

Trace Elements of Pyrite, Chalcopyrite and Sphalerite Across Distinct Ore Types and Lenses at the Rosebery VHMS Deposit, Western Tasmania

Vinicius Godoi Pereira Da Cruz¹, David R. Cooke¹, Rebecca Carey¹, Ivan Belousov¹, Lejun Zhang¹, Corey Jago^{2,3}

¹University Of Tasmania, Hobart, Australia, ²MMG Limited Rosebery mine, Rosebery, Australia, ³Sustainable Minerals Institutes, University of Queensland, Brisbane, Australia

Volcanic-hosted massive sulfides (VHMS) are a major class of polymetallic, base and precious metals deposits. Understanding how trace elements are distributed in sulfides across these deposits can lead to efficient mining and unlock possibilities for critical metals by-product production. The Rosebery Zn-Pb-Cu-Au-Ag deposit in western Tasmania contains over 20 ore lenses with several distinct types of mineralisation. Three main episodes of mineralisation events have been recognized: (1) Cambrian syn-volcanic VHMS mineralisation; (2) Middle Devonian deformation related quartz-carbonate-sulfide veins and (3) Late Devonian metasomatic pyrrhotite and magnetite rich bodies associated with the emplacement of regional Sn granitoids. In this study we obtained and compiled LA-ICP-MS trace element data for pyrite, chalcopyrite and sphalerite from six ore lenses from Rosebery across a range of mineralisation styles. The objective was to identify systematic changes in trace elements patterns across the deposit. Cambrian massive sulfides, Cambrian baritic lenses and Devonian deformation related quartz-carbonate veins show minimal trace elements variations. Pyrite has a fairly constant trace element pattern and shows no statistically significant distinction across the studied mineralisation types. Sphalerite shows the most significant variation between mineralisation styles. When associated with Cambrian mineralisation sphalerite is significantly depleted in Fe and slightly enriched in Ga, whereas sphalerite associated with Devonian metasomatism is enriched in Sn, Fe, Cu, Bi, Ag and In. Cambrian chalcopyrite is characterised by comparatively higher Co, Ge and As whereas Devonian chalcopyrite has higher In, Bi and Au. Our results are concordant with geological observations elsewhere that sulfides from Sn systems are enriched in indium. The results highlight that Cu-Bi-Au have been added to Rosebery during Devonian metasomatism.