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Metal mobilization during high temperature alteration of mafic-ultramafic rocks: implications for the metal sources of ultramafic-hosted volcanogenic massive sulfide deposits

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Ultramafic-hosted volcanogenic massive sulfide (UM-VMS) deposits associated with mafic-ultramafic rocks show strong structural control and are located at or in the vicinity of low angle detachment faults, such as oceanic core complexes (OCC) in mid-ocean ridge environments. These deposits are variably enriched in precious (Au-Ag) critical (Co) and the base metals Cu, Zn, and Ni but the source of the metals enriched in the deposits remains poorly known. The Troodos ophiolite, Cyprus, and the ODP Hole 735B on the Atlantis Bank are investigated to better characterize the source of metals and the deposit genesis. The ODP Hole 735B recovers gabbroic rocks down to 1508 meters below seafloor (mbsf) and shows evidence for high temperature hydrothermal alteration in the upper 250 mbsf. There the rocks are significantly depleted in Cu and S and primary magmatic sulfides are absent, implying efficient metal mobilization. Similarly, the Troodos ophiolite shows evidences for relics of OCC with seafloor-related high temperature hydrothermal alteration and associated massive sulfide mineralizations. Within the western Limassol Forest complex in the Troodos ophiolite, the Dhierna main shear zone separates serpentinized ultramafic rocks from sheeted dykes. Here, massive sulfide mineralizations enriched in As, Au, Co, Cu and Ni are observed and are characterized by pyrrhotite, pentlandite, chalcopyrite, cubanite and cobaltite. Additionally concentrations of Au, Cu, Zn, Ni and Co in the peridotites decrease with increasing serpentinization towards the detachment fault also implying metal mobilization during hydrothermal alteration along the detachment fault.