

REE distributions: a new IOCG exploration tool.

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

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RUNNING TITLE

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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 hydrolytic 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.

TABLE OF CONTENTS

List of Figures.....	3
List of Tables.....	5
Introduction	6
Background	11
IOCG mineral systems.....	11
Regional Geology.....	12
IOCG mineralisation in the Middleback Ranges.....	15
Methods	17
Results	18
Discussion.....	62
Comparison of the Princess and Moola Prospects and Myola Volcanics.....	62
REY distributions and their petro genetic and exploration significance.....	63
Towards a preliminary genetic model.....	68
Conclusions	71
Acknowledgments	73
References	73
Appendix	77

LIST OF FIGURES

Figure 1 Regional-scale map showing the Middleback Ranges within the Olympic Province. Major IOCG deposits are located. 7

Figure 2 Schematic cross-section illustrating idealised alteration zonation in IOCG deposits (Hitzman et al. 1992). 8

Figure 3 Geological sketch map of the Middleback Ranges, also showing the three sampling localities. 9

Figure 4 (a-h) Photographs of hand-specimens of typical lithologies (scale-bars: 1 cm). (a) Myola Volcanics porphyry rhyolite (sample: MV01); (b) Felsic breccia (sample: ML01); (c) Banded felsic gneiss; granitic veinlet is seen on the RHS of image (sample: ML02); (d) Granite veinlet (sample: ML06); (e) Granite (sample: ML07); (f) Flow banded rhyolite-dacite volcanoclastic (sample: ML15); (g) Hematite breccia (sample: PS01); (h) Metasedimentary rock (sample: PS03). 20

Figure 5 (a-h) Petrographic images of typical lithologies; all transmitted cross polarised light images except g) (reflected light cross polars). (a) Myola Volcanics porphyry rhyolite (sample: MV01), Microcline porphyryblast within a fine grained matrix comprised of quartz, feldspar and sericite. Chlorite, sericite and rutile are associated with feldspars. Fabric is defined by elongated zones of coarse-grain minerals and martite stringers (opaque mineral). (b) Felsic breccia (sample: ML01); Chlorite dominated breccia infill. RHS of image is a clast of granite composed of quartz, altered feldspars and minor zircon. (c) Banded felsic gneiss (sample: ML02); Fabric is defined by coarse-grain chlorite and sericite. Rock is dominated by quartz and altered feldspars. (d) Granite veinlet (sample: ML06); Central mineral is heavily chlorite altered hornblende surrounded by quartz, muscovite and altered feldspars. (e) Granite (sample: ML07); Granite is dominated by quartz, heavily altered microcline, plagioclase, chlorite, sericite and titaniferous hematite. Opaque mineral in centre of image is chalcopyrite. (f) Flow banded rhyolite-dacite volcanoclastic (sample: ML15); Fine grained volcanoclastic is dominated by quartz, feldspar, muscovite, titaniferous hematite and ilmenite. (g) Hematite breccia (sample: PS01); Bladed hematite (fine- and coarse-grained in infill and clasts respectively) dominates the breccia. (h) Metasedimentary rock (sample: PS03); The very fine-grained rock is dominated by quartz, chlorite and sericite with minor kutnohorite and quartz-carbonate crackle veins. Scale bar: 500 µm. 22

Figure 6 (a-k) Back-scatter electron images showing accessory minerals. a) Equigranular rutile (Ru) associated with monazite (Mon) from the Princess Prospect metasediments; rutile is potentially hydrothermal (sample ID: PS06). b) Zoned and broken zircon (Zrc) is common throughout the sample suite (sample ID: ML04 - felsic banded gneiss). c) The felsic volcanoclastic rock has symplectic rutile (darker grey) and hematite (Hm) (brighter grey) after ilmenite (Il). Bladed Ti-poor hematite is also observed in this image (brightest mineral) (sample ID: ML14). (d) Myola Volcanics – late-stage pyrolusite (Pyl); zonation is apparent in image however analysis showed no obvious chemical variation (sample ID: MV01). e) & f) Granitic veinlet - hematite with ilmenite exsolution lamellae is associated with a homogenous coarse grained rutile. Inset f) is a close up of exsolution textures (sample ID: ML03). g) & h) The contact between felsic banded gneiss and granitic veinlet commonly has rutile and ilmenite; inset h) Rutile and ilmenite close up (sample ID: ML04). i) This rutile from the Princess Prospect metasediments may represent a corroded detrital grain (sample ID: PS06). j)

