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Assessing Proximity to Iron Oxide-Copper-Gold (IOCG) Mineralization Using Monazite Chemistry

Caroline Tiddy¹, David Giles¹, Adrienne Brotodewo¹, Diana Zivak², June Hill³, Jim Hodgkison⁴, Mitchell Neumann⁴

1. MinEx CRC, Future Industries Institute, University of South Australia, Adelaide, SA, Australia, 2. Department of Earth Sciences, University of Adelaide, Adelaide, SA, Australia, 3. CSIRO Mineral Resources, Perth, WA, Australia, 4. OZ Minerals Limited, Adelaide, SA, Australia

Geochemical indicators of proximity to mineralisation have been proposed for a variety of minerals (e.g., chlorite/epidote/micas for porphyry systems: Cooke et al. 2021: Econ. Geol.). Monazite is a mineral that has not received much attention in this space but is interesting to consider as it is a resistate mineral phase, meaning it can withstand processes of weathering and transport. Monazite has been demonstrated to preserve chemical compositions that can be linked to iron oxide-copper-gold (IOCG) mineralization at Prominent Hill in the northern Gawler Craton, South Australia, and that is distinguishable from the chemistry of monazite in surrounding unmineralized basement rocks that grew in association with other geological processes (e.g., metamorphism) (Forbes et al. 2015: J. Geochem. Expl.). The limitation of Forbes et al. (2015) is that the study was restricted to one deposit.

In this study, we assess the chemistry of hydrothermal monazite from the Carrapateena IOCG deposit in the central Gawler Craton. We compare the Carrapateena monazite chemistry to metamorphic monazite and monazite grown in association with shear zones. Carrapateena monazite is characterised by elevated light rare earth element (LREE) and depleted Y and Th concentrations, which is comparable to observations from the Prominent Hill deposit. Additionally, the Carrapateena monazite is depleted in Nd. The observation of similar monazite chemistry in multiple IOCG deposits is used here to propose broad-scale criteria for IOCG exploration within the Gawler Craton.

Monazite hosted within younger cover sediments overlying the mineralized basement rocks at both Prominent Hill and Carrapateena also preserves the chemical signature of IOCG-related monazite. These observations suggest that monazite chemistry is preserved during weathering, erosion, transport and redeposition processes. The IOCG-related chemical signature of monazite therefore has the potential to be dispersed within cover sequence materials, effectively increasing the geochemical footprint of mineralization.