SEG 2017 Conference

Geodynamic complexities in arc and post-collisional settings of the SW Pacific and China - essential ingredients for porphyry mineralisation

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Porphyry ore deposits are the world's major resources of copper and molybdenum, and are significant resources of gold and silver. They only form in convergent margin settings at discrete points in space and time, when conditions become favourable for mineralization. Tectonic perturbations are required to transform magmatic arcs from conditions that promote widespread volcanism to more restricted plutonism. Establishment of long-lived mid- to upper-crustal magma chambers promotes magmatic fractionation, volatile exsolution and can ultimately lead to porphyry-style mineralization and alteration.

Geodynamic triggers for porphyry mineralization can be recognized in young oceanic island arc settings of the SW Pacific (e.g., Philippines, Indonesia, Papua New Guinea, Fiji), continent-continent collisional and post-collisional settings (e.g., Tibet and Middle-Lower Yangtse River regions, China), as well as in young continental arc settings (e.g., Peru, Chile). Detailed investigations of these individual porphyry provinces reveals transient geodynamic complexities that perturbed or post-dated subduction, creating a favorable structural architecture, and facilitating magmatic fractionation to conditions that can lead to high grade porphyry-style mineralization. Geological architecture and geodynamic phenomena have combined in several ways to produce conditions favorable for porphyry mineralization, with specific combinations varying from province to province. Favorable conditions for mineralization can also be repeated several times in the evolution of a convergent margin, creating overlapping metallogenic belts that are each characterized by their own belt-specific features, but restricted to discrete periods in a protracted history of arc-related magmatism.