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# Can Earth's deep-sea hydrothermal vents help us understand the preservation and transport of geochemical signals on other ocean worlds?

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Hydrothermal venting occurs in every ocean basin on the Earth. The physical and chemical gradients created by mixing deep ocean water, including near-vent biomass, with vent fluids generate populations of particles with complex compositions. Some of these particles have characteristics that promote long-range transport on ocean currents; the aggregation of nanoparticulate minerals with natural organic matter is one such characteristic. The composition of these particles can record and transport information on the physical, chemical, and biological conditions where they formed. However, some or all the information could be lost due to processes occurring in transit. In this contribution, we will examine the potential for deep-sea hydrothermal plume particles to generate and transmit unique signals at varying distances from the source. We will use two complementary approaches. First, we will summarize iron speciation in particles (> 200 nm diameter) from deep-sea hydrothermal plumes collected at a range of distances from the source (1 m to 4300 km). Synchrotron iron X-ray absorption spectroscopy is the main observable for this part of the investigation. Second, we will report a series of geochemical models that predict mineral precipitation for measured hydrothermal vent fluids (MARHYS database) that are mixed with modern seawater and simulated seawater that is relatively reduced. This allows us to consider oceans on the Early Earth, and a large contingent of exo-oceans. A subset of the models will correspond to field studies with particulate iron speciation data allowing for direct comparison of model results and field data. With the data and models, we will address the following questions: (1) what is the source signal, as measured by iron speciation, and how does it change with transport distance; (2) is there agreement between the models and particulate iron speciation at the source; (3) how would particle formation be different within oceans that are relatively reduced compared to the modern Earth?