Dissolved-particulate exchange in the proximal hydrothermal plume at the Aurora vent field, Gakkel Ridge, Arctic Ocean

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The Aurora vent field (82° 53.83' N 6°15.32' W) is located on a volcanic mount at the western edge of the ultraslow-spreading (0.6–1.3 cm yr^{-1}) Gakkel Ridge in the Arctic Ocean, which is the slowest spreading mid-ocean ridge on Earth. Here, hydrothermal activity has first been documented by Edmonds et al. (2003; Nature) based on water column anomalies in light scattering intensity, temperature, and elevated mangenese concentrations. The Aurora Seamount was revisited in 2014 during RV Polarstern cruise PS86. Here we report chemical data on the distribution of the proximal hydrothermal plume and its fallout particles in the water column and the surrounding sediments.

Deviations from element ratios dissolved in the plume water samples indicate the presence of hydrothermally sourced particles. Fe, Mn, δ^3He, and CH_4 show distinct enrichments in the plume samples relative to the samples from the background sites. Large volume pumps were deployed to sample plume particles, which were collected on filters and analyzed to deduce sources and partitioning of elements in the plume. Al is predominantly detridal and not influenced by hydrothermal particle fallout. Thus, we use the Element/Al ratio as a reference for its behavior in the plume water. We observed elevated Fe/Al ratios in plume particles due to Fe particles that form within the hydrothermal plume. Mn does not show these elevated concentrations, as the Mn/Al ratios in the particle samples are identical to those of the background sites. We conclude from these data that Fe, but not Mn, forms particles in the plume. A positive correlation between Fe/Al, and elements like As, P, Mo, V, Cr, Co, And Ni may indicate that these elements are scavenged by the positively charged surfaces of Fe-hydroxide particles. Moreover, elevated concentrations of these elements were detected in surface sediment samples in close proximity to the active vent. The surface sediments were characterized by Cu concentrations of up to 8225 mg kg^{-1}. Cu concentrations in sediment core tops a few km off the vent site are only approximately 50 mg kg^{-1}.