

## **Particles, nanoparticles and colloids in a black smoker hydrothermal system**

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Seafloor sulfide systems form at the interfaces of hydrothermal fluids and seawater, where rapid precipitation reactions occur, forming minerals that range from nano- to macro-scale. The precipitation of hydrothermally emitted elements constrains their eventual emplacement, whether in hydrothermal chimneys, metalliferous sediments, or the distal water column.

Niua hydrothermal vent field is an actively forming seafloor sulfide deposit in the north eastern Lau back-arc that exhibits 325° C boiling fluids at 1100 m water depth [1]. The boiling and mixing that occur at the confluence of these hydrothermal fluids and seawater results in a variety of precipitates including nanoparticles, colloids, and larger particles. At Niua, these particles were characterized using techniques such as XRD, TEM/ED, SEM/EDS, and  $\mu$ -XAS. The dominant mineral phases are chalcopyrite, nanophase ZnS, and barite. Rare minerals including gold and bismuth tellurides are also present and range from the nanoscale up to several microns in size. Analysis of the initial (nano)particles as they precipitate from fluid allows insight into element transport and bulk deposit formation.

[1] Gartman *et al* (2018) *Geology* **46**, 39-42