Albitization and REE-U-enrichment in IOCG systems: Insights from Moonta-Wallaroo, Yorke Peninsula, South Australia

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ALBITIZATION AND REE-U: MOONTA-WALLAROO

ABSTRACT

Iron Oxide Copper Gold (IOCG) deposits are the products of crustal-scale metasomatic alteration, generally considered to be associated with the emplacement of large felsic intrusions. These systems are typified by zoned, broad alteration haloes comprising the products of an early, barren albitization event, and late, ore-hosting potassic/calcic (skarn) alteration associated with mineralization. Yttrium and rare earth elements (REY), and also uranium, are prominent components of most IOCG systems. The REY-signatures of feldspars and accessory apatite, Fe-(Ti)-oxides and other minerals are geochemical tracers of alteration stages within a magmatic-hydrothermal system.

This study sets out to identify links between magmatism and initiation of hydrothermal activity, and to test the hypothesis that albitization is a pre-requisite stage for REE-U enrichment in magmatically-derived IOCG systems. The compositions and trace element concentrations in key minerals have been analysed using scanning electron microscopy, electron probe microanalysis and laser-ablation inductively-coupled plasma mass spectrometry in a varied range of magmatic to metasedimentary lithologies from the Moonta-Wallaroo region, an area in which broad regional-scale alkali alteration is recognised.

Results confirm a strong link between albitization and REE-U-enrichment. The process of albitization is seen to consume, redistribute and lock-in REY, LILE and HFSE via complex fluid-rock reactions dependent on the pre-existing mineral assemblages and fluid characteristics, providing a holistic model for IOCG-driven alkali metasomatism. The trace element signatures recorded by K-feldspar reflect a transition from magmatic to hydrothermal stages within an evolving IOCG system.

Although further constraints on these signatures are required, they could prove invaluable in mineral exploration as they suggest a quantifiable distinction between alteration associated with mineralization, and regional background. This hypothesis requires testing elsewhere in the Olympic Province and in analogous terranes.

KEYWORDS

Albitization, REE-U enrichment, IOCG, Feldspar, Trace elements, Moonta-Wallaroo

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