Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.20767

Garnet Geochemistry: A Regional-Scale Exploration Tool

JOËLLE D'ANDRES[1], JOHN A MAVROGENES[1], MATTHEW VALETICH[2] AND ELENA BELOUSOVA[3]

[1]Australian National University
[2]AngloAmerican
[3]Geological Survey of Queensland

Presenting Author: joelle.dandres@anu.edu.au

Garnet's ability to preserve growth zonation and retain trace elements has made it a valuable tool for studying the evolution of hydrothermal and/or ore-forming fluids. Garnet is also a common accessory mineral in metamorphic terranes and its prevalence in host rocks, metasomatic halos, and various ore lodes makes it an ideal candidate for geochemical exploration.

This study presents garnet geochemical analyses from a suite of ore deposits in NE and NW Queensland, Australia, with a primary focus on the Eastern Succession of the Mount Isa Inlier. We collected garnet geochemical data from host rocks and ore zones in BHT, skarn, SEDEX, and IOCG deposits, which host economic concentrations of Pb, Zn, Ag, Cu, and Au, as well as potential economic concentrations of REE, U, and by-products such as Sb, Cd, In, Ge, and Ga.

To secure future resources in these critical commodities, it is necessary to improve exploration methods, particularly under cover. This study aims to evaluate the potential of garnet to improve our understanding of the formation, evolution, and regional distribution of these deposits. Using petrographic observations, major and trace element chemistry, we identify several garnet generations and study their relationship to the main ore pulses.

Preliminary results indicate that the Ca and Mn content of garnet can vary significantly as function of the proximity to ore, as previously observed in BHT deposits [1]. In addition, the uptake of chalcophile elements like Cd by garnet in selected deposits is shown to be affected by the ore assemblage, correlating with major commodities like Zn. We further test the efficacy of garnet as an exploration tool by focusing on their trace element concentrations and investigate its geochronological potential (U/Pb, Lu/Hf)[2].

This study provides new insights into the genesis of a range of deposits, with significant implications for mineral exploration in the studied regions and beyond. By demonstrating the potential of garnet as a geochronological and exploration tool, our findings have the potential to inform future exploration strategies.

[1] Walters and Bailey (1998), *Economic Geology* 93 (8), 1307–1329 [2] Yan *et al.* (2019), *GSA Bulletin* 132 (5-6), 1031-1045.