

Evidence for possible re-dissolution of subsurface deposits in hydrothermal fluids from 9°50'N EPR

Jill McDermott and Karen Von Damm*

Low-temperature hydrothermal fluids are generated when high-temperature fluids mix with seawater during their ascent to the seafloor. This study proposes that low-temperature fluids also undergo further reactions in the subsurface prior to expression at the seafloor, including possible re-dissolution of previously precipitated minerals such as anhydrite and metal sulfides. Low-temperature fluids are therefore not the product of simple conservative dilutions of high-temperature fluids with seawater, with possible additional biological reaction. Additionally, the deposits that form when high-temperature fluids mix with seawater may be merely a temporary sink for some species, including Ca, Sr, and SO₄.

Previously, low-temperature flow has generally been considered to be a simple dilution of high-temperature flow. However, unpublished time series data for 9-10°N EPR demonstrate Ca enrichment in low-temperature fluids with concurrent depletion in high-temperature fluids, relative to the local ambient seawater concentration. A coupled hydrothermal vent area involving the high-temperature vents Ty and Io and the low-temperature BM82 site is the focus of this study. During 1991-1997, only low-temperature flow was present at the site, and in 1997 Ty and Io formed. This is one of the only places on the seafloor where we have seen low-temperature flow partially focus into high-temperature flow, and where we continue to have both flow types. The high-temperature flow may be re-dissolving deposits that previously precipitated during the mixing of high-temperature fluids and seawater in the early years of study.

Calcium, strontium, sulfate, and metals data from April 1991 through December 2006 will be analyzed using simple mass balance calculations in tandem with geochemical modeling software to examine the relationships between adjacent high- and low-temperature vent areas. A mixing model of high-temperature fluids and seawater will be generated to determine those mineral phases which may have precipitated or re-dissolved in the subsurface as the fluid transformed from high- to low-temperature. Secondly, modeling will help to determine whether the end-member high-temperature fluid chemistry can be matched to the properties of the adjacent low-temperature fluid by a simple dilution with seawater. A third question to be addressed through modeling is whether low-temperature fluids or seawater can be matched to adjacent high-temperature fluids by heating and allowing contact with basalt, with extra CaSO₄ and SrSO₄ present. The suggested process of anhydrite re-dissolution has not been previously discussed. While the refinement of hydrothermal flux estimates is the ultimate goal, the processes controlling chemical composition must first be better understood.

**Presenting Author: Department of Earth Sciences and Complex Systems Research Center, University of New Hampshire, Durham, NH 03824, USA*