REE distributions: a new IOCG exploration tool.

Rutile in the Myola Volcanics is often associated with titanite (Ttn) and Fe-oxides (sample ID: MV01). k) The rutile in the felsic volcanoclastic rock is observed to replace Fe-oxides (sample ID: ML17).	24
Figure 7 (a-f) Petrographic images – (a, b & e) reflected light, plane polars light; (c, d & f) transmitted light, cross polars light. All images are from the Moola Prospect. a) This image from the hybrid zone shows pyrite (Py) and marcasite (Ma) with late-stage chalcopyrite (Cpy) (sample ID: ML15). b) Corroded pyrite with late-stage chalcopyrite was observed within a quartz-carbonate vein in the granitic veinlet; fine-grain sphalerite was also observed within the vein (sample ID: ML03). c) Late-stage carbonate vein within the granitic veinlet (sample ID: ML04). d) Hornblende (Hbl) is commonly altered to chlorite (Chl); feldspars are often altered by chlorite and sericite. Muscovite (Mu) can be both coarse- and fine-grained (sample ID: ML04). e) Titaniferous hematite (Hm) showing ilmenite exsolution lamellae (<1 µm across and ~10 µm long) (sample ID: ML01). f) Simple twinning of microcline (Ksp) with sericite (Mu) alteration within granitic clast in felsic breccia (sample ID: ML01).	26
Figure 8 (a-i) Back-scatter electron images of Fe-oxides and sulphides; all images are from within the silicic breccia at the contact between the granite and felsic volcanoclastic in the Moola Prospect except for c), f), g) & h). a) Early pyrite (Py) has chalcocite (Cc) along fractures. Massive chalcocite is associated with wittichenite (Wit) and has late-stage delafossite (Dlf) (sample ID: ML13). b) Kutnohorite (Ku) is zoned with respect to Mn; coeval growth is supported by Cu-sulphate (?) inclusions within the core of the kutnohorite grain. (sample ID: ML13). c) Pyrite within the Princess Prospect metasedimentary rocks is zoned with respect to As (sample ID: PS12). d) Early pyrite is proximal to minor sphalerite (Sp); covellite (Co) is observed growing into the void, and late-stage Kutnohorite and Cu-sulphates are forming within voids. Relationships in b) and d) may support a relationship between late-stage remobilisation of Cu and Mn (sample ID: ML13). e) Chalcocite replacing pyrite (sample ID: ML13). f) Hematite breccia: Princess Prospect. Bladed hematite (Hm) is rimmed by a late-stage magnetite (Mt) that has elevated REY in comparison to the Hm (sample ID: PS02). g) Moola Prospect: granite. Late-stage uraninite (U) and monazite (Mon) is commonly closely associated with chalcopyrite and apatite (Ap) and is proximal to kutnohorite veins (sample ID: ML10). h) Moola Prospect: granite veinlet. Corroded pyrite is rimmed by late-stage uraninite (sample ID: ML03). i) Native dendritic copper (sample ID: ML13).	30
Figure 9 (a & b) Reflected light images in plane polarised light; martite texture – hematite (Hm) replacing magnetite (Mt). This feature is predominant in the Myola Volcanics. c) Chondrite-normalised REY fractionation trends for fresh magnetite, slightly altered magnetite and martite show the degree of martitisation is associated with REE enrichment.....	33
Figure 10 Chondrite-normalised REY fractionation trends for titaniferous hematite (Moola Prospect). Note irregular distribution; there is a slight increase of REY down-hole.	34
Figure 11. Back-scatter electron image showing the relationship between titaniferous hematite, rutile and ilmenite in the flow-banded rhyolite found towards the base of ML001DD. Primary titaniferous hematite is observed throughout the sample; this coarse grained rutile shows fracturing and replacement by late-stage impure ilmenite. Chondrite-normalised REY fractionation trends for a) ilmenite, b) rutile and c) hematite, clearly indicating that the late-stage ilmenite is associated with an influx of REY.	35

