Ore vectoring in IOCG systems: trace elements in garnets from the Groundhog skarn, Punt Hill, South Australia

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Trace elements in garnet from Groundhog, S.A.

ABSTRACT

The Groundhog Cu-Pb-Zn prospect, Punt Hill district, eastern Gawler Craton, South Australia, is a recently discovered ore system located within the 1.6 Ga Olympic iron oxide-copper-gold (IOCG) Province. The prospect is characterized by a retrogressive calcic skarn/IOCG-type footprint. Laser-ablation inductively-coupled plasma mass spectrometry spot analyses and grain-scale element mapping of garnet and accessory minerals, supported by optical and scanning electron microscopy and electron probe microanalysis, determines distributions of rare earth (REE), incompatible and ore-forming elements within skarn and marker horizons.

Distinct textural categories of garnet, each reflecting stages in the evolution of the skarn system, are recognised. Fe-rich prograde andradite is oscillatory-zoned, with high W and As, relatively low ΣREY, and low HREE/LREE ratio. Retrograde garnet is Al-rich, characterised by ΣREY concentrations an order of magnitude higher, high HREE/LREE, and high concentrations of incompatible and high field strength elements. Marked Cr enrichment defines the garnet rim.

Trace element distributions in texturally-distinct categories of garnet are applied as mineralization vectors along the two controlling structures. Based on Cr concentrations in rim garnet, the NNE-trending structure is interpreted to control fluid flow, with increasing intensity of mineralization towards NNE. Vectors defined by REY- and W-concentrations in prograde and retrograde garnets indicate that NW-SE structures drive skarn-forming fluids on the regional scale. This has potential for defining metallogenic patterns in the broader Punt Hill area. Application of such vectors requires, however, that the data is adequately interpreted in the contexts of textures and of prograde-to-retrograde evolution of the system. Groundhog is an oxidised IOCG system with skarn alteration positioned distal to a deep magmatic fluid source. Comparison of garnet chemistry at Groundhog and Hillside points to a possible N-S, W- to Sn-enriched trend within the Olympic Province. Results may offer a basis for defining specific settings for magma generation within the province.

KEYWORDS

Ore vectoring, garnet, skarn, IOCG, Groundhog, Punt Hill, mineral trace element signature

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