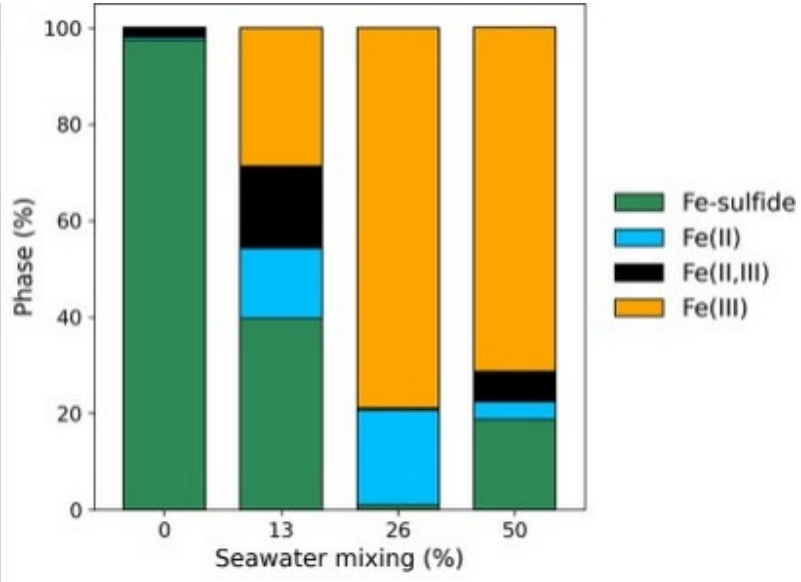
Hydrothermal Vent Twins Offer New Insights to Ocean Chemistry



Linear combination fitting results for Fe K-edge X-ray Absorption Near Edge Structure (μ-XANES) Spectroscopy measurements as a function of seawater mixing: Iron (Fe) sulfides (green), non-sulfide Fe(II) (blue), mixed-valence Fe(II, (oxy)hydroxides III) (oxy)hydroxides (orange), and Fe(III) (black).

Evans, G. N., Matzen, S. L., Odlyzko, M., Kaçar, B., Anbar, A. D., Toner, B. M., & Seyfried, W. E. (2026). Iron speciation and partitioning of micronutrient transition metals in laboratory synthesized hydrothermal plume particles. *Geochimica et Cosmochimica Acta*, *418*, 97-115. https://doi.org/10.1016/j.gca.2026.02.002

Work was performed in part at NSLS-II

Scientific Achievement

Researchers recreated hydrothermal vent conditions to explore how iron (Fe) and other trace metals in vent fluids react with cold seawater to form metal-rich nanoparticles.

Significance and Impact

Insights on how hydrothermal vents influence global ocean chemistry provide important clues about the chemical environments that supported early life on Earth.

Research Details

- Fe K-edge μ-XANES measurements at the XFM beamline at NSLS-II revealed how iron speciation changed during seawater mixing.
- Iron shifted from sulfide minerals to (oxy)hydroxides, while other micronutrients partitioned preferentially into different mineral phases.
- The formation of nanoparticles from magnetite and metallic iron in unmixed hydrothermal fluids was not predicted by current geochemical models.