

Halide systematics in pore waters of hydrothermal sediments: Some observations

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Measurements of Chloride, Iodide, Bromide, and Fluoride in pore fluids from several sedimentary hydrothermal systems are presented together with evidence from other isotopic systems (e.g., $^{87}\text{Sr}/^{86}\text{Sr}$) with the purpose of evaluating contributions of various processes to the halide systematics in the pore fluids. Whereas for chloride contents there is distinct evidence for both low Cl and high Cl fluids, especially in hydrothermally affected sediments of the Escanaba Trough, which can be traced back to hydrothermal processes, there is no evidence, as yet, for low chloride fluids in the Guaymas Basin of the Gulf of California. Data for both iodide and bromide show the influence of thermal decomposition of organic matter in the sediments, though complex patterns are evident in the pore fluids of the Escanaba Trough drill holes. For the distribution of fluoride no clear trends are observed. Further work on the chlorine isotope geochemistry in sedimentary hydrothermal fluids should be a worthwhile contribution to the overall understanding of the systematics of halides in these hydrothermal systems.

Pore water iodine concentrations and $^{129}\text{I}/\text{I}$ ratios of the Hydrate Ridge (ODP 204): Implication for the origin of gas hydrates

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We measured iodine and bromine concentrations in a total of 256 pore water samples collected from all nine sites drilled during ODP 204 at Hydrate Ridge, Oregon continental margin. In a subset of samples, focusing on Site 1245 and 1251, we have also determined $^{129}\text{I}/\text{I}$ ratios. Because of the strongly biophilic nature of iodine, concentrations and isotope ratios of iodine can be used to identify the origin of organic source material of gas hydrates.

A pronounced maximum of iodine concentration is observed at several sites, especially at the flank of the ridge. The highest value at the maximum reaches 2.2 mM in Site 1245. However, these maxima are less pronounced in the summit sites and absent in the sites located in a slope basin east of the Hydrate Ridge, although iodine is still strongly enriched ($>0.5\text{mM}$ at depth) compared to seawater (0.0004mM). All $^{129}\text{I}/\text{I}$ ratios are below the marine input ratio ($R_i = 1500 \times 10^{-15}$). The majority of the samples show iodine ages of Eocene time, which indicates the age of a major source of iodine and methane related to gas hydrates. This age range is beyond the ages of the currently subducting sediments and any local formations underlying Hydrate Ridge. It suggests that fluids must have traveled considerable distances and very likely come from the overriding wedge. Although the distribution of older formations in this wedge is still under investigation, profiles suggest Early Eocene marine sedimentary formations are present in contact with the crystalline backstop. Fluid flow models of active margins suggest that fluids may have moved along the decollement over long distances, transporting iodine and methane to the current locations.

The iodine maximum in site 1245 correlates well with an increase in $^{129}\text{I}/\text{I}$ ratios, suggesting the presence of a strong component of younger iodine in this location. These maxima reflect mixing between an old endmember ($> 50\text{ Ma}$) with a young endmember ($< 10\text{ Ma}$). The source for the latter material could be either the currently subducting sediments or formations in the immediate vicinity of Hydrate Ridge.