Influence of the Tonga Subduction Zone on Seafloor Massive Sulfide Deposits in the Lau Back-Arc Basin

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Southward propagation of the Eastern Lau Spreading Center (ELSC) toward the Tonga Subduction Zone (TSZ) has resulted in a gradient of seafloor lithology from basalts in the north to mixed basalts, dacites, and rhyolites in the south (Escrig et al. 2009). Close to the TSZ, both lithology and localized addition of magmatic volatiles influence vent fluid compositions (Mottl et al. 2011). Here, a detailed study of the morphology, mineralogy, and geochemistry of seafloor massive sulfide (SMS) deposits from six hydrothermal fields along the ELSC reveals that SMS deposits strongly reflect both of these influences on vent fluid composition in addition to deposit-level interactions with ambient seawater.

Geochemical analyses of ELSC SMS deposits show that concentrations of As, Sb, Pb, and Ba increase from north to south. At southern vent fields, galena and barite are present and the abundance of barite-rich flanges increases from north to south. However, the southernmost Mariner vent field is an exception to these trends, with high-temperature, chalcopyrite-lined tapered spires and squat, peripheral deposits of barite, wurtzite, and galena. This contrasts with deposits in other vent fields that exhibit wurtzite and chalcopyrite lined conduits ± barite-rich flanges.

Along the ELSC, concentrations of As, Sb, Pb, and Ba reflect both lithology and fluid saturation with wurtzite, galena, and barite. At Mariner vent field, magmatic volatile influence lowers fluid pH and suppresses precipitation of lead and zinc sulfides relative to copper-iron sulfides; entrainment of seawater (and sulfate) buffers pH and results in precipitation of galena, wurtzite, and barite.

The mineralogy, geochemistry, and morphology of SMS deposits reflect elemental concentrations in hydrothermal fluids as well as mineral saturation. Along the ELSC, the relative proximity of the TSZ affects element concentrations by influencing seafloor lithology, and mineral saturation by lowering pH through the influence of magmatic volatiles. The specific morphology, mineralogy and geochemistry of SMS deposits in this region thus provide insight into the range of processes responsible for the local geochemical environments in which they form.

[1] Escrig *et al* (2009) *Geochem. Geophys. Geosys.* **10**, Q04014. [2] Mottl *et al* (2011) *Geochim. Cosmochim. Acta*, **75**:1013-1038.