



Synchrotron based spectromicroscopy to study the fate of metals in the environment

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Synchrotron scanning transmission X-ray microscopy (STXM) is a well-developed analytical technique that has become widely available at facilities globally [1]. Applications of STXM to Earth and environmental science research questions have yielded discoveries of submicron processes affecting the transport and reactivity of atmospheric aerosols, marine trace metals, soil minerals and organic matter, and more. STXM can be strategically placed within a portfolio of microprobe and bulk synchrotron measurements to scale-up observations and add the context of co-occurring elements [2]. In this presentation, the intra-particle chemical speciation and morphology of carbon and iron will be examined using data from conventional STXM, ptychography, and complementary microprobe and bulk spectroscopic analyses. Two recent field campaigns to deep-sea sites of hydrothermal venting, Rainbow (Mid Atlantic Ridge) and Endeavour (Juan de Fuca Ridge), will be highlighted. Overall, we find that iron-bearing nanoparticles are aggregated with organic matter at both vent sites within the particulate size fraction (greater than 200 nm). These composite particles sustain chemical conditions different from bulk deep ocean waters and appear to have unique transport properties. The findings will be placed within the context of more than a decade of spectromicroscopy observations for similar deep ocean environments. This research used resources of the Advanced Light Source, which is a U.S. Department of Energy (DOE) Office of Science User Facility under contract number DE-AC02-05CH11231.

References:

[1] Feggeler et al. 2023 <https://doi.org/10.1016/j.elspec.2023.147381>

[2] Toner et al. 2016 <https://doi.org/10.1021/acs.accounts.5b00282>