New approaches to exploration for IOCG-style mineralisation, Middleback Ranges, S.A.

Thesis submitted in accordance with the requirements of the University of Adelaide for an Honours Degree in Geology.

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November 2013

THE UNIVERSITY of ADELAIDE

RUNNING TITLE

REE distributions: a new IOCG exploration tool.

ABSTRACT

Iron oxide copper gold (IOCG) systems display well-developed spatial zonation with respect to alteration assemblages, mineralogy and the distribution of rare earth elements (REE). The Middleback Ranges, South Australia, located in the Olympic Province, Gawler Craton, hosts anomalous Fe-oxide-bearing Cu-Au mineralisation, and are considered potentially prosperous for larger IOCG-style deposits. This study investigates whether the distribution of REE and other trace elements within selected minerals represents a potential exploration tool in the area. Iron-oxides (hematite and magnetite), potassium feldspar, albite and accessory minerals have been analysed by laser-ablation inductively-coupled plasma mass spectrometry (LA-ICP-MS) from two prospects (Moola and Princess) and in samples of the Myola Volcanics. The resultant multi-element datasets are compared to other IOCG systems.

The results support the presence of sizeable and/or multiple IOCG alteration envelopes within the Middleback Ranges. Significant evolving hydrothermal events resulted in hydrolithic alteration and remobilisation of REE within the Moola Prospect and Myola Volcanics.

Replacement of early magnetite by hematite (martitisation) in the Myola Volcanics is accompanied by an influx of REE visible on LA-ICP-MS element maps showing partial martitisation at the grain-scale. It is thus inferred the initial generation of magnetite must have pre-dated introduction of oxidised, REE-enriched hydrothermal fluids into the system. Sulphide assemblages observed within the Moola Prospect are complex and record sequential recrystallisation under evolving fS_2 and fO_2 conditions. Trace minerals, cycles of brecciation and replacement, and distributions of REE within minerals are similar to that observed in other IOCG domains. The Princess Prospect displays REE distributions in minerals which are dissimilar to the Moola Prospect, the Myola Volcanics and also those reported from other IOCG domains. This is interpreted as indicating that the Moola Prospect and Myola Volcanics in the south of the Middleback Ranges are more prospective IOCG targets.

KEYWORDS

Middleback Ranges, Iron-Oxide Cu-Au (IOCG), Rare Earth Elements (REE), incompatible elements, exploration, alteration.

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