Analysis of seafloor massive sulfide from MAR and BAB deposits

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Seafloor massive sulfide (SMS) or polymetallic massive sulfide (PMS) deposits are a new frontier in global metal resources. Hydrothermal chimney structures (black smokers) are grown on sulfide mounds precipitating base metals from hot fluids (>250ºC) cooling during interaction with cold seawater ~2-4ºC), and are the surface expression of a fluid pathway. Black smokers are rich in the critical metals such as Cu and Au. The pathway these fluids take beneath sulfide mounds on which they grow are largely unclear. These pathways or conduit zones are generally described from ancient land based volcanogentic massive sulfide deposits or from limited deep drilliing of ridge deposits such as TAG, and Bent Hill, which suffer from extensive core loss.

Here we take the approach of comparing Cu sulfide bearing chimneys from a mid-atlantic ridge deposit (Ashadze -1) with Cu sulfide bearing chimneys and subseafloor massive sulfide zones from a transitional arc-back arc ridge location, Solwara 1. Solwara 1 is unique as extensive resource drilling it provides spatial and depth constraint through the mound. This drill core allows us to compare the geochemistry of chimneys and compare them to the subseafloor mineralisation at Solwara 1. This will allow us to predict, more effectively, the likelyhood or style of mineralisation at depth at undrilled mid-atlantic ridge type deposits.

These two sites are important because, they are both formed in different, end-member tectonic environments and they share critical similarites: 1) similar age of ~6000 years maximum age; 2) copper as chalcopyrite dominated sulfide mineralisation. The source of copper at Solwara 1 is suggested to be from magmatic fluids; whereas at Ashadze the source of Cu is suggested to be from wall rock leaching. This research will advance our understanding of the chemical signatures of MAR and BAB style chimneys and allow a prediction of subseafloor mineralsiation style.