Solid-state chemistry of near-field hydrothermal particles

BRANDY M. TONER*[1,2], BRANDI R. CRON[2], COLLEEN L. HOFFMAN[2,3,4], SARAH L. NICHOLAS[5], BRANDY D. STEWART[1]

[1]Department of Soil, Water, and Climate, University of Minnesota-Twin Cities
[2]Department of Earth and Environmental Science, University of Minnesota-Twin Cites
[3]School of Oceanography, University of Washington
[4]Joint Institute for the Study of Atmosphere and Ocean (JISAO)
[5]National Synchrotron Light Source (NSLS-II), Brookhaven National Laboratory
*Correspondence: toner@umn.edu

Deep-sea hydrothermal venting creates hydrodynamic features—plumes—at the interface between the seafloor and the deep ocean. Plumes host a wide variety of physical, chemical, and biological reactions that generate solids. These solids have complex chemical composition, strong physical heterogeneity, and the potential to affect the biogeochemistry of multiple elements in the deep ocean. In this contribution, the characteristics of near-field hydrothermal plume particles will be examined using a multi-modal approach: multiple elements (C, S, Fe), multiple analytical observations, multiple spatial scales of inquiry, and multiple field locales. The analytical approach will focus on samples returned from deep-sea hydrothermal vents with characterization using X-ray microscopy, X-ray fluorescence imaging, X-ray diffraction, and X-ray absorption spectroscopy. The goal of this work is to define the source characteristics of hydrothermal plume particles, and ultimately, to understand the transport and fate of hydrothermally derived solids. The work has implications for the transport potential and bioavailability of hydrothermally derived particulate Fe in Earth's oceans, as well as how we might detect evidence of hydrothermal venting on other ocean worlds.