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Chlorite chemistry as a new exploration tool in the propylitic halo of porphyry-epithermal systems

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Intrusion-centred mineral districts host many major ore deposits of diverse styles and metal associations, primarily porphyry and epithermal types. The characteristically zoned hydrothermal alteration and geochemical dispersion associated with these deposits have long been important tools for exploration. However, the mineral assemblages, textures and geochemical signatures that characterize each zone may also be present within barren hydrothermal systems, or produced by other processes such as regional metamorphism. Discriminating mineralized and barren systems, being able to locate strongly-mineralized hydrothermal centres, and recognizing the distal footprints of ore-grade mineralization continue to be great challenges to the minerals industry.

In the 'green rock' environment of propylitic alteration, alteration intensity decreases markedly outside the visible sulphide halos so that conventional geochemical and geophysical techniques struggle to detect proximity to mineralization. Recent work, part of a series of AMIRA projects led by the University of Tasmania, has developed new tools for exploration in this domain based on the trace element chemistry of propylitic minerals. Chlorite, in particular, has proven to be a key recorder of trace element dispersion and intensive parameters in the propylitic environment, providing a tool for vectoring towards the centre of mineralized systems and even for predicting absolute distances from ore [1]. Epidote has also proved to be a useful mineral for assessing the potential size and direction of an ore body [2].

In this talk, the approach and methodology are summarised, and illustrated with examples from several case studies, including the Batu Hijau Cu-Au porphyry system, Indonesia, the Northparkes Cu-Au system, Australia, and the Ujina deposit, Collahuasi district, Chile. The current take-up of this methodology within the exploration industry and barriers to its wider applicability are considered.

References:

[1] Wilkinson, J.J. et al. (2015) Jour. Geochem. Explor. 152: 10-26

[2] Cooke, D.R. et al. (2014) Soc. Econ. Geol. Spec. Pub. 18: 127-152

