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Reconnaissance Study of Critical Element Enrichment in Ores and Chalcopyrite, Viburnum Trend, Missouri, USA

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The world-class Viburnum Trend (VT) district, Southeast Missouri, USA is unique among MVT systems due to its dominance of Pb over Zn (~6:1), high Cu tenor, and elevated Ni and Co in ores. The ~40-mile-long N-S-trending system deposited base metals primarily in carbonates of the Cambrian Bonnetterre Formation west of the St Francois Mountains. Copper-rich zones also occur locally in the underlying Cambrian LaMotte Sandstone. This contribution presents reconnaissance whole rock and mineral chemistry across and along the trend.

Whole rock samples were classified as high Zn (HZ, > 5 wt % Zn, max Cu ~1550 ppm), Pb-Zn, and Cu-rich (Cu>1 wt %). Preliminary geochemical analyses indicate HZ samples (n=22) contain highest median Ag (~83 ppm) and Cd (~2000 ppm) while Pb-Zn samples lack distinctively high trace element concentrations. Cu-rich samples (n=39) contain the highest median concentrations of As (977 ppm), Co (522 ppm), Ge (51 ppm), In (11.9 ppm), Mo (78 ppm), and Ni (1340 ppm).

Micro-XRF maps of three Cu-rich samples from the Fletcher Mine helped researchers qualitatively identify areas of Ge enrichment for follow-on laser ablation (LA-ICPMS) mapping. These maps suggest that germanium is variably enriched (100's to >2000 ppm) in growth zones within chalcopyrite either in the lattice structure or as homogeneously distributed micro-inclusions. Indium was measured mostly at the ppm level but reached concentrations more than 100 ppm in one sample. Based on whole rock data, if all Ge is presumed to be hosted in sphalerite (HZ samples) or in chalcopyrite (Cu-rich), these minerals have median Ge concentrations of ~40ppm and ~225 ppm, respectively. Median In concentration if entirely hosted by chalcopyrite is ~51 ppm. Ongoing analyses of additional samples will help elucidate the distributions of these and other critical elements in Cu-rich samples from the Viburnum Trend and potentially aid their recovery during processing.