluids. Fairly large air bubbles are tracked by the split beam system as single targets with average TS between –60 and –55 dB. Weak echoes derived from smaller organisms or particles define an irregular dense “cloud”. The cloud is most pronounced at a depth where positive methane and temperature anomalies were detected. The echo response is consistent with zooplankton aggregations, and this was confirmed by sampling.

The 2006 cruise demonstrated that the largest vent field extends for at least 1 km along a major normal fault. A cluster of several smaller vent sites located at a relative young volcanic ridge define the second main vent field. These sites are composed of white smoker chimneys discharging up to 270ºC fluids and occur together with large irregular sulphate constructions that emanate more low-temperature fluids.

Sampling of hydrothermal fluids demonstrated end member H_2S concentrations around 6 mmol/kg and H_2S/Si ratios of 0.05 to 0.6. Hydrothermal fluids of some of the vent sites have salinity of approximately 80% of seawater, indicating water separation and some vapour enrichment. Silica end-member concentration goes up to 14 mmol/kg, and based on quartz solubility this would correspond approximately to reaction zone conditions of 300ºC and 500-600 bars.

No typical vent endemic fauna were observed at the two vent fields. The lack of vent fauna may be related to the isolation of the AMOR combined with infrequent hydrothermal activity at this ultraslow spreading ridge.