Targeting VHMS mineralization at Erayinia in the Archaean Yilgarn Craton, Western Australia: geochemical and hyperspectral halos

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Despite having been a target for volcanic-hosted massive sulfide (VHMS) mineralization since the 1960s, few resources have been defined in the Archean Yilgarn Craton of Western Australia. Exploration challenges associated with regolith and deep cover exacerbate the already difficult task of exploring for small, deformed deposits in stratigraphically complex volcanic terranes. Furthermore, the abundance of intercalated black shale horizons in prospective sequences, coupled with saline groundwater, has made the interpretation of electro-magnetic responses difficult. Systematic lithogeochemistry, pXRF (for qualitative vectoring), and hyperspectral analysis of drillcore is a cost effective method to aid the discovery of new orebodies. Such methods are being used to identify vectors to VHMS mineralization at Erayinia, ~150 km SE of Kalgoorlie. Coupled with extensive soil geochemistry, reverse circulation (RC) drilling and heliborne VTEM geophysics, several new zones of mineralization have been discovered north of the King deposit, and ~4.5 km to the NW along a second VHMS prospective stratigraphic horizon.

At King, east of the Claypan Fault, a small Zn-(Cu) orebody (~2.15 Mt at 3.47% Zn) occurs as two small stratiform replacive lenses in a structurally overturned volcanic-dominated sequence. The local stratigraphy includes: BIF and tuff in the stratigraphic hanging-wall, rare black shale at the ore horizon, and felsic to intermediate volcaniclastic rocks and garnet-amphibolite in the footwall. Mineralization is dominated by pyrite–sphalerite and is closely associated with pyrrhotite–magnetite-(chalcopyrite) stringers at depth. A cap of supergene Cu mineralization has been remobilized from the overturned chloritic feeder zone. Hydrothermal alteration is characterized by silica-sericite ± chlorite ± albite ± carbonate in felsic to intermediate rocks, and silica-epidote ± chlorite ± magnetite in garnet amphibolite. Footwall felsic volcanic rocks are calc-alkaline and predominantly of FII affinity, with gently dipping LREE- and flattish chondrite-normalized HREE-profiles similar to other VHMS-hosting felsic rocks of the Yilgarn Craton. Significant enrichments of Si, Fe, Mg, K, Ca (and depletions of Na) occur in footwall lithologies, with anomalous Ag, As, Bi, Pb, Sb and Sn in rocks and soils.

In 2014, drilling ~4.5 km NW of the King deposit (west of the Claypan Fault) identified widespread hydrothermal alteration and Zn-(Cu) mineralization across a strike length of ~3 km. Massive pyrite was intercepted associated with black shale. Stringer pyrite-sphalerite occurs in hydrothermally altered felsic volcaniclastic rocks in a sequence dominated by amphibolite-facies metabasalt. Felsic volcanic rocks are dacitic in composition, calc-alkaline, of FI to FII affinity, with chondrite-normalized REE profiles similar to those from the King deposit. Black shales contain high Eu/Eu* and anomalous concentrations of the following pathfinder elements approaching massive pyrite and Zn mineralization: As, Bi, Hg, In, Sb, Se, Sn, Tl, Te. Hyperspectral analysis shows systematic shifts in chlorite (Fe/Mg), carbonate (Ca,Mg,Fe) and white mica (Al) chemistry approaching mineralization.

During 2016, RC drilling of a VTEM anomaly (coincident with a Zn-Cu-Tl-Sn-Bi soil anomaly) ~3 km north of the King deposit identified a thin horizon of Zn-Pb mineralization (1m at 4.66% Zn, 2.04% Pb, 0.7 g/t Au). Initial lithogeochemistry results will be presented.