Chemistry of nanoparticulate and (sub)micron sized particles emanating from hydrothermal vents

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Deep-sea hydrothermal vents and the waters in the reactive mixing zone above vent orifices appear to be an important source of fine material that can pass through normal filters (0.2 and 0.4 μm). In this work, nanoparticle size is defined operationally as that material which can pass through a 0.2 μm filter. We investigated three vent sites (Lau Basin, MAR and 9 N EPR). Chimneys from these vent sites have fluids that range from sulfide rich to metal rich. Using SEM-EDS, TEM, XRD and EELS, we identify materials found in these (nano)particulate phases including pyrite, metal sulfides, silicate and aluminosilicate material. Enrichment of Mg and K in the latter suggest that reverse weathering or authigenic clay formation may occur in the waters within 1-2 meters of the vent orifice where hot vent waters mix with cold oxygenated bottom waters. Use of synchrotron techniques will improve understanding of the mineral phases and phase transformations occurring in these systems through insight into the oxidation state and bonding environment of mineral-forming elements.