REE distributions: a new IOCG exploration tool.

Figure 12 Chondrite-normalised fractionation trends for a) albite and b) microcline. See text for additional information.....	37
Figure 13 Chondrite-normalised REY fractionation trends for accessory minerals. a) Apatite, containing significant amounts of REY. Granitic apatite within the Moola Prospect displays a concave trend similar to Hillside ore-stage altered skarn (Ismail <i>et al.</i> in press). b) Titanite is particularly HREE-rich, a feature unique to a subset of environments within IOCG and skarn systems. c) & f) Rutile, showing variable REY plots throughout the sample suite; see text for explanation. e) Late-stage pyrolusite is a significant carrier of REY and is LREE-enriched. e) Kutnohorite REY patterns differ between samples. Note: standard used for kutnohorite analysis did not contain Tb, Y, Tm or Yb – these elements are not displayed.....	38
Figure 14 a) & b) Rb-Sr-Ba ternary plots for feldspars. Note albite is relatively rich in Sr in comparison to microcline. c) Rb-Ba binary plot showing distinct trends for microcline from felsic volcanoclastics, rhyolite porphyry, and granite. These plots allow for discrimination among lithologies. d) & e) U-Th-Pb ternary plots for feldspars, showing that albite has increased concentrations of U and Th with respect to Pb.....	55
Figure 15 a) Reflected light image displaying the martite texture of hematite (Hm) replacement of magnetite (Mt). Remaining images are LA-ICP-MS element maps for the martite grain shown in (a). The degree of martitisation correlates with REE enrichment (particularly LREE). A moderate correlation can be seen between martitisation and the concentrations of Mn and Zn. Maps showing the distributions of V and Co illustrate their presence in Fe-oxides. Scales are in counts per second (logarithmic scale).	57
Figure 16 a) Back-scatter electron image of kutnohorite grain displaying compositional zonation (scale bar 1 mm). Remaining images are LA-ICP-MS element maps of this grain. Mn, Mg, Fe and Ca maps show that the grain-scale compositional zonation is largely attributable to major variations in Mn content. Kutnohorite is also zoned with respect to, and is a significant carrier of various metals and incompatible elements. Scales are in counts per second (logarithmic scale).	58

LIST OF TABLES

Table 1 Archaean to Paleoproterozoic stratigraphy of north-eastern Eyre Peninsula (Parker 1993).....	13
Table 2 Petrographic summary of main lithologies.....	28
Table 3 Summary of LA-ICP-MS trace element data for Fe-oxides (ppm).....	41
Table 4 Summary of LA-ICP-MS trace element data for feldspar (ppm).....	45
Table 5 Summary of LA-ICP-MS trace element data for rutile (ppm).....	49
Table 6 Summary of LA-ICP-MS trace element data for apatite (ppm).....	51
Table 7 Summary of LA-ICP-MS trace element data for kutnohorite (Ku), pyrolusite (Pyl) and titanite (Ti) (ppm).	53
Table 8 Results of Zr-in-rutile geothermometry using the calibration of Watson <i>et al.</i> (2006).....	60
Table 9 Electron probe microanalytical data for chlorite. Estimated formation temperature is calculated based on the calibrations of Cathelineau (1988) and Jowett (1991).....	61